ELECTRONIC INDUSTRIES

★ Wartime and Peacetime Markets for Electronic Products

★ Industry Planning. Future of UHF

★ Re-Negotiation of Radio Contracts

JUNE

Caldwell-Clements, Inc.

Quick, complete information and prices for your purchasing department.

Application data for your engineering and design departments.

Service from stock.

A copy of the Mallory catalog for ready reference.

Mallory Distributors Are on the Job With Essential Electronics Supplies and Service

On small orders with high priorities, your Mallory distributor can be a life saver. He can supply you—usually from stock—with parts that might hold you up for months until the manufacturer can put them in production.

When you need essential electronic parts for plant replacements, test or experimental work, or pre-production models of war devices, your local Mallory distributor is at your service. Depend on him for standard Mallory switches, phone jacks and plugs, rheostats, potentiometers, resistors, condensers, rectifiers, noise filters, vibrators, Vibrapacks* and other Mallory Approved Precision Products.

Count on your Mallory distributor for services like these—

—Quick and complete information and prices for your Purchasing Department

—Application data for your engineering and design departments

—A copy of the Mallory Catalog for ready reference

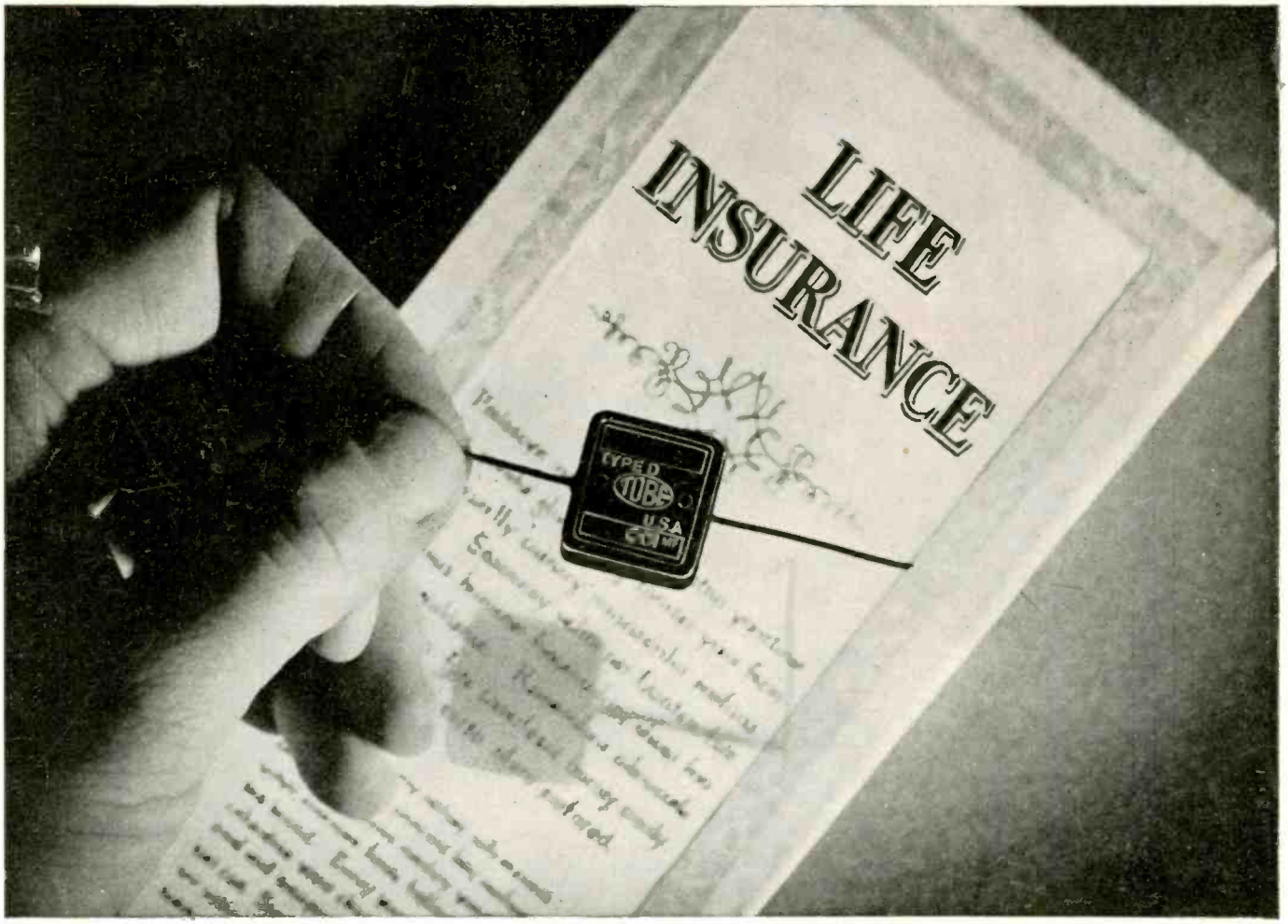
We are making every effort to maintain adequate stocks at Mallory distributors—to save you time and trouble.

Phone your local Mallory distributor. Or if you do not know the Mallory distributor nearest you—write us and we will put him in touch with you.

*Reg. U. S. Pat. Off.

P. R. MALLORY & CO., Inc. **INDIANAPOLIS, INDIANA** • *Cable Address*—PELMALLO

P. R. MALLORY & CO. Inc.
MALLORY
APPROVED
PRECISION PRODUCTS



NOW AVAILABLE FOR YOUR PRODUCTION REQUIREMENTS!

The first oil-impregnated condenser to be found physically and electrically interchangeable with the majority of mica capacitors used in the by-pass and coupling circuits of radio and radar equipment.

The Tobe Type DP Molded Paper Capacitor has *long life built into it* through every step of manufacture. Rigid inspections maintain a standard that is exceptionally high—so high, in fact, that "returns" are almost completely unknown.

For the first time since its introduction we are *now* in a position to accept immediate orders for Type DP, with *prompt delivery assured.* They will be filled in order of receipt and we suggest you act promptly. For production samples or further information write TOBE DEUTSCHMANN CORP., CANTON, MASS.

SPECIFICATIONS—TYPE DP CAPACITOR

CAPACITANCE	.001 to .01 mfd.
WORKING VOLTAGE	600 volts DC—flash test 1800 volts DC
SHUNT RESISTANCE	At 185° F.— 1000 megohms or greater
	At 72° F.—50000 megohms or greater
WORKING TEMPERATURE RANGE	Minus 50° F. to plus 185° F.
OPERATING FREQUENCY RANGE	Upper limit 40 megacycles
	Q at one megacycle—25 or better
POWER FACTOR	At 1000 cycles—.005 to .006

These capacitors meet Army and Navy requirements for immersion seal.

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

EDITORIAL CONTENTS AND ARTICLES LISTED ON PAGE 4

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ELECTRONIC INDUSTRIES

JUNE, 1943

In this Issue

FRONT COVER—Wartime Markets for Electronic Products—Radio Assembly. (Photo taken in GE factory.)

SUPPLEMENT—War-Production Chart of the Electronic Industries. Statistics. And on reverse side—Directory of Electronic Manufacturers, principal offices, branches in Washington, New York, Chicago

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Inside this package there's something important...

UNTIL the war is over, there are very few things that we can tell you about the KLYSTRON* tube.

We can say that it is a vital factor in electronics, that it was developed by the Sperry Gyroscope Company following initial research at Stanford University.

Right now, the KLYSTRON* is making very important contributions to essential military equipment. And other advances in this field have been made—after the war is over, some of these will undoubtedly contribute to the security and comfort of a world at peace.

SPERRY

GYROSCOPE COMPANY

BROOKLYN, NEW YORK

DIVISION OF THE SPERRY CORPORATION

*The names KLYSTRON and RHUMBATRON were officially registered at the U. S. Patent Office on October 3, 1939, by Sperry Gyroscope Company, Inc. KLYSTRON is registration No. 371650. RHUMBATRON is registration No. 371651.

Quartz shortage

REQUIRES GREATER CUTTING ACCURACY . . . LESS WASTAGE . . . FEWER DUDS

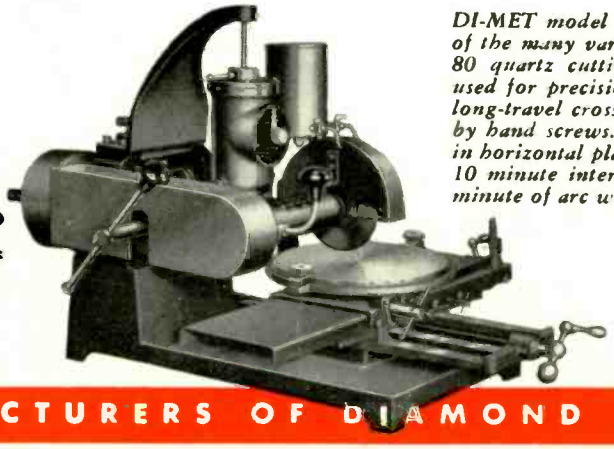
Limited quartz supplies demand more accurate cutting to obtain the greatest number of acceptable blanks per block. Because of design and features engineered especially for cutting quartz, Felker DI-MET machines not only cut to exceptionally close tolerances, assuring a maximum quantity of accurate blanks per pound, but keep production at peak with minimum breakage and with excellent surface finish!

MORE BLANKS from the same quartz

For highly consistent and accurate results DI-MET models 80 and 120 quartz cutting machines are equipped with the Felker Hydraulic Retardant. This Retardant controls down-feed to a definite speed, which can be adjusted from a fraction of a foot to 10 feet per minute.

Cutting speed of the DI-MET Rimlock or DI-MET Resinoid blade is always well in advance of the feed rate, and the movable arbor is so balanced as to permit utilizing the most efficient blade pressure upon the quartz without forcing. Blades will not bind or buckle because excessive and variable pressures are impossible, thus eliminating runouts and breakage of crystals. Feeds remain constant regardless of surface area being cut. Wafers and blanks are sliced truer and sides are kept parallel because cutting action is uniform from start to finish. Instant acting controls permit rapid employment or disengagement of Hydraulic Retardant for raising or lowering the arbor. These and many other desirable DI-MET features with specifications on all DI-MET quartz cutting machines are fully described and beautifully illustrated in our new catalog. If you cut quartz, write for your copy today!

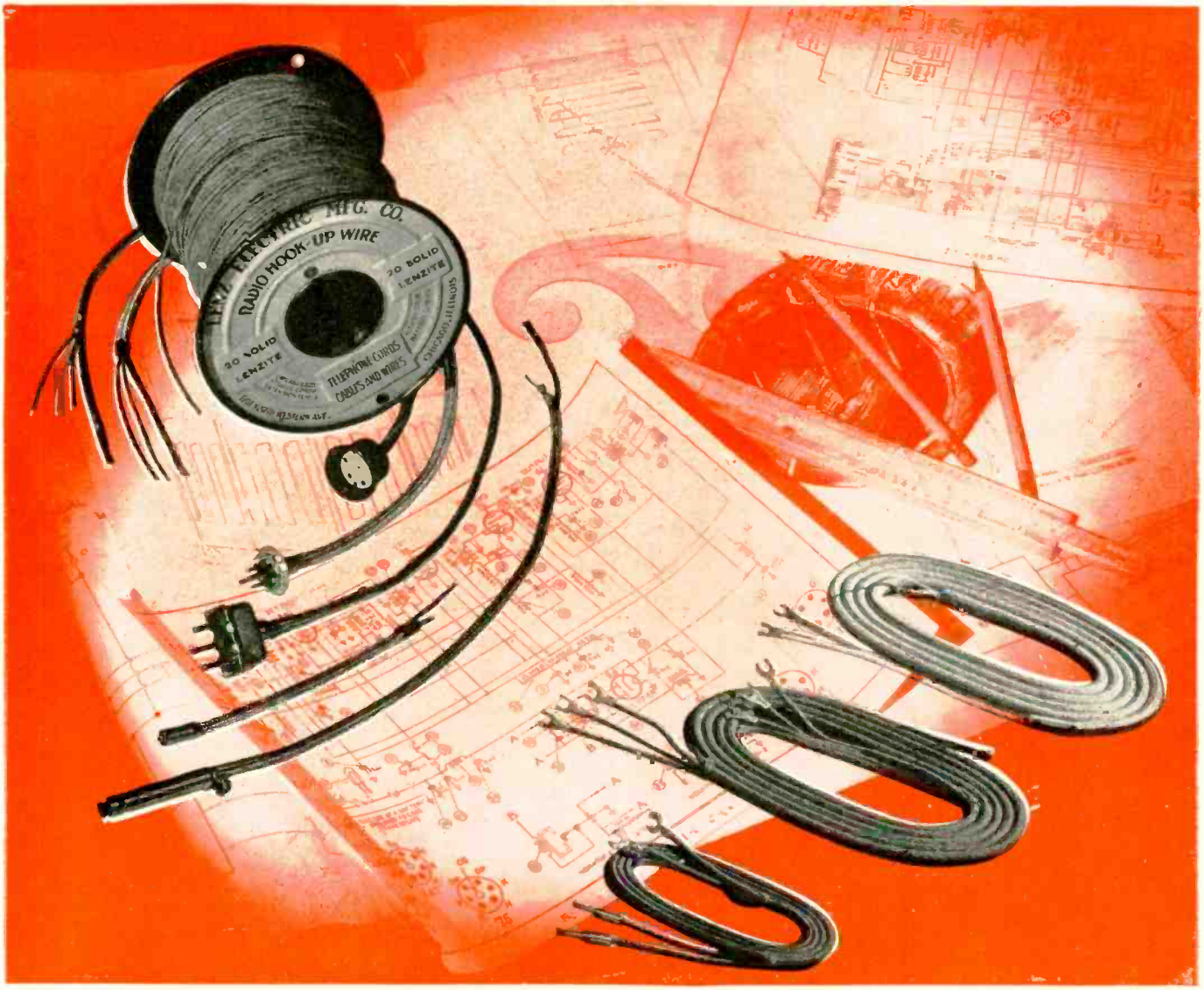
FELKER MANUFACTURING CO., 1114 BORDER AVE., TORRANCE, CALIF.



DI-MET model 80 with HVCT-12 Rotary Table — One of the many variations of the versatile DI-MET model 80 quartz cutting machine. HVCT-12 Rotary Table, used for precision orientation of the quartz piece, has long-travel cross and through-feeds manually operated by hand screws. Table tilts to ± 10° and rotates 360° in horizontal plane. Vertical adjustment is graduated in 10 minute intervals, horizontal adjustment reads to 1 minute of arc with vernier.

FELKER DI-MET

MANUFACTURERS OF DIAMOND ABRASIVE WHEELS



"15 ZEROS HEADED YOUR WAY—"

Messages like these, crackling through the ether enable our flyers to meet and defeat attacking enemy forces. The efficiency of aviation radio communications has played a major role in our air victories, and the engineers who design and produce this equipment deserve their share of the glory.

That millions of feet of Lenz wires and cables were selected for this equipment is a source of considerable pride to this organization.

The Lenz wire engineers are always ready to consult with the designers of communications equipment on their wire and cable specifications. No matter how stringent and exacting the requirements, how severe the conditions under which the equipment must operate, Lenz engineers will help you find just the right wire for the job.

LENZ

ELECTRICAL CORDS, WIRES AND CABLES

LENZ ELECTRIC MANUFACTURING CO.

1751 N. Western Ave., CHICAGO, ILLINOIS

"IN BUSINESS SINCE 1904"

For 32 years Magnavox has been serving the radio industry. Now our engineering skills and factory facilities, which have made such important contributions to radio, are concentrating on winning the war.

Magnavox

TAKE OUR WORD FOR IT—the new Magnavox factory is an excellent plant . . . six acres under one roof . . . facilities, talent and resources to handle anything in the communication and electronic field.

With engineering skill amplified and production capacity increased we are able to exceed the enviable achievements already made by our organization in war work.

As prime and sub-contractor Magnavox has set many new records. Some facilities are again available for additional contracts. Write, phone or wire. The Magnavox Company, Fort Wayne, Indiana.

The skill and craftsmanship which won for Magnavox the first Navy "E" award (and White Star Renewals) among radio receiver manufacturers, has served the radio industry capably for 32 years.

MAGNAVOX IS NOW WORKING FOR THESE BRANCHES OF SERVICE:

ARMY—Air Corps . . . Signal Corps . . . Ordnance

NAVY—Aeronautics . . . Ordnance . . . Ships

COAST GUARD

MARINE CORPS

MARITIME COMMISSION

expands facilities

SOME OF THE EQUIPMENT MAGNAVOX IS MAKING FOR THE GOVERNMENT:

Army and Navy Radio Receivers
Aircraft Interphone Communication Equipments
Battleship Speaker Amplifier Announcing Systems
Loud Speakers for All Purposes
Motor Driven and Hand Operated Antenna Reels
Aircraft Carbon Microphones
Tank Receiver Head Set and Microphone Equipment
Sound-Slide Projectors for Military Training
Radio Detection Equipment Radio Direction Finders
Electrolytic Filter and By-pass Capacitors
Firing Controls Arming Controls

Magnavox

The Great Voice of Radio

COMMUNICATION AND ELECTRONIC EQUIPMENT

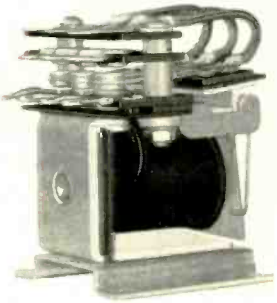
FROM "HAM" TRANSMITTER RIGS

TO INTER-PLANE COMMUNICATION

RELAYS BY GUARDIAN

★ Today they are off the air . . . voices stilled . . . home-built rigs carefully covered. For most of yesterday's "hams" are lending their experience, knowledge, and ingenuity to the war effort . . . creating and perfecting new communication devices . . . the amazing new flight recorder, for instance . . . or Radar. But whether they work in a wartime lab or have their "office" in a Fortress, they are still close to one of their early friends—"Relays by Guardian".

One of the newer developments is a multi-purpose aircraft radio relay pictured at the right. It is built in contact combinations up to three pole, double throw. Coils are available in resistances from .01 ohm to 15,000 ohms. At 24 volts DC it draws 0.12 amperes. This relay is also built for AC with a contact rating of 12½ amperes at 110 volts, 60 cycles. Standard AC voltage is 92-125 volts but coils are available for other voltages.



Aircraft Radio Relay
DC Model—Bulletin 345
AC Model—Bulletin 340

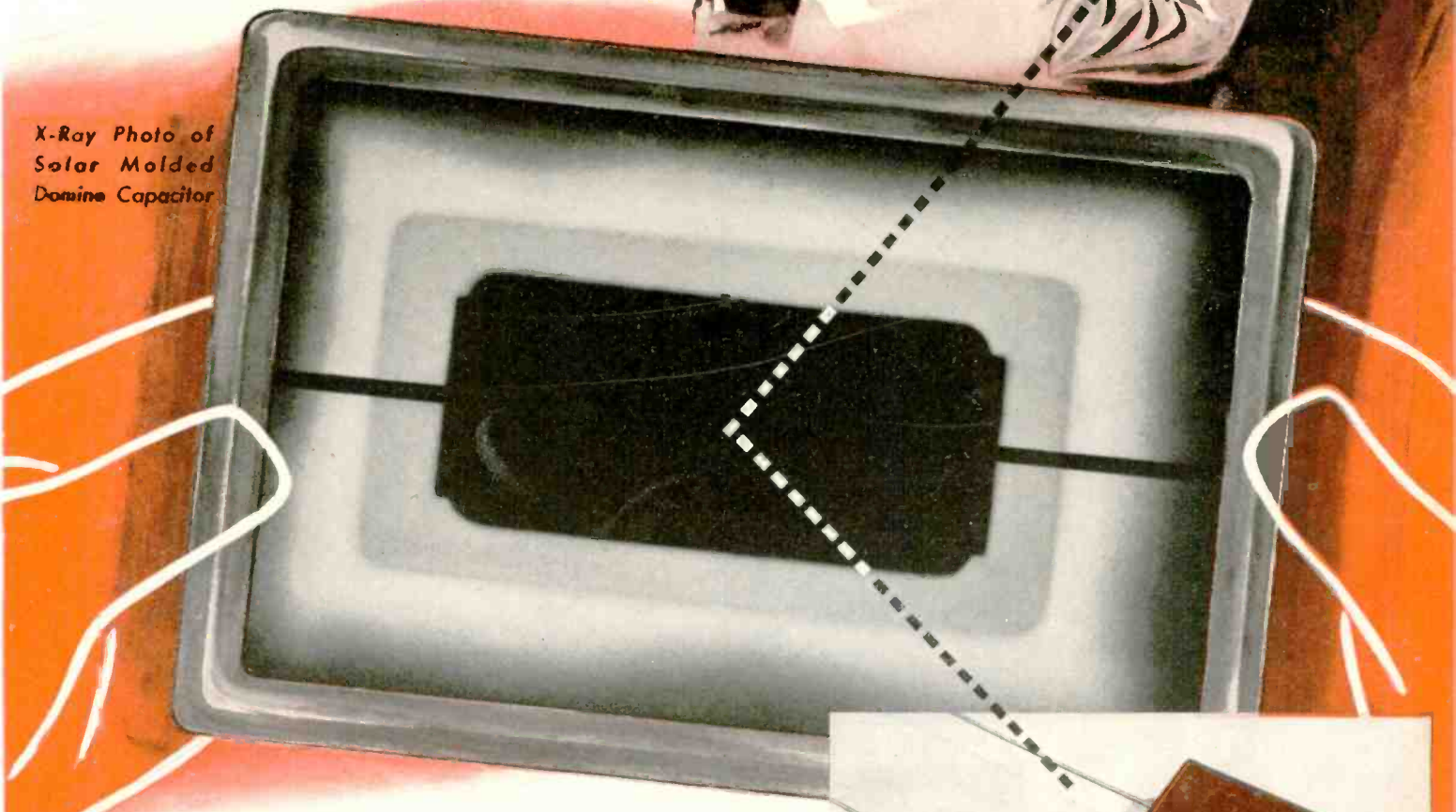
Write on your business letterhead for these new bulletins: B-8, Six pages of Aircraft Contactors—195, Midget and Signal Corps Relays — B2A, Aircraft Relay — SC65, Solenoid Contactor.

GUARDIAN ELECTRIC

1622-G WEST WALNUT STREET CHICAGO, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY

Physicals FOR CAPACITORS!



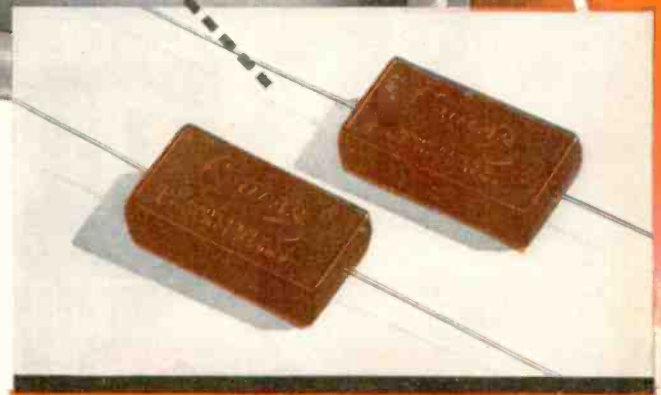
X-Ray Photo of Solar Molded Domino Capacitor

There's an inside story of capacitors, too.

The genius of Roentgen is helping select the A-1's, not only in the field of medicine but also for quality inspection of molded capacitors.

Today, fluoroscopic inspection is an established procedure at Solar, assuring accurate centering of windings in Domino Molded Paper Capacitors. This "ounce of prevention" guarantees capacitors which truly reflect "Quality Above All"!

Solar Manufacturing Corporation, Bayonne, New Jersey.



SOLAR DOMINO TYPE MPW

3761

Solar SOLAR —II— CAPACITORS —II—

CAPACITORS: ELECTROLYTIC • MICA • PAPER • TRIMMER • TRANSMITTING

WILCOX-GAY CORPORATION

QUALITY SINCE 1919

The Mark of Quality

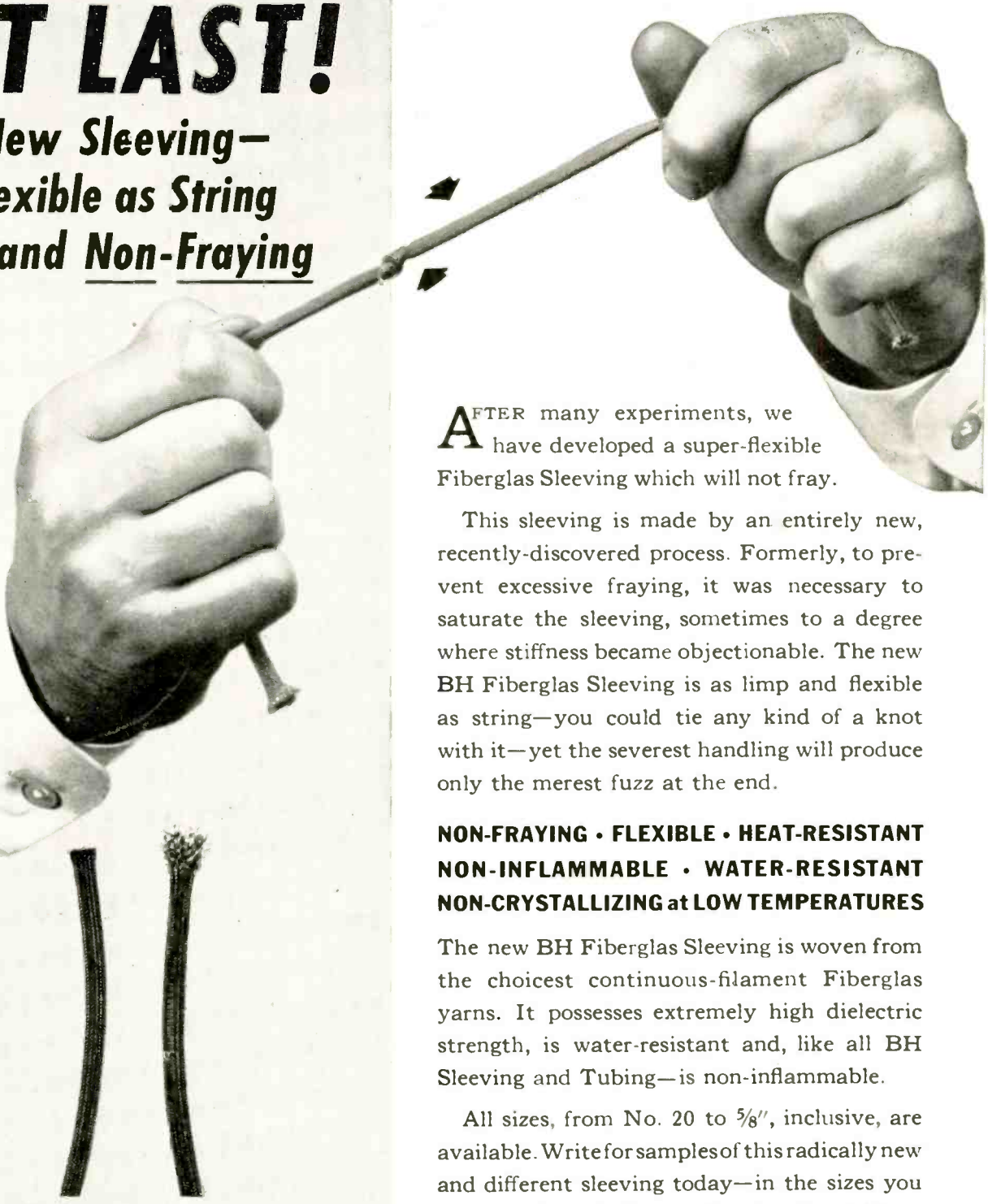
WILCOX-GAY CORPORATION

CHARLOTTE, MICHIGAN

"Producing for war...planning for peace"

AT LAST!

A New Sleeving— Flexible as String and Non-Fraying



AFTER many experiments, we have developed a super-flexible Fiberglas Sleeving which will not fray.

This sleeving is made by an entirely new, recently-discovered process. Formerly, to prevent excessive fraying, it was necessary to saturate the sleeving, sometimes to a degree where stiffness became objectionable. The new BH Fiberglas Sleeving is as limp and flexible as string—you could tie any kind of a knot with it—yet the severest handling will produce only the merest fuzz at the end.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

The new BH Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses extremely high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes, from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. I, Conshohocken, Pa.

THIS – NOT THIS

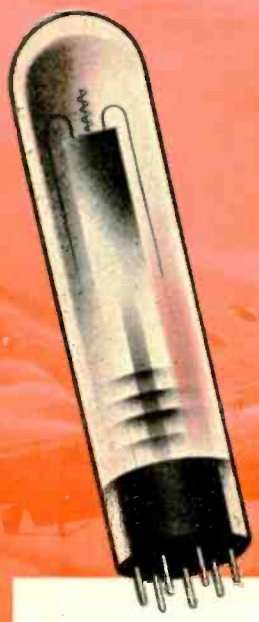
BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

LETHAL WEAPON

IN THE WAR ON U-BOATS



THE NEW SCIENCE OF ELECTRONICS

has profoundly changed the art of war. Our forces fight today with electronic weapons of incredible power, speed, precision. It is satisfying to the men of Radio to know that these weapons—borne of their knowledge and skill—have proved so successful on every battlefront where our boys, planes, tanks and ships have come to grips with the enemy.

The revelations concerning RADAR and its part in the war came as no surprise to those whose job is to supply our fighting forces with modern electronic equipment. Since before Pearl Harbor these Americans have been working shoulder to shoulder with our armed forces in applying the power of electronics to the art of war. Out of this united effort have come fighting weapons never before known—on land, at sea or in the air. In this pioneering work it has been National Union's privilege to play a progressively increasing part. A greater National Union has been built to cope with vastly larger responsibilities. Today, National Union is ready to consult with and assist other manufacturers in the use of electronic tubes. Tomorrow, when peace comes—when the industrial usage of electronics gets the green light—engineers and production men will find at National Union unexcelled service and cooperation in perfecting new electronic applications for the production, testing and packaging of their products.

NATIONAL UNION RADIO CORPORATION • NEWARK, N. J. • LANSDALE, PA.

NATIONAL UNION

RADIO AND ELECTRONIC TUBES

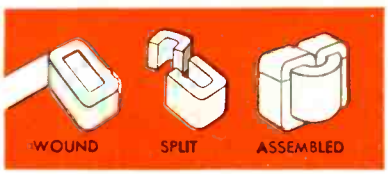
Transmitting Tubes. Cathode Ray Tubes. Receiving Tubes. Special Purpose Tubes. Condensers. Volume Controls. Photo Electric Cells. Exciter Lamps. Panel Lamps. Flashlight Bulbs.

FOR MORE ELECTRONIC WEAPONS FASTER

Simplify Transformer Assembly

with HIPERSIL* two-piece cores

Hipersil cores eliminate hard-to-handle little transformer laminations. Made from a new magnetic steel that has ⅓ more flux-carrying capacity . . . they are wound from *one strip* and then split in two pieces.



This split-core construction saves valuable man-hours because there are only 2 or 4 pieces to assemble around the windings.

Hipersil cores offer hitherto unavailable improvements to manufacturers of radio transformers, relays, reactors, chokes and loading coils. For example:

SMALLER SIZE . . . ideal for airplanes, tanks, "walkie-talkie" sets, etc.

LIGHTER WEIGHT. Because of better magnetic properties, Hipersil saves 30 to 50% in weight . . . particularly important in aircraft and portable equipment.

WIDER RANGE OF LINEAR RESPONSE. Knee of the saturation curve for Hipersil is higher than for ordinary silicon steel. It gives approximately ⅓ greater straight-line response for winding and core cross section.

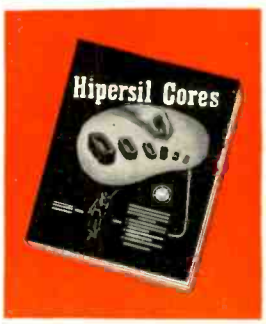
Ask your Westinghouse representative about standard Hipersil core sizes now available for war production.

*Registered Trade-mark, Westinghouse Electric & Mfg. Co., for HIgh PERmeability SILicon steel.

GET THE FACTS ABOUT HIPERSIL

Write for B-3223, a data book crammed with application and performance facts about Hipersil. Address: Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

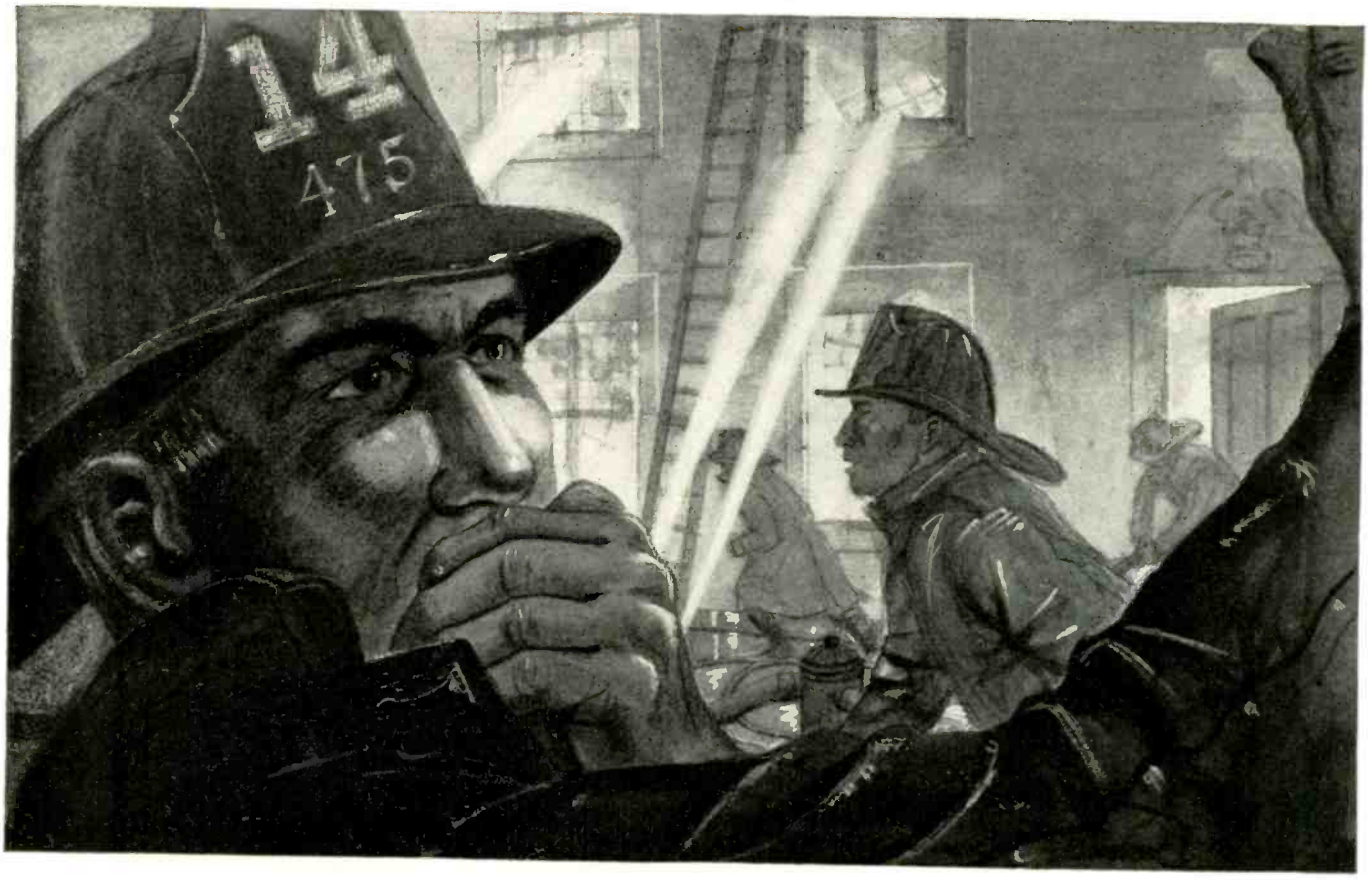
J-70408



Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

HIPERSIL



For tough assignments

Above the din of engine motors and excited spectators, a Fire Chief directs his men. The microphone in his hand has a tough assignment. Upon its ability to transmit clear, undistorted orders, free from extraneous noises, depends much of the action of the fire-fighters.

Some day the standard equipment of all fire departments will probably include Electro-Voice Microphones specifically designed for such applications. Right now, however, these new developments, like your boy, are away from home . . . in the thick of battle.

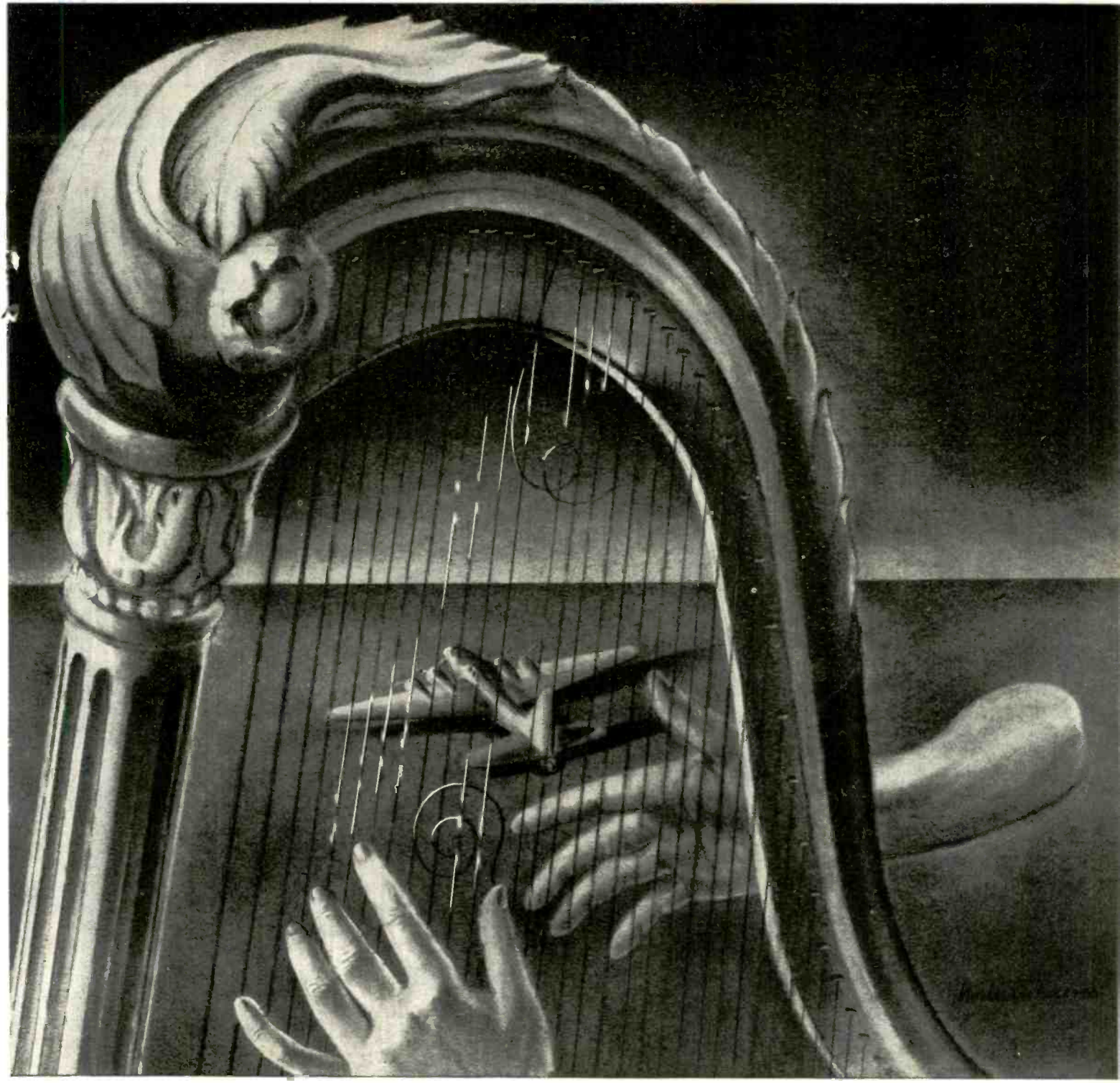
Meanwhile, if your limited quantity needs may be filled by any of our Standard Model Microphones, with or without minor modifications, we suggest that you contact your local radio parts distributor. His knowledge of our products will be of invaluable aid in helping you to solve your problems. He can also be a vital factor in expediting your smaller orders.

. . . Any model Electro-Voice Microphone may be submitted to your local supplier for TEST and REPAIR at our factory.

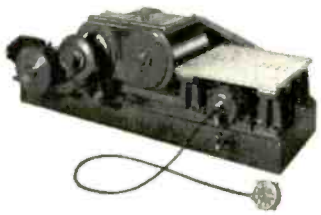
Electro-Voice MICROPHONES

ELECTRO-VOICE MANUFACTURING CO., INC.

1239 SOUTH BEND AVENUE, SOUTH BEND, INDIANA



VIBRATIONS WILL BREAK A HARP STRING AND GROUND A BOMBER



TWO OF OUR NEW
JOHNSON
VIBRATION MACHINES

For producing Horizontal, Vertical, circular motion.

Vibration Machine VMJ2H Horizontal motion, frequencies up to 6,000 CPM. Loads 100 to 150 lbs. Accelerations to 12G.

Vibration Machine VMJ3C Circular translatory motion, 45° plane, vertical or horizontal mounting. Frequencies up to 3,000 CPM.

The effects of resonant vibrations cannot be computed. They can be determined only by "break-down" test.

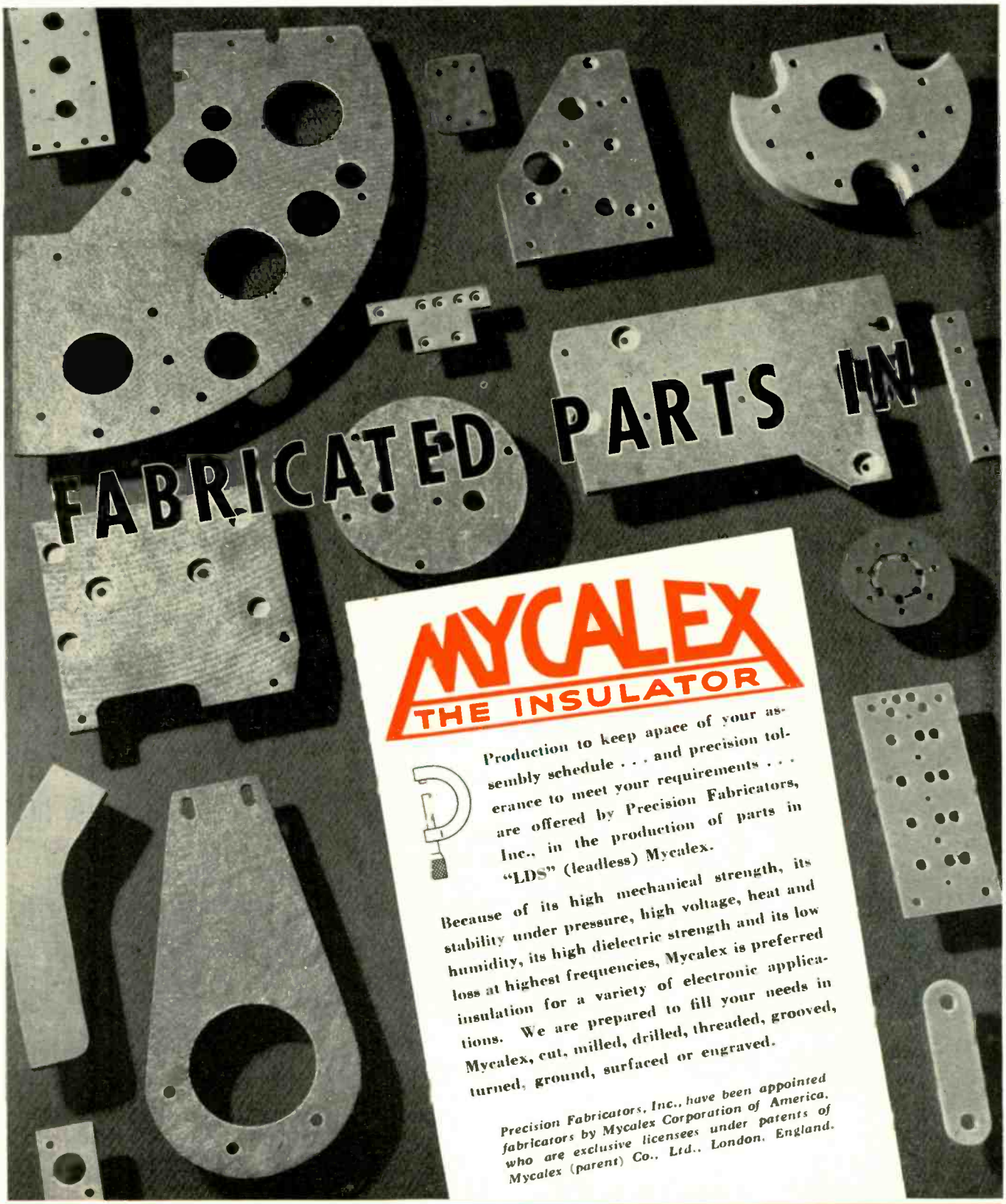
For the testing of instruments, radios, tubes, communications, armaments and parts, Waugh Laboratories offers a wide choice of equipment. Their Mechanical Oscillators range from low frequency high amplitude machines to machines of low amplitude and extremely high frequencies.

These equipments are for SALE or RENT. Write for descriptive booklets.

Waugh Laboratories field service, if desired, also is available on a per diem *basis.*

WAUGH *Laboratories*

PACIFIC COAST BRANCH: 180 EAST CALIFORNIA STREET, PASADENA, CALIFORNIA • 420 LEXINGTON AVENUE, NEW YORK CITY



MYCALEX
THE INSULATOR

Production to keep apace of your assembly schedule . . . and precision tolerance to meet your requirements . . . are offered by Precision Fabricators, Inc., in the production of parts in "LDS" (leadless) Mycalex.

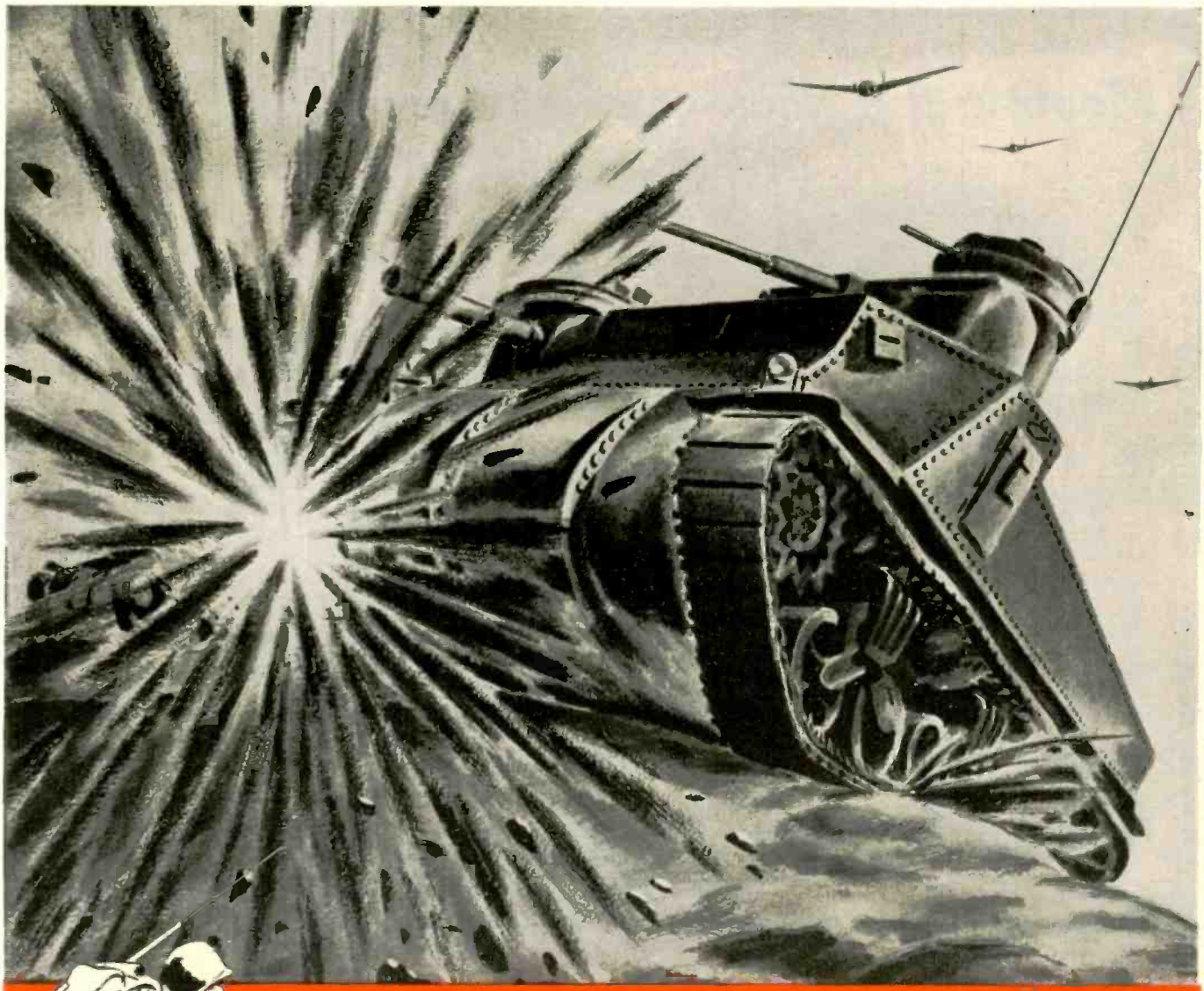
Because of its high mechanical strength, its stability under pressure, high voltage, heat and humidity, its high dielectric strength and its low loss at highest frequencies, Mycalex is preferred insulation for a variety of electronic applications. We are prepared to fill your needs in Mycalex, cut, milled, drilled, threaded, grooved, turned, ground, surfaced or engraved.

Precision Fabricators, Inc., have been appointed fabricators by Mycalex Corporation of America, who are exclusive licensees under patents of Mycalex (parent) Co., Ltd., London, England.

PRECISION *Fabricators* INC.

120 NORTH FITZHUGH ST., ROCHESTER, N.Y. • NEW YORK OFFICE: 369 LEXINGTON AVE.

SPECIFICATION FABRICATORS OF MYCALEX ★ PHENOL FIBRE ★
VULCANIZED FIBRE ★ RUBBER ★ ASBESTOS AND OTHER MATERIALS



"that darned walkie-talkie S-S-STUTTERED"

Stutterers don't give commands in the Signal Corps. In the stress of battle you can't have a man who stammers. Neither can you have equipment that will fail at the critical moment. Not when seconds mean the difference between success or failure in battle.

With men's lives at stake, you can't afford to use anything less than the best. When a design calls for Capacitors, specify C-Ds. Thirty-three years devoted to the exclusive manufacture of capacitors is your assurance of absolute reliability. Our Engineering department will be glad to cooperate with you. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

DYKANOL FILTER CAPACITORS

Type TQ

The Type TQ Dykanol Filter Capacitors have been designed for low power transmitters, high power public address systems and portable power amplifiers. Several of the more important features are listed below:

Impregnated and filled with Dykanol—a non-inflammable, high dielectric impregnant of stable characteristics.

Dried, impregnated and filled under continuous vacuum.

Hermetically sealed—these Capacitors are not affected by moisture, time or temperature up to approximately 200° F.

Conservatively rated—can be safely operated continuously at 10% above rated voltage.

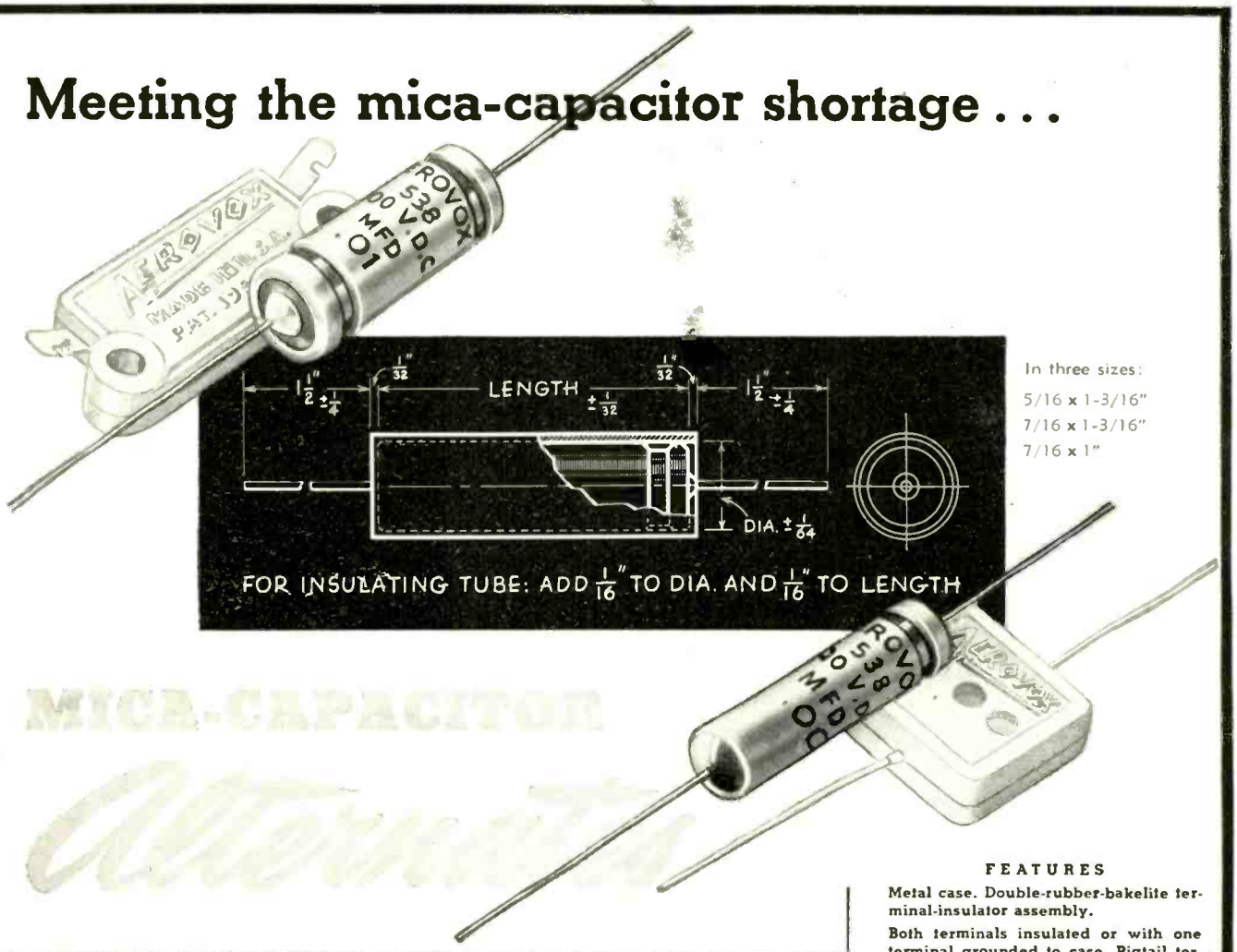
For further details write for Catalog No. 160T

Cornell-Dubilier capacitors

MORE IN USE TODAY THAN ANY OTHER MAKE.

MICA • DYKANOL • PAPER • WET AND DRY ELECTROLYTICS

Meeting the mica-capacitor shortage . . .



In three sizes:
5/16 x 1-3/16"
7/16 x 1-3/16"
7/16 x 1"

• An alternate choice for those hard-to-get mica capacitors in most applications—that was the problem put up to Aerovox engineers.

Various applications were studied. Voltages, capacitances, frequencies, power factor—these and other factors were considered along with dimensional limitations, after the manner of A.A.E.* Out of it all evolved this new Aerovox Type 38 mica-capacitor alternate now in production.

Here is a miniature oil-filled metal-case tubular. Ideal for assemblies where both space and weight are at absolute minimum. Requires no more space than mica capacitor it replaces. Conservatively rated. No skimping of insulation or oil-fill despite minute dimensions (see drawing). Meets all standard specifications for paper-dielectric capacitors used as mica alternates. (See brief specifications)

Type 38 mica-capacitor alternate is but one of several new wartime capacitors described and listed in our latest Capacitor Catalog. Write on business letterhead for your registered copy.

*Aerovox Application Engineering.

FEATURES

Metal case. Double-rubber-bakelite terminal-insulator assembly.

Both terminals insulated or with one terminal grounded to case. Pigtail terminals.

Normally without outer sleeve. Can be had with insulated sleeve, adding 1/16" to diameter and length. Note dimensional drawing.

Vegetable (Hyvol) or mineral oil impregnant and fill.

300 to 800 v. D.C.W. Capacities of .001 to .01 mfd.

Capacitance tolerances up to but not including .01 mfd. —20% +50%; .01 mfd. —10% +40%.

OUR WAR EFFORT

From January 1941 to December 1942, Aerovox . . .

- Stepped up production output 500% for our armed forces.
- Increased production floor space 300%.
- Sought, hired, trained and put to work additional workers—a 300% increase in productive personnel.
- Opened second plant in Taunton, bringing work to available workers there.
- And—doing more and more; growing week by week!

AEROVOX Capacitors

INDIVIDUALLY TESTED

AEROVOX CORPORATION, NEW BEDFORD, MASS., U. S. A. • SALES OFFICES IN ALL PRINCIPAL CITIES
Export: 100 VARICK ST., N. Y. C. • Cable: 'ARLAB' • In Canada: AEROVOX CANADA LTD., HAMILTON, ONT.

LOOK WHAT THIS hp INSTRUMENT can do for you

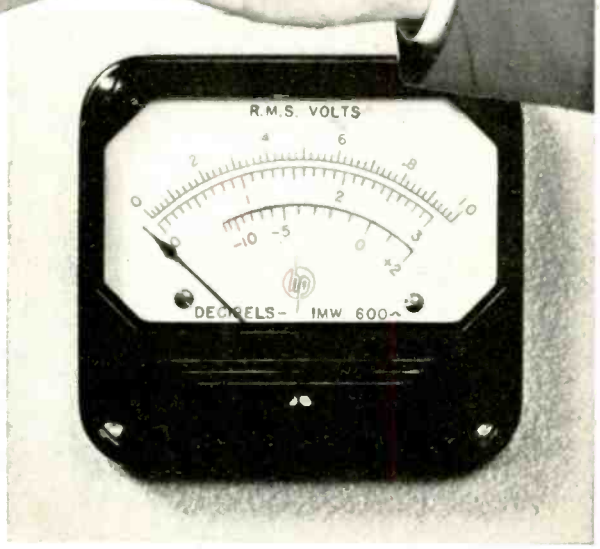
Meet the Requirements of the Most Exacting A. F. Production Test Problem. Combined with an *-hp-* resistance tuned Oscillator all of the measurements usually required on audio equipment can be made quickly and accurately with a minimum of additional equipment.

Measure Total Harmonic Distortion at Nine Specific Frequencies. The Model 325B is designed to measure total harmonic distortion at the nine specific frequencies recommended by the FCC for measurements on frequency modulation as well as amplitude modulation equipment. On special order, filters for other frequencies from 30 cps to 20 KC can be supplied. The amplifier and voltmeter section is flat from 10 cps to 100 KC so that harmonics as high as the 5th of 20 KC will be correctly indicated.

Measure Noise and Hum Level in A. F. Equipment. Sufficient sensitivity is available in the Model 325B to measure noise and hum level in audio frequency equipment such as amplifiers and broadcast equipment. With the addition of a detector, distortion and noise level can be measured in carrier output of transmitting equipment.

Use It as a Vacuum Tube Voltmeter. The instrument can be used as a voltmeter for measuring voltage level, power output, amplifier gain, and in making all of the other measurements for which a high impedance voltmeter with a wide frequency range is necessary.

The vacuum tube voltmeter section is a two stage amplifier with feedback to insure stable operation. It is identical with the Model 400A voltmeter except the frequency range is limited to 100 KC. The input amplifier of 325B can be used directly with the voltmeter section to give full scale indication on 3 MV



Voltmeter face. Note that voltage and D. B. are calibrated separately.

Use It as a High Gain Amplifier. Terminals at the meter output are provided for waveform observations with an oscilliscope and to allow the instrument to be used as a high gain amplifier. The overall gain is 75 DB from 10 cps to 100 KC.

Model 325B Noise and Distortion Analyser *is almost indispensable for laboratories or production tests in the audio frequency field. Many outstanding features are not mentioned here. Write for complete details today.*

HEWLETT-PACKARD CO.

STATION A, BOX 135U PALO ALTO, CALIFORNIA

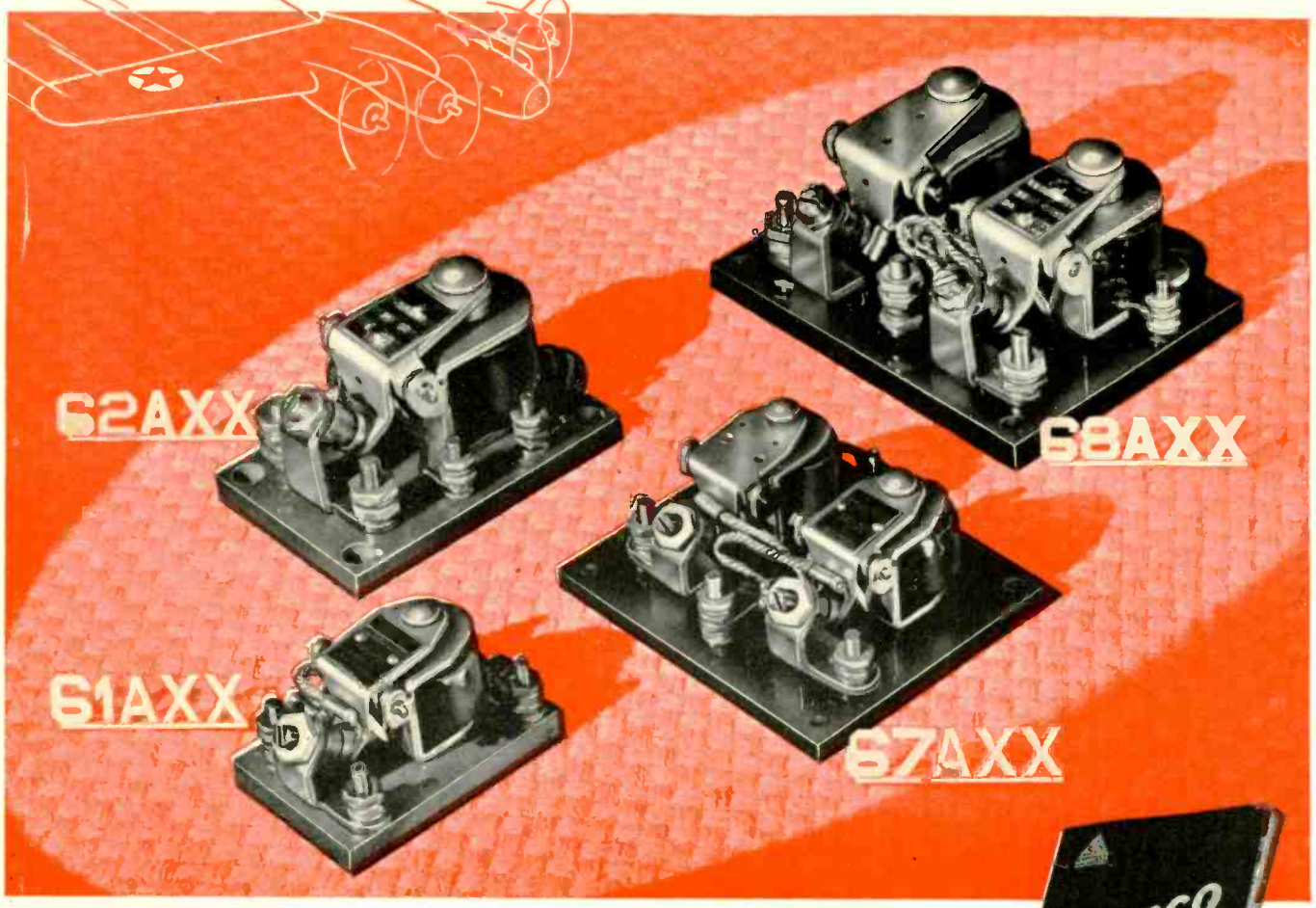
Dunco High-Inrush Load

RELAYS FOR AVIATION SERVICE

SHOCK-TESTED . . . VIBRATION-TESTED . . . ALTITUDE-TESTED

Relays to match the ultra-exacting requirements of aircraft service are nothing new to Struthers Dunn, Inc. We've been making them for years—and each year has seen the development of units to set higher and still higher standards of performance and dependability in this field.

Dunco Aviation Relays receive numerous exacting tests in addition to those ordinarily applied to industrial types. They must perform in rarefied air as encountered at highest altitudes. They must withstand torturing shock, vibration, and acceleration. Their contacts must make, carry, and break currents far greater than they will encounter in normal service. Some tests require thousands of amperes at 24 volts direct current. Typical units of less than 1⅓ lbs. are required to develop contact pressures comparable to those of industrial contactors weighing 100 lbs. or more. *They do not fail!*



HERE IS YOUR GUIDE TO RELAY SELECTION AND USE

Write for your copy of the Dunco Relay Catalog and Data Book. It contains complete information on relays, timers, and solenoids for a wide variety of applications, as well as helpful data on their proper selection and use.

STRUTHERS DUNN, Inc.

1321 ARCH STREET, PHILADELPHIA, PA.

DUNCO DISTRICT ENGINEERS IN 28 CITIES WILL HELP SOLVE YOUR RELAY-TIMER PROBLEMS

IT'S EASY FOR YOU TO DESIGN WITH

PYRANOL CAPACITORS

Because

YOU'LL find that G-E Pyranol* capacitors, especially because of their small size, are ideal for all built-in applications, such as in electronic devices, communications equipment, motors, control, transformers, and fluorescent-lamp ballasts.

The use of Pyranol as the treating material has made it possible to reduce physical size. Its use also makes these G-E capacitors far superior, in permanence and uniformity of characteristics, to those formerly available.

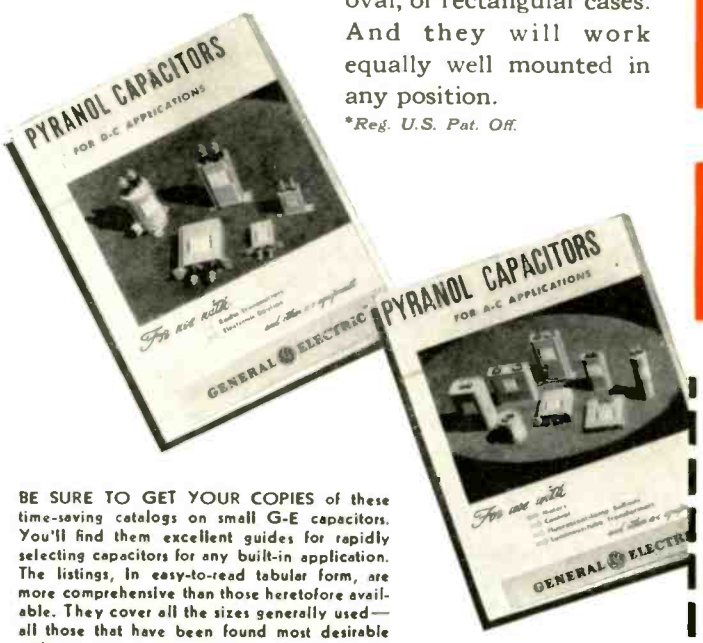
Many of the ratings are available in cylindrical, oval, or rectangular cases. And they will work equally well mounted in any position.

*Reg. U.S. Pat. Off.

1. They are small and compact

2. They can be mounted in any position

3. They are available in many shapes and sizes



BE SURE TO GET YOUR COPIES of these time-saving catalogs on small G-E capacitors. You'll find them excellent guides for rapidly selecting capacitors for any built-in application. The listings, in easy-to-read tabular form, are more comprehensive than those heretofore available. They cover all the sizes generally used—all those that have been found most desirable with respect to ratings and dimensions.

General Electric Company, Section B 407-52
Schenectady, N. Y.

Please send me complete information on small Pyranol capacitors for built-in applications.

☐ For D-c Applications (GEA-2621A)
☐ For A-c Applications (GEA-2027E)

Name .....

Company .....

Address .....

City ..... State .....

5700

GENERAL ELECTRIC

RADAR puts the finger on our enemies!

Hiding above the clouds there's a plane. Anti-aircraft guns let loose—down crashes the enemy bomber.

How can you hit enemies you can't see—through clouds, darkness and fog? The answer is Radar—radio detecting and ranging equipment.

How Radar does it

Radar sends out a wave which searches the sky or sea. When this beam hits a plane or ship, it bounces back to the Radar. Traveling with the speed of light, the beam makes this round trip in a few thousandths of a second and tells you . . . *there he is!*

You keep the Radar focussed on him. It tells you his direction, distance, speed, whether he's climbing or descending. Having this information, gunners direct their fire with deadly accuracy.

* * *

Radar is the result of the work of many research groups in this country and abroad. Bell Telephone Laboratories has played an important part in its development. Western Electric today is one of the world's largest manufacturers of Radar.

Western Electric
ARSENAL OF COMMUNICATIONS EQUIPMENT

As millions of controls are *Electronically* tested . . .

DuMONT CATHODE-RAY TUBES score over 5000 hours of trouble-free service

★ Hour after hour, day-in day-out, DuMont cathode-ray tubes check Clarostat controls coming off the production line. The single-dot trace meandering diagonally across the screen in response to resistance vs. rotation, provides "all the answers" at a glance for inspectors and engineers alike.

In several Clarostat-designed test positions, DuMont tubes check controls ranging from 1000 ohms to 10 megohms. Resistance curve, taper, hop-off, transition points or ink blends, flaws or cracks, possible noise sources, useful rotation — these are checked visually, positively, quickly; far better than with the usual earphone test.

In such service for several years past, DuMont tubes have already scored well over 5,000 hours each, and are still going strong, *without a single failure or replacement.* Compared with the 50-hour life expectancy of early tubes, this tells the story of a decade of remarkable engineering and production refinement, as well as the exceptionally high vacuum of DuMont tubes.

Altogether a typical industrial application which, because of the hour-after-hour operation, provides convincing evidence of DuMont tube life. And especially significant today when such tubes are used for many *continuous-service* functions.

★ Write for literature

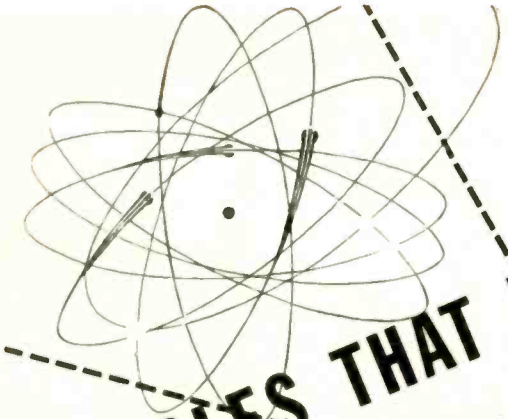
DUMONT

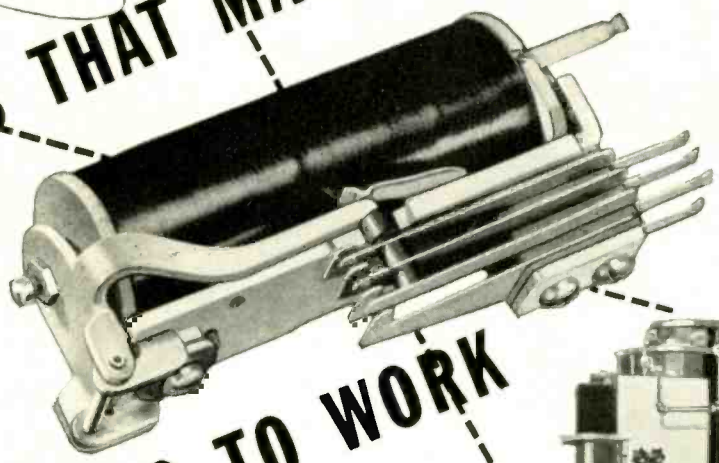
ALLEN B. DU MONT LABORATORIES, Inc.

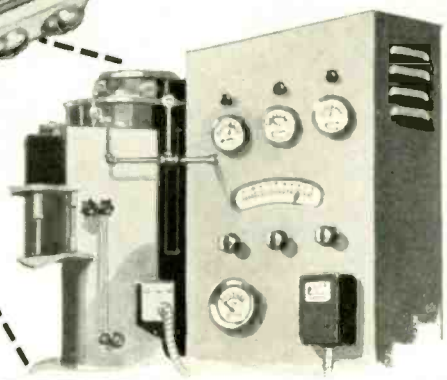
Passaic • New Jersey

Cable Address: Wespexlin, New York

MUSCLES THAT MAKE ELECTRONS GO TO WORK







To capture the power of the electron—to make it behave and do a specific job—often requires control devices which must be carefully selected and precisely engineered to fit the conditions of the problem.

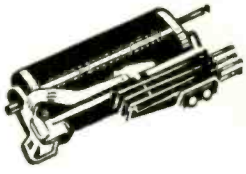
Automatic Electric relays and stepping switches, by bridging the gap between the electron tube and the job to be done, are helping to take new electronic ideas out of the laboratory and put them to practical use. They are the "muscles" that make electrons go to work.

Automatic Electric field engineers are today working with the makers of electronic devices of every kind, offering time-saving suggestions for the selection of the right control apparatus for each job—and extending the benefit of the technique which comes from fifty years of experience in electrical control applications. As a result, Automatic Electric controls are finding increasing use both in the implements of war, and in the plants where war products are made.

If you have an electrical control problem—whether electronic or not—first, be sure you get the Automatic Electric catalog. Then, if you would like competent help in selecting the right combination to meet your need, call in our field engineer. His recommendations will save time and money.

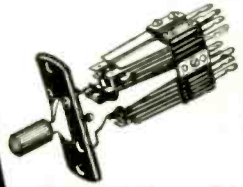
AMERICAN AUTOMATIC ELECTRIC SALES COMPANY
1033 West Van Buren St.
Chicago, Ill.

The Automatic Electric line of control devices includes:



RELAYS—A complete range of light and heavy duty types, for operation on a-c or d-c power, and with endless coil and contact combinations.

STEPPING SWITCHES—magnet driven selector switches for automatic or directed selection of circuit channels, in capacities of 10 to 100 circuits.



LEVER KEYS—Locking and non-locking types in any desired contact combination, for manual switching of control or communication circuits.

The Automatic Electric catalog of control apparatus includes also a complete listing of control accessories, such as solenoids, counters, jacks, plugs, impulse senders, lamp and target signals, etc. Write for your copy.

Relays AND OTHER CONTROL DEVICES by AUTOMATIC ELECTRIC

MUSCLES FOR  **THE MIRACLES OF ELECTRONICS**

Keep that Fight in Your TURNER Mike

carl e. graham
1224 hemsdale n.w.
canton, ohio
phone 3-5579

April 3rd

The Turner Co.
Cedar Rapids, Iowa

Gentlemen:

I donated a P. A. system for use during a Greek Benefit show, held in Loews' theatre before 2500 persons and after what happened, I wonder who received the most benefit--Greece, or the Turner Co.

22-D microphone, serial #7687, purchased last Saturday, the day of the benefit, was knocked into the orchestra pit by the first act, with 19 more acts to follow.

It caromed off a musician's head, which, in itself, is enough to wreck anything, then disappeared thru the door leading to the basement.

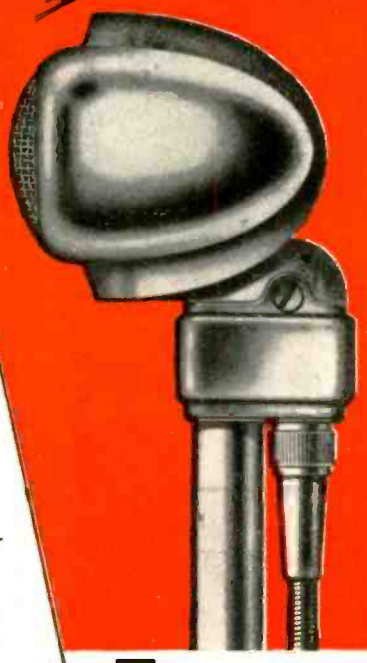
When returned to the stage, and found to be in working order, the M. C. not only gave me a plug, but, stopped the show and told everyone that the mike was a Turner Dynamic, etc. and where to buy it.

I tried to smooth out the damage done to the bezel and grill, but am returning the unit; replace the bezel and you might check the unit, although it seems to be all right.

C. O. D. it when returning and, if possible, rush it.

Very truly yours,

Carl E. Graham



TURNER
Model 22-D

Turn to Turner---for a Mike with "Built-In" Fight

Whatever your need for a Microphone, you can be sure of complete satisfaction under any acoustic or climatic condition when you specify Turner. Thousands of satisfied users can vouch for the rugged construction, the accurate response and superb performance of Turner Microphones under the toughest usage.

Today's Turner Microphones are being used for vital war communications, in War Plants, Airdromes, Ordnance Plants, Docks, Army Camps, Broadcasting Studios, Police Transmitters and other highly sensitive spots where accuracy is essential. IF YOU HAVE A HIGH PRIORITY RATING, you can still buy Turner Microphones. Write today, explaining your problem, and we will help you select the Turner unit best suited to your needs.

The Turner Company
CEDAR RAPIDS, IOWA

GET THIS *free* TURNER CATALOG

. . . Write now to obtain your Free copy of Turner's new 8-page, fully illustrated, colorful Microphone Catalog. Select the one you need, at the price you want to pay.

Turner Crystal Microphones licensed under patents of the Brush Development Co.

NOSE TO THE GRINDSTONE

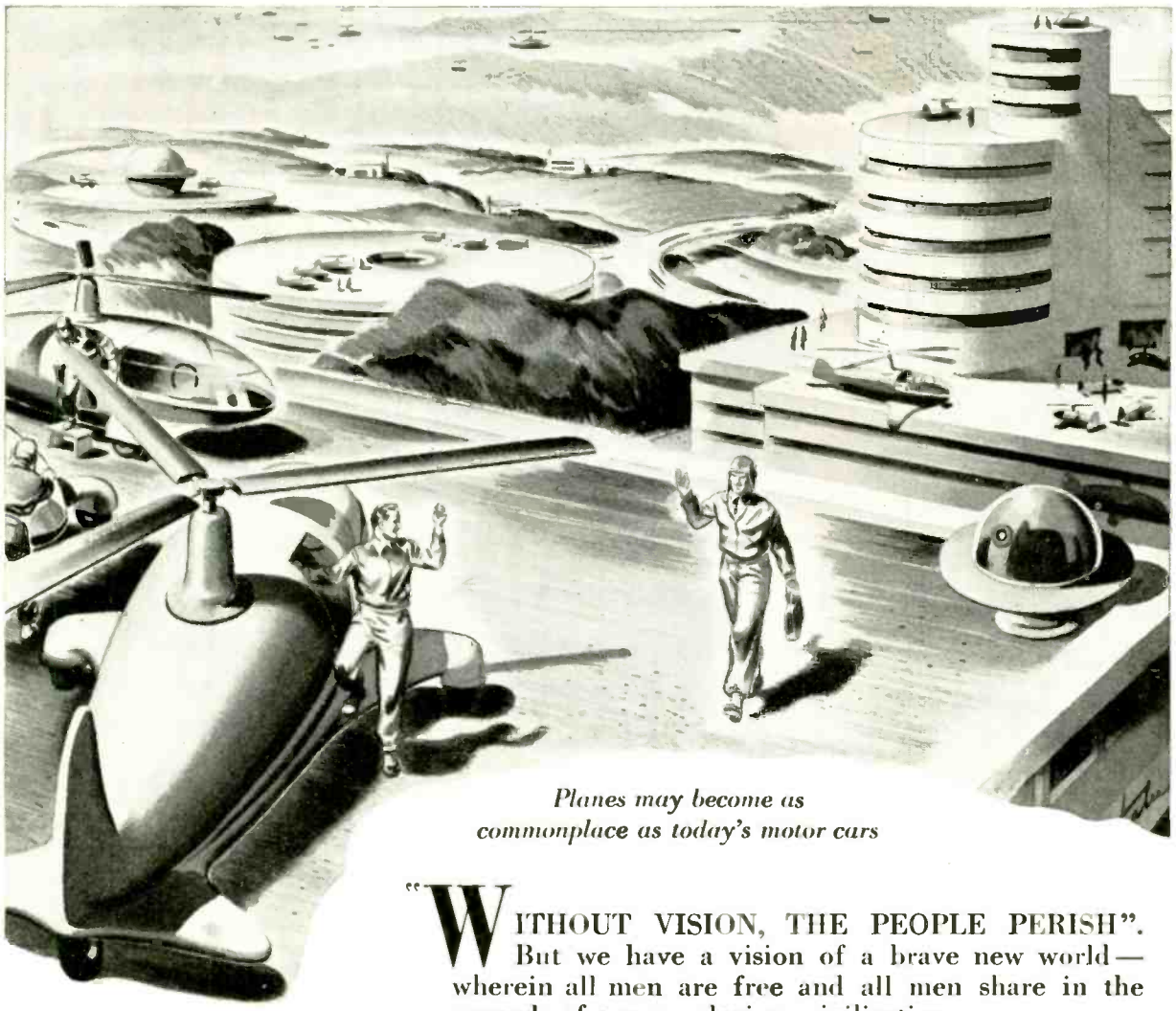
"Our noses are held to the grindstone of war production . . . but our eyes are fixed on the future." This is how one Stancor engineer described our present operating policy.

War problems are urgent, challenging, and stimulating. To solve them calls for midnight oil; but the lessons learned and discoveries made apply also to the problems of peace. When the war is won, industry will be confronted by a revolutionary development of electronic engineering . . . and Stancor engineers, seasoned by war demands, will be ready to serve you.

STANCOR

STANDARD TRANSFORMER CORPORATION
1500 NORTH HALSTED STREET · CHICAGO

SALUTE TO THE WORKERS OF TOMORROW!



Planes may become as commonplace as today's motor cars

"WITHOUT VISION, THE PEOPLE PERISH". But we have a vision of a brave new world—wherein all men are free and all men share in the rewards of a more glorious civilization.

What the face of this world will be like, none can know. Will factories be of revolutionary design—lighted by the health rays of artificial sunlight? Will the workers travel to and fro in their own planes—with ample leisure for education and relaxation?

This much we know. Out of modern, forward-looking industries such as Small Electric Motors (Canada) Limited, will come electrical equipment, for ships and planes, for factories and homes, of revolutionary design.

For here is a new company in Canada—with new ideas and ideals. Now engaged solely in original designing and precision making of essential war equipment, Small Electric Motors (Canada) Limited looks confidently to a brilliant post-war future.

DESIGNERS
AND MANUFACTURERS

of all types of precision electrical apparatus including

D.C. & A.C. Motors for specialized purposes
Aircraft Generators
Aircraft Engine Starters
Alternators
Motor Generators
Electric Pumps
Motors with Governors
Gyros, etc.

Small Electric Motors (Canada) Limited

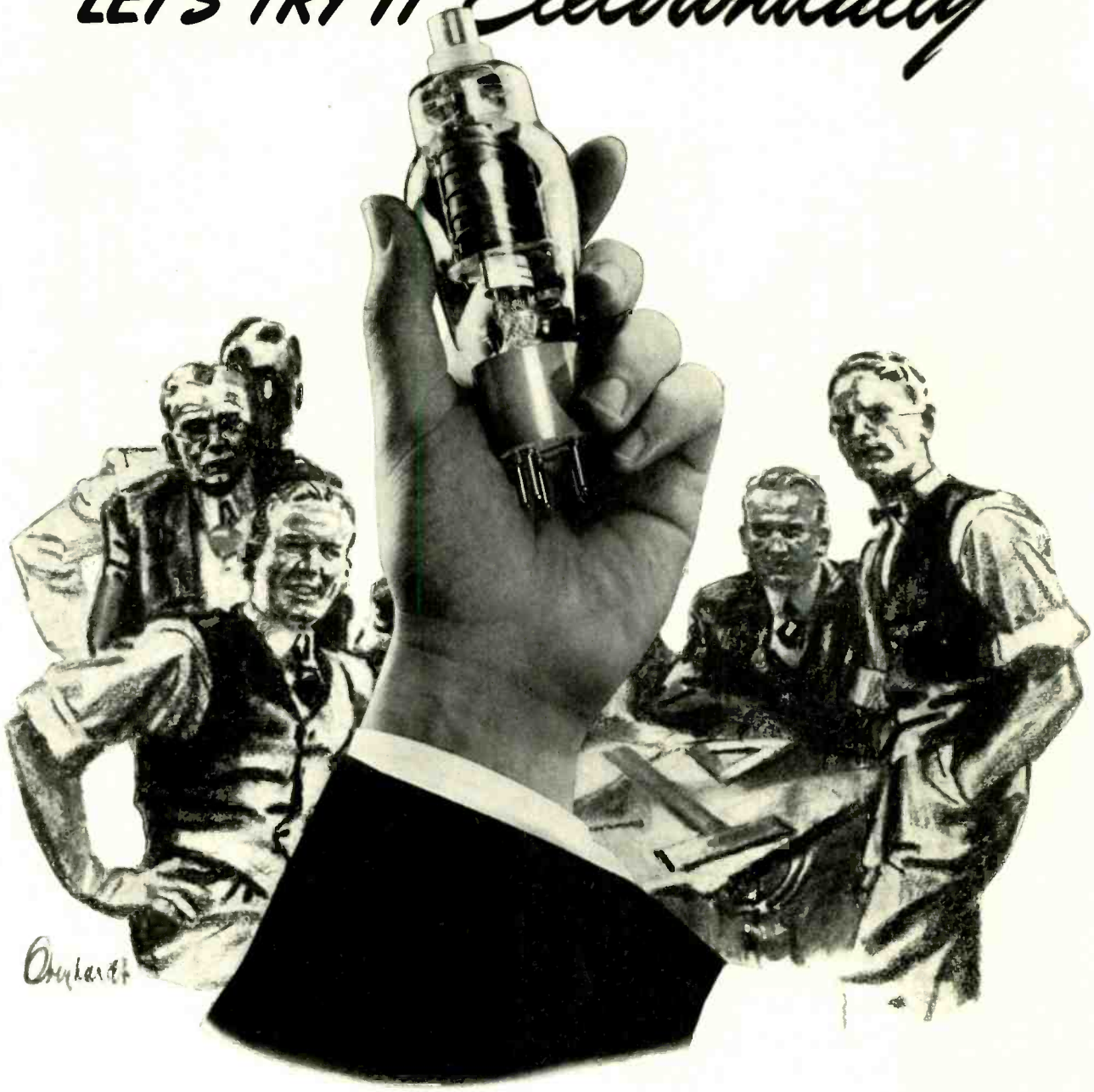
and its subsidiary

Semco Instruments Limited

1-43

LEASIDE • TORONTO 12 • CANADA

"LET'S TRY IT *Electronically*"



It is surprising how frequently electronics are mentioned when new products are being planned.

Those who are in a position to see the accomplishments of electronics in the war, can appreciate how this science is bound to affect our post-war world. The added flexibility and scope that electronics impart to many products gives them new and wider horizons. Today no product planning is complete without consideration of electronics.

Here at TUNG-SOL we see our post-war job as adapting to peacetime uses the many transmitting, receiving and amplifying tubes developed for war.

The services of our staff of research engineers are at the disposal of manufacturers who intend to employ electronics. When you want to "Try it electronically" TUNG-SOL is ready to help you.

TUNG-SOL
vibration-tested
RADIO TUBES

TUNG-SOL LAMP WORKS INC., NEWARK, N. J., *Sales Offices:* ATLANTA, CHICAGO, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK
ALSO MANUFACTURERS OF MINIATURE INCANDESCENT LAMPS, ALL-GLASS SEALED BEAM HEADLIGHT LAMPS AND THERMAL SWITCHES

EVERY MINUTE *Counts!*

PRODUCTION LINES MUST NOT SLOW DOWN!

Lafayette Radio is strategically located to give you *quick* deliveries on radio and electronic parts and equipment. Millions of items have been shipped from Chicago, the shipping hub of the nation, to industrials, training schools and all branches of the armed services. Lafayette's procurement and expediting service has helped to prevent work stoppages on many vital war production lines.

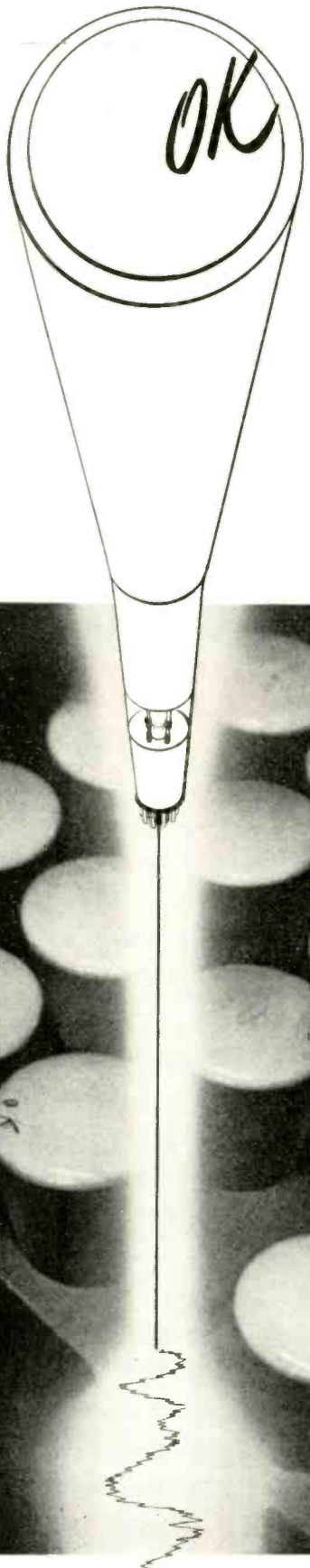
Many instances are on record wherein Lafayette has made immediate delivery on hard-to-find key items, eliminating costly delays in giant armament programs. This is because Lafayette handles the products of every nationally known manufacturer in the radio and electronic field. A single order to Lafayette, no matter how large or how small, will bring prompt delivery of *all* your requirements.

Free — 130 page Catalog — "Radio and Electronic Parts and Equipment." Write 901 W. Jackson, Chicago, Ill. Dept. 6J3

LAFAYETTE
RADIO CORP.
CHICAGO

★ ★ ★ ★ ★ ★ ★

"Quick Delivery of Radio and Electronic Parts and Equipment"



FOR THE BIGGEST JOB IN THE WORLD!

WHETHER it's a simple strand of wire or a cathode ray tube, we at Philips have only one standard that merits the O. K. of our electronics engineering experts. That standard is perfection.

Today, our O. K.'s contribute towards the biggest job in the world. Today, Victory is our primary and exclusive concern.

* * *

Manufacturers for Victory—Cathode Ray Tubes; Amplifier Tubes; Rectifier Tubes; Transmitting Tubes; Electronic Test Equipment; Oscillator Plates; Tungsten and Molybdenum in powder, rod, wire and sheet form; Tungsten Alloys; Fine Wire of all drawable metals: bare, plated and enameled; Diamond Dies.

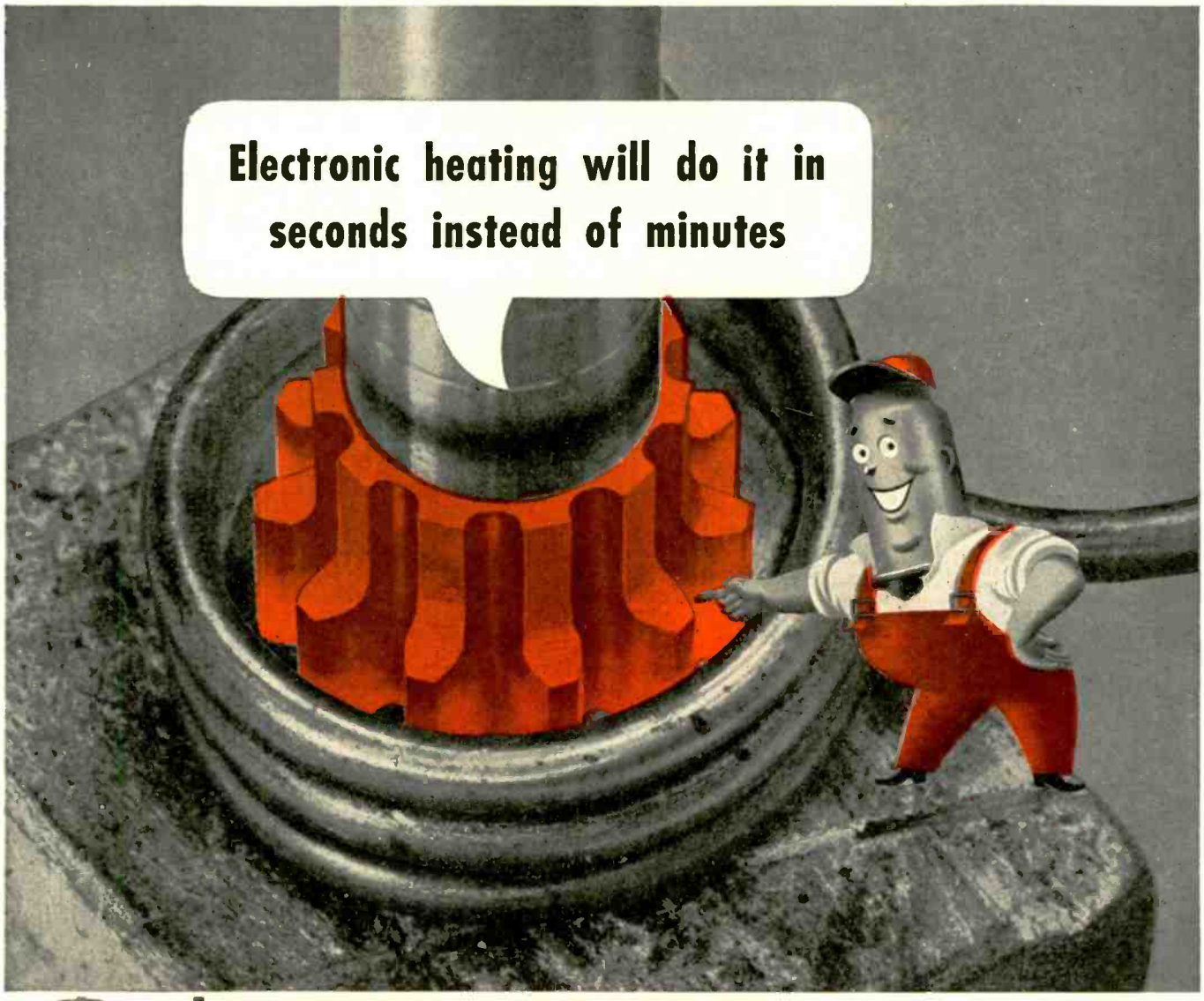
X-Ray Apparatus for industrial, research and medical applications. (Philips Metalix Corporation.)

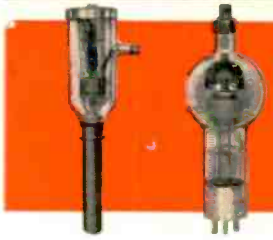
NORTH AMERICAN PHILIPS COMPANY, INC.

Electronic Research and Development

Factories in Dobbs Ferry, N.Y.; Mount Vernon, N.Y. (Philips Metalix Corp.); Lewiston, Maine (Elmet Division)

Electronic heating will do it in seconds instead of minutes





Two electronic tubes, the G-E phanotron and the G-E pliotron, supply the high-frequency waves used in electronic heating.

BY ELECTRONIC heating, small gears can now be case-hardened to a predetermined depth in a few seconds. The hardness pattern may be rigidly controlled as to shape and size. The whole rim of teeth, the tooth tips or the tips and sides of the teeth may be hardened as desired.

In other electronic heating applications, a metal rod is brazed to its metal bushings and terminals in 11 seconds . . . in another, a metal shell is soldered to its base in 3 seconds . . . and in a third case, a glass tube is fused to a metal base in airtight, permanent bond in 20 seconds. Scores of new wartime uses are showing the advantages of uninterrupted operation, high speed, and quality production.

G-E electronic tubes have two functions in electronic heating. The G-E phanotron supplies the direct current. The G-E pliotron converts this current to high-frequency waves and creates the heating field.

This field may be localized . . . precisely controlled as to amount, direction, or area limit. Few heating methods offer industry such flexibility, accuracy and uniform results.

It is the purpose of the G-E electronic tube engineers to aid any manufacturer of electronic devices in the application of tubes. General Electric, through its nation-wide distribution system, is also prepared to supply users of electronic devices with replacement tubes.

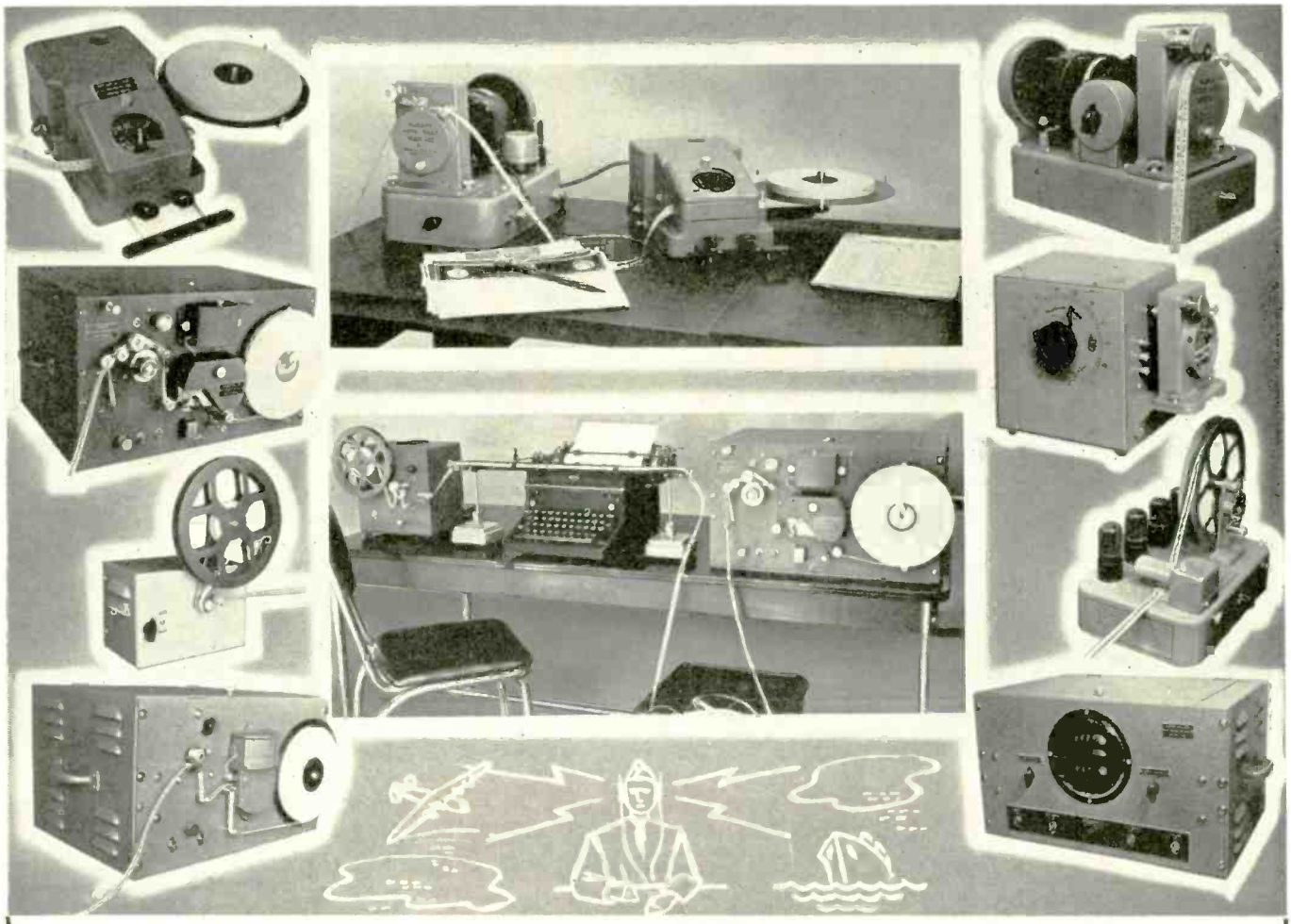
Also, we will be glad to place interested men in your plant on our mailing list. For example, we will send a full-color spectrum chart showing electronic tubes and applications. Write on company letterhead. *Electronics Dept., General Electric, Schenectady, New York.*

On Sunday evening listen to the General Electric Mazda Lamp program over the N. B. C. network. See newspapers for time and station.

GENERAL ELECTRIC

162-86-8850

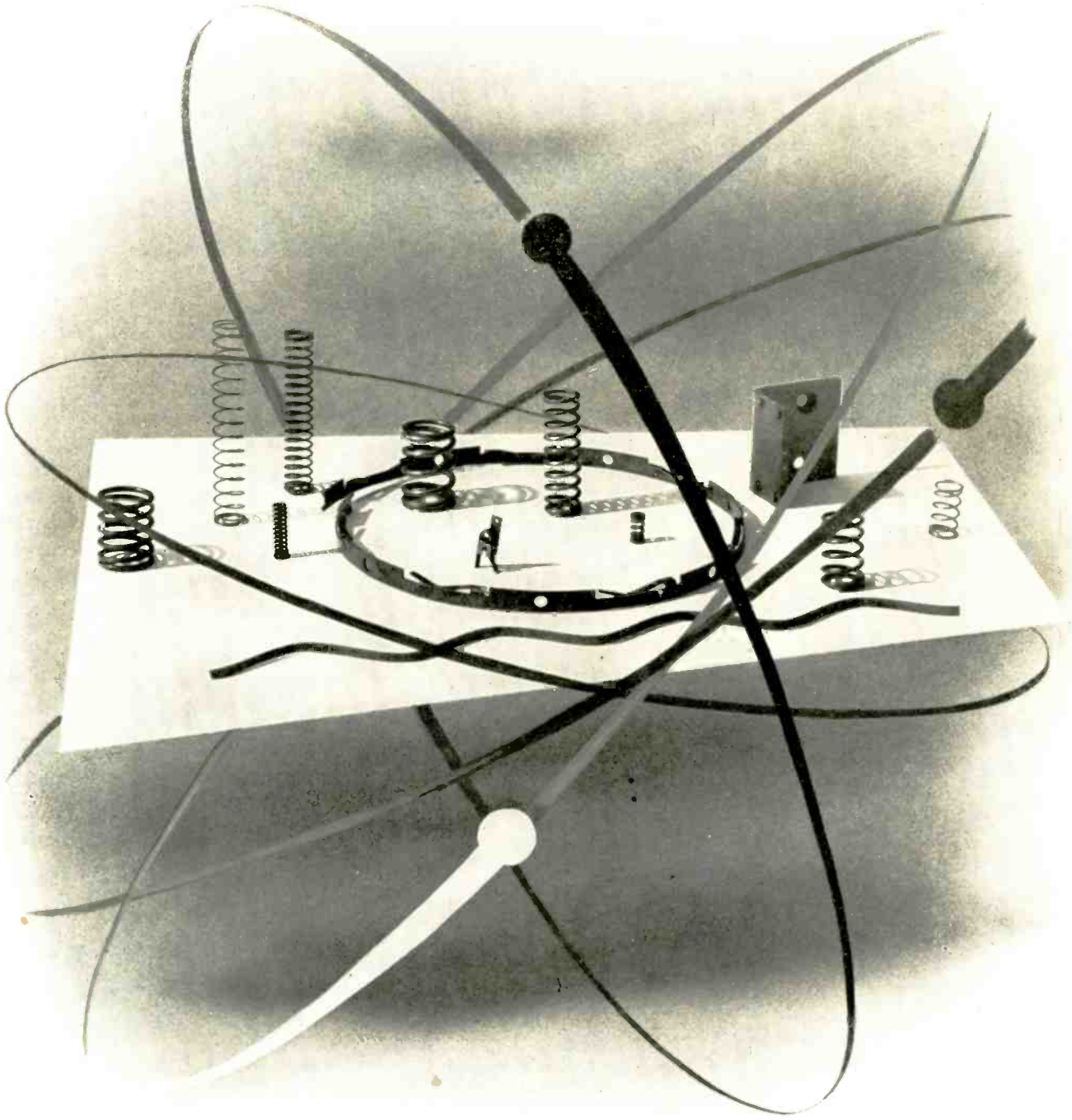
OUT OF INQUIRING MINDS AND PROGRESSIVE SPIRITS...



Led by Ted McElroy, undisputed authority in the world of wireless communications, our corps of creative telegraphic engineers have produced, and are producing, a bumper crop of equipment for the transmission and reception of dots-and-dashes. Out of their inquiring minds and progressive spirits have come high speed transmitters for perforated tape, Wheatstone tape perforators, high speed recorders, photo tube units, radio beam keyers, high speed automatic radiotelegraph assemblies . . . and they're far from calling it a day.

Seemingly, McElroy engineers never sleep . . . they're constantly "on the search". McElroy men never copy and never imitate. Theirs is the job of creating . . . designing . . . building. If you have a problem in radio telegraphy, or an application incorporating electronic design, the services of these men are at your disposal.

McElroy MANUFACTURING CORPORATION
82 BROOKLINE AVENUE BOSTON, MASSACHUSETTS



Springs for an electronic world . . .

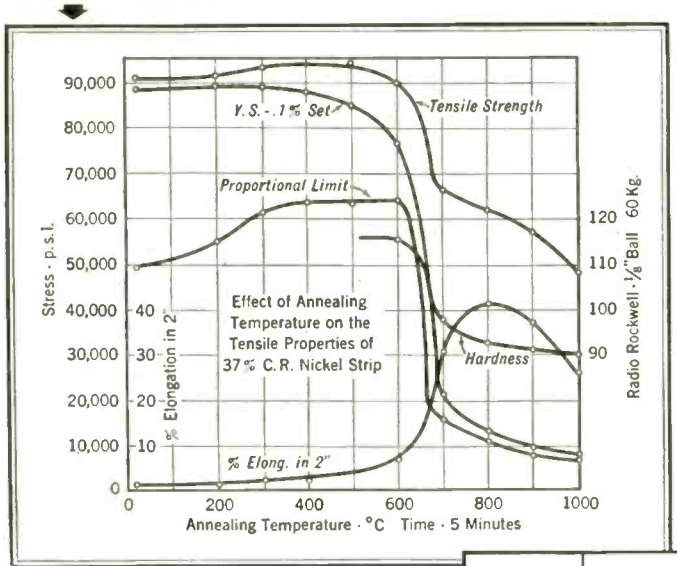
From basic design, through production in millions, Instrument Specialties Company is today re-defining spring usage in the electronic world . . . Unequalled performance characteristics are being obtained in Micro-processed springs by adding the unique abilities of a highly specialized organization to the inherent spring qualities of beryllium copper . . . nonmagnetic properties, corrosion resistance, strength, and high electrical conductivity . . . accomplishments possible only by "Micro-processing"; the elimination of drift and set, mass production to consistently close tolerances, and heat treatment for critical physical and electrical requirements. There is but one source for Micro-processed Beryllium Copper Coil and Flat Springs. . . . Dept. E-Z, INSTRUMENT SPECIALTIES COMPANY, Little Falls, New Jersey

RUGGED—

LIKE THE MEN WHO USE THEM

Radio transmitters and receivers are fine, sensitive instruments. • But they aren't delicate—at least not the ones in military service. • The terrific jolting and jarring received in tanks battling over desert terrain, and the tremendous strain encountered in bombers diving at enemy positions require radios that can really take it. And that's just what the U. S. Army Signal Corps and radio manufacturers have developed. • Such an achievement called for skillful design and construction, and *materials that can stand the gaff.* • Delicate elements in radio tubes are made of rugged, durable nickel. The following high mechanical properties of nickel account for its wide and successful use in tube elements.

STRENGTH AT ROOM TEMPERATURES—Strength properties of "A" Nickel can be altered over a wide range by rolling and annealing. However, for many radio applications a tensile strength of about 60,000 to 65,000 p.s.i. is desired in annealed nickel.



HIGH MODULUS OF ELASTICITY

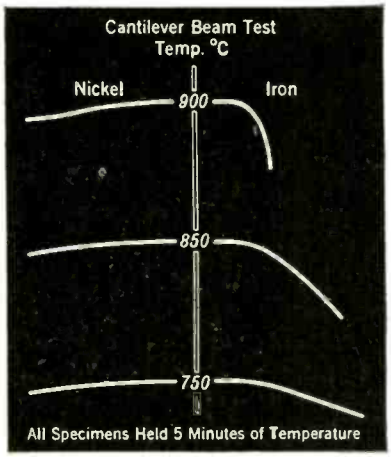
(A measure of rigidity or stiffness.)

Nickel's figure for tensile modulus (Young's) is 30,400,000 p.s.i. Assures minimum elastic displacement of tube elements. This, plus the high damping coefficient of nickel, aids in the war against microphonics.

•

STRENGTH AT HIGH TEMPERATURES

Tube parts of "A" Nickel give excellent results because of their strength at continuous elevated temperatures and withstand bombarding temperatures amazingly well.



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STRENGTH AT ARCTIC TEMPERATURES

As temperatures fall, nickel increases in strength, but unlike many ferrous metals, does *not* lose its normal ductility and toughness as measured by Charpy impact tests.

For additional information and copy of the new booklet "The Properties of Pure Nickel," please write:

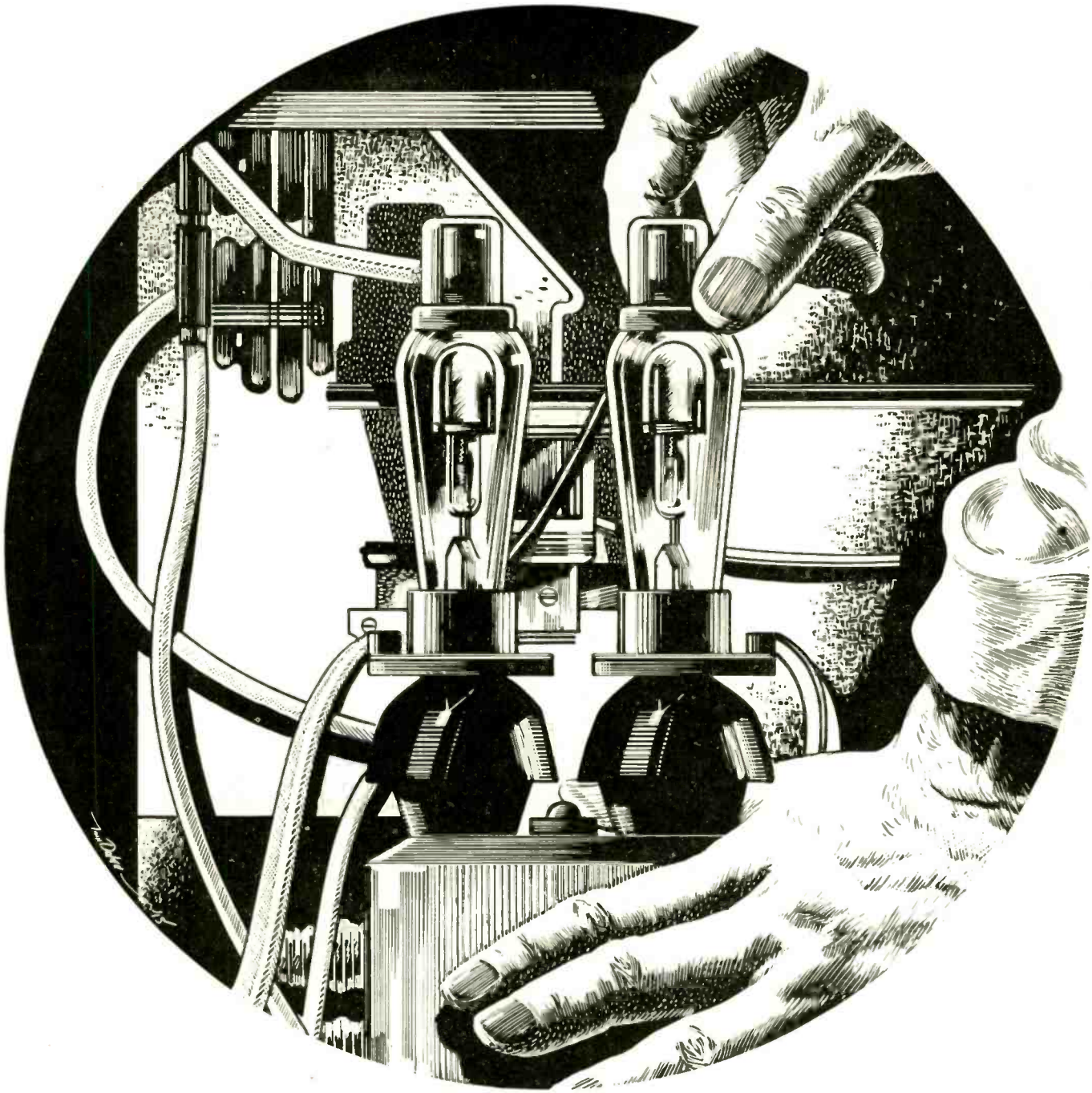
THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York, N. Y.

MATERIAL	Condition	Temperature °F.	Yield Strength 0.2% Offset psi.	Tensile Strength psi.	Elongation in 2 in. per cent	Reduction of Area per cent	Hardness Rockwell	Charpy Impact Strength ft.—lb.
NICKEL	Cold-drawn	Room	97,400	103,400	16.3	66.9	19C	204
		—110	101,800	112,300	21.5	60.9	22C	215

★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings



WHEN THE LAST SHOT IS FIRED!

. . . and industry resumes its peacetime production for civilian life . . . our boys will return to a better place to work . . . made possible by new uses for electronic tubes in highly efficient air-conditioning systems using the principle of electrical precipitation . . . New tube developments are almost a daily occurrence as Raytheon progresses in its wartime and postwar programs.

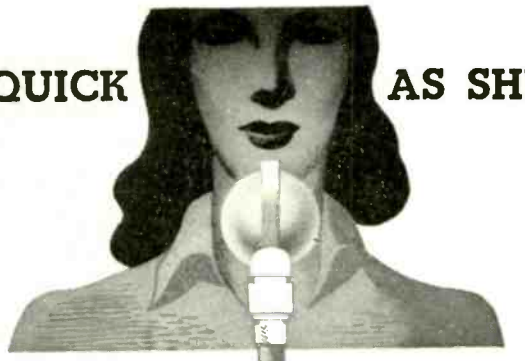
RAYTHEON

Raytheon Manufacturing Company

Waltham and Newton, Massachusetts

DEVOTED TO RESEARCH AND THE MANUFACTURE OF TUBES AND EQUIPMENT FOR THE NEW ERA OF ELECTRONICS

AS QUICK AS SHE CAN SAY JACK ROBINSON . . .



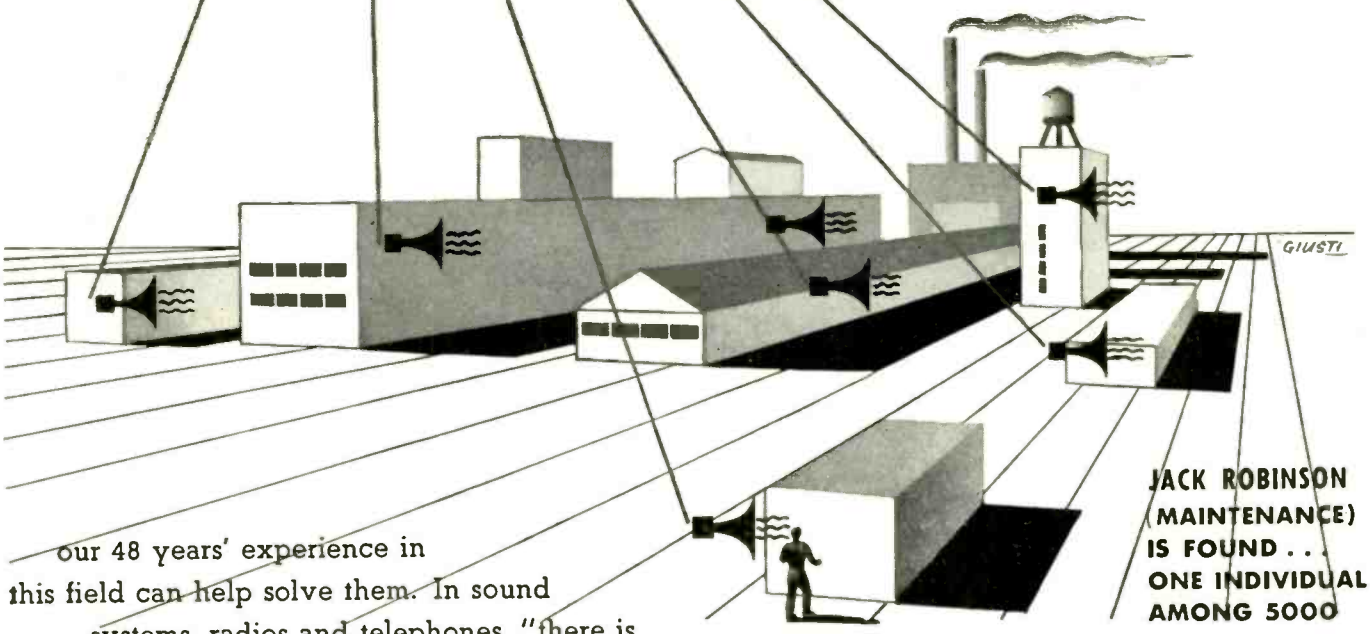
There's a break in the power line . . . and Jack Robinson is lost in the acres of machinery.

Yet he's found in a flash—thanks to Straight-Line Communication.

It's a shotgun that can't miss . . . it reaches individuals, groups, or the entire plant quickly, clearly.

But the amazing thing is that many modern plants still rely on time-wasting indirect methods of communication—despite the fact that paging by Straight-Line Communication does it better and quicker than by any other means. It more than pays for itself in a short period of time.

If your factory or plant has any communications problems whatever . . .



JACK ROBINSON (MAINTENANCE) IS FOUND . . . ONE INDIVIDUAL AMONG 5000

our 48 years' experience in this field can help solve them. In sound systems, radios and telephones, "there is nothing finer than a Stromberg-Carlson." Why not get in touch with the Sound Systems Division of the Stromberg-Carlson Company, 100 Carlson Road, Rochester, New York. Write for free booklet No. 1934.

STROMBERG-CARLSON

STRAIGHT-LINE COMMUNICATION SAVES MANPOWER • SPEEDS THE WORK TO VICTORY

Special Assembly Method — *showing single metal washer which facilitates protective coating against corrosion*

Standard Assembly Method—*showing conventional petal-shaped brass contact washer*

Now – if you are a manufacturer of electrical equipment for military use – we offer you a complete design and manufacturing service, producing Selenium Rectifier power supply units for use with your equipment.

And, if your production lines require D.C. power, we can design Selenium Rectifiers for any power range. Units available with either the widely used standard assembly or the new special assembly, coated for protection against marine and other high humidity services.

All equipment powered by long-life, trouble-free I. T. & T. Selenium Rectifiers – accepted as standard by the electrical industry.

Consulting Engineering Service available. For descriptive bulletins address Department F.

SELENIUM RECTIFIER DIVISION

Federal Telephone and Radio Corporation

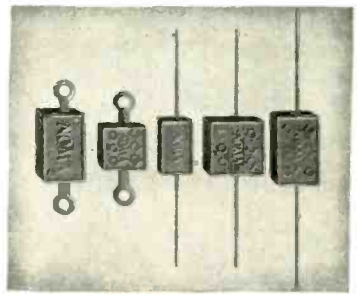
AN IT&T ASSOCIATE

1000 Passaic Ave.
East Newark, New Jersey

MICA CAPACITORS

DEPENDABLE AS THE NAME BEHIND THEM

In this global war, *communication* . . . the vital link between our fighting forces . . . must not fail whenever courageous lives are at stake. For in the heat of battle . . . when co-ordination is so important . . . whether on land, on the sea, or in the air . . . each component part of the communication equipment must perform efficiently. That is why every NOMA mica capacitor is built toughly for endurance . . . built to stand the gaff of war . . . to function faithfully under the severest conditions . . . to be as *dependable as the name behind them*. Each capacitor is carefully tested for accuracy of capacity, voltage breakdown, and insulation resistance.



The same broad background of experience, engineering skill, and expert craftsmanship which made NOMA the most outstanding name in decorative lighting is now utilized in the manufacture of high quality mica capacitors. We are in a position to make prompt deliveries on types illustrated, in all capacities and tolerances shown in American War Standard C75.3 specification. Your inquiry invited on other types.

When planning for post-war production, a NOMA capacitor engineer will gladly confer with you.

NOMA ELECTRIC CORP.

NOMA BUILDING • 55-63 WEST 13th STREET • NEW YORK, N. Y.

MANUFACTURERS OF FIXED MICA DIELECTRIC CAPACITORS

This might be your boy . . . or the kid next door. Yesterday he was a little shaver. Today, he's a full-fledged fighter on his own up there in the skies!

Yes, he's on his own . . . but never alone. For riding with him in his plane are the radiomen of **"The Invisible Crew"** of Bendix.

With these special aircraft radio devices, he talks with fellow pilots, and keeps in touch with comrades on the ground. He picks up distant radio stations to guide him on his course. He "sees" what lies ahead, even through impenetrable fog. Daily, as a matter of course, he uses new electronic devices far too confidential to talk about now.

Through these engineering marvels that guide and protect him, he senses secrets of the future . . . the future that he's fighting for.

RADIOMEN OF "THE INVISIBLE CREW"

These "Radiomen" have the ability to withstand extreme service conditions as a result of the painstaking efforts of the Bendix Radio Engineers. No detail is too small to escape the grueling tests that insure unfailing performance. Electronic research continually steps up already high performance to exceed every standard previously reached.

BENDIX RADIO

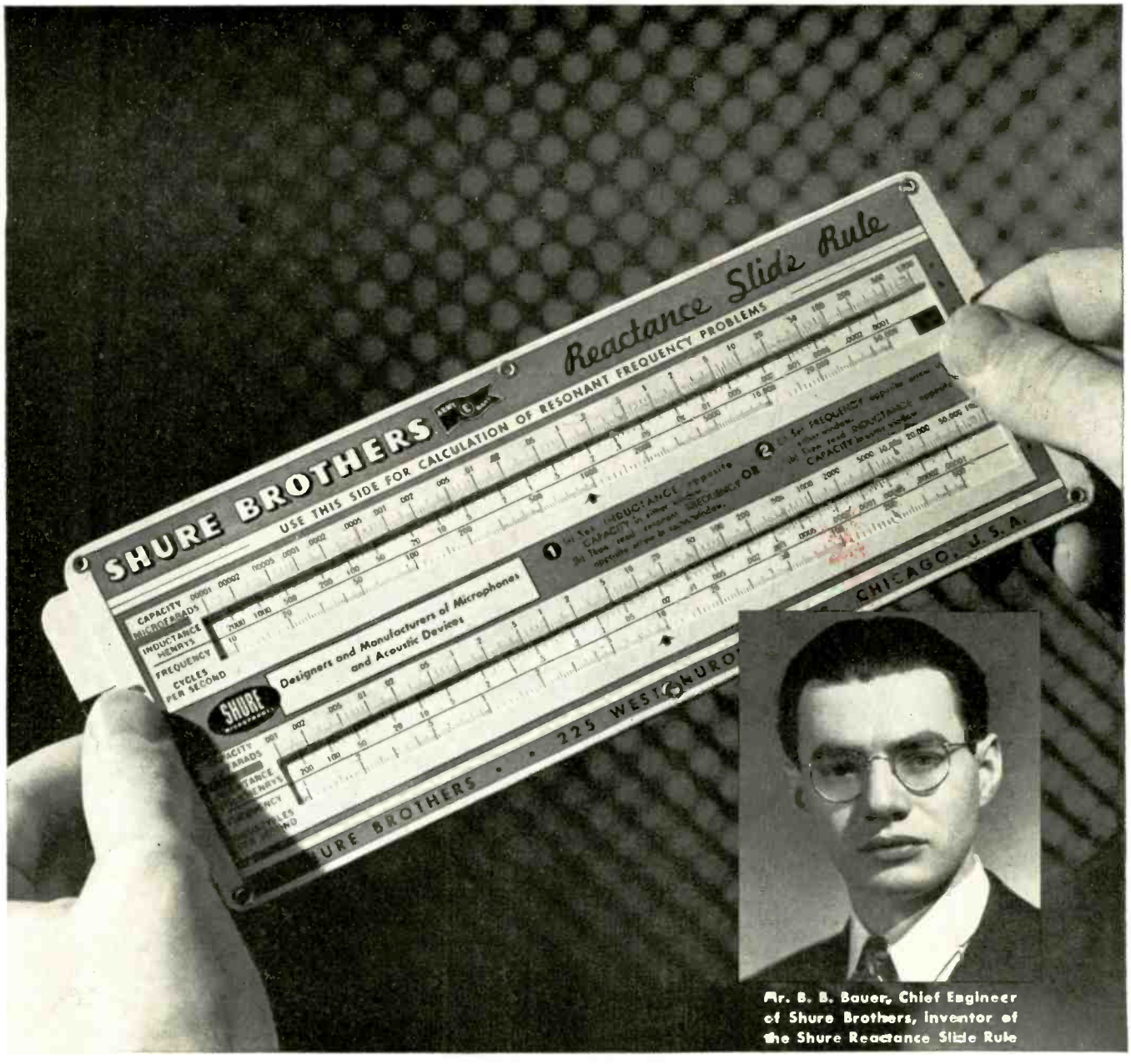
Back America's invincible crew . . . our fighters on every front. Buy War Bonds and Stamps regularly.

★

More than 25 Bendix plants are speeding "The Invisible Crew" to work battle fronts.

THE INVISIBLE CREW
Precision Equipment by Bendix
AVIATION CORPORATION

BENDIX RADIO DIVISION



Mr. B. B. Bauer, Chief Engineer of Shure Brothers, inventor of the Shure Reactance Slide Rule

Our Engineering Staff is pleased to serve 45,848 Engineers, Technicians and Students with the

Shure Reactance Slide Rule

During these days, while our efforts are devoted to the job of supplying the Army, Navy, and Air Force with microphones, we are pleased that our engineering department has also been of additional service to industry.

45,848 engineers, technicians and students have found the Shure Reactance Slide Rule a big help in radio computations. Makes the calculation of complicated problems in resonant frequencies extremely simple. Also helps in the solution of circuit problems involving inductances and condensers. Covers a frequency range of 5 cycles per second to 10,000 megacycles. Indispensable for radio and electrical engineers, technicians and circuit designers.

If you haven't your Slide Rule—we will be pleased to send it to you with complete instructions. Kindly send 10c in coin to cover handling.

ARMY E NAVY

SHURE MICROPHONES

SHURE BROTHERS, Dept. 174K,, 225 West Huron St., Chicago, U. S. A.

Designers and Manufacturers of Microphones and Acoustic Devices

ELECTRONIC PRECISION PARTS

MACHINED FOR ACCURACY

HAYDU BROTHERS are playing a vital part in the important and strenuous war efforts of the Electronic Industries . . . supplying this field with over twenty-two million precision parts daily.

No matter how large the quantity, how close the tolerance, how impossible the problem, we have always arrived at a solution that saves time, money and materials . . . and waste of time, money or materials is criminal in these war times.

Additional space, extra equipment permits us to serve more clients . . . faster, better, at greater economy. We have the experience, engineering staff, the men and the machines to undertake your difficult problems. Consult us at once.

HAYDU Bros.

A MEMBER OF THE RADIO MANUFACTURERS ASSOCIATION

Mt. Bethel Road, Plainfield, N.J.

SPECIALISTS IN BURNER TIPS

TUBE PARTS, WIRE FORMS, METAL STAMPING FOR RADIO, ELECTRICAL, AVIATION AND INSTRUMENT MANUFACTURERS

Chicago Telephone Supply Company products have been synonymous with quality workmanship and dependable performance for 46 years. From the engineer's blueprint to the craftsman's finished product, Chicago Telephone Supply products are planned to give maximum operating efficiency and trouble-free long life.

Variable resistors (carbon and wire wound), switches (separate and in combination with variable resistors), plugs, jacks, key switches, push switches, telephone generators and ringers and similar electronic components. Also other devices not illustrated here.

If you are a manufacturer of electronic equipment we invite your inquiries. Our engineering skill, great production facilities and dependable delivery service are at your disposal. Send us your specifications.

CHICAGO TELEPHONE Supply Company

ELKHART ★ INDIANA

Manufacturers of Quality Electro-Mechanical Components Since 1896

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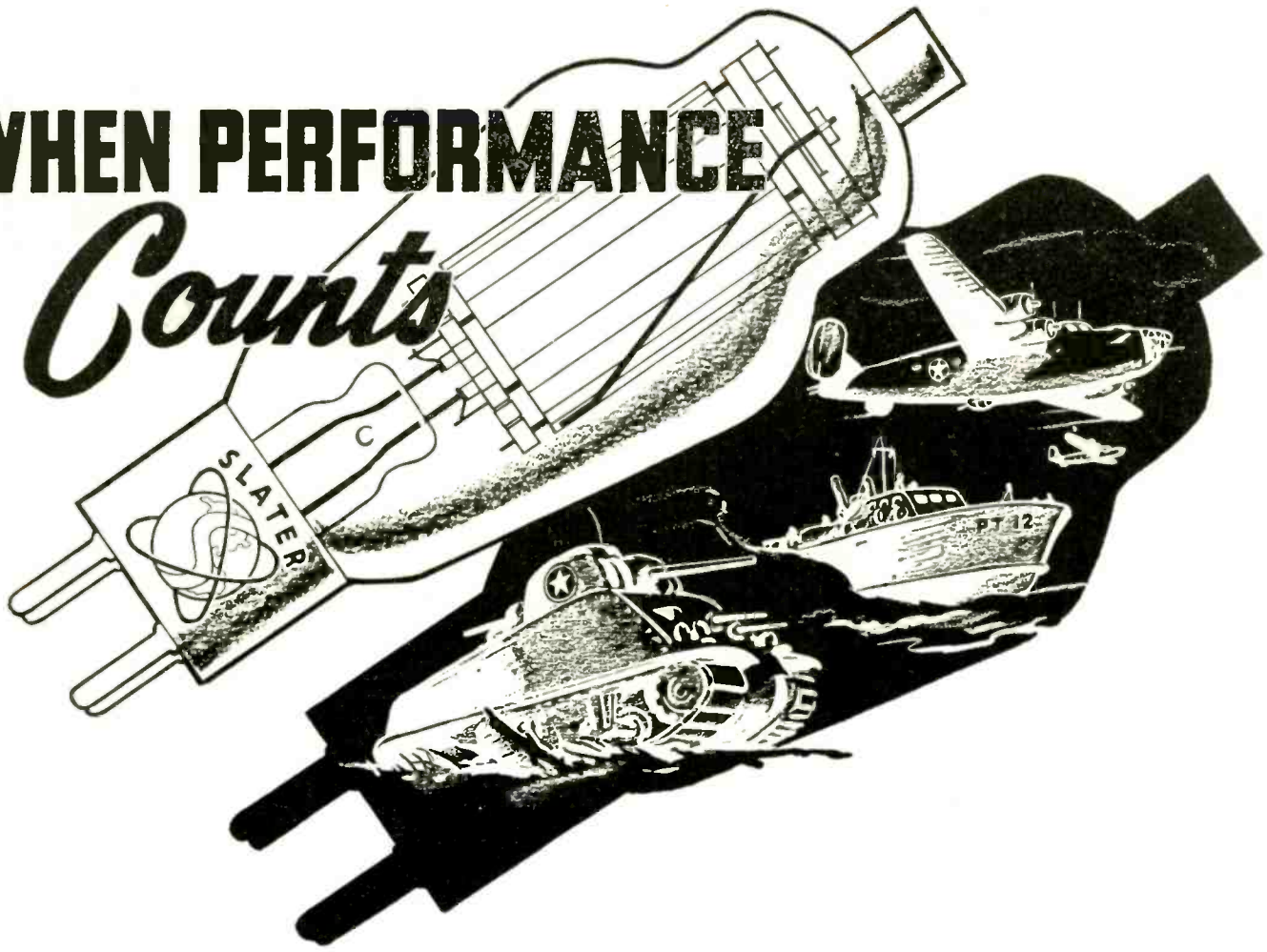
WHEN PERFORMANCE *Counts*



In this war . . . more than ever before . . . skill, courage and confidence permeate every fibre of our fighting men. For they know that the devices and equipment built into their airplanes, tanks, ships, and for the ground forces can be fully depended upon, in action. That is why . . . at Slater . . . all of our technical skill, ingenuity, and every measure of our resources are concentrated in making electronic tubes that will truly back up the men behind the guns . . . that will serve faithfully . . . *when performance counts.*

☆

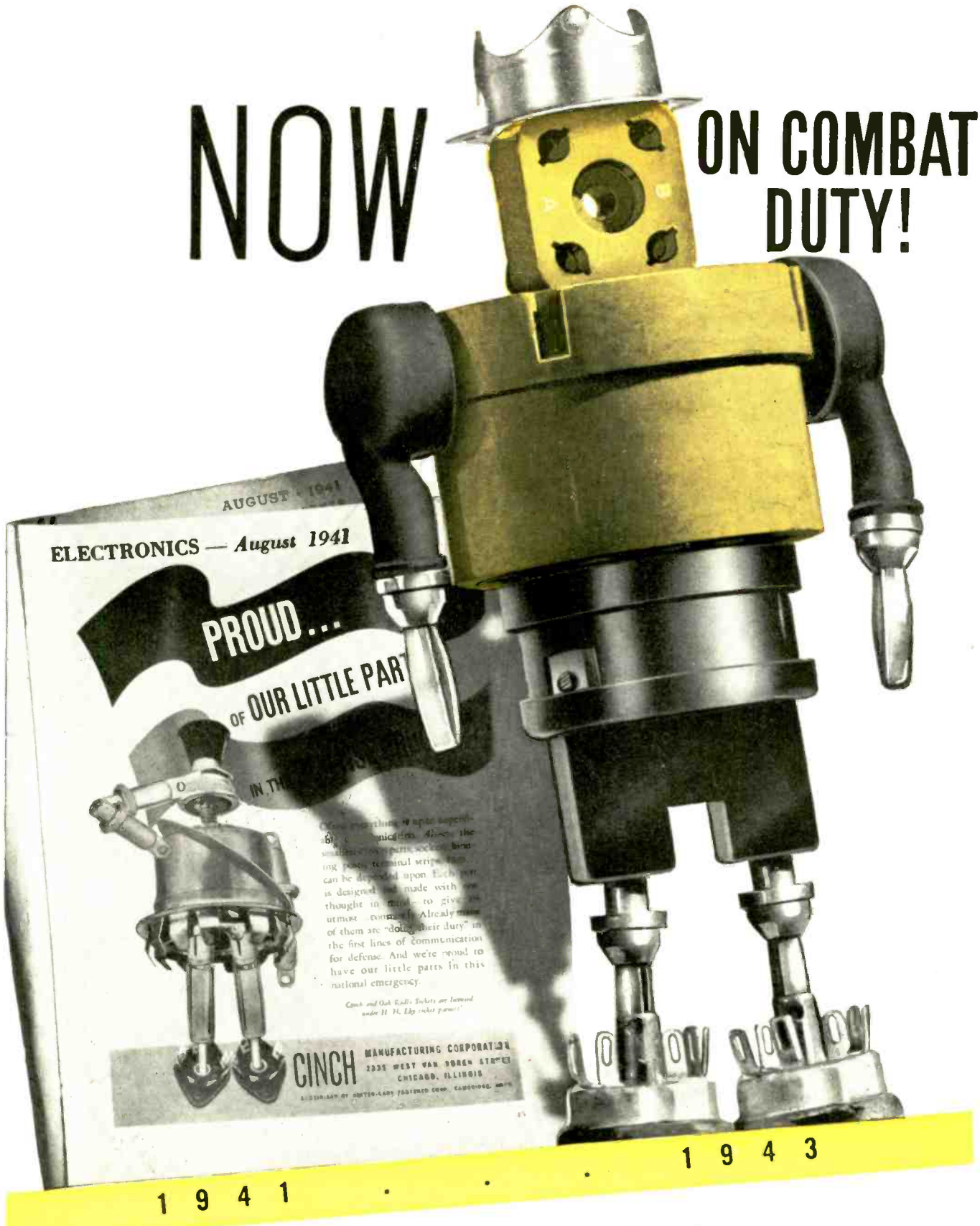
FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

SLATER ELECTRIC & MFG. CO.

BROOKLYN, NEW YORK

MANUFACTURERS OF PRECISION ELECTRONIC TUBES AND INCANDESCENT STREET LIGHTING LAMPS

NOW ON COMBAT DUTY!



Anticipating the most urgent and exacting requirements in the first line of communications, CINCH parts meet the need as it arises

CINCH MANUFACTURING CORPORATION
2335 W. Van Buren St.
CHICAGO, ILLINOIS
SUBSIDIARY UNITED-CARR FASTENER CORP., CAMBRIDGE, MASS.

Designs for War...

Hermetic Sealing

The hermetic sealing of transformers covers a wide range of problems, and an equally wide range of applications. The two units illustrated at the left, for example, represent a high voltage transformer for high altitude operation, and an audio unit weighing approximately one ounce.

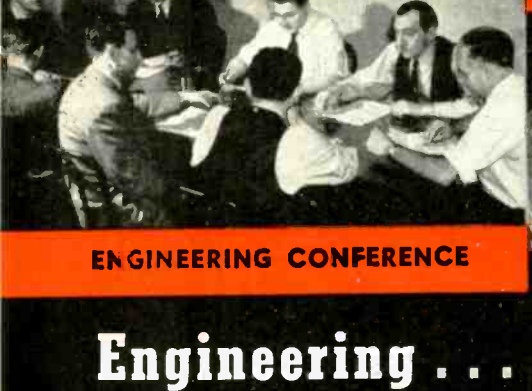
There is more to hermetic sealing than meets the eye. The illustrations below show some of the factors contributing to the high quality of UTC hermetically sealed units.

May we design a war unit to your application?

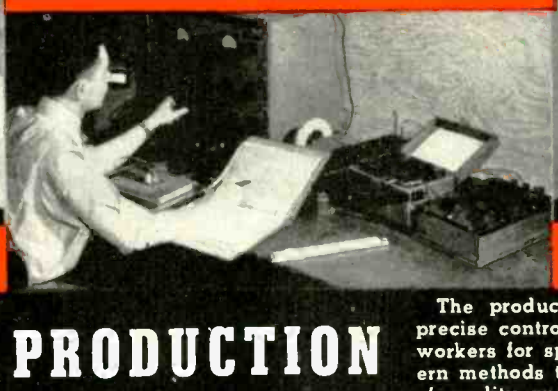
For obvious reasons, the units illustrated are not actual war items.

Engineering . . . PRODUCT

Engineering starts with research, continues through the conference table, and then goes through the proving of electrical design, sealing methods, vibration test, etc.



ENGINEERING CONFERENCE



DESIGN PROVING . . . AUDIO

DESIGN PROVING . . . POWER

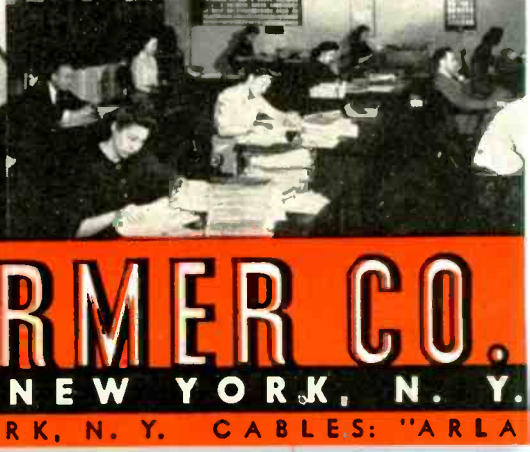
Engineering . . . PRODUCTION

The production of war units generally requires precise control. This requires the scientific choice of workers for specific operations . . . the use of modern methods throughout . . . and continuous control of quality and production flow.

APTITUDE TESTING assures worker suited to operation

MODERN METHODS induction heating

CONTINUOUS CONTROL for uniformity of production



UNITED TRANSFORMER CO.

150 VARICK STREET ★ NEW YORK, N. Y.

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

ELECTRONIC INDUSTRIES

O. H. CALDWELL, EDITOR M. CLEMENTS, PUBLISHER
480 LEXINGTON AVE., NEW YORK, N. Y.

Aeonic Immutability

Stability is a much considered factor of late, when the characteristics of equipment are tested under so many conditions of use: vibration, power source changes, temperature, humidity, barometric pressure, and numerous other effects. Now we see the use of a new term: secular stability, meaning in general the capability of the device to "stay put" with age. Radio equipment has usually had such a short life due to obsolescence or change of style, that too little thought has been given to the causes of actual aging.

The main problem is not so much that of extending the life of the components as it is that of maintaining constancy of frequency calibrations and operating levels. These items are particularly troublesome in the ultrahigh frequency ranges of operation. So secular stability (or aeonic immutability if you prefer) may have a place in future specification forms.

In Planning Plant Organization

In any chart of operating organization there must always be "solid" lines representing the direct functioning of the organization, through definite channels of authority and control. In other words, as we go up from the lowest unit to the highest, along these solid lines, we find the superior broadly responsible for practically all phases of the subordinate's activities.

But also there must be "dotted" lines to indicate some of the important cross-relationships that should exist between different units. By proper use of these relationships, one unit can plan its work effectively without strict conformity to the protocol necessary in following the solid-line organization.

Contacts Down the Line

For instance, there should be a well-defined, informal relationship between purchasing and the warehouse, such as a daily report of stock and shipments. Purchasing then would be on notice to question automatically a production-release the size of which might seem entirely at variance with the warehouse condition on that particular item. Likewise, such an informal arrangement between research and sales, encouraging suggestions by salesmen to engineers, and vice versa, would tend to stimulate and guide thinking, without necessity of too many formal conferences.

In all of these arrangements, the guiding purpose should be: "To speed operations, to catch mistakes, and to avoid unnecessary red tape."

Air-conditioning Via PE Tubes

Uncle Sam has gotten electronic-minded in connection with his recent huge building program. He has even found a new application for photo-electric tubes to serve air-conditioning.

"Somewhere in the United States" a vast office building was recently completed, roughly circular in outline, and measuring over a mile around!

As the sun sweeps around this huge structure during the day, it was necessary to get advance control of the air-cooling apparatus in the various sections. Local thermostats would have been too slow. It was necessary to get the cooling turned on **before** the sun got in its work.

Photocells were the answer. As each PE unit glimpses the sun shining on its section, cooling machinery is started up, ready to cope with the solar heat that shortly will be pouring onto the structure.

Looking Ahead

The entire radio industry is now operating full time on war emergency production — most firms to full capacity; others continuing to expand to even greater proportions. Engineering and production staffs are being pushed to the limit to keep pace with the demands of the armed forces.

In the process of such development much new knowledge of future importance has been gained, experience in operation broadened, short cuts designed, and new ideas of improved circuits conceived. As a result, the consensus of opinion among all radio executives and engineers is that post-war radio will eclipse in performance and appearance anything that has preceded it. It is also admitted that when this war ends there is bound to be a tremendous demand for new goods. If all this is true, then it would seem wise to start formulating soon, a program to provide radio production after the war.

HOW CONTRACT RE-

by ROLAND C. DAVIES and EARL B. ABRAMS
Washington Editor Arlington, Va.

The United States has been saved a total of $234,591,090 on Signal Corps procurements, mainly for its electronic and radio equipment and parts, since Pearl Harbor. Compared to the total recovery of $2,539,000,000 in the year ending last March 31 for renegotiation of contracts by the Army, Navy and Maritime Commission, this Signal Corps saving represents a sizable proportion.

This recovery in Signal Corps appropriations has resulted from three methods of recapturing procurement amounts. These three methods are (1) the negotiation of bids, (2) the renegotiation of individual contracts and (3) overall negotiations for the return of excess profits on the production by a company for the annual or fiscal period.

Prior to December 27, 1941, the Signal Corps, as did all government agencies, advertised for bids for the material it needed, but on that date competitive bidding was eliminated under the authority of Executive Order 9001 based on the first War Powers Act. In its place negotiated contracts were substituted.

Stemming from the same authority the renegotiation of individual contracts has resulted in a total saving of $86,801,631.09 for the period from April 28, 1942, through April 30, 1943. This amount includes approximately $7,600,000 from the recapture of allowances for patent royalty payments as a result of the license - free patent agreements which were entered into between the government and practically all important manufacturers of communications equipment.

Price adjustment

As of April 27, 1943, the Price Adjustment Section of the Signal Corps has reached agreements with 67 companies totalling a refund of $47,010,668. This refund is based on the provisions of Section 403 of the Sixth Supplemental National Defense Appropriations Act as amended.

When the competitive bidding system of awarding contracts was brought to a halt, the Signal Corps had already begun functioning on a voluntary basis for the renegotiation of contract prices where it was obvious that costs were out of line. The first move in this direction was taken during February, 1942 when a cost analysis section was set up in the Office of the Chief Signal Officer to keep a record of current procurement costs. Cost analysis expert auditors, selected on recommendations from the Federal Reserve Banks, started functioning in all major contractors' plants.

Renegotiation of individual contracts naturally followed along the lines already set up.

Recapture of excess profits

The process of overall renegotiations for the recapture of excess profits is one which has been not completely understood by many war production companies vitally affected by it.

Briefly, the authority for overall renegotiations stems from Section 403 of the Sixth Supplemental National Defense Appropriations Act of 1942 as amended by Section 801 of the Revenue Act of 1942. The

LIEUTENANT COLONEL Paul F. Hannah who heads the Signal Corps Purchases Branch handling all contract awards

W. R. BIGGS (left) and W. L. Goodwyn (right) of the Price Adjustment Section of Signal Corps who conduct the overall renegotiations. Under them are the two Price Adjustment field offices in Philadelphia and Chicago

NEGOTIATION Works

Principles followed by Signal Corps officials. What radio-electronic manufacturers may expect. Deductible allowances for salaries, advertising and war losses

story of "Section 403" is an interesting one because it shows the general path which the government travelled toward the policies that are now in effect.

In 1934 Congress passed the Vinson-Trammell Act to limit profits on naval construction to 10% of the contract price. In 1936 this Act was amended to permit contractors to offset the loss on one contract against the profits on another and likewise for the results of a year; and in the same year these provisions were applied to merchant ship construction. In 1939 this Act was revised to allow 12% profit for Army and Navy aircraft contracts. However, on June 28, 1940, all such profit ceilings were reduced to 8%.

Two years later, Executive Order 9217 based on the Second War Powers Act designated the War Production Board, War, Navy, and Treasury Departments, the Reconstruction Finance Corporation, and the Maritime Commission to inspect plants and audit books of defense contractors to prevent the accumulation of unreasonable profits.

Proposed 6% limit

This was the situation the end of March, 1942. At that time, the House adopted a bill proposing to limit all profits on all war contracts to 6%. Opposition of the War and Navy Department to this provision was based on the fact that this virtually placed contracts on a cost-plus basis. They felt that the rate of profit should be related to the war contribution and performance of the contractor.

There were many reasons for this viewpoint. Different lines of business with the same volume of sales might require widely different amounts of capital, skill and services. Some companies might be financed by the government through advance payments or direct loans, while others would be using their own capital. Some firms might have the use of government facilities in the manufacture of their products. Others would be using their own plants.

A very important point stressed by both the Army and Navy was that many vital war items require highly developed inventive genius, original design and mechanical skill over a period of years. Also to be given consideration, the Army and Navy thought, was the fact that many products required such precision that few contracts can qualify. And finally, the two Services believed that weight should be given to the fact that the costs of a new producer might be twice those of an original contractor because of his lack of skill and "know how."

Based on experience

Congress, acting upon this theory that the contract prices of each contractor should be adjusted after consideration of experience in the performance of such work and after negotiation with the contractor, passed Section 403. This Section provides that contracts in excess of $100,000, made after April 28, 1942, be renegotiated. It also provides for the renegotiation of any contract, even though made prior to April 28, if final payment had not been made on that day.

Section 403 is definitely not a tax act. The statute itself defines renegotiation as the revision of the contract price. This is accomplished by mutual agreement between the contractor and the price adjustment section.

There are several general principles in determining what excess profits are. The government feels that stimulation of quantity is primary. It follows from this that reasonable profits should be determined on the basis of individual cases without restriction or any fixed formula. Net profits should be determined on war business as a whole rather than on specific contracts and for a fiscal period. As volume increases the margin of profit should decrease. Corresponding profits in pre-war base years should be considered. (The base taken for this point is the average profit of a firm for the years 1936-1939.) Government agencies also

RADIO-EQUIPMENT for every branch of our fighting services—Army, Navy, and airforces—is involved in these contracts which are now being renegotiated in the light of actual manufacturing experience

RE-NEGOTIATING AGENCIES RECOGNIZE DEDUCTIONS ALLOWED FOR FEDERAL TAX PURPOSES

The exclusions and deductions allowed for Federal-tax payments are also recognized by the War and Navy Departments, the Treasury and the Maritime Commission, as legitimate expenses of companies engaged in war production, in considering excessiveness of profits in their renegotiation of contracts and operations for the war effort.

These deductions and allowances include:

Advertising	Interest
Amortization	Losses from prior years
Conversion	Salaries and wages
Depreciation	War losses

believe that reasonableness of profit should be determined before provision is made for federal income and excess profits tax. And, finally, they feel the contractor's right to a reasonable profit and his need for working capital must be distinguished.

Margin of profit

In determining the margin of profit for an individual firm certain factors are taken into account. These include price reductions and comparative prices, efficiency in reducing costs, economy in the use of raw materials, efficiency in the use of facilities, and the conservation of manpower, the character and extent of sub-contract in the quality of production, the complexity of manufacturing technique, the rate of delivery and turnover, inventive and developmental contributions, and cooperation with the government and with other contractors in developing and supplying technical assistance. Consideration is also given to possible increases in cost of materials, imminent wage increases, risks, delays due to the inability to obtain materials, rejections, spoilage, cutbacks in quantities and guarantees of quality and performance.

Price adjustment section

The provisions of Section 403 are put into practice by the Price Adjustment Section of the Signal Corps which has assigned to it at this writing 313 communications firms. The Price Adjustment Section is part of the Contracts and Awards Section of the Purchases Branch in the office of Major General Dawson Olmstead, Chief Signal Officer of the Army.

The exclusions and deductions allowed for Federal tax purposes—amortization, depreciation and conversion; losses from prior years and war losses; interest; advertising; and salaries, wages and other compensation — are recognized by the War and Navy Departments, Treasury, and Maritime Commission as legitimate expenses of companies engaged in war production in considering excessiveness of profits in the renegotiation of contracts and operations for the war effort.

Just as in the case of the reasonableness of compensation, the test for advertising expenditures allowable is whether they are ordinary and necessary and bear a reasonable relation to the war production business activities of the enterprise. In making this test of reasonableness, consideration is given to the amount spent for institutional advertising and for product advertising of the nature of institutional advertising. Ordinarily product advertising specifically offering products for current sale (as distinguished from institutional advertising to keep the advertiser's name or names of its peacetime products) is charged in full to commercial business, but product advertising by subcontractors may be allowed in a reasonable amount as a charge against renegotiable business with respect to products sold primarily for use in war production.

Amortization

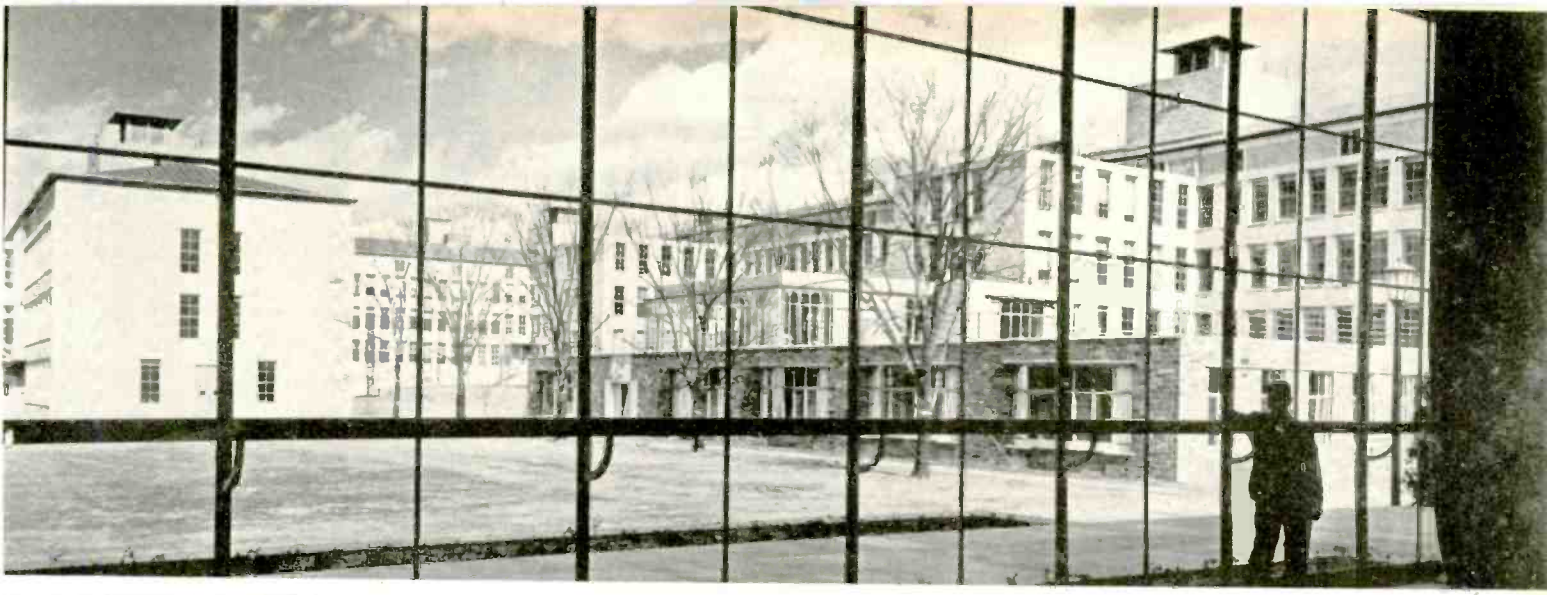
Amortization may be carried on under the five-year Certificate of Necessity issued by the Secretaries of War or Navy, if desired, the contractor may amortize his costs of war facilities at ordinary rates of depreciation. For the purposes of renegotiation the amount of amortization allowed under the Internal Revenue Code's Section 124 except to the extent of depreciation will not be allowed as an item of cost. But the amount of such amortization in excess of depreciation will be deducted from profits in renegotiation procedures, although the residual value of the amortized facilities will be considered and reasonably ascertained. However, there is no authority for reopening renegotiation agreements to give consideration to accelerated amortization under a shortened 5-year period.

War facilities, not covered by Certificates of Necessity, which represent permanent capital additions, are depreciated at ordinary rates, although machinery used for war production in extraordinary consecutive day and night shifts may be allowed higher rates of depreciation than for buildings. Full costs in converting facilities to war production which are not permanent additions, will be allowed in renegotiation, but commercial inventories unsaleable due to wartime regulations or loss of market are not included in such allowances.

Net losses

For net losses the renegotiating authorities may give consideration under proper circumstances to losses incurred in prior years on war production contracts and subcontracts but the full amount of these losses are not allowed in determining renegotiations. However, they can be given weight in considering excess profits under the period being renegotiated. War losses are recognized in renegotiation if the contractor or subcontractor furnishes satisfactory evidence about the property destroyed or seized. So long as the borrowed capital is used for war purposes it does not matter when the obligation was incurred for the consideration of interest costs in renegotiation. Interest on long-term bonds and obligations issued before the war is allowable if the capital was used for war production, but the general principle in renegotiation in the case of interest payments is to weigh them in scale of whether or not they were borrowed funds allocable to sales subject to renegotiation. In the case of salaries, wages and other compensation consideration in renegotiation is given to the nature of work, extent of responsibility, experience and effectiveness of the officer or employee and increases in compensation since January 1, 1939.

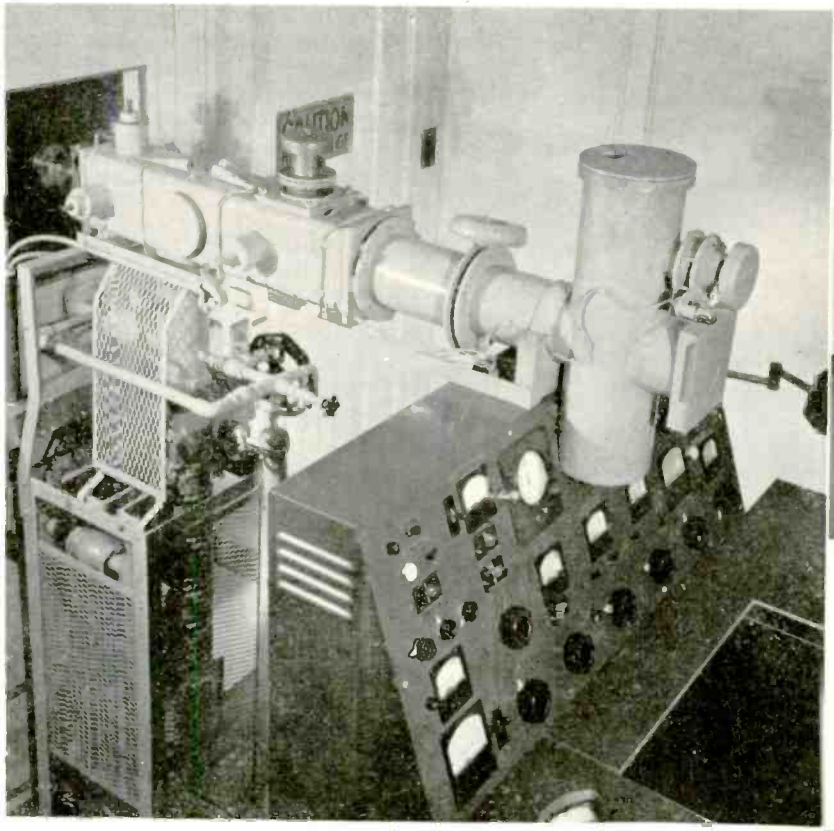
Reserves for reconverting plant facilities to peacetime operations at the end of the war are not allowed as a deductible factor.



MAIN STRUCTURAL GROUP, as viewed from an adjoining building. One-story section is restaurant which can be reached from a wing of one of the main buildings in the background, through an attractive second story lounge

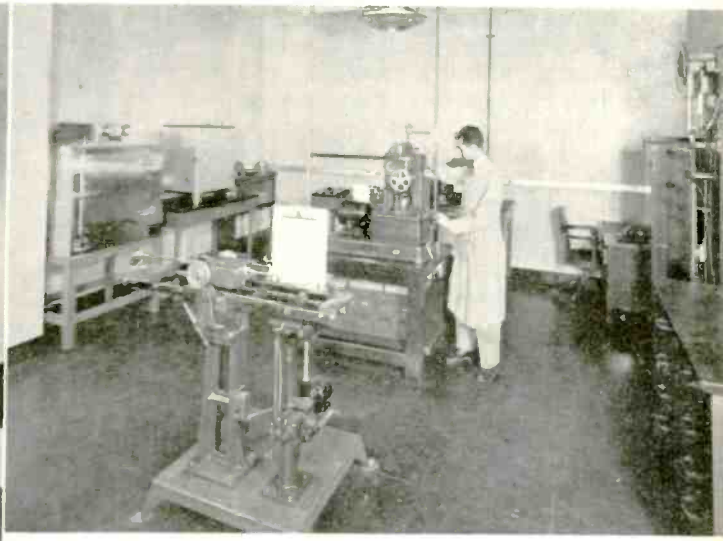
Murray Hill Laboratories

A new center of Bell Laboratories research activity, on a tract of over 200 acres



THE STUDY OF ATOMIC STRUCTURE is one phase of research activity at Murray Hill. Above an electron-diffraction camera is set up for investigating the crystal structure of surface films. A beam of high-speed electrons, scattered from the surface of the material being studied, records its diffraction-pattern on a photographic plate

THE NEW MURRAY HILL unit of Bell Telephone Laboratories is situated in New Jersey, about twenty-five miles from New York City, several hundred yards away from the nearest highway. Designed to meet all the special needs of research scientists and engineers, at a location possessing the quiet and lack of electrical disturbances of a rural community, this laboratory provides increased operating efficiency and comfort for the large research staff



INDIVIDUAL LABORATORIES are completely equipped for the investigation of particular projects. In the one above, an investigation of the physical properties of rubber is under way. Tensile, compression and plasticity tests are conducted here on rubber compounds under controlled temperature and humidity conditions

THE ACOUSTICS BUILDING, below, is separate from the main structure. It houses, besides the sound research laboratories, a "dead" room, two connecting "live" rooms and a large listening room, which also serves as an auditorium

The FOOD INDUSTRIES

SOME TUBES IN FOOD INDUSTRIES

Photoelectric vitamin assays
U-V vitamin D irradiation
Wrapping, counting, sorting
Dehydration and sterilization
Germicidal lamp safeguards
X-ray examination and treatment

According to Napoleon, armies fight on their bellies. According to Secretary Claude Wickard, food will win this war and write the peace.

Few persons realize that agriculture and food processing constitute America's greatest industry. To those of us who have been accustomed to think of food only three times a day, the present precarious wartime situation comes as something of a shock.

Food production up 38%

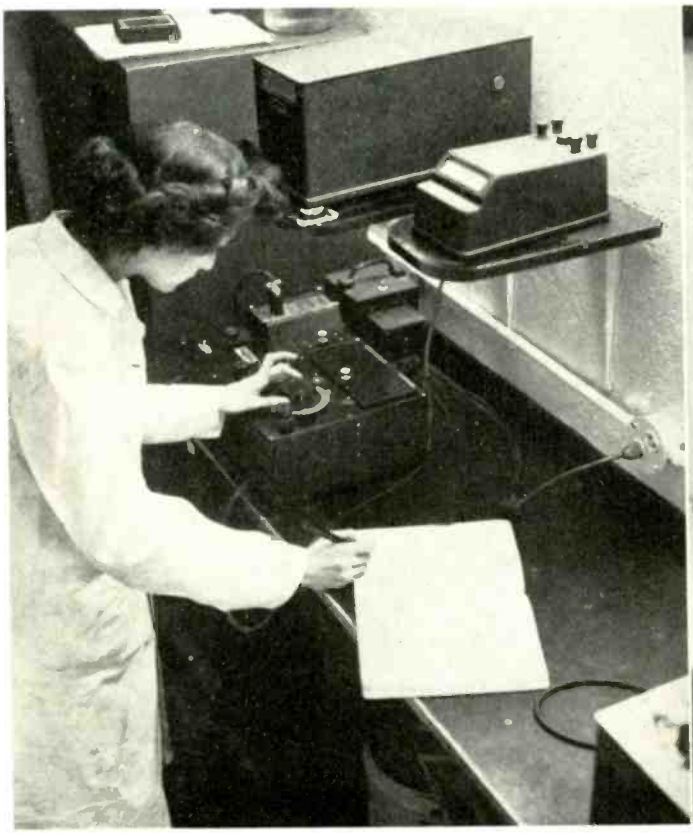
Facilities that have been adequate for feeding perhaps 145 million people are suddenly called upon to feed 200 million, and this obligation will continue for a long postwar period. Such expansion calls for certain routine changes in methods, addition of all possible labor-saving equipment, and intensive study of any new, radically different processes which might, even under unfavorable cost conditions, increase the production of food. The revolution towards dehydration is a case in point.

Food industry applications of various electronic methods have directly or indirectly increased production or stepped up efficiency in the past. Since the food processors have for several years made wide use of certain electronic devices, it is only natural that the current crisis in food should inspire renewed attention to electronic methods, including those which heretofore may have been classed as experimental or costly. Such is indeed the case.

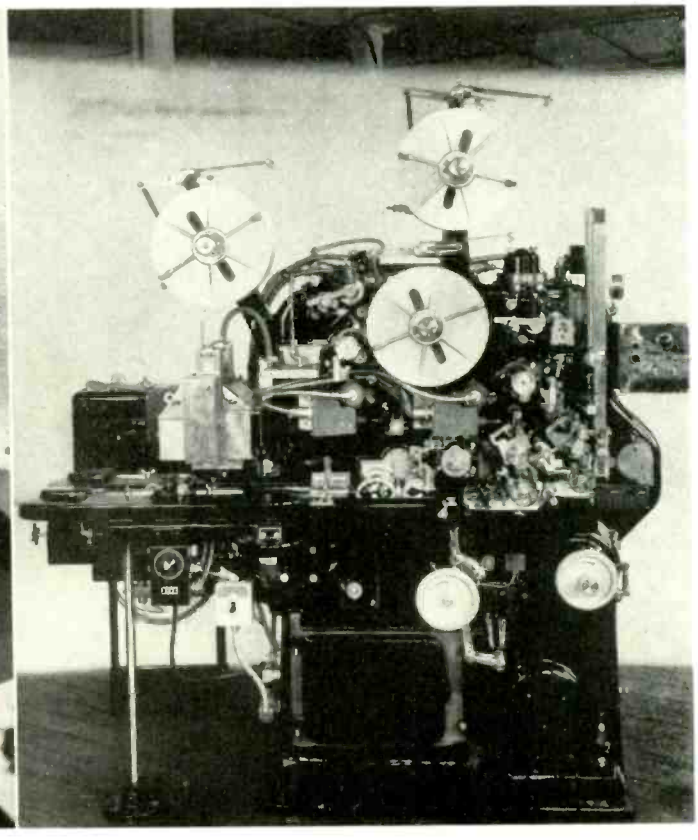
It requires little imagination to predict that the food industries can emerge from the war as a going market for a considerable dollar-volume of industrial electronic equipment. The validity of such a prediction will depend on three main factors: (1) the intensity of the sales effort, which is needed now as well as after the war. Incidentally, food industrials may be able to offer highest priorities in the near future. (2) reduction in costs of certain types of electronic equipment which would already be in wide use if such use had been economically justifiable. (3) more research and development effort applied to possible electronic answers to many of the food industries' special problems.

In short, the future of this vast potential market lies almost entire-

RUNNING A VITAMIN ASSAY with fluorescence-measuring photoelectric instrument at Food Research Labs., Long Island City



PHOTOELECTRICALLY CONTROLLED unit made by Package Machinery Co. to wrap 1200 individual sticks and 240 bundles of gum per minute



As A Potential Market

From farm to table, the agricultural processing and associated food industries offer a vast new market for electronic devices

ly in the hands of the electronic industry itself. The purpose of the present paper is to describe current applications of electronic devices to the food industries, and to discuss briefly some of those applications which should sooner or later progress beyond the experimental stage.

Vitamin analysis

The discovery and development of vitamins and their principles has within a decade wrought a virtual revolution in food. It should be of interest that laboratory research and production control of these important nutritional elements owe a major portion of their success to several electronic methods for quantitative analysis.

In the colorimetric or spectrophotometric methods to be described, use is made of the fact that chemical reactions frequently produce colored solutions. The depth or density of such a colored solution is a function of the quantity of the substance being measured if other variables are eliminated.

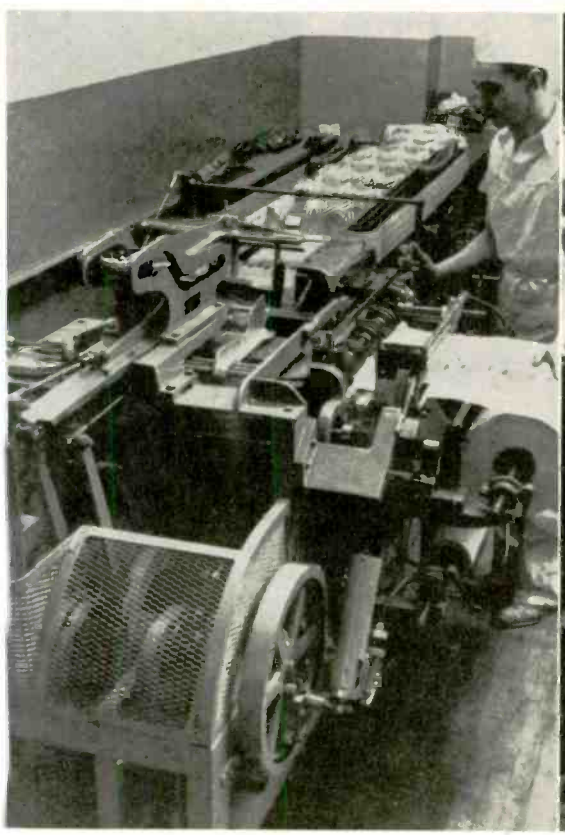
Most of these methods involve production of visible or ultra-violet light, transmission through, reflection from, or fluorescence of, a sample of the material to be analyzed, and quantitative measurement of the result by means of photocells or phototubes often in a Wheatstone bridge circuit, with current amplification if necessary.

Vitamin A determination

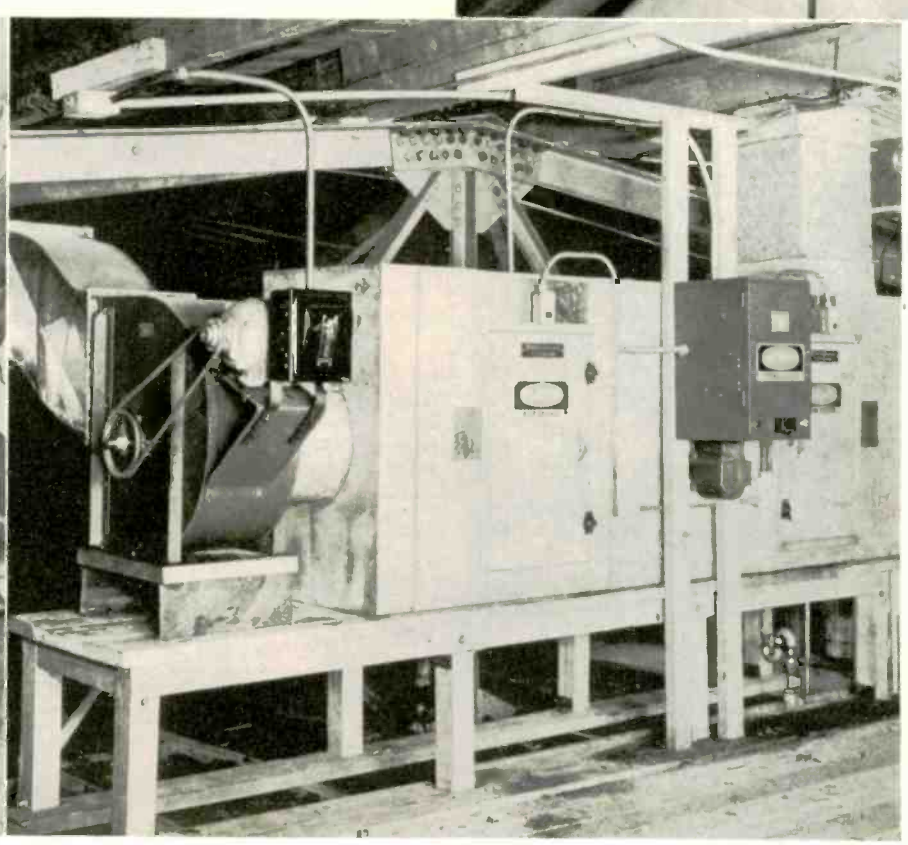
A method for the measurement of vitamin A in fats requires a suitable solution of the unsaponifiable matter of the fat, held in a

PASTEURIZATION test using a GE "luximeter" to indicate the depth of color of phosphatase

CLEAN AIR is supplied to fermentation vat room of a brewery by Westinghouse precipitron unit



BREAD PACKAGING machinery using Westinghouse P-E control to insure uniform position of printing on wrapper



glass cell of precise construction. The cell is placed in a beam of light of 3280 Angstrom units wavelength, from a sodium vapor source. The absorption of light by the sample, accurately measured by some sort of photoelectric method, bears a direct relation to the amount of vitamin A present.

When a chloroform solution of vitamin A is treated with antimony trichloride a blue color forms, then quickly fades away. With the proper kind of photoelectric colorimetric equipment, the peak density of the color is read on a galvanometer, as the point of minimum light transmission through the sample. The method yields results calculated to be accurate to within 1 per cent.

Fluorescence measurements

Accurate determination of thiamin, or vitamin B_1, may be achieved by oxidizing the chemical to thiochrome, in solution. In a fluorophotometer, a test tube of the solution is placed in a beam of ultra-violet light of known quality. At each side of the tube, at right angles to the beam, two photocells responsive to visible light measure the amount of fluorescence produced by the sample. The reading of a galvanometer or the null-point setting of a slide-wire potentiometer may then be referred to a calibration chart for determination of the vitamin content.

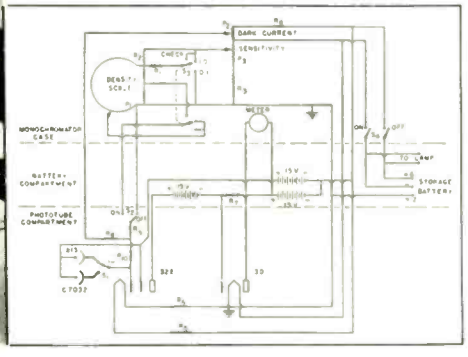
Vitamin B_2, likewise, may be accurately determined by the intensity of its fluorescence, to light of 4400 Angstrom units, as well as by the colorimetric method. Most of the other vitamins are measurable by either or both methods, in several variations, with the exception of vitamin D. Although experiments are now under way on the photoelectric determination of this important vitamin, the most satisfactory method in general use entails experiments on white rats.

Greater accuracy with spectrophotometer

Increasing use of "unabridged" spectrophotometers should be expected. In contrast to the several types of units described, the unabridged instrument allows step-by-step measurements to be made of the transmission by a sample of light of all wavelengths, in much the same manner as is currently used to specify and measure color for its own sake.

All such vitamin determination methods have two fundamental places in the food industries. First, as used by the research laboratories, the instruments facilitate analyses and speed development of new processes for production, isolation, or synthesis of vitamins and related products. Second, on the production front, the use of such instruments affords quick, convenient means for maintaining the increasingly important check on the vitamin content of the final food product. Whether vitamin content is natural, by enrichment, or a combination of the two, does not, in general, affect the test results.

Although there have been a number of applications of the "electric eye" to wrapping, sorting, counting, weighing, and grading operations in various food processing plants, a trip through almost any one of them reveals a dozen additional places where some sort of photoelectric control could be used to advantage, particularly in these times of manpower shortage.



UNABRIDGED SPECTROPHOTOMETER measures light transmission of sample at all wavelengths for most accurate vitamin assays. Diagram of electronic null-point system of Beckman unit below

Photoelectric control

A typical wrapping operation is used by the bread industry. High speed wrapping machinery using wrapping paper printed in rolls is more efficient, faster, and more accurate when human control is replaced by photoelectric. In general, the problem is to prevent the errors in the repeat-printing, the automatic wrapping, and temperature and humidity changes in the paper base, from causing the paper feed to creep ahead or behind the actual wrapping, with the result that the labels stray from their desired position on the wrapper.

A phototube, an amplifier, and a thyratron, in general, provide 100 per cent accurate control of the operation. A special registering spot or target printed along the roll, intercepts the light beam. The phototube signal is generally compared with a periodic signal taken from the wrapping machine so as to adjust the paper feed rate to proper synchronism with the wrapping and cutting mechanisms.

One of the most intricate systems of this type, designed by the Package Machinery Co., has been in constant use for several years on a machine which wraps sticks of gum, first individually and then in packages of five sticks, at rates up to 1200 sticks per minute.

The National Sugar Refining Company uses a counting system for empty raw sugar bags on an overhead conveyor, as a check on daily production. General Mills, Inc., counts packages in one plant.

Thoughtless sales engineering

Hundreds of photoelectric counting systems have been sold and installed, sometimes, it must be admitted, without much forethought, and without adequate engineering care as regards ambient light effects and other troubles, and frequently without reasonable follow-up instructions and precautions to those charged with operation and maintenance of the equipment. This potentially important market is worth better treatment than that.

A number of intriguing possibilities for the use of ultra-high fre-

ELECTRON RAY bridge-type conductivity meter checks solutions at National Sugar Refining Co.

VITAMIN A ANALYSIS at Food Research Labs., Inc., with Rubicon abridged photoelectric spectrophotometer

quency alternating current in the food industries has been the subject of sporadic experimentation. Various jobs can be done, and done well, but the limiting factor of high cost of equipment has thus far precluded widespread commercial applications.

However, the vast wartime expansion of the electronic industries may just make it possible to manufacture suitable equipment for these and many other electron-tube applications at a cost that will justify their use.

Costs too high

High frequency dielectric treatment of grains, for the purpose of killing infestations, is one possibility. Richard T. Cotton, Senior entomologist in the Department of Agriculture, has followed the subject with interest. Over a decade ago, the department investigated an experimental installation in a grain elevator in Baltimore. The apparatus consisted of a twenty kw Westinghouse oscillator on 42 megacycles. A rectangular glass chute between copper plate electrodes served as the treater. A transmission line fed the rf to the treater plates, connected through a "trombone" type of inductor with a thermal ammeter to assist in tuning the treater for maximum transfer of energy to the dielectric, the grain passing through.

The tests were entirely satisfactory, but later discussions with Westinghouse and General Electric regarding production models of the unit left no doubt as to its economic impossibility. Cost was estimated at $45,000 per unit at that time. One unit would treat 5,000 bushels of grain per day. To compete with existing conditions, the unit would not only have to cost less, but would have had to handle at least 100,000 bushels per day.

Dr. C. G. Lemon, of the Radio Society of Great Britain recently described a unit costing $1,250 which would be capable of treating ten tons of grain per hour at an operating cost of 3c per ton, but at this writing it is not known whether any actual installation has been made.

The Chicago Commonwealth Edison Company has developed somewhat similar apparatus (cf "American Miller," Feb., 1943) but the factor of too high cost seems still to exist.

High frequency dehydration

In normal times, a boatload of food shipped to Europe was 15 per cent food and 85 per cent water. Mothered by necessity, dehydration and debulking of food has come into very wide use at the present time. However, anyone who has dined a few times on some, at least, of the dehydrated foods later "reincarnated," will attest that the flavors and textures leave something to be desired. When life and death hang in the balance no one complains about such minor details as flavor, but the postwar future of dehydration, with its obvious economies, will depend on certain improvements.

High frequency dielectric heating and drying of meats and vegetables is one of the most attractive possibilities in the electronic field. If successful, it might eclipse any other single market.

Experiments promising

Again, tubes will do the job, and apparently do it far better, but someone has to pay the premium. According to V. W. Sherman of the Federal Telephone and Radio Corp., Newark, N. J., ten megacycle energy through carrots and similar vegetables is able to remove 99 per cent of the water in less time than with other methods and without the common "case hardening" of the vegetable. This is to be compared with 93 to 95 per cent removal as a standard. No accurate production-line cost comparison tests have as yet been run.

The Department of Agriculture, at its Albany, California, research laboratory, is at present conducting experiments on a small scale. Considerable work has been done in Germany and at least one German patent has been issued.

Innumerable applications of electronic devices to the food indus-

(*Continued on page* 152)

THE ROLE of UHF AFTER THE WAR

by S. YOUNG WHITE
Formerly of Loftin-White

The impetus given to ultra high frequency technique by current developments will open up a vast new field for public services

It is safe to predict that great activity in the 50 to 250-megacycle portion of the frequency spectrum will be a leading factor in radio progress after the war. Let us survey the field and with our very limited human perception attempt to intelligently evaluate the possibilities and limitations of this type of transmission, as well as the instrumentation and apparatus that the radio engineer will be called upon to produce at a cost level low enough to assure wide public acceptance.

If we limit the discussion to an upper frequency limit of 250 mc., we have available more or less normal tube types that lend themselves to disciplined design at a reasonable overall cost to the user. The upper limit in frequency where useful gain and stability of oscillation are still found in such tubes, is vaguely in this region. We shall also limit ourselves to tunable receivers capable of covering at least a substantial portion of this spectrum.

Accuracy and stability requirements

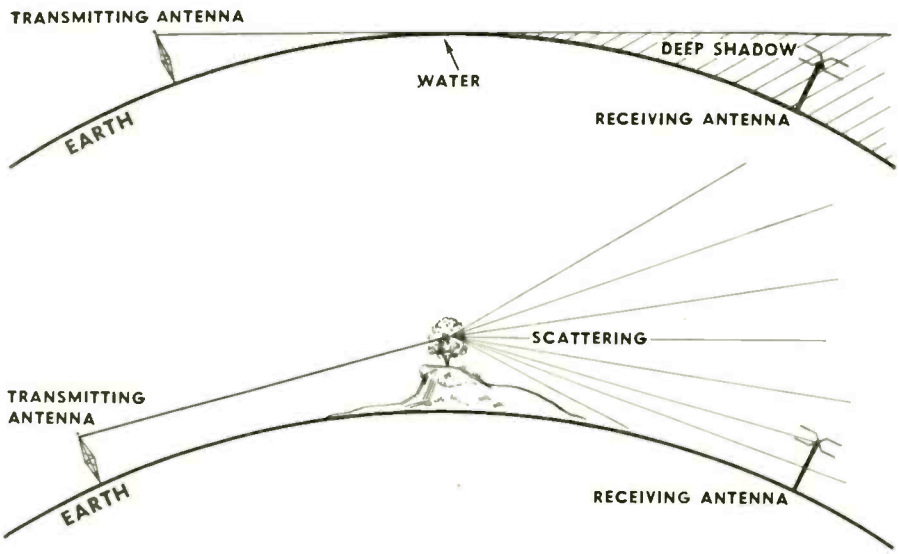
At this time we have two different standards of design when we think of frequency allotment requirements. In the normal broadcast band the requirement is ten kc. channels, side by side, and at the higher frequencies a sliding scale frequency allotment of one-tenth of one per cent. This latter standard was adopted at a time when the art was not as far advanced as at present.

If the 200 mc. spread in the 50-250 mc. region is allocated at the rate of every 0.1 per cent there are, in round numbers, 1300 channels. If allocation is in terms of 10 kc. channels there are 20,000 such channels.

The problem of gaining the use of these extra 18,700 channels is strictly up to the radio engineer. The Federal Communications Commission can obviously allocate frequencies only on a basis of their utilization with apparatus that can be commercially produced, and the demand for these extra channels will undoubtedly be so great that every effort must be made to satisfy it.

Let us look at the prewar art. Circuit simplicity has been one of the great handicaps of uhf, since you can wind three turns of No. 14 wire around a pencil, solder it to a three plate variable condenser, hook up a tube such as the 6J5, and obtain good oscillation up to nearly 200 mc. The same haywire design with an Acorn tube will allow you to exceed 400 mc. When you analyze this type of circuit in order to improve it in the matters of frequency stability and efficiency you find every component is hopeless, and to discipline it in these matters requires another attack. It is evident that frequency stability must be regarded in absolute rather than relative terms.

The second attempt the engineer will make will invariably consist of taking standard broadcast frequency technique and modifying it for uhf by reducing the value of inductances and so on. This also will be found almost equally hopeless.



HOW THE RANGE OF A UHF station is affected by terrain. Above, the range is simply optical plus ten per cent for bending. The shadow is so pronounced that almost not a signal is heard below horizon, regardless of power of transmitter. Below, the range is indefinite, as the signal is scattered by trees and wires on top of the hill. Of course, much weakened signals result, but the coverage is larger than over the water

The third attack will be the correct one—forget most of what you know and design directly in terms of the new frequencies and their tremendous accuracy requirements. The difficulty will then be found that you cannot design the parts until you have the whole, and you obviously cannot make the whole without the parts. It is useless to design a coil by itself unless you have a specific structure into which it will fit. You have only two inches of wire available to use in the whole circuit, and you want all of it in the coil, not in the form of hookup leads.

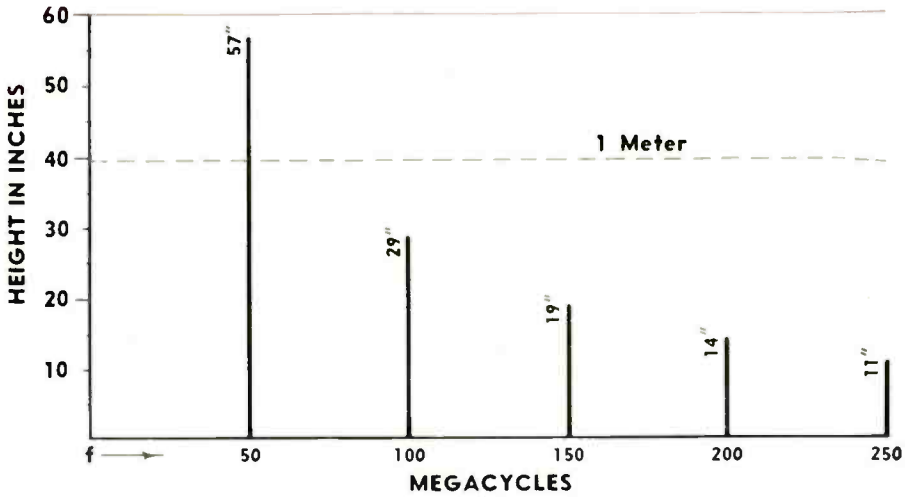
The final design must be a streamlined whole, rather than the aggregation of parts we are used to. It will of necessity have absolute "Secular Stability"—the property of being unchanged by time. It will probably be of glass or ceramic, possibly all in one piece. And the multitude of circuit elements, now used for trimming, tracking, aligning, bypassing, etc., will be simplified to the point where in effect some of them will become imaginary. We can be sure it will not resemble the current type of construction.

An entirely different dial will be necessary to allow the user to pick out the channel desired from 20,000 others, and some rather fine tolerances in the mechanical movement will be necessary. Perhaps the receiver will hunt for the signal by scanning the spectrum, identify the signal desired by some identification in the carrier or the modulation itself, such as a super-audio tone, and lock on it tighter than any operator or mechanical system could.

We are not saying that a single ten kc. channel of 2000 mc. can be tuned in and held but the point is, that the tighter we hold our accuracy the more thousands of channels we will have for public service.

Station coverage

For non-directional transmission in this portion of the spectrum we must keep the following facts in mind. There is little reason to believe the Heaviside layer will enter into such transmission ranges except very sporadically. We all know the amateur 60 mc. band has a nice skip every so often, but only during a few hours a year. Observations at higher frequencies have been meager because of rather small number of stations observed. Of course we even have skip effects



HOW THE ENERGY intercepted by a quarter-wave antenna decreases as the frequency goes up, based on the fact that a transmitter lays down a signal in microvolts per meter

at optical frequencies (we call them mirages) but it is probable the phenomena will not play a large role in our use of these frequencies.

In some hundreds of hours listening on 1 microvolt signals the writer only observed one fadeout, extending about 30 seconds. That was when a trailing skirt of a raincloud dragged along the ground directly between transmitter and receiver, and caused a fade of about 20 db.

Several years observations with a receiver of maximum possible sensitivity (one-quarter microvolt into the input line) and with all spurious and if responses down about 100,000 times, showed that a lightning stroke a quarter mile away gave a one microvolt "thump." Static is non-existent.

Ignition noise

The receiver described gave results in sharp disagreement with the report of similar tests hitherto published by others, which reported results of how ignition noise level varied with frequency, and in effect stated that ignition noise is nearly constant up to 400 mc. or more. We ten-meter amateurs (the writer has been on the air as W9GVB) know all-too-well that a car can be heard over a quarter mile on 30 mc. At 60 mc. it is nearly as bad, but above 130 mc. or so the writer has heard no auto noise with the very sensitive receiver mentioned, which had a band acceptance ten kc. wide. No suppressors were required on the car carrying the receiver, even though the receiver operated from the car battery.

The observation must be made that it is very necessary that the receiver have no image, spurious, or if response for these results to be duplicated as every spurious response is a gate through which ignition noise can enter. There is also a difficulty inherent in uhf sensitive receivers: namely that the rf stage gain, and also the converter gain, is so low that very sensitive if amplifiers must be used. The slightest if response in the receiver and ignition walks through.

Another thought on ignition and man-made noise in general, is that there are so very many channels in the uhf that the energy content on only one channel is bound to be quite low.

Airplane ignition noise is quite another matter. The very high energy level in the circuits accounts for part of it, but does not explain all of it, especially on an apparently well-shielded engine, where the wires are shielded with solid copper tubing right up to and including the plugs. One possible reason might be that, in a large engine, there are leads of various lengths varying from about a foot to fourteen feet from the magneto to the plugs. These are evidently a quarter, half, three quarters, etc., of any wavelength you may use in this region, and the shields tend to be antennas rather than shields.

Length of antenna

At 50 mc the length of a quarter wave antenna is about 54 inches, and at 250 mc it is 11 inches. Now we must remind ourselves of a very simple fact: the transmitter does not lay down a field in microvolts per wave-length, but in microvolts per meter. Therefore the greater the effective height (or rather the effective length) of an antenna,

(*Continued on page* 154)

WNBT - W2XWG ANTENNAS. Lower turnstile elements simultaneously transmit television pictures and FM broadcasting without mutual interference

NBC'S NEW FM TRANSMITTER

Engineering details of the experimental equipment in the Empire State Building Tower at New York

Several years before our entry into the War, NBC placed in experimental operation on the Empire State Building tower, 1250 ft. above New York's streets, one of the first FM broadcasting plants in the world. It superseded the amplitude-modulated uhf broadcast transmitters which had long been in operation, and took its place alongside NBC's veteran New York television transmitters.

This FM newcomer was a 1,000-watt transmitter and its call letters W2XWG have since been identified with high-fidelity transmission in the fullest sense of the term. As explained by O. B. Hanson, NBC vice-president and chief engineer and Raymond F. Guy, radio facilities engineer, this new station was originally built as a part of NBC's exhaustive field tests of frequency modulation in uhf sound broadcasting.

The results of this field test are well known to the radio industry since the data were widely published. The full results of this field test were also made available to the Federal Communications Commission at the FCC "FM Hearing" of March, 1940.

Expansion program

Upon completion of the hearing and the formulation of industry standards, NBC immediately initiated an expansion program to increase the power of its New York station to the maximum permitted under the new standards, and also to build a similar station in Chicago. Construction of the Chicago station was halted by material shortages before completion. The New York station was completed, but for the duration of the war will operate on somewhat less than its full-rated power to avoid the use of certain tubes more urgently needed for the prosecution of the war.

INTERMEDIATE POWER AMPLIFIER. Radio frequency unit using a pair of 833-A tubes

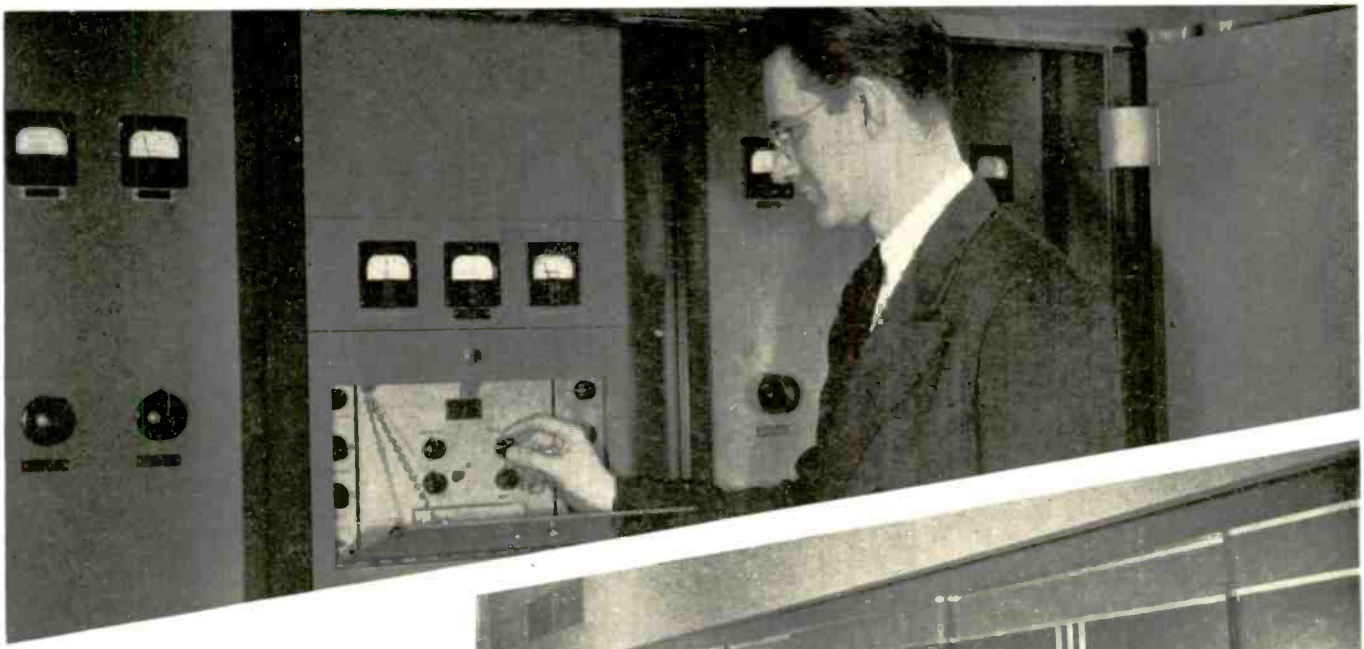
The new W2XWG transmitter is the RCA type FM1OA with a nominal rating of 10,000 watts. The modulating system is the well known "Crosby" type developed by RCA engineers. This system which utilizes a balanced reactance-tube modulator gives the utmost in fidelity and has been adopted by a number of transmitter manufacturers of broadcasting and other types of FM equipment. W2XWG is located in the Empire State Building, the tallest building in the world. The distinctive FM and television antennas at the very top of this building are visible for miles and have become familiar symbols of modern radio.

Transmitter

An accompanying picture shows the thoroughly modern "streamlined" installation of the transmitter proper. The front of the transmitter is indirectly lighted by concealed fluorescent illumination in the rear of the plaster drop curtain above the front of the transmitter. Cooling of the transmitter and ventilation of the transmitter room is accomplished by an elaborate ventilating system with inlet and outlet ducts in all compartments of NBC's large "Uhf Center" on the 85th floor of the Empire State Building.

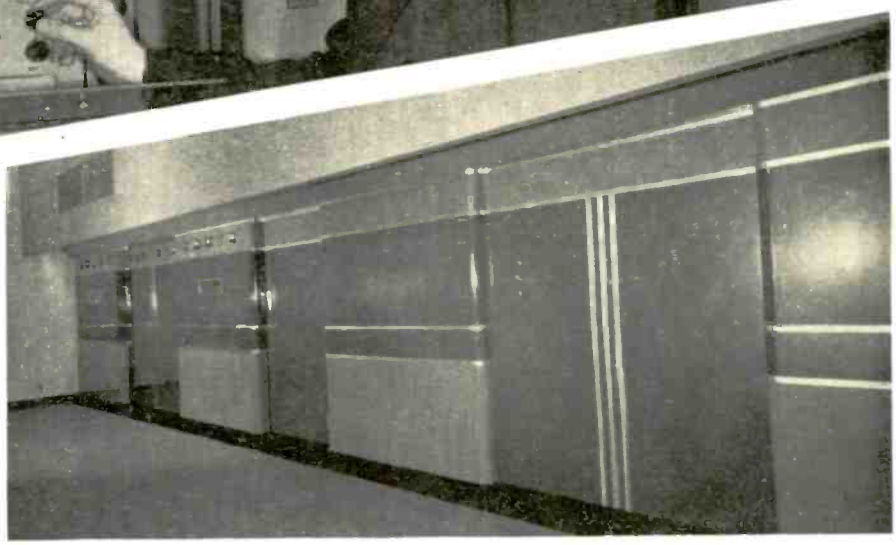
In modern equipment, most of the transmitter controls are located behind metal doors. Another picture shows the modulation and frequency control equipment being adjusted by engineer T. J. Buzalksi. The simple and efficient design of radio frequency amplifier stages in one of the transmitter compartments is also illustrated.

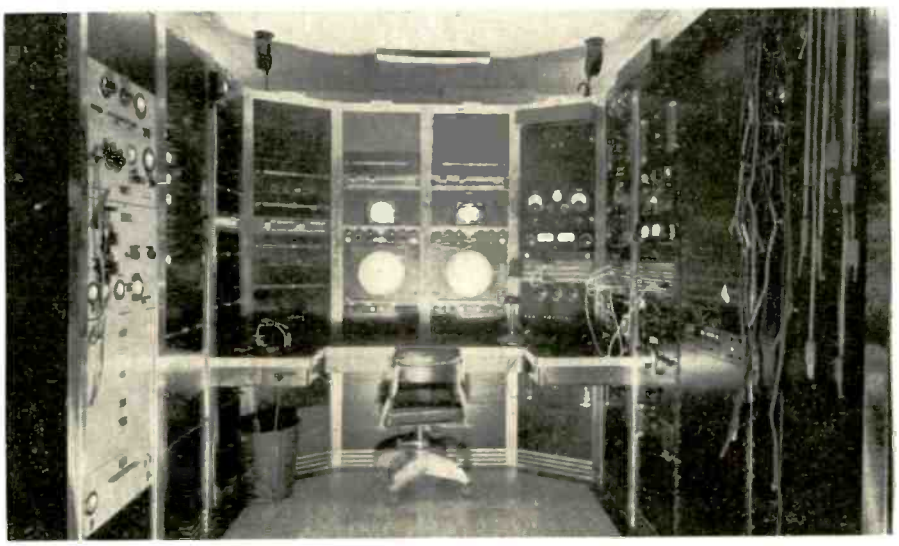
The antenna system of W2XWG is of particular interest. A diagram



MODULATOR EXCITER PANEL (above) showing concealed control

NEW W2XWG FM TRANSMITTER (right). This station will later use its commercial call letters W51NY





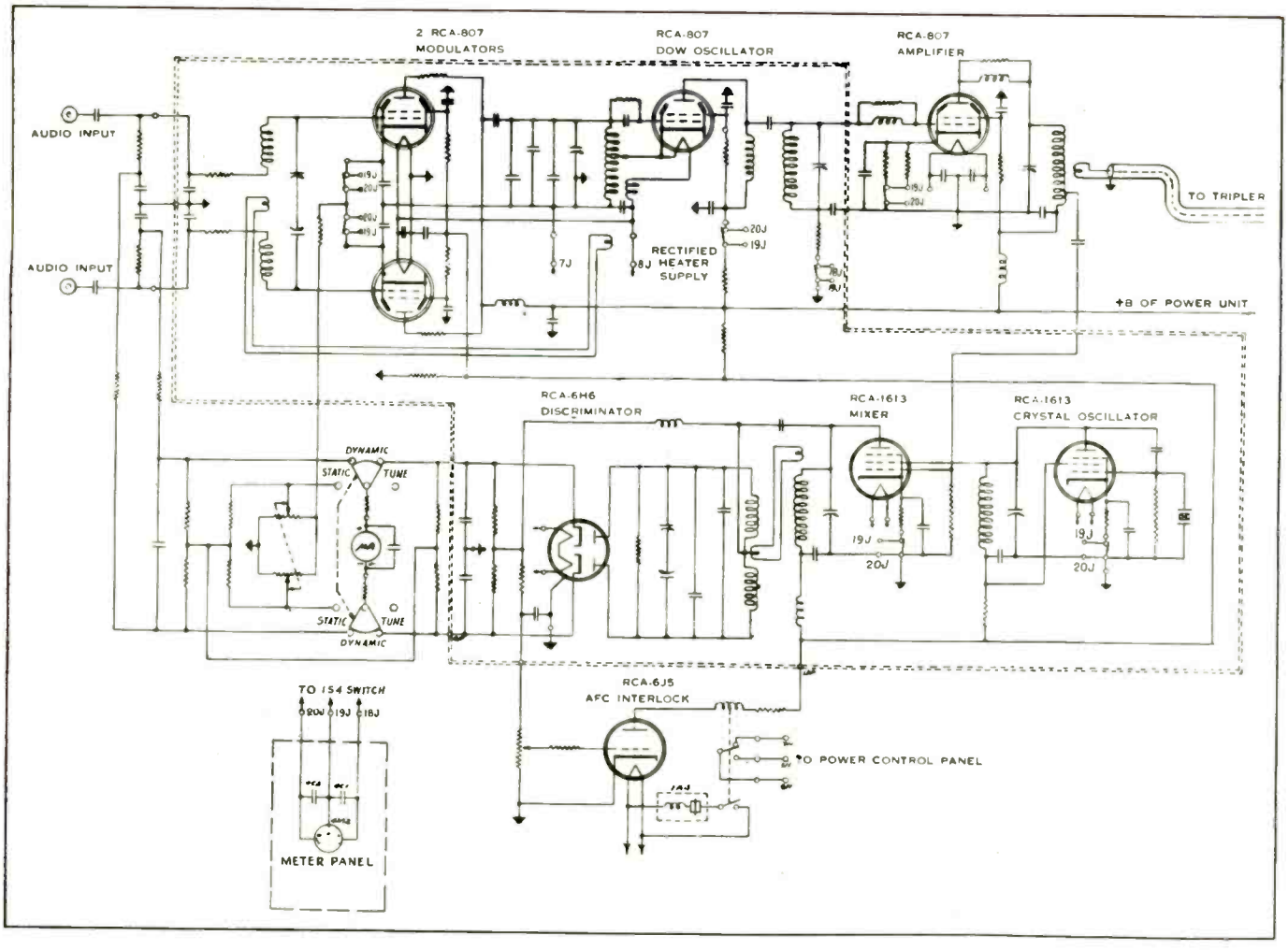
WNBT-W2XWG CONTROL ROOM of NBC "uhf center" at 85th floor of Empire State Building, New York City

illustrates the antenna systems used for both W2XWG and the television station WNBT. The lower antenna is an advanced type of turnstile array developed by RCA engineers to have a substantially uniform performance characteristic over the full range from 30 to 60 megacycles. This antenna has been used for several years for the simultaneous transmissions of both W2XWG and WNBT on separate frequencies, with separate transmitters and with separate programs. This antenna transmits the television pictures and by means of an array of coaxial filters, also transmits frequency modulation programs without mutual interference. Therefore, when listeners tune from NBC's television transmissions to its frequency modulation sound broadcasting, they are actually hearing waves which originate from the same antenna.

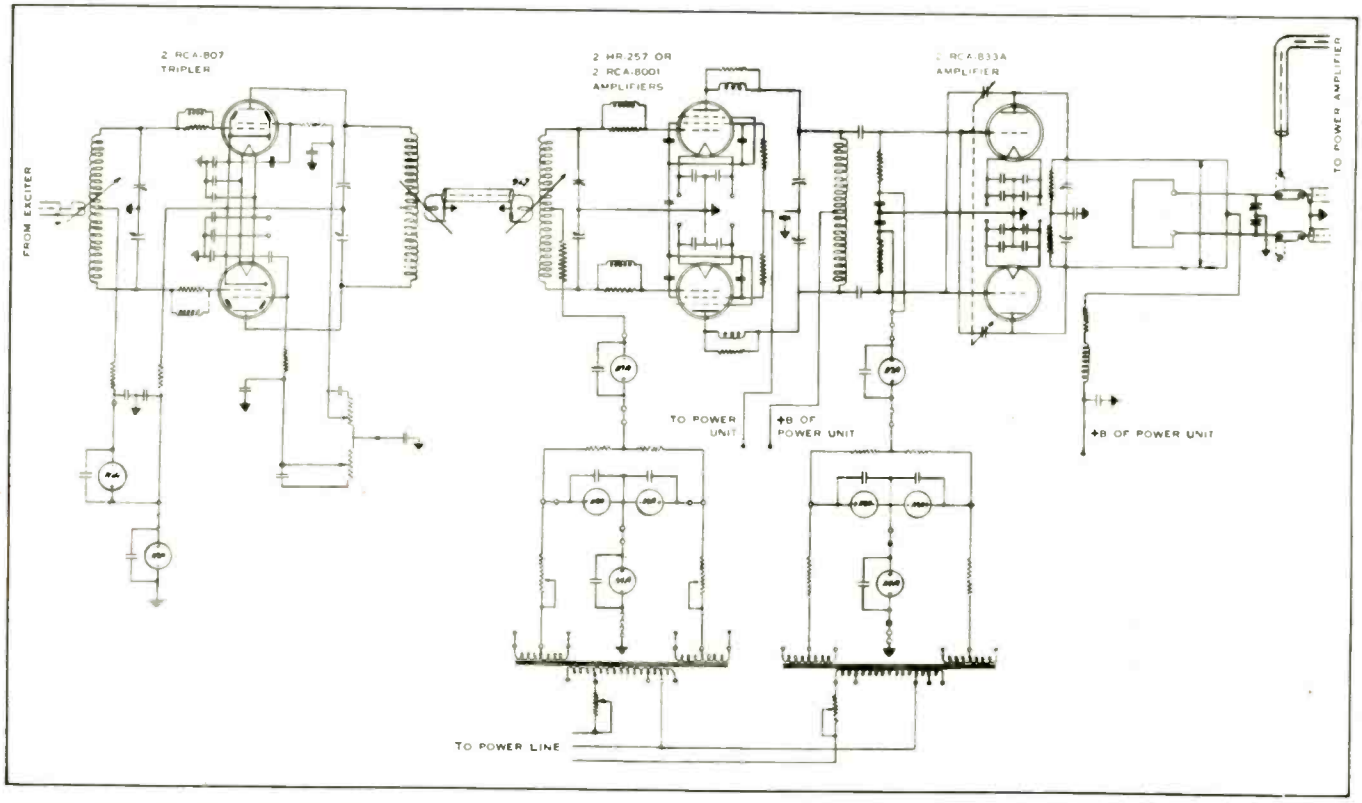
The horizontal loop antenna shown at the top was developed and built a number of years ago. It is a horizontal loop of the type which has subsequently come into popularity for uhf applications. The use of one antenna for two separate uhf services described herein may well receive widespread attention in coming years, since there will always be space limitations on high buildings and other elevated locations that could serve as antenna locations for many types of uhf radio services, if undue congestion were avoided.

Frequency modulator

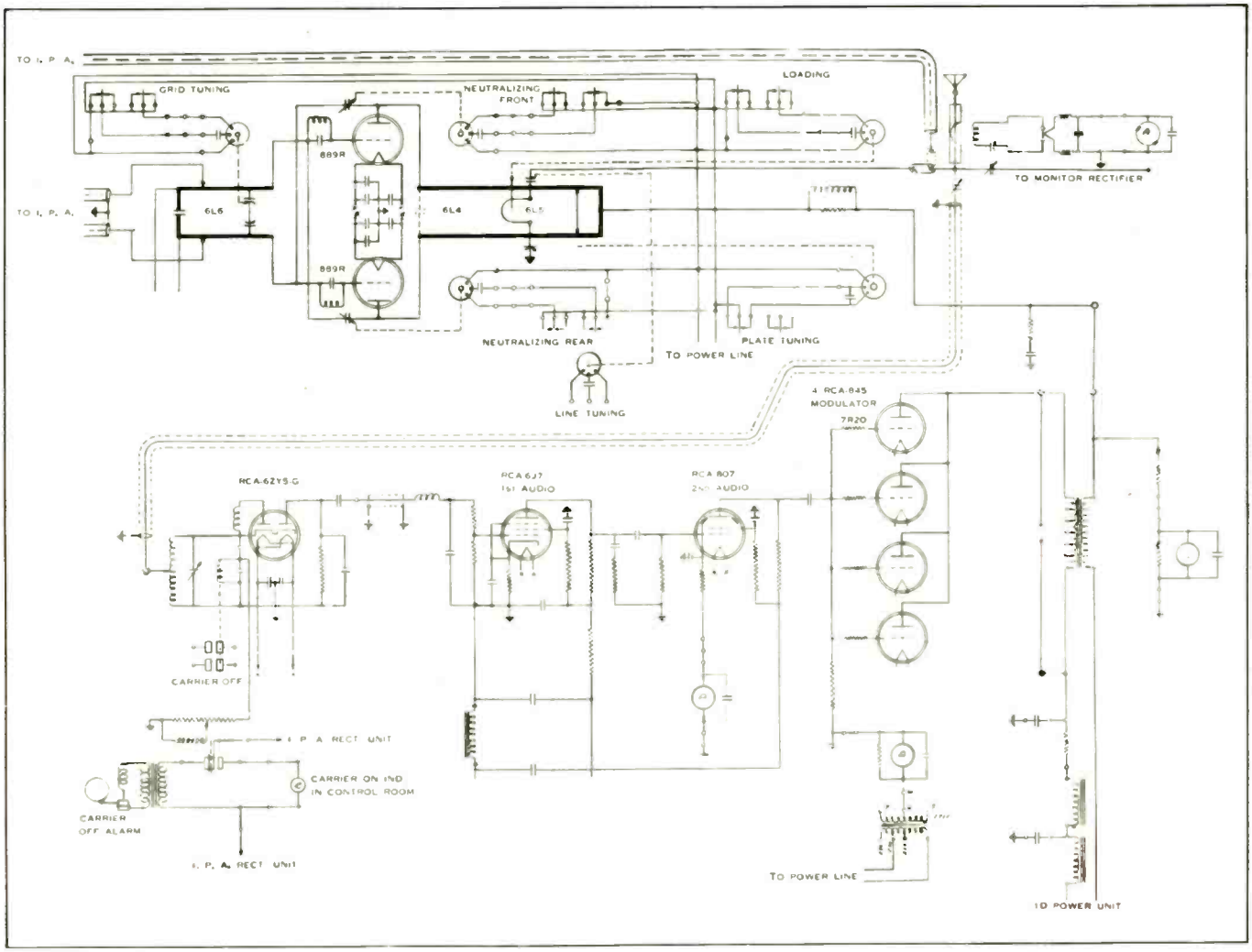
The modulating system is based on the "Crosby" balanced reactance-tube system of producing stabilized FM signals, developed by RCA engineers. The exact arrangement, shown in the layout of the Exciter Panel circuit, makes use of the frequency shift in a self-excited oscillator that occurs when any of its operating parameters are altered. These shifts, which are so troublesome with AM, have been carefully engineered to provide a



THE HEART of the system is the frequency modulated oscillator, with its automatic carrier stabilizer, all kept at a constant temperature for frequency stability



INTERMEDIATE RF AMPLIFIER increases the power level and triples the frequency



FINAL RF POWER AMPLIFIER with an automatic monitoring system that balances out any amplitude modulation products that may be present

stable but flexible frequency modulation system.

The oscillator (Dow circuit) tuning inductance is altered a definite amount by reason of a change in a shunting impedance produced by the plate impedance of a pair of modulator tubes. These tubes are biased in such a way that their plate impedance will vary in accordance with any audio frequency potentials impressed on their grids. All of the factors in this system have been set to produce linear modulation. In order to prevent the average carrier frequency from fluctuating during the modulation process, an auxiliary control circuit maintains this stability, which functions as follows:

A crystal controlled oscillator with the desired stability, but with a one megacycle frequency difference, heterodynes with the self-excited oscillator that is being modulated. The difference frequency of one megacycle is amplified and applied to a discriminator tube that delivers an output voltage that is proportional to that difference.

When the carrier frequency is such that this one megacycle difference is produced exactly, no voltage appears in the output. An output filter removes all modulation frequencies so as to produce a direct current. The potential from this filter controls the dc bias of the reactance tubes and thereby the average frequency of the oscillator. The filter prevents the reactance-tube bias from changing at the modulation frequency rate.

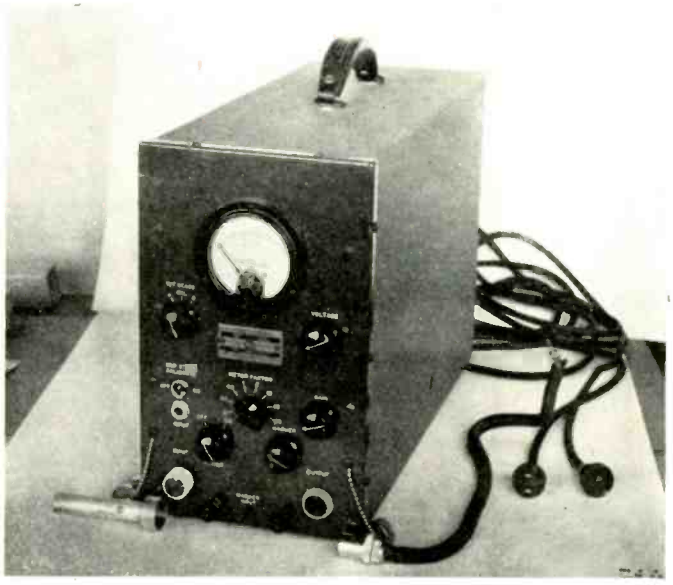
Amplifier tripler

The amplified output of the FM modulated oscillator is transferred by a coaxial link to a tripler panel to obtain the final frequency of 45.1 mc. An rf intermediate power amplifier unit consisting of two stages of push-pull amplification follows. These stages are engineered to maintain linear modulation characteristics over the wide range of modulation frequencies.

The power amplifier stage employs two RCA 889-R tubes in a push-pull circuit. The grid tank consists essentially of a three-fourths wave line which acts as an impedance transformer. The impedance reflected back to the intermediate power amplifier is adjusted by changing the position of the connections from the transmission lines to the grid tank, moving them up or down the line to raise or lower the impedance. The plate tank consists of a single-turn inductor which is resonated by the stray capacities and tuned by varying its length. Independently variable cross neutralization is used.

As will be noted on the diagram, all the normal adjustment operations that are associated with this final amplifier are motor operated, such as grid tuning, neutralizing each tube, plate tuning, line tuning and loading. (*Continued on page* 164)

Analysis of the oscillograms of detonation effects is readily carried out with the above equipment (Fig. 1) developed by Electro Products Labs, 549 W. Randolph St., Chicago



Wide band amplifier (Type 319A) manufactured by RCA adapted to transform the output of a piezo electric gage to operate an oscillograph

Internal Combustion Engine Analysis

Electronic devices aid in the study of engine operation and fuel utilization

The study of combustion engine fuels, and their most effective utilization, is closely linked with engine design and the adjustment of its controls. The well known indicator, so long used in steam engine management, has been found to be of little value in high-speed engine studies, either of the gas or Diesel types. The problems of the latter are in some regards similar, and for many tests the same types of equipment can be utilized, although the characteristic requirements of the test equipment may differ.

"Knock" characteristics

In Diesel work there needs to be a definite correlation between the start of injection and the time taken for the combustion (and the attendant pressure wave) to get under way with the type of fuel used. Several different valve-timing adjustments may be necessary, depending on the ignition speed of the fuel, its viscosity, the load, and the speed.

In gas engine developments and gasoline tests, a study of detonation or "knock" characteristics of the fuel is important. The knock that is noticed in a gasoline engine with some types of gasoline, or with some adjustments is actually a sound wave produced by abnormal pressure disturbances when the mixture is first fired. Pressure change rates greater than a certain value (which depends on the cylinder dimensions) produce but little power increment but become manifest as a "knock."

Detonation waves

The effect is something like hitting an oar with a hammer at the start of a stroke in rowing. Very little extra speed is produced, whereas the vibrations produced in the oar may cause damage. The frequency and amplitude of the sound waves in the cylinder depend upon the shape of the cylinder and the volume at the instant of firing, as well as the combustion speed and the density and pressure of the fuel mixture.

There are several systems by which these detonation waves are delineated and measured, the most common of which use the cathode ray oscillograph. In one development an electromagnetic pickup is inserted in the cylinder head by which the cylinder pressure alters a gap in a magnetic circuit thereby generating an emf that is amplified and applied to the oscillograph. A unit of this type produces an output which depends on the rate-of-change of the pressure wave. Several procedures may be selected in analyzing this wave, all of which have certain advantages and disadvantages. The oscillographic record of the rate-of-pressure-change shows considerable activity, since the output is the differential of the pressure diagram. In many tests it is almost necessary to transmit the generated "signals" through a selective filter, to eliminate all the output except the portion that is concerned with the detonation effect.

In the photograph Fig. 1, the Type 2300 filter utilizes resonance circuits with suitable couplings to provide a band width that is proper for the study of detonation effects at a particular engine speed. A range of 2000 to 8000 cycles is provided. The filter is connected di-

rectly to the vertical deflection terminals of a cathode ray oscillograph. The pressure operated pickups used with this filter employ the electromagnetic method of generating a voltage by converting diaphragm movements into flux changes through a many-turn coil of fine wire.

Another instrument developed for such tests is shown in Fig. 2. Here the PU 224 pressure pickup is also of the magnetic type and consists of a diaphragm, a permanent magnet, and a coil especially insulated to withstand the highest temperatures encountered. Pressures acting upon the diaphragm change an air gap, which in turn causes a change of magnetic flux through the coil and a voltage is generated therein. For detonation work the signal from the pickup is fed into the detonation selective amplifier which is tunable to any frequency between 2000 and 12000 cycles per second. Hence, it amplifies only the detonation signal to which it is tuned and reduces all other signals to negligible values. It actually amplifies the detonation signal 300 to 600 times depending upon the frequency.

Pressure curves obtainable

It may be noted that pickups of these types can be connected through an integration circuit to produce a pressure diagram directly, where the oscillogram ordinates are in terms of pounds pressure. However, the resulting curves may change in amplitude at different engine speeds, unless a compensated integrating circuit is used. The actual pressure amplitude at any point in the cycle is found to be more or less independent of speed if measured with a pickup that delivers an output voltage that is directly proportional to pressure. Such a pickup (shown in outline in Fig. 3) uses a pair of quartz crystals mounted back-to-back in a push pull connection.

Here two circular quartz discs (G) and (I) are separated by a central electrode (H) which is connected through a central lead (C) and a concentric shielded cable to the grid of an amplifier tube. The crystals are "poled" so that each delivers voltages of the same polarity to the common electrode at (H). An initial pressure is applied to the grounded faces by flat discs (F) and (J). The disc (F) is fixed but (J) is free to move up and down by the action of the pressure influenced diaphragm (N).

It will be noted that crystal (G) is perforated to permit passage of the central electrode lead, and that both crystals are chamfered to prevent the leakage of the generated potential from their inner surfaces to the shell (M). The whole device is obtainable to fit into the cylinder head through a hole drilled and tapped to fit a standard plug.

Carried by cable

The output voltage is carried by a special cable to a special wideband amplifier, which feeds the deflection plates of the cathode ray tube. It is possible to measure pressure of the order of 20 tons per square inch with well made and mounted crystals. They will deliver around 3 millivolts per 100 lbs.

These units have high impedance characteristics and the input circuit of the connected amplifier tube has a gridleak of around 100 megohms. An amplifier particularly adapted for this work is shown. Such amplifiers must be well shielded to prevent false pickup from ignition leads, etc. As an example the piezoelectric effect from the rubber connection cable when vibrated by the running engine has been found capable of producing disturbances in the oscillogram! The crystals are ground with a natural frequency of the order of one-half megacycle so as to be substantially off the normal useful frequency range, which is but a few hundred cycles in most tests.

Individual experience and preference of operators influence their selection of the type of pickup. It may be mentioned that the pressure units of the piezo type can be connected to a "differentiating" circuit to give rate-of-change diagrams at will, so that either type can be made to give both types of diagram.

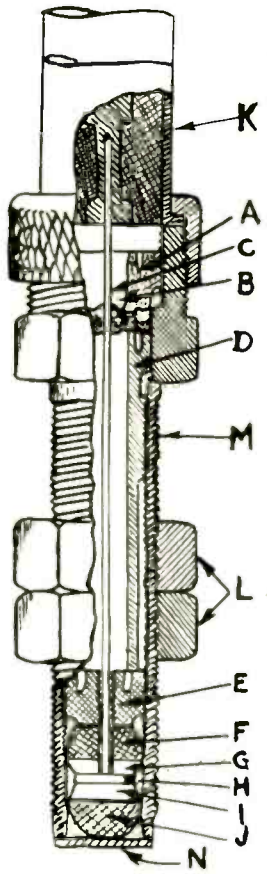


Fig. 3. A piezo pressure gage for cylinder combustion measurements

Other studies possible

Detonation and cylinder pressure studies are only part of the electronic measuring equipment used to further the designer's knowledge of what is going on in an engine. Unlooked-for variations in engine performance have been traced, for example, to actual cylinder stretch. While many of these effects may be only a few ten thousandths of an inch, they produce measurable effects on performance.

Electrical engineers have long measured and compensated for the phase differences in equipment circuits to obtain maximum performance. Now by applying the same type of measuring apparatus, automotive designers are correcting for the changes in operating characteristics caused by the torsional strains in crankshafts, resonance conditions in valve springs, connecting rod strains, and fuel flow-time through manifolds and valves.

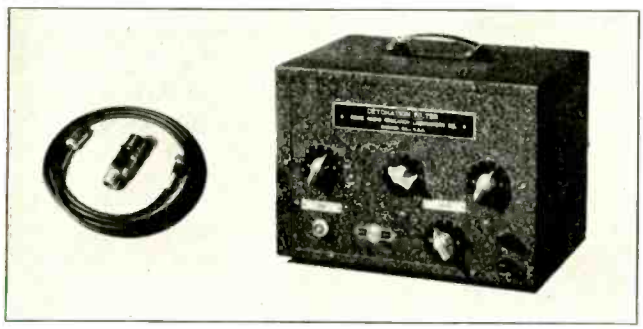


Fig. 2. A selective amplifier developed by Rowe Radio Research Laboratory, 2422 N. Pulaski Rd., Chicago, for automotive engine studies

OPTIMUM TURNS RATIO for

by ROBERT M. HANSON

Research and Design Engineer, Thordarson Mfg. Co.

The design of an audio transformer for a specific application depends upon the associated circuit constants for best efficiency

Engineers are often confronted with the problem of designing amplifier systems that are efficient only over a limited frequency range, or even for a single frequency. While the discussion that follows will treat the application of the midget type of audio frequency transformers, the rules will also apply to electronic installations of any power, that have to do with the amplification of a single frequency. The data presented in graphic form is accurate for a specific application but is offered only to illustrate the theory.

An interstage transformer may have its primary impedance increased by tuning the winding to parallel resonance with a condenser. This primary impedance will be the load for the tube and equal to $2\pi f\ L_p\ Q$. L_p is the primary inductance and Q is the quality factor. This value of Q is determined by the winding resistance and the core loss of the transformer. In actual practice the Q will usually range from 2 to 10.

The voltage developed across the primary of an interstage transformer is given by the expression:

$$E_p = \frac{R_L}{R_L + R_p}\mu\ e_g$$

where R_p = plate resistance of tube
R_L = primary impedance of transformer
e_g = signal voltage at grid of tube
μ = amplification factor of tube.

This formula may be modified for the pentode condition where R_p is very large compared to R_L and becomes:

$$E_p = e_g\ G_m\ R_L$$

G_m = transconductance of tube

The secondary voltage of the transformer will be N_s/N_p times E_p where N_s/N_p is the turns ratio, and this secondary voltage will be called E_s.

The voltage gain of the stage will be:

$$E_s/e_g = \mu\ \frac{R_L}{R_L + R_p}\ N_s/N_p$$

and for the pentode condition:

$$\text{gain} = G_m\ R_L\ N_s/N_p$$

Examination of these expressions leads to the conclusion that maximum gain will be obtained if the primary impedance is as large as possible, and if the step-up ratio of the transformer is also as high as possible.

The primary inductance of a transformer is proportional to the square of the number of turns, and may be stated:

$$L_p = C\ N_p^2$$

C = a constant determined by core area, permeability, length of air-gap, etc.

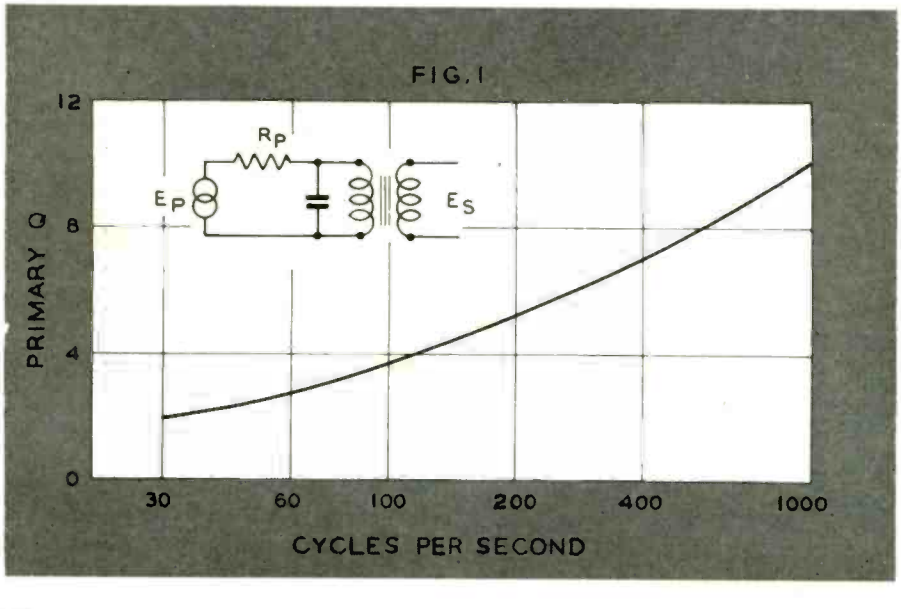
An interstage transformer operating into the grid of a Class A amplifier tube will not be required to deliver power, and the transformer minimum wire size will be limited by production problems, rather than current carrying ability. Consequently the midget type transformer has a limited total number of turns that may be wound into the coil. Any desired ratio may be selected if the sum of primary and secondary turns does not exceed this limit. As an example, a certain small lamination size might be suitable for a maximum of 18,000 turns of No. 44 En. wire and the following combinations are among the possibilities:

Ratio Sec./pri.	Pri. Turns	Sec. Turns
0.5	12000	6000
1.0	9000	9000
2.0	6000	12000
5.0	3000	15000

An increase in the step-up ratio of the transformer must be accompanied by a decrease in the number of primary turns, and consequently a decrease in the primary inductance. There will be a specific ratio for each application that will give the optimum balance between turns ratio and primary impedance and result in the maximum voltage gain for the amplifier stage. It most certainly cannot be assumed the highest step-up ratio will result in the maximum voltage gain.

The application of the interstage transformers may be divided into two general groups. The first is where the primary is loading a high plate resistance tube of the pentode type, and the second is

Fig. 1. The usual audio transformer shows an increase in the quality factor Q as the frequency increases



Interstage TRANSFORMERS

where the tube is a low plate resistance tube such as a triode. The source resistance in the first case may be as high as one megohm, while in the second case it will usually be less than 10,000 ohms.

The voltage gain of the pentode stage, where the plate resistance was large compared to the load impedance, was given as:

$$a = G_m R_L N_s/N_p$$

It was also shown that the primary impedance

$$R_L = 2\pi f L_p = 2\pi f C N_p^2$$

And substituting:

$$a = G_m 2\pi f C N_p^2 N_s/N_p$$
$$a = A N_p N_s$$

Let: K = Total number of turns in both windings

Then: $K - N_p$ = Number of secondary turns N_s

$$a = A N_p (K - N_p)$$
$$a = A K N_p - A N_p^2$$
$$\frac{d a}{d N_p} = A K - 2 A N_p$$

Now by setting $\frac{d a}{d N_p} = 0$, we may determine the condition for maximum gain.

So: $A K - 2 A N_p = 0$

and $$N_p = \frac{K}{2}$$

This establishes that maximum voltage gain will be obtained when the transformer ratio is 1 to 1. This fact will be valid for all interstage transformer applications either tuned or untuned providing the source resistance is relatively much larger than the primary impedance of the transformer.

A similar situation exists when the primary impedance of the interstage transformer is equal to the source resistance. The general formula for voltage gain was:

$$a = \mu \cdot \frac{R_L}{R_L + R_p} N_s/N_p$$

Assuming R_L equal to R_p, this expression may be rewritten:

$$a = \mu \frac{R_L}{2 R_L} N_s/N_p = \frac{\mu}{2} N_s/N_p$$

Fig. 2 gives the results of computations for the proper ratio of a tuned transformer for maximum gain at 150 cycles per second. The results are based upon the following reasonable assumptions: (a) The Q of the tuned winding was 5 for all ratios; (b) The source

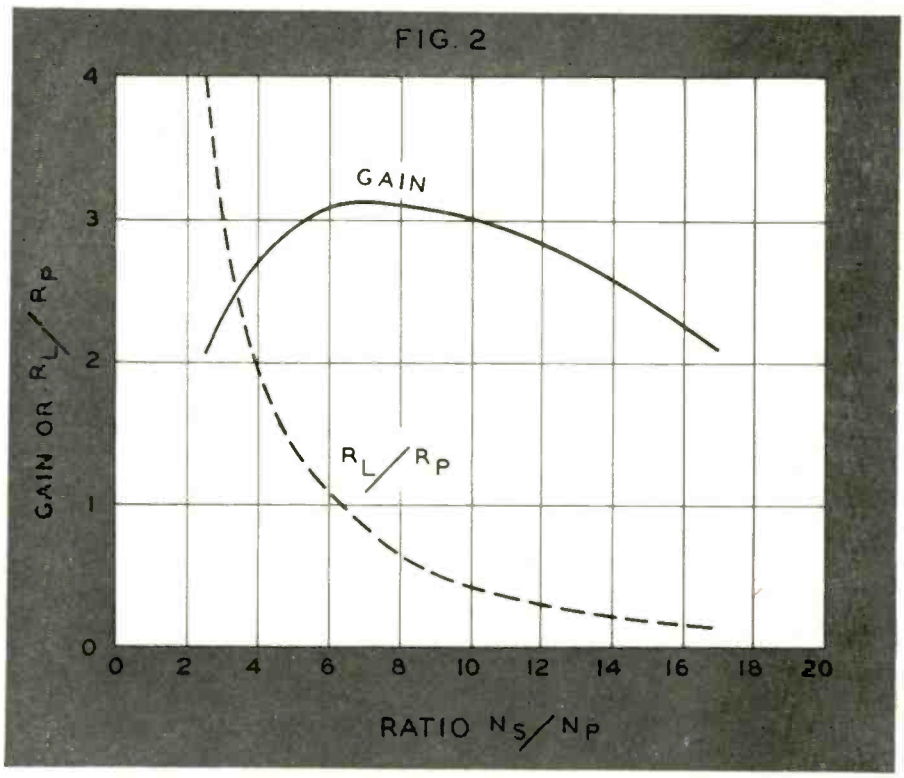
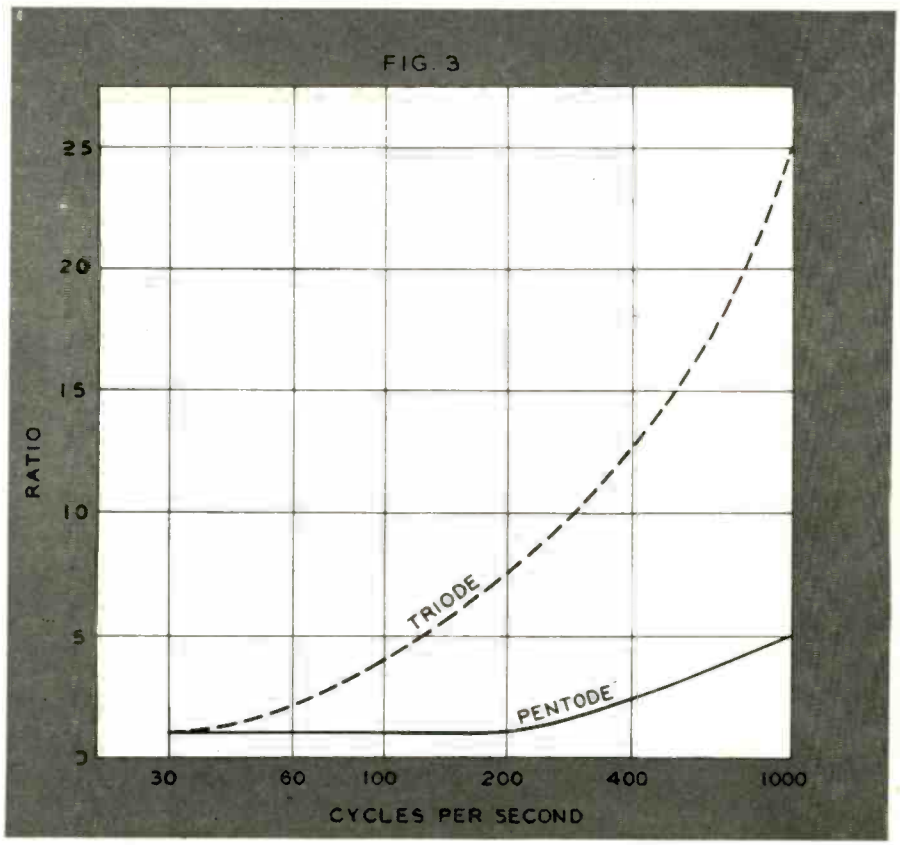


Fig. 2. Each special purpose transformer has its own turn-ratio optimum

Fig. 3. Higher ratios are permitted when high audio frequencies only are required



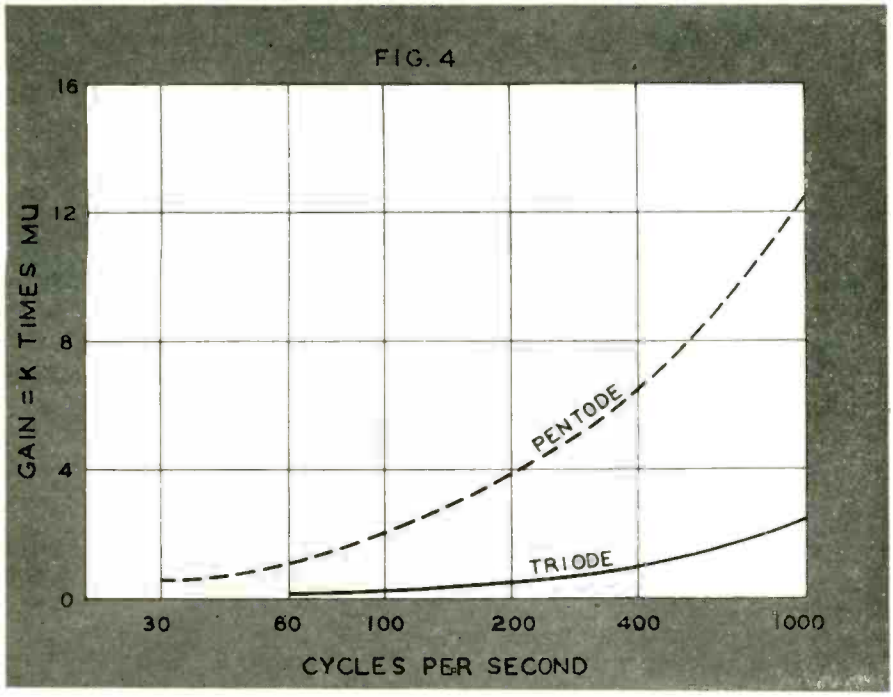


Fig. 4. Gain expectancy when optimum ratio is employed

resistance was 10,000 ohms; (c) The core structure was such that an inductance of 2.1 henry was obtained when the ratio of primary to secondary turns was 6.2, and it was also assumed that the inductance would vary as the square of the number of turns over the range involved; (d) The ratio was varied and gain calculations based upon a fixed sum of primary and secondary turns.

Fig. 2 shows that the maximum stage gain will be obtained when the transformer ratio is such that the primary impedance will equal the plate resistance of the tube (source resistance). The results are plotted to show the general case rather than specific values.

It is now possible to draw the following general conclusions regarding the optimum ratio.

1. A 1 to 1 ratio should be used when the source resistance is either equal to, or larger than the primary impedance of the transformer.

2. When it is possible to design a 1 to 1 ratio transformer with a primary impedance greater than the source resistance, the gain will not be as great as if the primary turns are reduced until the primary impedance is equal to the source resistance, and these extra turns added to the secondary to give a step-up ratio. The expected stage gain will be equal to 0.5 times the amplification factor of the tube, times the step-up ratio of the transformer.

Fig. 1 shows the assumed values of Q used in preparing a chart of ratio versus frequency for a specific core size and core material. These values are not an example of an actual design but are merely given to illustrate the effect of frequency on the optimum ratio for maximum stage gain.

Fig. 3 has two curves, one showing optimum ratio of a midget transformer loading a pentode tube, and the other curve operation with a triode tube. The effect of using a better core material would be to shift the curves toward the left and increase the optimum ratio for each frequency. These curves show that for every condition of source impedance, operating frequency, circuit Q, and transformer materials and size, there will be an optimum ratio for maximum voltage gain of the stage.

Fig. 4 is a graph of the voltage gain to be expected from the ratio given in Fig. 3. The gain is plotted as a constant to be multiplied by the amplification factor of the tube. At a frequency where the optimum ratio is 1 to 1 and the primary impedance of the transformer is equal to the source resistance, the stage gain is seen to be equal to one-half of the amplification factor of the tube.

The use of the very small transformers in a circuit generally indicates that it is necessary to get high electrical performance in a very small volume of equipment. Consequently it is especially desirable to obtain the ultimate electrical efficiency from the circuit. This means that each element of the circuit must be designed to give the best operation when used in its proper place.

The above discussion brings out the need for complete circuit information in order to achieve the best possible transformer design. Even the proper ratio cannot be properly determined until the factors of, (a) size and material limitations, (b) operating frequency, (c) operating voltage level and expected variations, (d) direct current component in winding, (e) source resistance, (f) input admittance of following tube, and (g) available commercial production facilities, are in the hands of the engineer.

Consideration should also be given to the choice of the proper winding to be tuned. A 1-to-1 ratio transformer with concentric windings will have approximately 20 per cent more resistance in the outside winding because of the longer mean length of turn. When high primary impedance is desired, the lowest resistance winding should be tuned with the parallel condenser, and this winding should be the secondary. The primary impedance at resonance will be the lowest value when the highest resistance winding is tuned as the primary. The general rule is to tune the winding where the highest Q will be obtained.

In practical design some allowance must also be made in inductance to permit tuning to the exact value. This is usually done by variation of an airgap in the magnetic circuit. This practical requirement results in the utilization of somewhat less than the maximum capabilities of the transformer size.

THE ELECTRONIC ERA

We have developed new weapons, some so revolutionary that they quickly modified the science of tactics. Other new weapons are in process now.

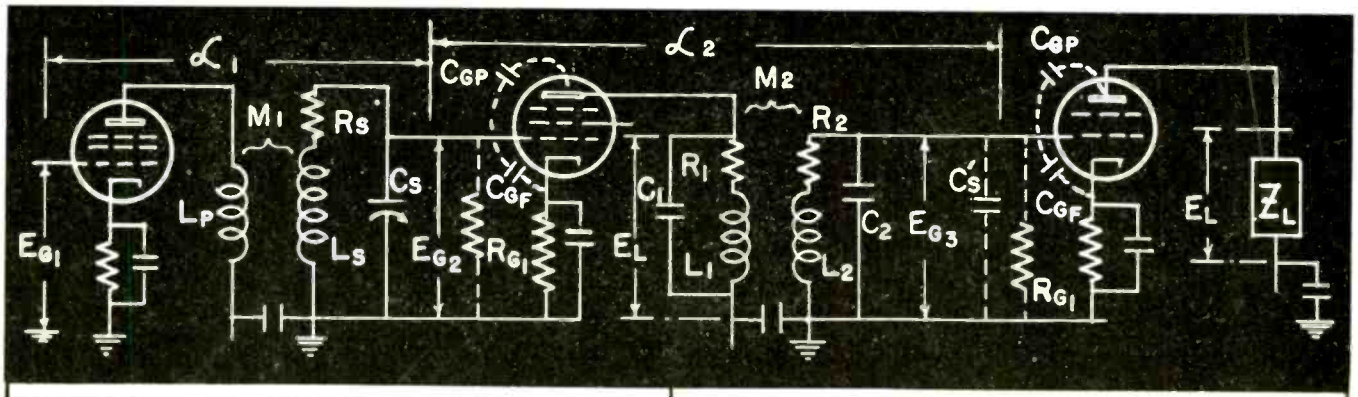
—Lt. Gen. Brehon Somervell

Police-radio protection pays its own way. Under today's conditions four times as many patrolmen would be required for comparable protection of life and property.—*Lloyd N. Chatterton, President International Municipal Signal Association.*

FORMULAS FOR R. F. VOLTAGE AMPLIFIERS

Design rules by which the best operating conditions for transformer-coupled amplifiers can be determined

Compiled by W. E. Moulic, Jr.



UNTUNED PRIMARY TRANSFORMER

1A) GAIN AT RESONANCE

$$\mathcal{L}_1 = \frac{E_{G2}}{E_{G1}} = \frac{G_M}{\frac{M}{R_P L_S} + \frac{1}{\omega_0 M Q_S}}$$

$$\mathcal{L}_1 \doteq G_M \omega_0 Q_S M \quad \text{(FOR PENTODES)}$$

WHERE $Q_S = \frac{\omega_0 L_S}{R_S}$

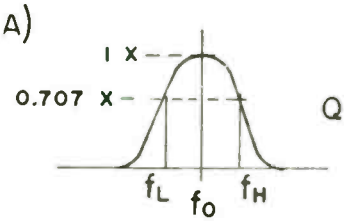
2A) REFLECTED LOAD TO INPUT TUBE AT RESONANCE

$$R_L = \frac{\omega_0^2 M^2}{R_S} = \frac{Q_S \omega_0^2 M^2}{\omega_0 L_S}$$

3A) EFFECTIVE Q_S' WITH SHUNT LOAD R_{G1}

$$Q_S' = \frac{1}{\sqrt{\frac{L/C}{R_{G1}}} + \frac{1}{Q_S}}$$

4A)



$$Q = \frac{f_0}{f_H - f_L}$$

f_L AND f_H ARE FREQUENCIES AT WHICH GAIN IS 0.707 OF PEAK VALUE

SYMBOLS:

M = MUTUAL INDUCTANCE, HENRIES
ω_0 = RESONANT ANGULAR VELOCITY
R_P = PLATE RESISTANCE, OHMS
G_M = GRID-PLATE TRANSCONDUCTANCE, MHOS.
K = COEFFICIENT OF COUPLING.

DOUBLE TUNED TRANSFORMER

1B) GAIN AT RESONANCE

$$\mathcal{L}_2 = \frac{E_{G3}}{E_{G2}} \doteq G_M K \frac{\omega_0 \sqrt{L_1 L_2}}{K^2 + \frac{1}{Q_1 Q_2}}$$

WHERE $K = \frac{M}{\sqrt{L_1 L_2}}$, $Q_1 = \frac{\omega_0 L_1}{R_1}$, $Q_2 = \frac{\omega_0 L_2}{R_2}$

2B) COUPLED LOAD AT RESONANCE

$$R_L \doteq \frac{Q_1 \omega_0 L_1}{1 + K^2 Q_1^2}$$

WHERE $L_1 = L_2$, $Q_1 = Q_2$

3B) CRITICAL COUPLING

$$K_C = \frac{1}{\sqrt{Q_1 Q_2}}$$

4B) BAND WIDTH BETWEEN PEAKS

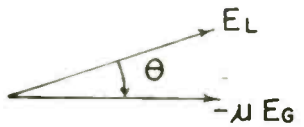
$$f_2 - f_1 \doteq K f_0 \sqrt{1 - \frac{1}{K^2 Q_1^2}}$$

$$\doteq K f_0$$

WHERE $Q_1 = Q_2$

5B) INPUT RESISTANCE

$$R_{G1} = -\frac{X_{C_{GP}}}{\mathcal{L} \sin \theta}$$



θ = LEADING + FOR INDUCTIVE LOAD.

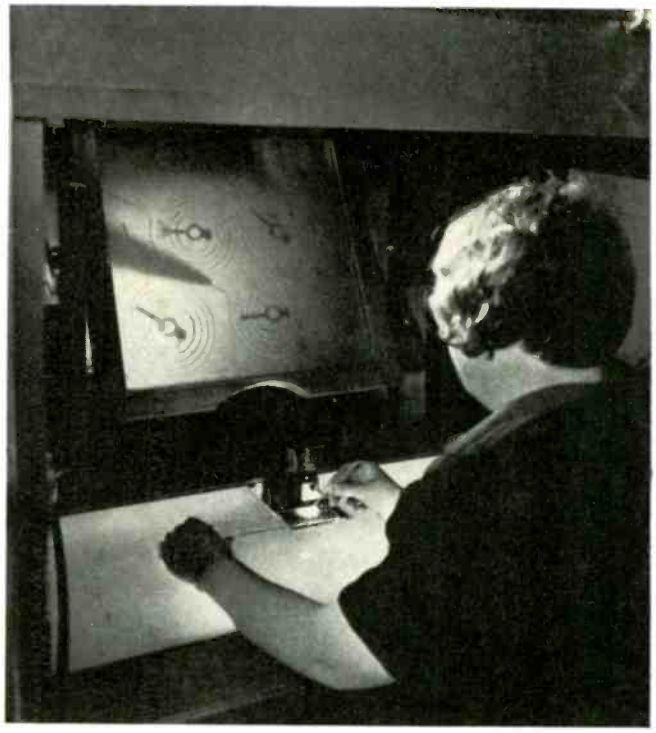
6B) INPUT CAPACITY

$$C_S' = C_{GF} + C_{GP}(1 + \mathcal{L} \cos \theta)$$

(θ SAME AS 5B)

1. *Inspection of Small Commutators*

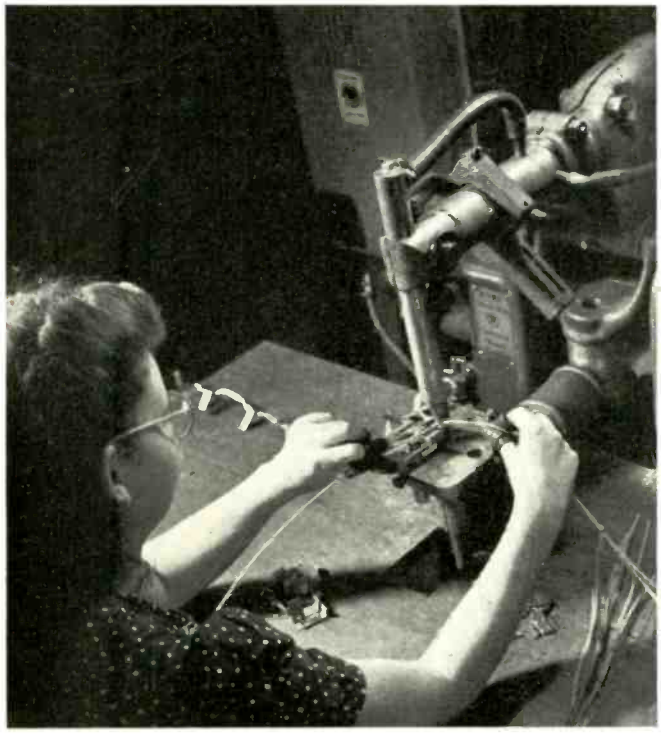
stepped up 20% by means of improvised equipment which throws 22-times enlarged image on glass screen. Screen carries vertical lines to check precision of mica and copper segments. Aero Digest named this best production short cut of month, awarded Westinghouse worker $100 war bond



2. *Shadowgraph Instrument*

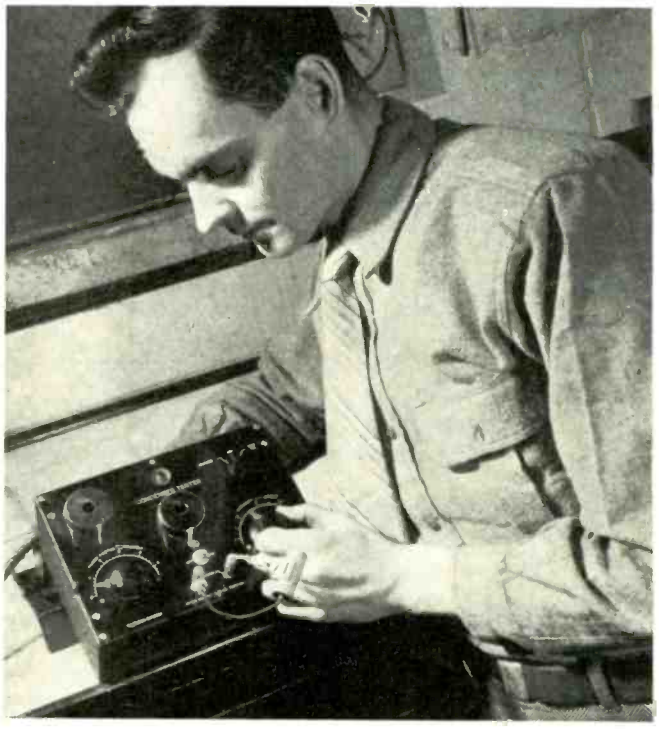
at Weston's Newark, N. J., plant does same thing for delicate meter movement springs. Vastly enlarged shadow-image on screen enables operator to "see at a glance" whether springs conform to precise standards required

10 FACTORY Short Cuts



3. *Quick Brazing With Spot Welder*

can be accomplished cheaply and easily on a production line basis. Advantages are lower heat, faster operation, and elimination of the need for special preparation of the joint. Phos-copper brazing alloy is used in this Westinghouse set-up



4. *Compact Condenser Tester*

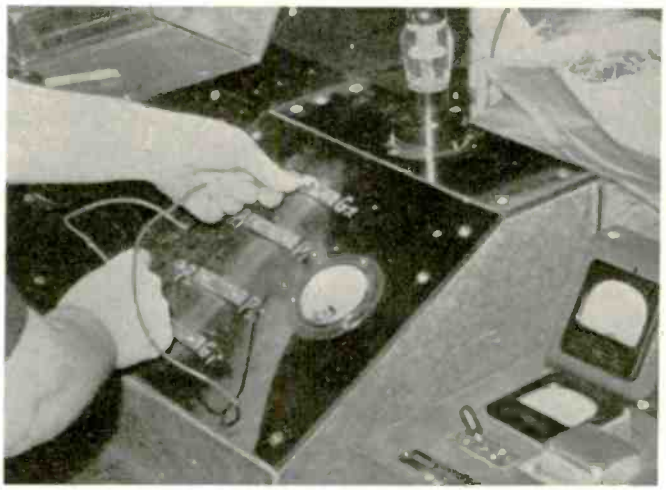
built by Cities Service Oil Company tests for leakage, by action of small neon lamp at top of panel, measures capacity, with bridge and electron ray tube, and reads power factors up to 5%. "Magic eye" under hood at center of panel

5. *Complicated Testing Simplified*

by careful design of automatic testing equipment. This "Autosyn check" unit used by Douglas Aircraft Company, Long Beach, California, speeds testing circuits for lights, etc., before inner wing is joined to fuselage

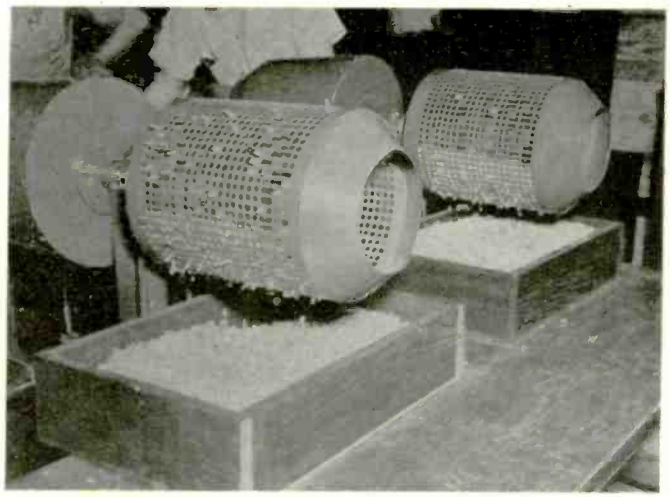
6. *Close Limit Gaging*

of galvanometer pole-pieces at Helland Research Corp., Denver, Colorado, with a Metron four-range electric comparator. Inductance bridge air-gap introduces unbalance; high range magnifies dimensions 10,000 times on meter



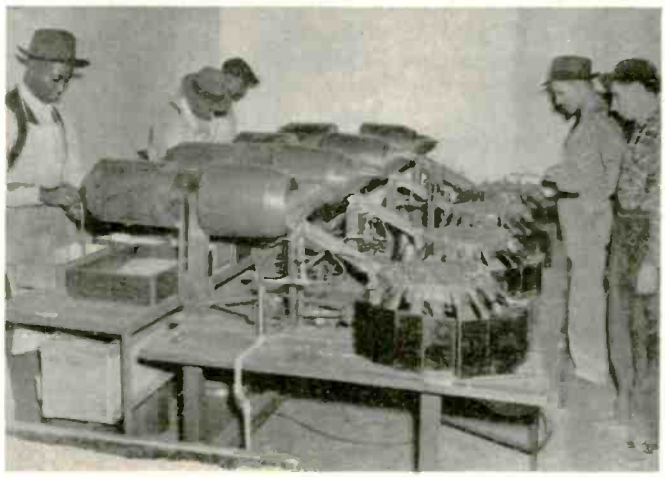
7. *Drag-Over-Switch*

speeds checking tubes for shorts in Newark National Union small transmitting tube works. Instead of throwing numerous toggle switches, operator has only to whip test prod down across copper bars on panel and watch for meter deflection



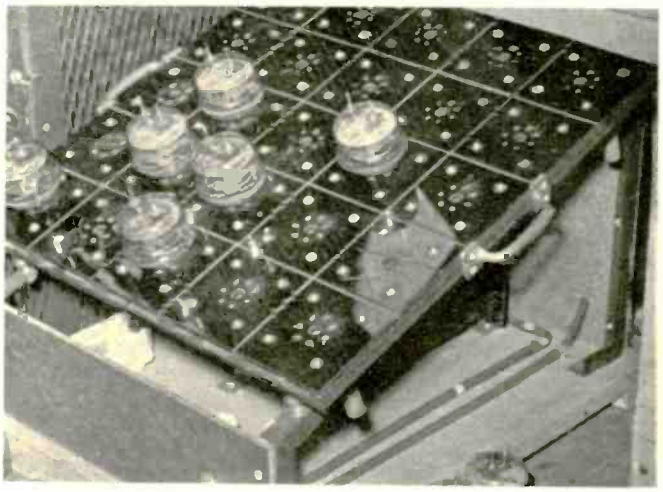
8. *Salvaging Rivets Exact Science*

with these units developed by Fisher Body division of General Motors. Interchangeable revolving cylinders first sort rivets according to thickness regardless of length or head type



9. *Further Sorting of Rivets*

first according to head type, then by length, is accomplished here by automatic "go-no-go" systems which kick out various types and lengths to the appropriate distribution troughs



10. *Plug-In Tube Preheaters*

in final test department at National Union save time and steps. "Server" inserts tubes in preheaters and keeps cathodes hot until operator at test position (shown here) needs more, when the full preheater panel is plugged in at test position

Where to Find Specific Information on

Electronic Uses in INDUSTRY

by W. C. WHITE
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As a result of the greatly increased interest and activity in the science of electronics, there has been an accompanying increase in the amount of information published on the subject. This has ranged all the way from the merely glamorous to highly scientific articles. It has been presented in new books, as well as in numerous articles that have appeared in periodicals.

For factory managers, their engineers, electrical superintendents, laboratory men, or electricians, whether the plant be large or small, it is none too easy, however, to find detailed information on specific electronic applications.

The publication "Electronic Industries" is now doing an excellent job in filling this need. It cannot possibly in the near future, however, cover the very large amount of material that has been made available on the subject in past years.

20,000 articles

Even electronic engineers do not generally appreciate how large a number of articles on electronic devices and applications have been published. The figure is certainly well over 20,000.

It is the purpose of this article to make known to readers of "Electronic Industries" such references as they may find helpful in applying electronics to their own processes, methods, or problems.

The application of electron tubes to industry occurred, of course, at a much later date than their use in radio. In fact, prior to 1930, there were only a few such applications in industry. This early period and early reference to electron tubes outside the radio field is covered in a report of a Joint Subcommittee of the American Institute of Electrical Engineers. This appeared on pages 650-654 in the Transaction Section of "Electrical Engineering" published in the December, 1940, issue. It is entitled "A Decade of Progress in the Use of Electronic Tubes in Other Than the Field of Communication."

As has been stated, the references that follow have been selected from a very large number as being the most helpful to the technical men in manufacturing plants. For this reason, special attention has been given to certain articles in trade magazines describing electronic applications in their particular industry, not only in a specific way but from the viewpoint of men in that industry.

Basis of selection

In general, the list is made up of fairly recent articles but occasionally some articles of unusual merit written ten or more years ago are included because they cover their subject so well. In some cases also, the references are fairly old because the development occurred then—and there have been few recent changes or additions to the technique.

Many of the references listed fall into two broad classes. The first is descriptive of equipment that is available for purchase, while the other is descriptive of circuits and methods devised by the writer of that article to accomplish certain specific results in the case of a particular problem.

The number of articles listed on a given subject or application has been governed to some extent by the current activity in the subject. Thus high-frequency heating and welding control, being active at the present time, have relatively numerous references listed.

Scope of subject

Because of the breadth of the modern science of electronics, it has been necessary to limit the scope of this list.

No foreign-language articles have been included, because they have not, during the past few years, been easily available. Also only a few English - language foreign publication references have been employed and only where it was felt that equivalent information in American publications was lacking.

A few of the references are not descriptive of electronic devices but are included because they are on the subject of items frequently used with the application of electron tubes.

A considerable number of the articles listed also include further lists of references, so that once a start has been made it is usually relatively easy to find out where most of the available information on a given subject exists.

A special section has been added to the group of references covering phototubes and some of their characteristics or specific applications. The use of phototubes also, of course, enters the picture in the case of some of the other sections.

As the list is primarily directed to tube applications in industry, there are included no articles on the design, theory, or construction of tubes themselves. For a similar reason, the list includes no references primarily in the field of radio communication or broadcasting.

Notes on use of references

The inclusion of an index, as well as references grouped by nature of the application, has been found helpful as it allows a study of either a specific application or a general field.

This index has been compiled from the viewpoint of providing information on detailed applications. Such information is often not apparent from the title of the article.

The foreign publications referred to are as follows:

"I.E.E. Jour." — Journal of the Institute of Electrical Engineers, a British publication.

"Jour. Sci. Instr."—Journal of Scientific Instruments, a British publication.

"Philips Tech. Rev." — Philips Technical Review, a Dutch publication.

"Proc. Royal Soc." — Proceedings of the Royal Society, a British scientific publication.

The abbreviation "h.f.," of course, refers to "high frequency."

Amplifiers

1. Automatic Neutralization of the Variable Grid Bias in a Direct Current Feed-Back Amplifier. Preston B. Carwile and F. A. Scott. "Rev. of Sci. Instr.," April, 1930; Vol. 1, pp. 203-206.
2. Exact Compensation for the Effect of A and B Battery Changes When Using the Vacuum Tube as a DC Amplifier. Raymond C. Dearle and Lorne A. Matheson. "Rev. of Sci. Instr.," April, 1930; Vol. 1, pp. 215-226.
3. Amplifiers for Precise Oscillographic Measurements. Sigmund K. Waldorf. "Franklin Inst. Jour.," June, 1932; Vol. 213, pp. 605-622.
4. Direct-Current Amplifier With Good Operating Characteristics. A. H. Taylor and George P. Kerr. "Rev. of Sci. Instr.," January, 1933; Vol. 4, pp. 28-32.
5. Supersensitive Amplifier for Measuring Small Currents. F. J. Moles. "General Electric Review," March, 1933; Vol. 36, pp. 156-158.
6. Improved DC Amplifying Circuit. Lee A. DuBridge and Hart Brown. "Rev. of Sci. Instr.," October, 1933; Vol. 4, pp. 532-536.
7. On Balanced DC Amplifying Circuits. Louis A. Turner. "Rev. of Sci. Instr.," December, 1933; Vol. 4, pp. 665-671.
8. Stabilized Feed-Back Amplifiers. H. S. Black. "Elec. Engng.," January, 1934; Vol. 53, pp. 114-120.
9. Amplifiers for Alternating Current Bridges. W. A. Ford and H. W. Bousman. "General Electric Review," May, 1934; Vol. 37, pp. 224-226.
10. Some Experiments on the Amplification of Thermocouple Electromotive Forces. Ross Gunn. "Rev. of Sci. Instr.," September, 1938; Vol. 9, pp. 267-269.
11. Cyclotron Radio-Frequency Power Unit. N. I. Adams, Jr. and H. L. Schultz. "Rev. of Sci. Instr.," October, 1940; Vol. 11, pp. 303-305.
12. Behavior of a Balanced DC Amplifier. Roy C. Spencer and LeRoy Schulz. "Rev. of Sci. Instr.," January, 1943; Vol. 14, pp. 10-14.

Control Applications

General

13. Application of Electron Tubes in Industry. D. E. Chambers. "Elec. Engng.," January, 1935; pp. 82-92.
14. Trouble Shooting on Electric Control. L. G. Levoy. "Mill and Factory," March, April, June, 1942.
15. Practical Electronic Ways. W. D. Cockrell. "Elec. Mfg.," June, 1942; Vol. 29, pp. 34-37, 96, etc.

Furnaces and Kilns

16. "Electric Eyes" Control Kilns. R. H. Rogers. "Rock Products," September, 1939. Application to cement kilns.
17. A Thyratron-Controlled Annealing Furnace. Lester Tarnopol. "Rev. of Sci. Instr.," July, 1941; Vol. 12, p. 367.
See also phototube applications.

Lighting and Illumination

18. Vacuum Tube in Stage and Mobile Illumination. H. A. Breeding. "Electronics," August, 1930; Vol. 1, pp. 237-239.
19. Theater Lighting Control. D. M. Rollins and B. S. Burke. "Electric Journal," November, 1935; Vol. 32, p. 477.
20. Thyratron Reactor Lighting Control. E. D. Schneider. "Transactions A.I.E.E.," 1938, pp. 328-334.
21. Thyratron Circuit for Theater Lighting. Carl R. Wischmeyer. A.I.E.E. 41-50, December 1940; 11 pp.

Motors

22. Constant Speed DC Motor Control. J. A. Bearden and C. H. Shaw. "Rev. of Sci. Instr.," August, 1934, p. 292.
23. Thyratron Control of DC Motors. G. W. Garman. A.I.E.E. 37-175, December, 1937; pp. 1-14.
24. Thyratron Control of DC Motors. G. W. Garman. "General Electric Review," April, 1938; Vol. 41, pp. 202-208.
25. A New Electronic Variable-Speed Drive. S. D. Fendley. "Power Plant Engineering," February, 1943, p. 64.
26. Amplidyne Control for Paper Making. "Electronic Industries," February, 1943, p. 69. Uses tube amplifier.

Resistance Welding

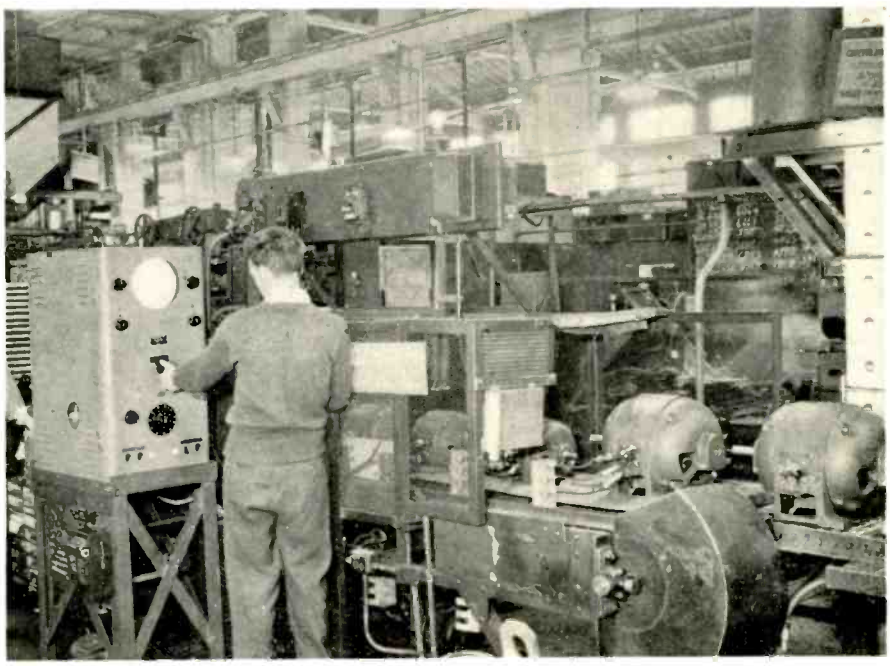
27. Spot and Line Welding of Stainless Steel. Warren C. Hutchins. "Elec. Wld.," April 1, 1933; Vol. 101, pp. 424-425.
28. A New Timer for Resistance Welding. R. N. Stoddard. "Elec. Engng.," October, 1934, p. 1366.
29. Thyratron Control Equipment for Resistance Welding (Part I: Spot and Seam Welders). H. L. Palmer. "General Electric Review," May, 1937; Vol. 40, pp. 229-235.
30. Welding Widened by Tube Control—I. E. H. Vedder and J. W. Dawson. "Iron Age," November 4, 1937; Vol. 140, pp. 28-33, 81-82.
31. Ignitron Contactor Control of Resistance Welding. Warren C. Hutchins. "General Electric Review," December, 1939; Vol. 42, pp. 544-547.
32. Latest Development in Resistance Welding. R. T. Gillette. "Weld. Jour." (N.Y.), March, 1940; Vol. 19, pp. 185-191.
33. A Survey of Aircraft Resistance Welding Equipment. L. P. Wood. "Weld. Jour.," November, 1941, p. 775. (Describes three stored energy methods.)
34. Electronic Welding Control (A series of articles in "Electronics.") Spot Welding Controls, August, 1942, p. 36; Seam and Pulsation Welding, September, 1942, p. 55; Special Welding Controls, October, 1942, p. 62; Timers for Welding Control, November, 1942, p. 65; Energy Storage Welding, December, 1942, p. 63; Servicing Resistance Welding Controls, January, 1943, p. 78.

Editor's Note: See also AC Resistance Welding Control. G. R. Sonbergh. "Electronic Industries," May, 1943, p. 52.

Miscellaneous

35. Vacuum Tube is Heart of New Elevator Control System. "General Electric Review," December, 1928; Vol. 31, p. 661.
36. Reliability of Electron Tubes in Elevator Service. C. C. Clymer. "General Electric Review," April 1932; Vol. 35, pp. 238-239.
37. Thyratrons and Selsyns Control of a High Pressure Steam Generator. "Power," April 19, 1932, p. 584.
38. Machines Stopped Automatically by Electronic Time-Delay Relay. "Elec. Wld.," May 20, 1933; Vol. 101, p. 643.
38A. Photoelectric Weft Straightener Control. C. W. LaPierre and A. P. Mansfield "Transac. A.I.E.E.," 1938, p. 513.
39. Thyratron-Controlled Thermostat. Julian M. Sturtevant. "Rev. of Sci. Instr.," September, 1938; Vol. 9, pp. 276-279.
40. Electronic Devices for Process Control—I. Theodore A. Cohen. "Chem. and Met. Engng.," Mar., 1942; Vol. 49, pp. 100-106.

PRODUCTION TESTING of the insulation of motor windings is handled in routine fashion with a General Electric insulation winding tester



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41. Automatic Train Control Developments. "Rwy. Elec. Engr.," May, 1923; Vol. 14, pp. 148-153.
42. Train Control. "Scientific American," April 1927, p. 270.
43. Automatic Vacuum Gauges. L. Smede. "Elec. Jour.," September, 1928; Vol. 25, pp. 437-440. (To start the vacuum pumps when the pressure in steel tank rectifiers reaches a certain definite value.)
44. Thyratrons Used to Maintain Proper Tension in Wire Reeling. T. R. Rhea. "Iron Age," December 4, 1930; Vol. 126, pp. 1667-1670.
45. Thyratron Relaxation Oscillator and Some of Its Applications. Herbert J. Reich. "Rev. of Sci. Instr.," October, 1932; Vol. 3, pp. 580-585.
46. Reactor-Rectifier Circuits Serve as Flasher and Dimmer. C. G. Suits. "Elec. Wld.," March, 11, 1933, p. 32.
47. Thyratron Tubes in Relay Practice. R. Wideroe. "Transac. A.I.E.E." 1347-1353, 1934.
48. A New Type of Warble Tone Generator. W. H. Bliss. "Elec. Engng.," April, 1934, p. 547.
49. Electrical Precipitation as Applied to Secondary Cleaning of Blast Furnace Gas. G. T. Hollett. "Iron and St. Engr.," May, 1934; Vol. 11, pp. 175-177.
50. Application of Thyratrons to an Induction Coil. L. C. Verman. "Jour. Sci. Instr.," May, 1935; Vol. 12, p. 167. (To replace make and break interrupter.)
51. Barkhausen Oscillator. F. B. Llewellyn. "Bell Lab. Rec.," August, 1935; Vol. 13, pp. 354-358. (A popular description of the action of type of oscillator for ultra high frequencies.)
52. Power Transmission by Direct Current. B. D. Bedford, F. R. Elder and C. H. Willis. "General Electric Review," May, 1936; pp. 220-224.
53. How Cab Signals Came to Be. A. H. Rudd. "Ry. Elec. Engr.," July, 1936; Vol. 27, pp. 153-157.
54. A New Electrostatic Precipitator. G. W. Penney. "Elec. Engng.," January, 1937; Vol. 56, pp. 159-163.
55. Some Unconventional Vacuum Tube Applications. F. H. Shepard, Jr. "RCA Rev.," October, 1937; Vol. 2, pp. 149-160.
56. An Answer to Fish Screening. J. O. Case. "Elect. West.," April, 1938; Vol. 80, pp. 32-33. (Uses thyratron to give pulses to affect fish.)
57. Some Electronic Switching Circuits. C. C. Shumard. "Elec. Engng.," May, 1938; Vol. 57, pp. 209-220.
58. Electronic Spark Generator for Spectrographic Analysis. J. T. M. Malpica and T. M. Berry. "General Electric Review," October, 1940; Vol. 44, pp. 563-565.
59. New Broadway Sign Controlled by Phototubes. "Electronics," December, 1940; Vol. 13, p. 48.
60. Ultrahigh Frequency Generators. I. E. Mouromtseff and others. "Electronics," April, 1942; Vol. 15, pp. 45-50.
61. Removing Air-Borne Dust in Industrial Plants. E. H. R. Pegg. "Power Pl. Engng.," August, 1942; Vol. 46, pp. 65-67.
62. Fish Diverter. "Rev. of Sci. Instr.," November, 1942; Vol. 13, p. 505.
63. Aircraft Engine Power Recovery. "Electronic Industries," December, 1942, p. 40. (Method of feeding electrical output from engines on test back to lines using electronic control.)

High-Frequency Heating

General and Miscellaneous

64. High Frequency Electric Glass Welding Provides Superior Control, High Speed. "Elec. News and Engng.," June 1, 1941; Vol. 50, pp. 16-18, 25.
65. Application of Vacuum Tube Oscillators to Inductive and Dielectric Heating in Industry. J. P. Jordan. "Transac. A.I.E.E.," Vol. 61, 1942.
66. Electronic Power Sources for Industrial Heating. "Electronic Industries," November, 1942, p. 57.

Electromagnetic Field

67. Surface Hardening—A New Job for Transmitting Tubes. George Babat and Michael Losinsky. "Electronics," June, 1938; Vol. 11, p. 44.

67A. Induction Heating. "Steel," November 27, 1939; Vol. 105, p. 54.

68. Construction of Heating Coils for Induction Surface Hardening. George Babat. "Heat Treat. and Forg.," January, 1941; Vol. 27, pp. 39-40.
69. Induction Heating With Electron Tubes. Dudley B. Clark. "Steel," May 12, 1941; Vol. 108, pp. 84-87.
70. Internal Surface Hardening by Induction Heating. H. E. Somes. "Westinghouse Engineer," February, 1942, p. 17.
71. Heating by High Frequency Induction. F. T. Chestnut. "Westinghouse Engineer," February, 1942, p. 11.
72. Electrical Equipment for Induction Heating. C. C. Levy and L. J. Lunas. "Westinghouse Engineer," Feb., 1942, p. 20.
73. External Surface Hardening by Induction Heating. W. E. Benninghoff and H. B. Osborn, Jr. "Westinghouse Engineer," February, 1942, p. 14. (Metallurgical aspect.)
74. Induction Heating Speeds Tin Plate Output. "Electronic Industries," December, 1942, p. 46.
75. Electronic Generators Extend Induction Heating Field. H. C. Humphrey. "Electronics," January, 1943; Vol. 16, p. 56.
76. Better Brazed and Soldered Joints Made Possible by Induction Heating. J. B. Jordan. "Product Engng.," Feb., 1943.

Electric Field

77. Electrostatic High-Frequency Heating Makes Possible Many New Designs. "Product Engng.," January, 1943; Vol. 14, pp. 40-43. (Its use in the manufacture of Plywood.)
78. Radio-Frequency Heating of Aircraft Parts. J. P. Taylor. "Electronic Industries," January, 1943, p. 50. (Devoted to heating of wood in electric field. Considerable data in form of curves.)

Indicators, Detecting Objects, Prospecting

79. Buried Metallic Bodies—Instruments for Detecting Metallic Bodies Buried in the Earth. T. Theodorsen. "Franklin Inst. Jour.," September, 1930; Vol. 210, p. 311.
80. Methods Used in Electrical Prospecting. J. I. Heller. "Electronics," November, 1931, p. 184.
81. Initial Impulse Indicator. O. W. Livingston and H. W. Lord. "Electronics," September, 1933; Vol. 6, pp. 257, 260.
82. New Method of Ground Fault Protection. F. M. Starr. "Elec. Engng.," November, 1934; Vol. 53, pp. 1472-1477.
83. The "Petoscope." A. S. Fitzgerald. "Electronics," October, 1935; Vol. 8, pp. 26-29. (Detects motion of an object against a stationary background.)
84. An Electromagnetic Metal Detector. D. G. C. Luck and C. J. Young. "RCA Rev.," October, 1936; Vol. 1, pp. 53-63. (A device intended primarily for inspecting prisoners and prison visitors for concealed weapons.)
85. An Electrical Instrument for Locating Buried Metallic Objects. Described in "Heating and Ventilating," March, 1937, p. 73.
86. A Practical Metal Detector. W. C. Broekhuysen. "Electronics," April, 1938, p. 17.
87. Water Level Indicator. L. A. Ware. "Electronics," March, 1940; Vol. 13, p. 23.
88. Portable Howling Detector for Metal Buried in Logs. "Scientific American," June, 1940, p. 351.
89. A Radio Frequency Device for Detecting the Passage of a Bullet. C. I. Bradford. "Proc. I.R.E.," November, 1941, p. 578.
90. Electronic Intrusion-Detection Systems. "Electronics," February, 1942, p. 38. (A survey of different types.)
91. Electronic Liquid Level Indicator. S. C. Coroniti. "Rev. of Instr.," November, 1942; Vol 13, pp. 484-488. (Method of continuously measuring the level of conducting and non-conducting liquids.)
92. Electronics Vs. Sabotage. "Electronic Industries," March, 1943, p. 60. (Includes fence alarms, X-ray sound detectors, photoelectric beams, etc.)

Rectifiers

93. Half-Cycle Magnetizer with Thyratron Control. H. W. Lord. "General Electric Review," September, 1937; Vol. 40, pp. 418-420.
94. Constant-Potential Battery-Charging Phanotron Rectifiers. O. Ajer. "General Electric Review," May, 1939; Vol. 42, pp. 221-223.
95. Rectifiers for Steel Mill Auxiliaries. G. E. Stoltz. "Iron Age," November 16, 1939; Vol. 144, pp. 48-51.
96. Sealed Tube Ignitron Rectifiers. M. M. Morack and H. C. Steiner. "A.I.E.E." 42-106, May, 1942; 14 pp.
97. Ignitron Rectifiers in Industry. J. H. Cox and G. F. Jones. "Elec. Engng.," October, 1942; Vol. 61, p. 713.

Inverters

98. A Single Tube Inverter. H. J. Reich. "Rev. of Sci. Instr."; Vol. 4, 1933, pp. 147-152.
99. Single-Tube Thyratron Inverter. O. W. Livingston and H. W. Lord. "Electronics," April, 1933; Vol. 6, pp. 96-98.
100. Parallel Type of Inverter. Frederick N. Tompkins. "Elec. Engng.," April, 1933; Vol. 52, pp. 253-256.

101. The Relaxation Inverter. H. J. Reich. "Elec. Engng.," December, 1933, p. 817.
102. "Ignitron" Type of Inverter. C. F. Wagner and L. R. Ludwig. "Elec. Engng.," October, 1934; Vol. 53, pp. 1384-1388.
103. Static Thermionic Tube Frequency Changer. A. Schmidt, Jr. and R. C. Griffith. "Elec. Engng.," October, 1935; Vol. 54, pp. 1063-1067.
104. Parallel Inverter With Inductive Load. C. F. Wagner. "Elec. Engng.," September, 1936; Vol. 55, pp. 970-980.
105. Operation of a Self-Excited Inverter—F. N. Tompkins. "Electronics," September, 1940; Vol. 13, p. 36.
106. Electronic Inverter for Interim Power Supply. D. E. Trucksess. "Bell Lab. Rec.," July, 1941, p. 338. (Describes an equipment which is normally a battery charger, but becomes an inverter when power fails.)

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108. Thyratron Voltage Regulators. Philip Sporn and G. G. Langdon. "Elec. Wld.," 1935; Vol. 105, p. 1182.
109. On Electronic Voltage Stabilizers. F. V. Hunt and R. W. Hickman. "Rev. of Sci. Instr.," January, 1939; Vol. 10, pp. 6-21.
110. A Direct Current Supply Apparatus with Stabilized Voltage. Lindenhovius and Rinia. "Philips Tech. Rev.," February, 1941; Vol. 6, p. 54.
111. An Electronic Voltage Stabilizer for 1 to 50 KV and 20 to 500 Milliamperes. L. G. Parrott and J. W. Trischka. "Rev. of Sci. Instr.," January, 1942; Vol. 13, p. 17.
112. Regulated Power Supplies. L. Morton and R. G. E. Hutter. "Physical Rev.," February 1/15, 1942; Vol. 61, p. 205.

Measurements, Recorders, Counters, Instruments

General and Miscellaneous

113. Use of Vacuum Tubes in Measurements. J. W. Horton. "Transac. A.I.E.E.," 93-102, 1935. (Very complete bibliography.)
114. "Electric Eye" Measures Protein in Flour. L. Zeleny. "Franklin Inst. Jour.," August, 1940; Vol. 230, p. 280.
115. Area Determiner. "Scientific American," September, 1940, p. 123. (For maps, plots, etc.)
116. Study of the Electric Hygrometer. R. N. Evans and J. E. Davenport. "Ind. and Engng. Chem." (Anal. Ed.), June 15, 1942; Vol. 14, pp. 507-510.
117. Measurement of Vibration With Electronic Instruments. "Power Pl. Engng.," December, 1942; Vol. 46, pp. 82-84.
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119. Electronic Machine Balances Rotating Parts. "Electronics," January, 1943; Vol. 16, p. 101.
119A. An Electron Microscope for Practical Laboratory Service. Zworykin, Hillier and Vance. "A.I.E.E. Transac.," 1941; Vol. 60, p. 157.
119B. Simplified Electron Microscopy. C. H. Bachman. "Electronics," February, 1943, p. 78.

Counting

120. Use of Thyratrons for High Speed Automatic Counting of Physical Phenomena. C. E. Wynn-Williams. "Proc. Royal Soc.," July 2, 1931, p. 295.
121. An Electronic Multiplier for High Speed Counting. O. W. Livingston and H. W. Lord. "Electronics," January, 1934; Vol. 7, p. 7.
122. Relay Memory for a Thyratron Counter. C. E. Wynn-Williams. "Proc. Physical Soc.," May 1, 1934, p. 303.
123. Electronic Counter for Rapid Impulses. B. Wellman and K. Roeder. "Electronics," October, 1942, p. 74. (Passes impulses along on a 300 to 1 ratio. Not exact.)

Electrical Quantities

124. Measurements of Small D-C Potentials and Currents in High Resistance Circuits by Using Vacuum Tubes. W. B. Nottingham. "Franklin Inst. Jour.," March, 1930; Vol. 209, pp. 287-348.
125. Improvement in Vacuum Tube Voltmeters. R. M. Somers. "Proc. I.R.E.," January, 1933; Vol. 21, pp. 56-62.
126. Practical Vacuum-Tube Circuit for the Measurement of Electromotive Force. S. B. Ellis and S. J. Kiehl. "Rev. of Sci. Inst.," March, 1933; Vol. 4, pp. 131-137.
127. Thermionic-Tube Measuring Instrument. T. B. Wagner. "Elec. Engng.," December, 1934; Vol. 53, pp. 1621-1623. (This thermionic-tube instrument gives direct measurements of current, voltage, power factor, or power in communication circuits and is accurate over a wide range of frequencies.)
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130. Measurement of Spot-Welding Current. W. F. Hess and others. "A.I.E.E.," 40-55, December, 1939, pp. 1-9.
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132. High-Speed Photoelectric Recorder. H. L. Clark. "General Electric Review," July, 1942; Vol. 45, pp. 384-386.

Gases and Liquids

133. An Ionization Manometer. O. E. Buckley. "Natl. Acad. Sci.," 1916; Vol. 2, pp. 683-685.
134. Studies With the Ionization Gage S. Dushman and C. G. Found. "Physical Rev.," 1921; Vol. 17, p. 7.
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136. High Vacuum Gages. F. M. Penning. "Philips Tech. Rev.," July, 1937; Vol. 2, pp. 201-208.
137. Electronic Flow Meter. J. M. Weinberger. "Electronics," January, 1940; Vol. 13, p. 30.
138. Thermal-Conductivity-Type Gas Analyzers. C. A. Hansen, Jr. "General Electric Review," April, 1940; Vol. 43, pp. 166-169

VIBRATION METER, developed by General Electric, shown with aircraft motor, determines vibration velocity and displacement

139. Recent Applications of Radio to the Remote Indication of Meteorological Elements. H. Diamond. "Elec. Engng.," April, 1941, p. 163.

140. Radio Sounding in the United States (Meteorological). C. B. Peare. "Electronics," January, 1943, p. 82.

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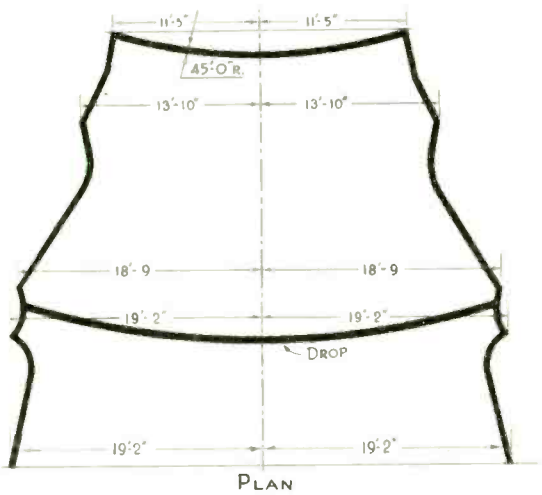
(*Continued on page* 140)

EXPONENTIAL STUDIO

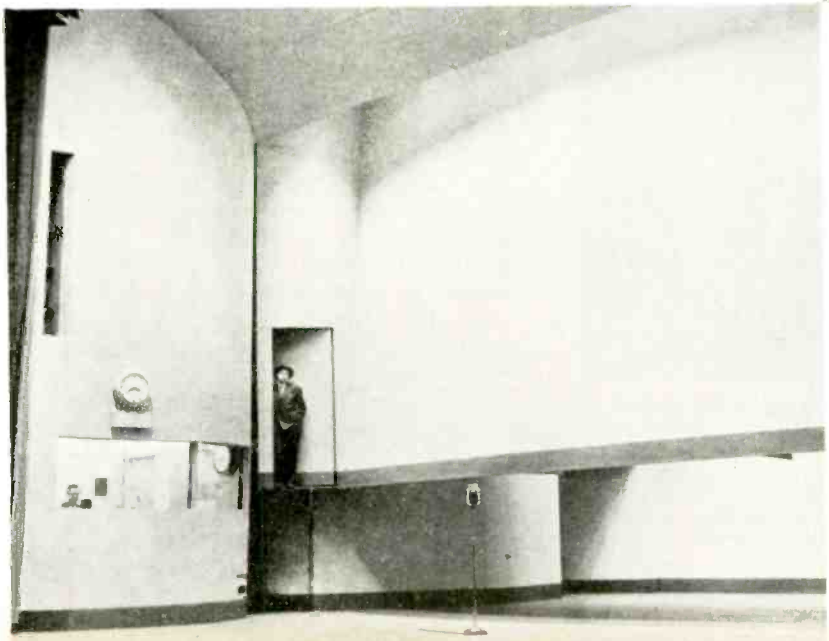
In this reconstruction of the old Guild Theater on 52nd Street, New York City, the stage was converted into exponential form, resulting in a sound balance so successful that whispers from any location on the 1500-sq-ft. stage can be heard with equal intensity, clarity and brilliance in any part of the 890-seat space given over to the radio-theater audience. Under the direction of the WOR engineers the stage sidewalls were shaped into the outlines of a huge horn, staggered with a series of convex curved walls, some portions of which are movable. All sections of stage sidewalls and ceiling are closed when stage is used for broadcasting. When the entire stage area is not needed, a 2-ton drop can be lowered to cut off the back portion of the stage. Further acoustic details are given on a following page.

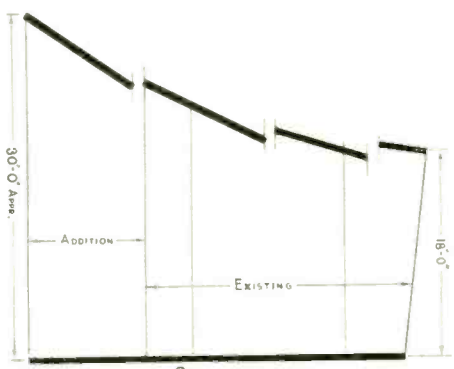


PLAN

EXPONENTIAL-HORN FORM given the stage section is clearly shown in both sketches and photographs. These also reveal details of the 2-ton curved "drop" which can be lowered to cut off the backstage, when entire space is not needed for a 125-piece orchestra

CONSTRUCTION DETAILS are seen above of the heavy drop. Below, the elevation sketch of the stage shows how the exponential-horn form has also been applied to the vertical section of the new WOR theater studio





SECTION

Conflicting Proposals for

RMA-FCC plan looks ahead to technical revisions

RMA's Plan, Announced by FCC's Fly

Plans of RMA, with cooperation of the Federal Communications Commission, to establish a "Radio Technical Planning Board" for the study of postwar services to the public, including FM and television, were announced by Chairman James L. Fly of FCC, April 28, at the annual meeting of the National Association of Broadcasters in Chicago. The FCC and other government agencies, it was proposed, would cooperate in extensive postwar technical studies to plan the use of ultra-high frequencies in the spectrum.

The RMA, through its Engineering Department under Director W. R. G. Baker, initiated the plans for the Radio Technical Planning Board, following suggestions made by Chairman Fly last November at the RMA-IRE fall meeting in Rochester, N. Y. The scope of RTPB organization and technical studies was similar to that of the National Television System Committee, which was organized by RMA with FCC cooperation, and which Chairman Fly said at Chicago "did a monumental work for the industry and the government."

Preliminary organization of the new RTPB was carried on during May, its operations to be financed entirely by RMA. The tentative organization plan, after revision was approved by the RMA board of directors at New York on April 15 and later by FCC, but awaited final action by the IRE board of directors. An initial appropriation of $10,000 for RTPB operations was made by the RMA governing board.

Dr. Baker as chairman

Under this plan, president Paul V. Galvin of RMA and Dr. L. P. Wheeler, president of IRE, were to appoint the RTPB chairman, with the approval of Chairman Fly of FCC. The RTPB board members and numerous panels and committees of technical experts were then to be appointed by the RTPB Chairman. Dr. Baker was to be appointed to the general chairmanship.

Among the topics to be covered by special committees or "panels" would be: Allocation; spectrum utilization; high-frequency generation; television and facsimile; direction finding and location; industrial, medical and scientific equipment; standard broadcasting; UHF broadcasting; relay systems; and radio communication.

Copies of the RTPB "Organization and Procedure" as approved by the RMA Board of Directors and FCC, provided for technical studies of radio-spectrum frequency allocations over which the FCC has jurisdiction of assignment, with RTPB primarily formulating recommendations to the Commission for such allocations. Radio services now are virtually limited to frequencies under 100 megacycles, but experimental work is being done up to 3,000 megacycles.

To study current research

Many technical experts and scientists would be drafted for the RTPB work, on its panels and committees. The Board itself would be composed of representatives of industry groups, such as Interdepartmental Radio Advisory Committee (IRAC), of government officials, including Army and Navy; National Association of Broadcasters, American Radio Relay League, and other regularly constituted radio groups and including all chairmen of the RTPB panels.

DR. W. R. G. BAKER, scheduled to be chairman of the industry Radio Planning Board according to announcement made under RMA-FCC plan. Dr. Baker is director of the RMA Engineering Division and vice-president in charge of electronic division of GE

At the Chicago convention of NAB, Chairman Fly announced the proposed establishment of RTPB—"by the radio industry itself"—and also immediately afterward on a CBS network broadcast, Mr. Fly stated that the RTPB would study "all current research developments in radio science." He recalled that RMA and its organization of National Television System Committee had done a "monumental work for the industry and the government;" that at the RMA-IRE fall meeting last November in Rochester he had suggested that the industry "move into the new era of planning for future radio services," and that from RTPB he anticipated "optimum results for the industry and the public."

IRE's Counter-Proposal

Not content with accepting the RMA-FCC plan, a drastic revamping of that postwar planning organization was formulated by the board of directors of the Institute of Radio Engineers at its special meeting in New York May 5. The new IRE proposal would leave in the hands of technical associations control of the projected Planning Board.

A committee, headed by Haraden Pratt, vice-president and chief engineer of Mackay Radio & Telegraph Co. and former IRE president, was appointed by the IRE Board after an all-day session, to draft a plan for this proposed postwar planning organization, as well as a charter, to be satisfactory to all the technical and industry groups invited to participate.

The IRE proposal, adopted by the board of directors of the Institute, representing over 10,000 engineer members, aims to put into force suggestions made to the Institute by Chairman Fly and Commander T. A. M. Craven of FCC, through creating a "radio technical planning association" to be sponsored by in-

Postwar Radio Planning

IRE outlines widely-representative board set-up

terested engineering and scientific societies, industrial and broadcasting associations, and the Government. Objectives will be to study all technical problems of such radio branches as broadcasting, television, facsimile and general communication, and to recommend methods for introducing new radio developments.

Stress democratic set-up

The new planning association will carry out the technical planning needed to build up a healthy postwar radio industry which will serve the public by speedily placing the new radio arts, many resulting from wartime developments, on a sound engineering basis and also by stimulating postwar radio services as contributing to employment and prosperity. In its work, the new association will assign specific tasks, such as frequency-allocation plans, to groups of engineers charged with the prompt development of detailed proposals in each definite direction. These groups will draw wide representation from the field, will have a democratic set-up and procedure and will judicially weigh and consider all matters before them. There will be no authority in the association to change their engineering findings.

The scope of the work to be covered in the IRE plan provides for the review and study of other matters than the actual allocation of frequencies and the promulgation of system standards. These include (1) the conversion of plants to peacetime products (cooperating with the Committee for Economic Development), (2) the status of the engineer in the developments of the future, (3) certain problems concerned with marketing, (4) patent system, and (5) legislation concerning engineering activities.

HARADEN PRATT of Mackay Radio, past-president of IRE, who is serving as chairman of Institute committee drafting the IRE counter-proposal on an industry planning board. Other committee members are Dr. A. N. Goldsmith, B. J. Thompson, RCA, and H. M. Turner, Yale

"The association will prepare plans and proposals in full accord with the public interest and in conformity with good engineering practices and make its findings widely known to those whom they may benefit," it was stated on behalf of the organizing committee, which besides Chairman Pratt, includes Prof. H. M. Turner, of Yale University, B. J. Thompson of RCA, and Dr. A. N. Goldsmith, consulting engineer and long-time editor of the IRE Proceedings.

It was further understood that a 20-member council would be formed to appoint the leadership of the projected board and to select the membership of its panels, as well as to outline the scope of the planning activities in the various fields of radio and communications.

IRAC represents government

The council, as planned under the IRE suggestions, would be composed of representatives in equal number from the RMA, IRE, IRAC, and broadcasters, with possibly smaller delegations from the AIEE, ASA, physicists groups, American Radio Relay League, and other suitable technical groups in the field.

It was further stipulated by the IRE plan that Government participation in the new Planning Board would be exercised not by the FCC but by the Government's Interdepartmental Radio Advisory Committee (on which the FCC has representation, along with representatives of the Army, Navy, Treasury, State Department, Interior Department, Commerce Department and other federal services). It is this Interdepartmental Committee which exercises primary control over the U. S. radio spectrum, since to it is assigned exercise of the President's right under the law to make first selection of the radio channels for the use of government and military services. From the channels that are then left after the Interdepartmental Committee has taken its needs, the FCC assigns remaining channels to the use of the general public. The IRE proposal, recognizing the wider responsibility of the Interdepartmental Committee, therefore nominated it as the Government agency to be represented on the new Radio Technical Planning Board.

THE RADIO INDUSTRY IN WARTIME—ITS MAGNITUDE JUNE 1, 1943

	Total Investment	Annual Gross Revenue	Number of Employees	Annual Payroll
Radio Manufacturers (1200)	$ 325,000,000	$3,000,000,000	300,000	$700,000,000
Radio distributors, dealers, etc.	280,000,000	200,000,000	100,000	150,000,000
Broadcasting stations (947)	90,000,000	191,000,000	20,000*	55,000,000
Commercial communication stations	60,000,000	.....	15,000	7,000,000
Listeners' sets (60,000,000)	3,800,000,000	.....	.....	335,000,000†

*Regular staff—not including part-time employees, artists, etc., who number at least 25,000 more.
†Annual operating expense for listeners' sets, for tube replacements, electricity, batteries, servicing, etc.

Operating Signal Corps pack radio equipment during recent maneuvers

WPB Revises Scheduling

New order, now effective, provides compulsory scheduling for 2000 items of electronic and wire communications

Described as one of the most important steps in military production scheduling yet instituted, a revision of the WPB electronic and wire communications Limitation Order L-183-A has been made effective. The new order has been formulated through the joint efforts of the WPB Radio and Radar Division and Communications Division and the Army-Navy Electronics Production Agency, following something over two months' experience under the original order. That experience indicated the need for modifications which would to some extent simplify procedure and make possible scheduling methods more closely in line with government requirements.

Covers all electronic components

Whereas the older order required compulsory scheduling of but three components — condensers, resistors and meters — the revision covers some 2000 items, including all electronic components and wire communication apparatus as well as a wide variety of radio equipment purchased by the Signal Corps and the Navy, such as switchboards, carrier telephone equipment, teletypewriters, battle announce and sound power telephones, spare parts groups and electronic subassemblies. The document has been analyzed by Ray C. Ellis, director, Radio and Radar Division, in the following statement addressed to all producers and suppliers of electronic equipment and components:

Urgency determines schedules

The summary of the order contained in this letter is not designed to be complete, and you are cautioned to read the entire order carefully for a full understanding.

The electronic equipment Precedence List has been in existence since October 1942. It is now made up of more than two thousand items, and includes not only the wide variety of radio equipment purchased by the Signal Corps and the various Bureaus of the Navy but also switchboards, carrier telephone equipment, teletypewriters, battle announce and sound power telephones, spare parts groups and electronic subassemblies of such items as gyro-compasses, fire control gear and medical equipments. The delivery schedules are arranged in the order of urgency which is indicated by designations called P/L numbers ranging from A-1 to L-250.

Signal Corps portable field transmitter-receiver in use

The Precedence Li as a scheduling instrument for ll electronic equipments (end items or complete sets as distinguished from subassemblies or components) was made mandatory on February 15, 1943 by Limitation Order L-183-a. In addition compulsory Precedence List scheduling was required of suppliers of three types of components, namely: capacitors, resistors and meters.

After more than two months' experience under Order L-183-a it was determined by the War Production Board and the Services that some revision of the order was necessary better to insure the delivery of equipments, and the order embodies amendments determined after careful study on the part of the War Production Board in cooperation with the Services and after discussion with industry.

(1) It continues the mandatory provision for scheduling electronic equipment—end items or complete

sets as distinguished from subassemblies of components—in accordance with Precedence List designations.

An educational program is planned to bring home to prime contractors the need for so apportioning their effort, engineering, materials, production and test facilities that equipments in the upper categories of the Precedence List are delivered on schedule, even if it results in the deferment of other equipments not so highly placed.

(2) It makes mandatory the passing on of the following information to all suppliers on all past and future purchase orders for all components: (a) name of claimant or customer on prime contract, and prime contract number; (b) required delivery schedules; (c) lead factor; and (d) Precedence List designation, if any.

In order to expedite effectively the materials and components necessary to support the manufacture of finished equipment in accord with Precedence List schedules, it is absolutely necessary that the orders for such components and materials be readily identifiable; hence, the requirements above noted.

(3) It gives permission to suppliers, in their own discretion or on request, to schedule deliveries of components in accordance with Precedence List designations. This is applicable only among orders bearing Precedence List designations as to each other in any given preference rating category. A delivery schedule specifically frozen by War Production Board action may not be disturbed by the component manufacturer, however, under this permissive authority.

Whenever suppliers are willing to schedule their deliveries, within the limits stated, in accordance with Precedence List designations, this provision gives them the legal right to do so without directives from the War Production Board.

(4) The War Production Board may specifically order or direct any supplier to schedule deliveries of components in accordance with Precedence List designations.

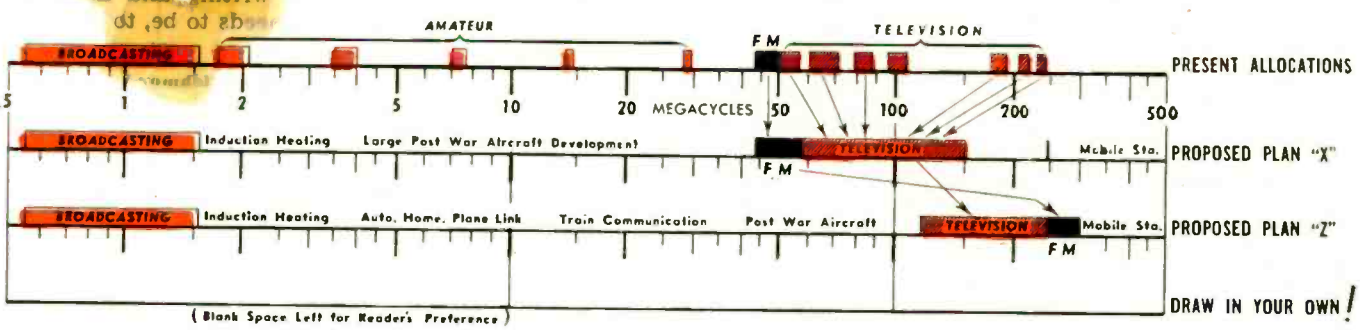
Compulsory rescheduling

Wherever it is difficult if not impossible for a supplier to reschedule his entire production and deliveries in accordance with Precedence List designations, but from time to time his deliveries of certain components that happen to be critical must be rescheduled in order to produce finished equipments in the top Precedence List categories, the War Production Board, through designated field specialists of the Radio and Radar Division working out of Regional Offices, will issue directives to support and compel such rescheduling. Components suppliers will be notified in the immediate future as to the names of the field specialists to whom authority to issue these directives is delegated. These spot rescheduling directives must be in accord with urgencies established by Precedence List designations; must not interfere with purchase orders having no Precedence List designations; and must not interfere with any schedule specifically frozen by War Production Board action.

(5) Additionally, the War Production Board may from time to time, as to electronic equipment or components, freeze schedules; reallocate unfilled orders; divert deliveries; or establish earmarked stocks of components.

(6) It is particularly important to note these two points in connection with the order: (a) No customer should be advised that a purchase order must have a Precedence List designation before it can be accepted. Order L-183-a does not alter the provisions of Priorities Regulations 1 requiring the mandatory acceptance of defence or rated orders; (b) Scheduling according to the Precedence List can take place only among Precedence List orders, and must not prejudice or retard any order not bearing a Precedence List designation.

SOME PROPOSALS FOR POST-WAR RADIO-SPECTRUM ALLOCATION



First on the agenda of any postwar radio "planning board" that may be set up, will undoubtedly be shifts in the allocations at the high-frequency end of the spectrum. Such shifts are generally considered necessary (1) to take advantage of recent advances in the art, (2) to provide space for growing services like aircraft radio, train and roadway communication, induction heating, etc., and (3) to consolidate present services.

Thus it will be desirable to assign television a single continuous band (instead of the present many "island" bands) and to provide for wider frequency bands, 8 mc or more wide (with the proviso that, later, black-and-white television bands can be thrown together in pairs to secure a range wide enough to permit color-television operation). Other services to be provided for are emergency calls, police and fire, industrial heating, medical diathermy, airplane landing beams, traffic control on highways, meteorological studies, surveying and mapping systems, globe-covering navigational aid equipment, etc.

In the accompanying diagram, the editors have put down on paper some of the suggestions for reallocation which are now being discussed among radio men.

The whole problem is exceedingly complicated and before any one plan can receive attention the needs of all concerned must be carefully considered. Since any plan will undoubtedly meet with some disapproval, the reader is invited to use the bottom line of the chart to satisfy himself as to what will be ideal. Until a committee can function that can weigh these matters from all angles, your version is about as authentic as any other!

ENGINEERS Needed As

Trained technical men

With the growing complexity of the electronic industries, it becomes increasingly evident that technical knowledge and engineering habits of thought are needed in executive and sales work, as well as in design and production.

Not only must the executives who do planning and make critical decisions have full and expert knowledge of the behavior and possibilities of electronic devices, but the men who direct future sales in these expanding fields must know intimately and thoroughly the uses of the products they are marketing.

Engineers shoulder loads

All this would seem to point to the trained engineer as the logical sales executive for electronic marketing. Yet selling and marketing have been operations to which engineering-trained men do not usually take readily. Such engineers usually prefer to keep to their own technical pursuits, leaving the sales end to others. In the electronic future, however, it is doubtful that the engineer-trained man can evade sales responsibility in all cases. And there is evidence also that when trained engineers get into broader management and executive leadership, great business success results.

Dr. C. B. Jolliffe

Examples of engineers who have taken over heavy business loads are Charles E. Wilson and Dr. W. R. G. Baker of General Electric; Walter Evans of Westinghouse; F. R. Lack, Western Electric Co.; Octave Blake, Cornell-Dubilier; J. S. Knowlson, Stewart-Warner; Lawrence Marshall and David T. Schultz, of Raytheon; Dr. Ray Manson of Stromberg-Carlson; Melville Eastham and H. B. Richmond, General Radio; Edgar Kobak, NBC and now Blue Network; Roger M. Wise, Sylvania; D. D. Israel, Emerson; Louis M. Clement, Crosley; W. P. Hilliard, Bendix; Robert Arnold, Arnold Engineering; John S. Meck, Meck Industries; Allen Dumont of Dumont; R. M. Heintz, Jack & Heintz; Victor J. Andrew, and many others.

But now to look ahead into the expanding electronic fields—what part will the trained engineer play in directing and planning sales in this growing field. What opportunity does sales management of electronic devices offer to radio-electronic engineers. "Electronic Industries" put these questions up to a number of engineer-trained executives, and here are some of their comments:

Engineer Holds Key to Situation

By H. B. Richmond
General Radio Company

It would seem to me that the place the trained engineer will have in future electronic marketing will depend entirely on the engineer.

I believe, however, that engineers are absolutely essential in such future electronic marketing. This is a relatively new and a highly skilled art. It, therefore, requires skilled engineers in order to obtain the most from the electronic tools available and to associate these tools together in such a manner as to provide for their most economical use. Only equipment designed so as to make full use of its capabilities can stand the test of competitive marketing. Therefore, the heart of the whole marketing problem is the trained engineer.

Only a person who is familiar with the possibilities of equipment is in a position to determine the uses to which it may be put. Marketing is placing the right equipment in the user's hands. Here, again, the trained engineer holds the key to the situation.

Electronic Men Must Wake Up to Opportunities

By Edgar Kobak
Exec. Vice-Pres. Blue Network

Engineering background and experience is helpful to the executive because:

1. It gives him a better understanding of the technical and operating side of the business.
2. He is inclined to want facts rather than guesses.
3. If he is a practical operating engineer, he usually has imagination—which is needed by the executive.
4. He learns to study the pros and cons of questions before him.
5. He is used to working side by side with workers.
6. With engineering experience he can better grasp figures, charts, and their meanings.

The engineer who is to carry on executive or marketing supervision must learn to express himself clearly, both in writing and in public. In fact, he needs to be, to some de-

H. B. Richmond

Marketing EXECUTIVES

must sell electronic devices

gree, an evangelist who can stimulate and inspire others.

On the other hand, it must also be admitted that many engineers who turn to executive work are probably not really engineers at heart. Such men may have a natural inclination for executive work rather than engineering or research.

Electronics, the key to all future industrial business activity, will affect the postwar world from many standpoints—political, communication and social. Already research and engineering are progressing faster than are the application and business activities in corresponding fields and the vision of things to come.

Electronic engineers must wake up to their opportunities as executives, administrators and protagonists of the future of the electronic industry. David Sarnoff pointed the way 25 years ago. The electronic industries need more men like him.

Must Do Better Job

By Dorman D. Israel
Emerson Radio

The part that will be performed by the trained engineer in electronic engineering matters is, of course, obvious. Methods and techniques are progressing along such rapid and highly scientific lines that training and skill will be essential to effective research and design.

Dorman D. Israel

As electronic products emerge from the laboratories and factories there is no question but that engineering knowledge will be essential, at least in the early stages of electronic marketing. The field should attract thousands of electronic engineers now enjoying training in wartime developments.

The electronic engineer will be used in electronic marketing only so long as he is able to do a better job than a sales executive who does not have engineering training. The future of electronic marketing and its bearing upon the electronic sales engineer, therefore, depends entirely upon individual and group ability of these engineers.

Broad Engineering Knowledge Important

By Dr. C. B. Jolliffe
Radio Corporation of America

The trained engineer has contributed not only in the development of equipment, devices and applications of radio and electronics, but has been of very effective use in the marketing of the devices which he has developed.

In the introduction of any new engineering application a trained engineer is usually required to supervise the installation and initial operation of the devices. As a device becomes more and more standardized, less engineering is required for installation and operation, and the equipment is developed into standard package material. When this point has been arrived at the aim is to be able to offer to a customer a device which he can apply to his particular use without personnel of specific training and without instruction other than that which can be given by printed matter which accompanies the equipment.

The radio-receiver field and, to a large extent, other forms of radio apparatus which were known before the war, have developed to this state. However, the new applications of vacuum tubes to the field of electronics and electronic applications are largely in the development stage and most of the newer products which have been classed in this category must be geared to customer requirements.

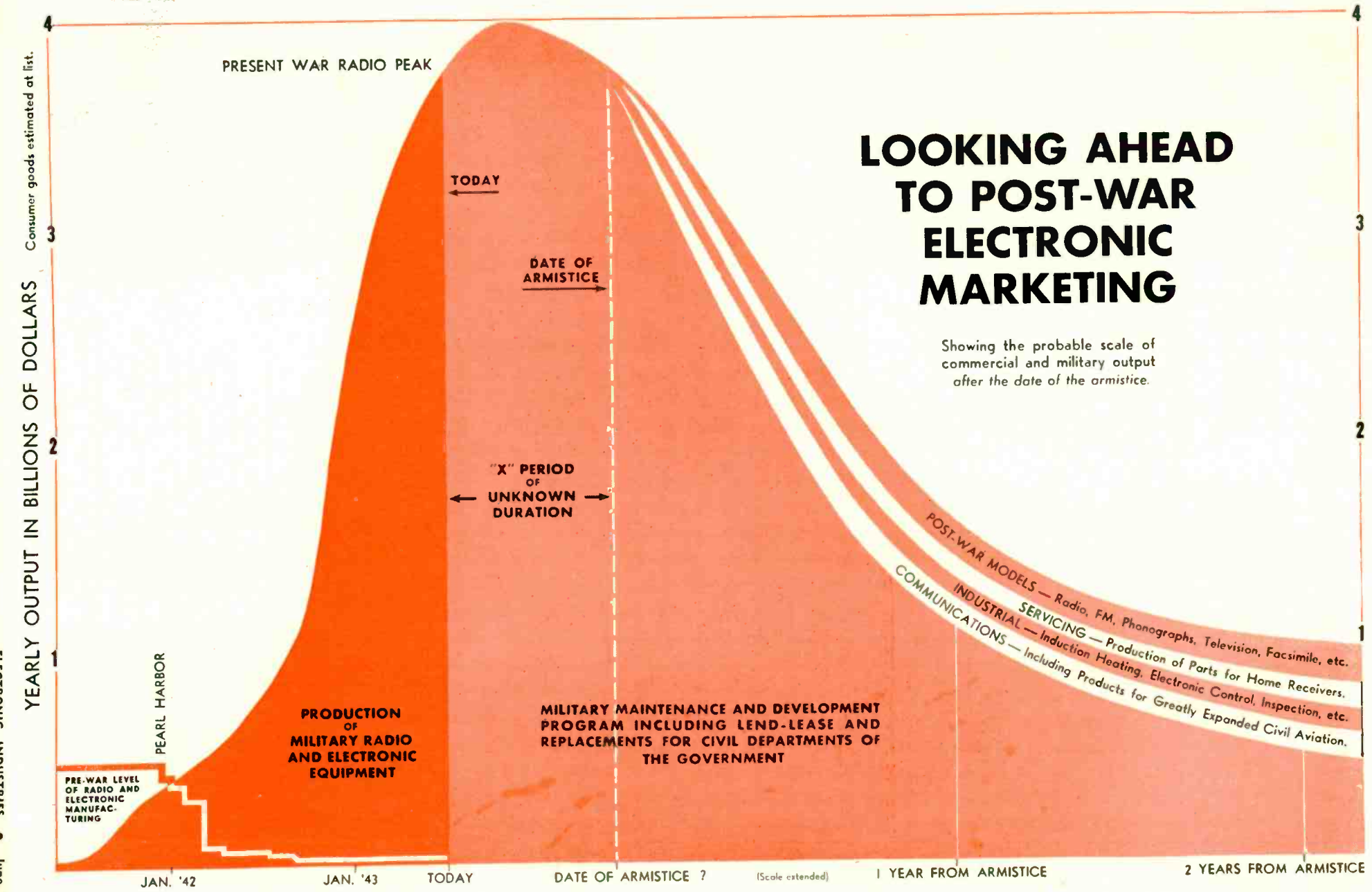
RF heating

In the case of one field, for example, the use of radio-frequency power for heating, the trained engineer is at present playing a most important part, not only in the development but in the marketing of the equipment. In general, the industries employing such apparatus have had no prior experience with electronics or radio devices and are not equipped with engineering skill to apply the equipment to their particular processes. The customer, therefore, must rely upon the knowledge of development and application engineers for determining the type of apparatus which best meets his requirements or which can be adapted to his production techniques to secure the best and most efficient results.

These engineers who participate in this electronic marketing must have considerably more than a knowledge of electronics, or how to operate the radio-frequency generator. Broad engineering knowl-

(*Continued on page* 150)

Edgar Kobak


LOOKING AHEAD TO POST-WAR ELECTRONIC MARKETING
Showing the probable scale of commercial and military output after the date of the armistice.
YEARLY OUTPUT IN BILLIONS OF DOLLARS
Consumer goods estimated at list.
4
3
2
1
PRESENT WAR RADIO PEAK
TODAY
DATE OF ARMISTICE
"X" PERIOD OF UNKNOWN DURATION
PEARL HARBOR
PRE-WAR LEVEL OF RADIO AND ELECTRONIC MANUFACTURING
PRODUCTION OF MILITARY RADIO AND ELECTRONIC EQUIPMENT
MILITARY MAINTENANCE AND DEVELOPMENT PROGRAM INCLUDING LEND-LEASE AND REPLACEMENTS FOR CIVIL DEPARTMENTS OF THE GOVERNMENT
POST-WAR MODELS — Radio, FM, Phonographs, Television, Facsimile, etc.
SERVICING — Production of Parts for Home Receivers.
INDUSTRIAL — Induction Heating, Electronic Control, Inspection, etc.
COMMUNICATIONS — Including Products for Greatly Expanded Civil Aviation.
JAN. '42
JAN. '43
TODAY
DATE OF ARMISTICE ?
(Scale extended)
1 YEAR FROM ARMISTICE
2 YEARS FROM ARMISTICE

Planning for FUTURE Electronic MARKETS

by MILLARD H. NEWTON*

Why tomorrow's production must dovetail with today's during a transition period leading to essential uses

As war production diminishes gradually or otherwise, the paramount question that will confront every manufacturer in the radio-electronic field is marketing.

Inasmuch as every operation of business is carried on for the ultimate purpose of selling a product or service to some one, whether it be a single customer in Uncle Sam or a thousand customers in industry, the function of marketing becomes a direct responsibility of an organization from one end to the other. It begins when you decide to make a certain product and it is the dominating factor in deciding such questions as "How to make it," "How many to make," "Where to sell it" and "What channels."

Each day's news from Washington and the various battlefronts puts emphasis on the need of preparedness for marketing. It gives ample evidence that the process can not follow the prewar pattern. The need therefore is for careful if not cautious planning, plus some degree of market analysis in order that the method may be workable.

Changes influence products

Many marketing policies will be dictated or influenced by the extensive changes already wrought in national and individual affairs and by the inevitable future changes in industrial, economic and social conditions. In marketing, it would be sheer folly for a manufacturer to ignore the vast re-orientation of industries, people and markets or the uncertainties of the employment situation when war production slackens and demobilization begins.

Equally important is the likelihood of rigid postwar controls, the problem of wages and prices, taxes and buying power, credit and monetary control and dozens of other complex national problems.

To the electronic or radio manufacturer, an additional problem of far-reaching consequence is the probable shift in frequency allocation for television, FM and short-wave broadcasting—changes that will require extensive modification of design and production. To this we must add the necessity of reconversion, with all its problems of time and finance, and must also acknowledge the possibility of a rush into the commercial market with numerous hasty promotions.

Measuring the market

All of these critical situations would cause less concern if the market itself could be more definitely measured or if the various divisions could be evaluated on a volume basis. Today, this cannot be done with any degree of certainty despite the existence of worldwide electronic optimism.

Our imagination is still staggered by the present four billion dollar yearly volume of radio war production, roughly twenty times as big as the biggest peacetime year and based on a comparatively few types of war equipment. It may be no less difficult to comprehend the immensity of it when the curve starts to drop. Then, as volume recedes, postwar planning will begin to blossom but it will not improve our conception of wartime magnitude.

Any perspective on the electronic market would probably be faulty if it did not take into account the factors that are favorable and unfavorable—factors clearly existing even though their implications are uncertain. Some of them are outlined below.

There we have the introduction to postwar marketing. Here and there, a manufacturer will feel that he is susceptible to some of these factors and immune to others, but his "pros" and "cons" will include most of them. Some manufacturers will no doubt try to evaluate the volume of deferred purchasing and will break it down into groups like these:

a—Deferred installations or improvements by communications services, broadcasters, etc.

b—Deferred requirements of government civil departments.

c—Deferred installations of electronic apparatus in industry.

d—New devices, announced but not yet available.

FACTORS THAT GOVERN MARKET ANALYSIS

FAVORABLE	UNFAVORABLE
Huge military maintenance and developmental requirements.	Demobilization and unemployment.
Lend-lease rehabilitation program.	Renegotiation of war contracts.
Volume of deferred purchasing.	Delay in re-conversion.
Accumulated purchasing power.	Continued economic controls.
Attempted control of inflation.	Delayed release of critical materials.
Unlimited application possibilities.	Taxation of spendable income.
New discoveries and developments.	Labor unrest.
High rate of obsolesence or exhaustion.	Shortage of trained manpower.
Public expectation of things to come.	Limited facilities for maintenance.
Eagerness of outlets to get products.	Declining spread between cost and selling price.
Reciprocal trade agreements.	Intensified activity by pressure groups.

*Marketing consultant on the staff of "Electronic Industries."

e—Deferred purchasing by amateurs.

f—Depletion of distributor-dealer-service stocks.

g—Deferred purchase of home radios, FM, phonographs, etc.

War's continuing influence

How far and how fast the war peak will drop, and how much of it can be replaced by peacetime promotions, is the great unknown in any marketing plan. Surely, the rate of decline is the key. It alone will show whether or not there is a great enough period to permit an orderly and planned readjustment under which the market can seek its natural level. Thus, there is an interval which may be called the X period. It will give the industry an indeterminate wait-and-see period.

In view of the uncertainties and complexities of the situation, perhaps it will be safer for each manufacturer to try and visualize his own possibilities—his own piece of the picture—rather than attempt to gauge the size or the trend of the total market. However, one broad conclusion that seems to be sound if not widely realized, is this: Any immediate substitute for war work —any cushion against a too-sudden drop in volume when the war ends —must depend mainly on applications that are definitely essential.

Until the day of final victory, wartime conditions and limitations will remain. Even after an armistice is announced, a year or more may elapse before the full needs of military maintenance can be supplied. In the meantime, the manufacturer will have the job of reconversion with all its accompanying problems. Hence the first attempt at marketing should apply to those fields wherein it will be possible to do business as listed elsewhere.

In going beyond this category of essential needs, the manufacturer must first determine how long it will be before he can get the materials to make civilian deliveries and to what extent the tax-control of individual spending will affect the purchases of new radios, FM, phonographs, television and the much-heralded new things to come.

The output of these products will be small in comparison to the war volume and also a small part of plant capacity for some time to come.

Tremendous production program

In the meantime, this country will go through a world-war aftermath that is sure to bring new difficulties in making plans for mark-

TYPE OF PRODUCT MAY DETERMINE TYPE OF DISTRIBUTION NEEDED

Necessary Engineering or Installation Technique Is Also an Important Factor in Deciding on Channels of Marketing

Direct to **GOVERNMENTS** for war or replacement	Direct to other **MANUFACTURERS** Intra-industry marketing	**YOUR PRODUCT**	Through **FACTORY BRANCHES**	Through **DISTRIBUTORS** of Finished products	Through **Electronic PARTS JOBBERS**	Through **RETAILING & MAINTENANCE** outlets
✓	✓	**FABRICATED or PROCESSED MATERIALS** *Example: Insulation*				
		FINISHED PRODUCTS *Requiring:*				
✓	✓	**PRE-SALE ENGINEERING** *Example: Induction heating*	✓	✓		
✓		**INSTALLATION by MANUFACTURER** *Example: High power transmitter*	✓			
		LOCAL INSTALLATION TECHNIQUE *Example: Control equipment*	✓	✓	✓	✓
		SALE to LARGE PLANTS ONLY *Example: Combustion analysis*	✓	✓		
		CITYWIDE SALES EFFORT *Example: Simple alarm system*	✓	✓	✓	✓
		TRAINING of LOCAL PERSONNEL *Example: Scientific apparatus*	✓	✓		
		WAREHOUSING in SALES CENTERS *Example: Fast-moving, standard mdse.*	✓	✓	✓	✓
		STOCK CARRIED by DISTRIBUTORS *Example: Packaged products*		✓	✓	
✓	✓	**ASSEMBLIES**	✓		✓	✓
✓	✓	**PARTS, TUBES, Etc.**	✓		✓	✓
✓	✓	**MAINTENANCE & SERVICING EQUIPMENT**	✓		✓	✓
✓		**RADIO, FM, PHONOGRAPHS, TELEVISION, Etc.**	✓	✓		✓

This checksheet is not intended to be complete nor to be representative of any one set of conditions. The purpose is to illustrate a general principle that the necessary type of distribution will be indicated by the amount of presale or installation engineering required by the product itself. Hence it shows more checks than a single manufacturer would make in planning his own individual channels. The first step should be a listing of the absolute requirements of the product itself.

Extent of local engineering required, usually shows whether a branch sales office is needed. In some cases, Reps may serve the same purpose.

Distributors will need competent sales engineers and installers. This group may include electrical contractors, mill supply houses, etc.

Many members of this group are already serving industrial concerns and communication services. They are accustomed to priority selling.

These outlets are secondary, consisting mainly of radio dealers, service dealers, sound specialists and others likely to expand into electronic marketing.

IMMEDIATELY AVAILABLE MARKET POSSIBILITIES

MILITARY REPLACEMENTS AND MAINTENANCE— Necessitating a continuation of sales effort directed toward the government and the prime contractors who will handle much of this business.

COMMUNICATIONS—On land, sea and air, with a greatly enlarged program of aircraft radio equipment for postwar patrol, commercial transport and cargo service.

INDUSTRIAL ELECTRONICS— With greater attention to the possibilities of industrial diathermy and many other electronic aids to production.

LEND-LEASE REQUIREMENTS—Including all types of radio and electronic equipment for the Allied nations and war-ridden countries for civil and military reconstruction.

eting. We will have our first experience with postwar economic controls, a continuing battle against inflation and an unprecedented employment situation. In fact, the single problem of providing immediate jobs for half a million or more soldiers per month, may alone influence every other consideration in our national life. The obligation and the duty are so widely recognized that public sentiment can easily force us into a civilian goods production program far greater than anything we have ever known—perhaps overdoing it somewhat — but nevertheless hastening and accelerating our internal transition from war to peace, which every manufacturer will welcome.

Marketing fundamentals

Once a manufacturer finds that his way is open; that he has a producible product and a sizable market, he will want the answer to two basic marketing questions:

1—What are the factors essential to a marketing program?
2—What are the factors that will determine the type of distribution that is needed?

Some measure of guidance can be gotten from the charts and tables on these pages but the relative importance of the information given will vary with each manufacturer. Nevertheless, there are a few fundamentals that are common to all; among them:

1—Understanding of the specific postwar market.
2—A definite plan of procedure, promotion, field contact, etc.
3—Close teamwork between engineering and sales.
4—A selling organization suited to the buying habits of the market.
5—Knowledge of the nature and extent of competition to be encountered.
6—Flexibility to meet sudden or unexpected demands.
7—Absence of any disadvantage in performance, price, service, etc.
8—Adequate maintenance through local or factory services.

These essentials of a marketing plan, and others that are peculiar to a certain type of product or organization, already have received attention from many manufacturers who found it possible to engage in postwar planning simultaneously with their war production. However, few will admit complete preparedness. So it can be assumed that a great majority of the manufacturers will find it necessary to perfect their plans as they go. The machinery for meeting a market whose needs are only partly known or partly suppliable, can hardly be expected to start out full-powered. Furthermore, the job of planning must go hand in hand with decisions on distribution facilities because the plan and the distribution should be fashioned to fit each other.

An apparatus market

Distribution confronts the manufacturer with a special set of requirements, some of which are given in the accompanying chart. It is intended to illustrate the idea that the nature of the product or the local engineering that is needed, will often be the main influence in choosing channels of distribution.

The established divisions of the market, such as Communications, to cite but one, undoubtedly will be sold by methods similar to those of prewar days. When it comes to the industrial electronic field, it might appear that there is no precedent for the sales technique that will be necessary. But this is not true. In selling this division, it will be necessary to adhere closely to the general plan used in selling industrial equipment—a plan that is new to the radio-electronic industry. The industry has had some experience in filling priority orders. Now it must learn a marketing lesson that many other industries already know.

This lesson teaches us that General Industry is an apparatus market. Usually, it involves quotations on the apparatus that is needed to do a given job. Hence the manufacturer, or his local representative, will have considerable pre-sale engineering to do, depending on the size and engineering features of the installation. This, in turn, will call for local sales training and local sales engineering comparable to that of local electrical engineering firms and "Reps," many of whom have already qualified themselves to specialize in this field.

Specialized selling needed

Even under the most favorable circumstances, the manufacturer will have to anticipate selective selling, as contrasted with the indiscriminate selling of radio or other standardized products.

Whether the job can be done adequately by the combination of factory sales organizations and local specialists, remains to be seen. A few manufacturers who have studied the available methods and outlets feel that it will be necessary to have special types of distributors, possibly including electrical contractors, mill supply houses and other local concerns accustomed to serving industrial plants. Thus it will be no surprise to find electronic equipment ultimately marketed through any type of outlet that is qualified to engineer it, quote on it, install it and maintain it.

EDITOR'S NOTE

This article shows many of the guide posts and danger spots in planning for the postwar market. No attempt is made to suggest solutions to specific problems, nor does the article stress the ever-present need of resourcefulness and strategy, all of which the reader is expected to assume. The main purpose has been to bring out the vital points in formulating a marketing plan.

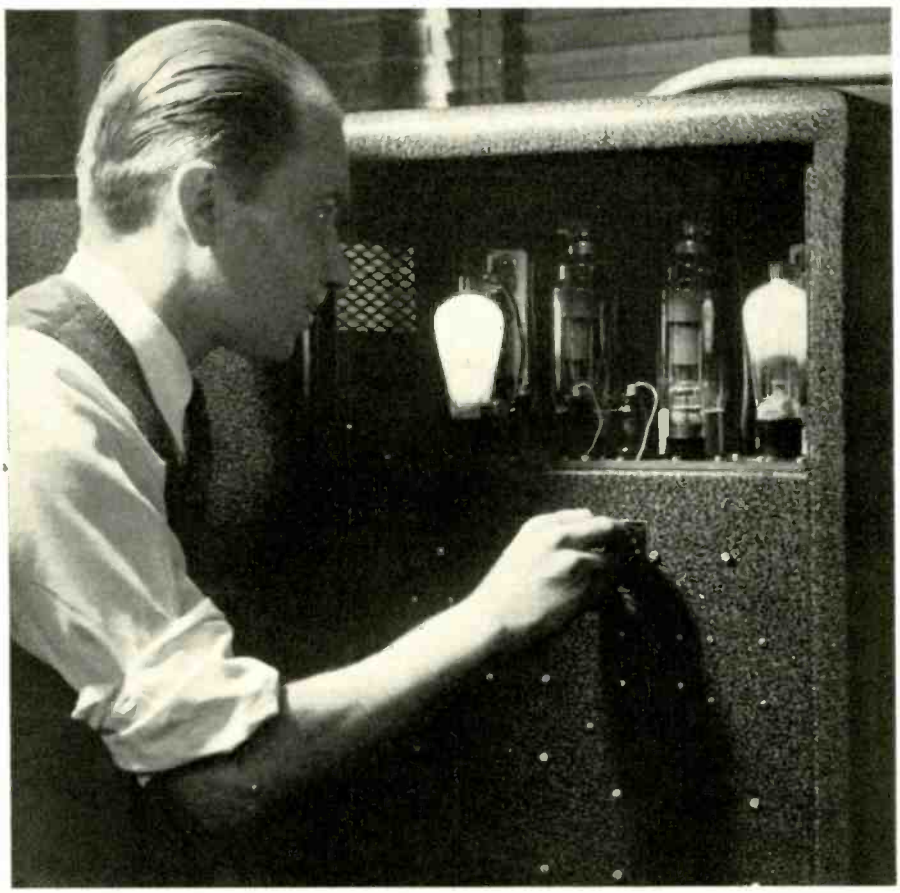
Problem of Servicing Industrial Equipment

by GILBERT SONBERGH

In spite of all legitimate efforts to avoid the necessity for maintenance and repairs, your present and postwar servicing program is a vital factor in successful operations. How are you going about it?

The first principle of service is to avoid it, insofar as possible, by thoughtful product design, by careful construction, by intelligent installation, and by patient user-education in preventive maintenance in the field. Skimping on any of these points is almost certain to cost a manufacturer more, in service troubles and in loss of customer confidence, than he saves. Industrial electronic equipment should be rather better than the $9.95 home radio bought to last a year or so on a quiet bedside table.

After all possible preventive precautions have been taken, the need still remains for an adequate service policy. Many factors influence the formulation of such a policy. It is obvious at once that the nature of the product is usually the principal factor in determining the methods of servicing and maintenance. (Not so obvious is the fact that servicing facilities, policies, and personnel already available, frequently should be the determining factor in the choice of the product to be manufactured).



Who is going to service thousands of electronic devices throughout the nation

It is a matter of record that more than one important electrical manufacturer has gotten into hot water by venturing into production of equipment he was not prepared adequately to service. In the coming postwar period nearly all of the electronic industrials will be faced with certain problems of what to produce. In making the decisions, it should be borne in mind that you must be able to deliver service soon after you deliver the goods, if the enterprise is to be a success.

"Let George do it"

A few of the largest and a large number of smaller manufacturers of industrial electronic equipment have repeatedly expressed the view that they don't want any part of servicing their sales. This attitude goes something like this: If the customer can't fix it himself, let him send it back to the factory. It probably springs from envying the manufacturer of rugged mechanical and electrical equipment which can take abuse for a decade before something finally goes wrong. Most electronic equipment is not, unfortunately, in that class.

Looking at it from the customer's viewpoint, such a service policy will very definitely dampen and retard the development of universal industrial use of electronic devices. First, interference to production while electronic equipment is sent back to the factory cannot be tolerated, and tubes will therefore not be given crucial production tasks. Second, thousands of smaller industrials will do without the marvels of electronics rather than hire a special radio or electronic engineer to sit and wait for trouble.

Service of some kind must, for the present, be provided.

EIGHT PLANS for SERVICING INDUSTRIAL ELECTRONIC EQUIPMENT

In presenting the eight basic service "plans" that follow, it must be pointed out that special products and special circumstances may make it necessary to use modifications or combinations of the methods described, or, in some cases, an entirely different approach. Many products can nevertheless be serviced under almost any of the plans described, in which case other considerations will dictate the policy to be followed.

1. Decentralized

If sales volume justifies maintaining branch offices in from a dozen to a hundred important cities, very adequate servicing of a number of types of products may be supplied. Such an organizational set-up affords an excellent opportunity for the "insurance type" of maintenance contract notably used by manufacturers of theater sound equipment. For a flat monthly fee regular check-ups and performance analyses may be made by company-trained experts. A disastrous breakdown costs the the customer nothing extra, or he is required to pay only for parts, as the case may be. Where the electronic equipment is the vital part of a production process (as for instance, induction heating oscillators), this plan should have ready acceptance.

2. Centralized

The small manufacturer may limit operations to a local area, in which case the factory is headquarters for the serviceman or engineer. Public address systems would be a typical example.

Geographical limits may be ignored in the case of unit sales of five to ten thousand dollars. One manufacturer of high-frequency heating equipment will exchange telegrams or fly a service engineer to a distant point if a breakdown occurs. Needless to say, this manufacturer designs equipment with quality components and issues a very thorough maintenance manual with each unit sold.

3. Customer-assigned

If the customer is large enough, the customer-assigned salesman may also be the service engineer. The large plant would have considerable service facilities of its own, but the frequent visits of the engineer would serve to inspect old as well as sell new equipment. He would always be "on call" to the customer's maintenance men and would have to be a man who is unafraid to roll up his own sleeves when repairs are to be made.

4. Local dealer

A future development for sales and service of the more expensive types of equipment (X-ray, welders, H.F. equipment, etc.) may be the authorized dealer (to be compared with an automobile dealer) who maintains facilities and personnel for sales, maintenance, and repair of equipment in his territory. The dealer owns part or all of his organization but may hold equipment and replacement parts on consignment.

5. Free-lance service

Many pieces of low-priced electronic apparatus (light controls, counters, P.A., etc.) may be marketed through independent industrial supply houses, retailers, or a new type of radio service shop. Indeed, such a plan seems to be definitely called for in the postwar picture. There are many obstacles and there will be many abuses. but the probability is that the more enterprising of the country's 50.000 radio service dealers will go after such industrial electronic sales and service business as they can get. If the go-getters happen also to be the ones who are best equipped with facilities and technical ability, this group can render a distinct service to scores of the smaller manufacturers of low-cost electronic devices. What will definitely be needed is a re-education of these free-lance servicemen to some of the non-electronic principles which industrial service entails. Optics, mechanics, industrial electrical theory and practice, and many other subjects will have to be taught, in some measure, to establish radio servicers as competent industrial workers. Of course, certain types of highly specialized equipment may never be so serviced.

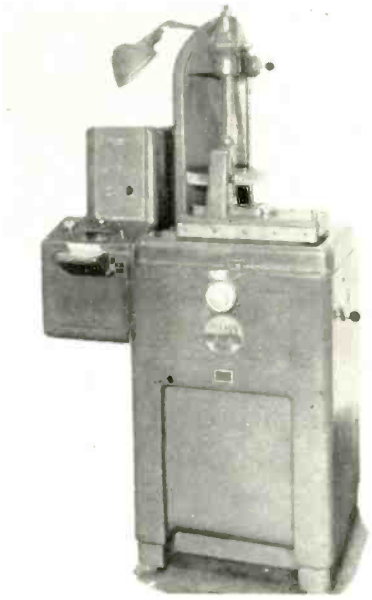
That these men will enter the field is not the question. The question is this: Will the manufacturers, large and small, cooperate with the servicemen, take the responsibility of preparing them. and take advantage of their numbers and geographical distribution, in the coming struggle to give the average industrial or electrical plant engineer confidence in the "fragile might" of the electron tube?

6. Maintenance by customer

When equipment sales are made exclusively to large manufacturers who possess complete facilities for electronic work, it is possible to dispense with a service staff. Satisfactory operation on this basis at present. and for some time to come, is distinctly limited in scope of

(*Continued on page* 162)

Electronic Tubes ON THE JOB



INVOLUTE MEASURING machine equipped with GE chart type electronic recording device manufactured by Fellows Gear Shaper Co.

Shape of Gear Teeth Checked by Electronic Recorder

Developments and improvements in the manufacture and use of small gears have meant that more and more attention is being given to the accuracy of gear tooth profiles, explains W. B. Parker, industrial department, General Electric Company, Boston office. Involute measuring machines are now used widely to check the teeth of finished gears for deviations from specifications.

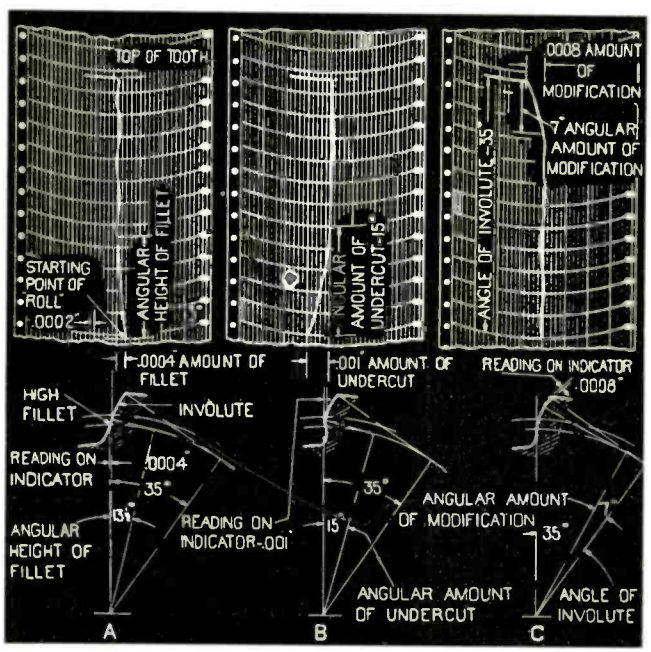
In principle, the involute measuring machine mechanically compares the tooth shape of the gear to a given standard in such a way that readings of the errors or deviations from the standard or designed shape can be taken from a dial indicator. Since these readings must be noted, recorded, and charted by an operator, the procedure is relatively slow and is subject to errors of human judgment.

To overcome this problem, the Fellows Gear-Shaper Company and the General Electric Company have developed an electronic recording device for use with the Fellows involute measuring machine. Employing a specially constructed chart-type, electronic recording instrument and an electric gage, the device makes possible a permanent record of the condition of the gear teeth. Deviations from standard as noted by the involute pointer are multiplied through the electric gage and traced directly on a paper chart. The operator does not have to take readings or plot curves.

The record of a perfect tooth, as drawn by the electronic recording device, is a straight line that parallels straight longitudinal lines printed on the chart. Variations from a straight line can be read to indicate errors to 1/10,000 in.

Three representative charts are shown with an explanation of each. Curved cross lines are spaced to equal a given number of degrees and to indicate the amount and location of error. Each longitudinal division of the chart represents 2/10,000 of an inch. The record of several teeth may be made side by side on one length of chart through the use of a chart rerolling control.

Many of these measuring machines are now in operation and the versatility of this electronic recording device is contributing to the accuracy and speed being attained in the production of many of the gears used in our war machines.



HIGH FILLET, undercut and tip modification as charted on electrical recorder

Radio on Big Construction Jobs

D. Reginald Tibbetts, consulting communications engineer, Moraga, Calif., writes: "I note with interest the article 'On Big Construction Jobs' in your March issue and your mention of my San Francisco-Oakland Bridge construction radiotelephone system. As a footnote to this it is interesting to know that it was officially stated my radio-telephones saved over $1,000,000 and three months' time in the construction of this great bridge. We had as many as 80 radiophone units and at all times every part of the construction work was tied together with portable-mobile sets on piers, barges, tug boats and Henry J. Kaiser's concrete barges.

Treasure Island

"Up to the time of the war I had specialized in construction communications. My father, the late Fred H. Tibbetts, was an active civil and construction engineer and encouraged me in the possibilities. After the San Francisco - Oakland Bay Bridge I supplied radiophone communications to the U. S. Army Engineers and their contractors in the building of Treasure Island in San Francisco. This man-made 500-acre island was built entirely by suction dredges. All were interconnected, to land bases and to tug boats, with my radiophones, giving excellent job coordination.

"On large dams the control of the concrete pouring is usually done by telephone connection between the head-tower engineer who controls the cableway machinery, and the man where the concrete is dumped. Continuous communication is vital, as much damage to property and possible loss of life could occur if a bucket weighing up to 50 tons were swung even a few feet the wrong way. The great trouble with wire lines is that they are always in the way of carpenters, steel men and riggers when the forms are being raised—a continuous process. At Boulder Dam it took a crew of four electricians on constant duty revising, repairing and extending telephone lines. Safety rules require that a cableway not operate unless communications are in perfect working order.

"At Shasta Dam we provided low-powered radiotelephones, 12 channels, to give communication between the head-tower master board and very small portable field sets. These field sets were a marvel of compactness: crystal - controlled transmitters and crystal-controlled superhet receivers, both receiver and transmitter used same antenna and provided for full duplex channel, with both carriers on all the time.

Pipe lines

"I have used radiophones many times also on short construction jobs, the most typical of which is the placing of pipe lines across rivers. The most usual method is to use a winch barge in the stream which pulls a section at a time from one bank. As each section is pulled out the next is welded to it. Radio communication between these points gives complete control over the operation as well as to any marine traffic."

Radio Sewing Machine for Plastics

A radio sewing machine has been developed experimentally by RCA Laboratories at Princeton, N. J. It has promise of becoming one of the new radio-electronic machines of the postwar period, when expansion of its use may be extended through wartime developments.

Instead of needle and thread, this machine uses radio-frequency current; instead of woven cloth, it works on thermoplastics—the new synthetic materials that are finding wide application in the making of raincoats and caps, weather balloons, and in the packaging of many types of food and oils.

RADIO-FREQUENCY current stitches a thin solid seam that is both air- and water-tight. Developed by RCA for the plastics industry in fabricating thermoplastic materials

It "stitches" a thin solid seam that is air-tight and water-tight, creating a bond that is stronger than the material itself.

The radio sewing machine was created to meet a definite need in the plastics industry. Thermoplastics, though resilient material, can be rolled into large cloth - like sheets, which makes them highly useful in any number of ways. When cut into patterns, the sections are usually put together by sewing with thread, by cementing, or by fusing with externally applied heat. None of these methods has been found to be entirely satisfactory for mass production.

Fusing by heat

Fusing by heat appears to be the most desirable method, but there are problems of maintaining uniform temperature, also of processing equipment getting gummy.

By generating heat inside the material itself, RCA's radio sewing machine eliminates these difficulties, according to Dr. G. H. Brown, research scientist of RCA Laboratories, under whose supervision C. N. Hoyler and R. A. Bierwirth developed the device.

The material to be sealed, or "sewed" is fed across a table top through two small roller wheels which serve as the "needle." The wheels have two functions, the first being to pull the material along. At the same time, they act as plates which set up a small electromagnetic field of radio-frequency current. As this current passes through the material, heat is generated by dielectric loss. The heat causes thermoplastics to fuse, or weld, in a tight bond.

Somewhat similar in appearance and operation to the conventional sewing machine, the radio device derives its current from a low-power radio-electronic oscillator. A small electric motor drives the roller wheels. Controls are in a foot pedal. Ordinary alternating current of 110 volts supplies the power.

Radio effective

Laboratory tests, according to Dr. Brown, have revealed the radio machine as an effective instrument for the handling of such thermoplastics as Vinylite, Koroseal and Pliofilm. All three of these materials are being used in a widening field of practical applications.

So far, only an experimental model has been developed. Recently, however, the device was set up in the plant of a large mid-west manufacturer, where tests under practical working conditions are being conducted to determine its eventual standard design for commercial operations.

Other methods of applying the same general principles to the problems of fabricating thermoplastics are under development in RCA Laboratories. It is possible, for instance, to use specially arranged electrodes in presses to seal the seams of a garment, or other product, in a single quick operation.

To Teach by "Talking Books"

Electronic penetration into another new field of education and information is marked by the appearance of the first "talking book" on American history, just announced by the American Foundation for the Blind, 15 West Sixteenth St., New York City. With this "talking book" for the blind, sightless children throughout the country are now able to study American history from phonograph records. The Foundation said it had recorded its first "talking book" on American history entitled "The Rise of Our Free Nation," by Edna McGuire and Thomas B. Portwood. J. O. Kleber is electronic engineer in charge of recording.

SURVEY of WIDE READING

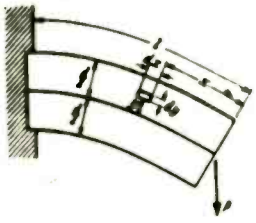
Electronic news in the world's press. Review of engineering, scientific and industrial journals, here and abroad

The Piezo-Electric Strip as Electro-Mechanical Transducer

H. Keller (Hochfrequenztechnik und Elektroakustik, Berlin, July 1942)

For small forces and considerable deviations it is advantageous to make use of the transverse piezo-electric effect, where electric force and mechanical tension are at right angles to one another. The conventional transducer used consists of two identical elongated and rectangular plates cut from a suitable crystal and three metal sheets constituting the electrodes and having approximately the same size as the crystal plates. One electrode is placed between the two plates; the two other electrodes are electrically connected and pasted onto the two outside faces of the crystal cuts. Electrically, the arrangement corresponds to a parallel connection of the crystals.

In operation, the crystal-electrode combination may be rigidly supported at one of its end planes or at both of them, the mechanical force (or deviation) occurring at the free end or in the middle, respectively. In both instances bending of the crystals along their longest axes takes place, as shown in the figure for the first mode of operation.



Bending of piezo-electric strip

The mathematical derivations, the results of which are given in the following, involve known considerations and formulas describing the behavior of piezo-electric substances and from the theories of elasticity, electricity and mechanics.

The voltage developed upon bending if one end only is supported is first derived:

$U_{volt} = 8.83 \times 10^5 \ \pi \ k \ l/e_i b \ d \ P$, as a function of the applied force P in grams, or

$U_{volt} = 2.2 \times 10^5 \ \pi \ k \ E \ d^2 s/e_i l^2$, as a function of the deviation s measured in cm.

The expressions for deviation and force are:

$s = k \ U \ l^2/100 \ d^2$

$P = k \ U \ E \ b \ d/400 \ l$; where

k = piezo-electric coefficient (electrostatic units per dyne)
l = length of plates (cm)
b = width of the plates (cm)
d = thickness of the plates (cm)
e_i = relative dielectric constant in the direction of d
E = elastic constant in the direction of 1 (grams.cm^{-2})

The formulas for the case where both ends are supported follow from the above expressions by considering the equivalent arrangement of the plates being supported along their middle line and subjected to forces applied to their ends of half the force actually applied to their middle. The following results are thus obtained: U as a function of force is to be reduced by 4, and as a function of deviation it is to be multiplied by 4; the expression for s is to be divided by 4, the expression for P is to be multiplied by 4.

Corrections are indicated for the electrodes being a little smaller and shorter than the crystal plates so that there is a narrow margin of the crystals not covered by the electrodes, as well as for unequal thickness of the two crystal plates.

Propagation of Light in Hollow Wave Guides

A. Mathieu (Schweizer Archiv fuer angewandte Wissenschaft und Technik, Solothurn, Switzerland, Sept. 1942)

The propagation of light waves in hollow wave guides is mathematically investigated with a view to use it in telephone or telegraph communication systems. An expression for the losses due to reflection on the walls of a cylindrical guide is derived, and the values found for normally polarized light —which is less damped than parallel polarized one—in a cylinder of 10 cm diameter are listed below:

Material	Angle of incidence	Coefficient of reflection	Loss in db/km
copper	9°	0.95	353
copper	4°30′	0.98	69
copper	2°15′	0.99	17
silver	4°30′	0.994	20
silver	2°15′	0.997	5

It is pointed out that these values are applicable only to perfectly straight conductors, and that a bend would result in a new orientation of the waves, changing the angle of incidence to such an extent that the method is of no practical use unless substances with higher coefficients of reflection are available.

It is suggested that the transmission of light be used in other than communication fields, e.g. to illuminate store houses containing readily inflammable material to avoid the danger of kindling a fire by electricity.

Noise in a Velocity-Modulated Amplifier

J. Mueller (Hochfrequenztechnik und Elektroakustik, Berlin, July 1942)

The noise in a klystron hf amplifier is investigated under simplified circumstances. The noise current—assumed to consist of constant-velocity electrons — entering the system sets up a noise voltage which velocity-modulates the electron stream, which is intensity- and velocity-modulated when leaving the first pair of electrodes. The intensity modulation resulting from this current at the input to the second electrode pair is computed. As the time required for the electrons to traverse the space between the second electrode pair is very short, the intensity modulation of the current is not changed during passage.

The output noise is compared with the useful energy derived from an antenna, and may be expressed as the antenna power required to produce it. The noise decreases with decreasing electron velocity in the space between the two pairs of electrodes, with increasing angular - velocity - time product in this space, with increasing current density and resistance.

On Network Calculations

H. Stanesby, E. R. Brand and R. L. Corle (The Post Office Electrical Engineers' Journal, Vol. 35, Parts 3-4)

Based on the possibility of transforming any symmetric filter into a lattice structure and an ideal transformer, a simple expression for insertion loss and phase change in a four-terminal reactance network is derived. The formula is valid provided dissipation losses may be ignored, the terminal resistances are constant, and the ratio of image impedance to terminating resistance is the same at both ends. Applications of method are given.

with but a Single thought

Gertrude Fontaine, mount operator at Hytron's Salem plant, and soldier in the Army of Production.

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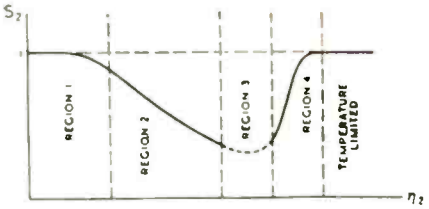


Space charge factor in diodes

On the Shot Effect

Lieutenant de Vaisseau M. Surdin (Wireless Engineer, London, March 1943)

In a space-charged-limited diode, changes in emission current produce changes in electron density distribution, and consequently in amplitude and cathode-distance of the potential minimum. Formulas for the resulting fluctuations in plate current are derived as function of fluctuations of the emission current, taking into account the influence of the space charge. The considerable smoothing effect of the space charge, when only a small fraction of the total emission current reaches the plate, is established, which smoothing effect diminishes with approach to the temperature-limited region.

In the diagram, S_2 is the space charge factor (ratio of the mean-square of the plate current in a space-charge-limited diode to the mean-square of the fluctuations of the plate current of a temperature-limited diode having the same mean plate current). The abscissa indicates $\epsilon V_2/kT$; ϵV_2, k, T being electronic charge, plate potential with respect to the potential minimum, Boltzmann's constant, and absolute temperature of cathode, respectively. It will be seen that the signal-to-noise ratio is most favorable when the tube is operated in region three.

Hypothesis on the Origin of Cosmic Rays

R. A. Millikan, H. V. Neher and W. H. Pickering (The Physical Review, April 1943)

In a previous paper, the authors had presented their atom annihilation hypothesis of the origin of cosmic rays. This hypothesis assumes that an atom in interstellar space, and there only, has the capacity of occasionally transforming the whole of its rest-mass energy into a charged particle pair—later established to be an electron pair—and that it is this transformation or annihilation of the atoms and the resulting electrons which are responsible for the cosmic rays.

The rest-mass energy of an atom is the amount of energy inherent in its mass when at rest, which may readily be computed from the mass-energy conversion formula. These energies are evaluated for the five known essential elements present in interstellar space; from them energies and velocities of the originated electrons are derived. Taking into account the effect of the earth magnetic field on moving electrons, the cosmic ray distribution was computed.

It is the main object of the present article to compare experimental results of cosmic ray distribution with the calculated one, which comparison seems to bear out the consequences of the hypothesis.

Ultrashort-Wave Generation

I. E. Mouromtseff (Electrical Engineering, May 1943)

This is the third article in a series on ultra-short waves, the first two dealing with electromagnetic theory and transmission lines, respectively. The four main types of uhf generators, conventional negative-grid generators, positive-grid oscillators, magnetrons and velocity-modulation generators are dealt with.

On Polarization of Ionospheric Waves

E. V. Appleton (Nature, London, Feb. 27, 1943)

It is pointed out that the radio waves reflected by the ionosphere in northern temperate latitudes are approximately left-handed circularly polarized. This polarization may be demonstrated by receiving two linear polarized, 90 deg. out-of-phase components of the circular wave by means of two loop antennas, beating the antenna outputs with a slightly different frequency, and comparing amplitude and phase relation of the two resulting frequencies. It is stated that the ground wave may be used for heterodyning, as the frequency of the reflected wave is being changed due to Doppler effect when the height of the reflecting layer in the ionosphere slowly reduces or increases at different times of the day.

On Filtered Thermal Noise

S. O. Rice (Journal of the Acoustical Society of America, April 1943)

The input of a band pass filter is connected to a source of thermal noise, represented as the sum of sinusoidal components having the same amplitude but with random phase angles. A certain amount of noise energy will be dissipated in the one ohm output resistor during a predetermined time interval. If the starting point of the time interval is regarded as chosen at random, the dissipated noise energy becomes a random variable, with the length of the time interval as parameter.

The article is concerned with the distribution of the dissipated energy for varying starting point. Mean value and standard deviation —as well as the standard deviation of the difference between two energies whose starting points are separated by a given time interval— are determined as functions of the length of the time interval. Values of these functions corresponding to an ideal band pass filter and to a filter having an exponential characteristic are shown in a diagram.

High Crystal Harmonics for Oscillator Control

I. E. Fair (Bell Laboratories Record, April 1943)

It is pointed out that the fundamental resonant frequency of oscillator crystals can not appreciably exceed 10 megacycles because the crystal required would have to be thinner than about six and a half thousandths of an inch. To obtain higher resonant frequencies, harmonics may be used, however, for higher harmonics the reactance of the crystal becomes negative which prevents them from being useful.

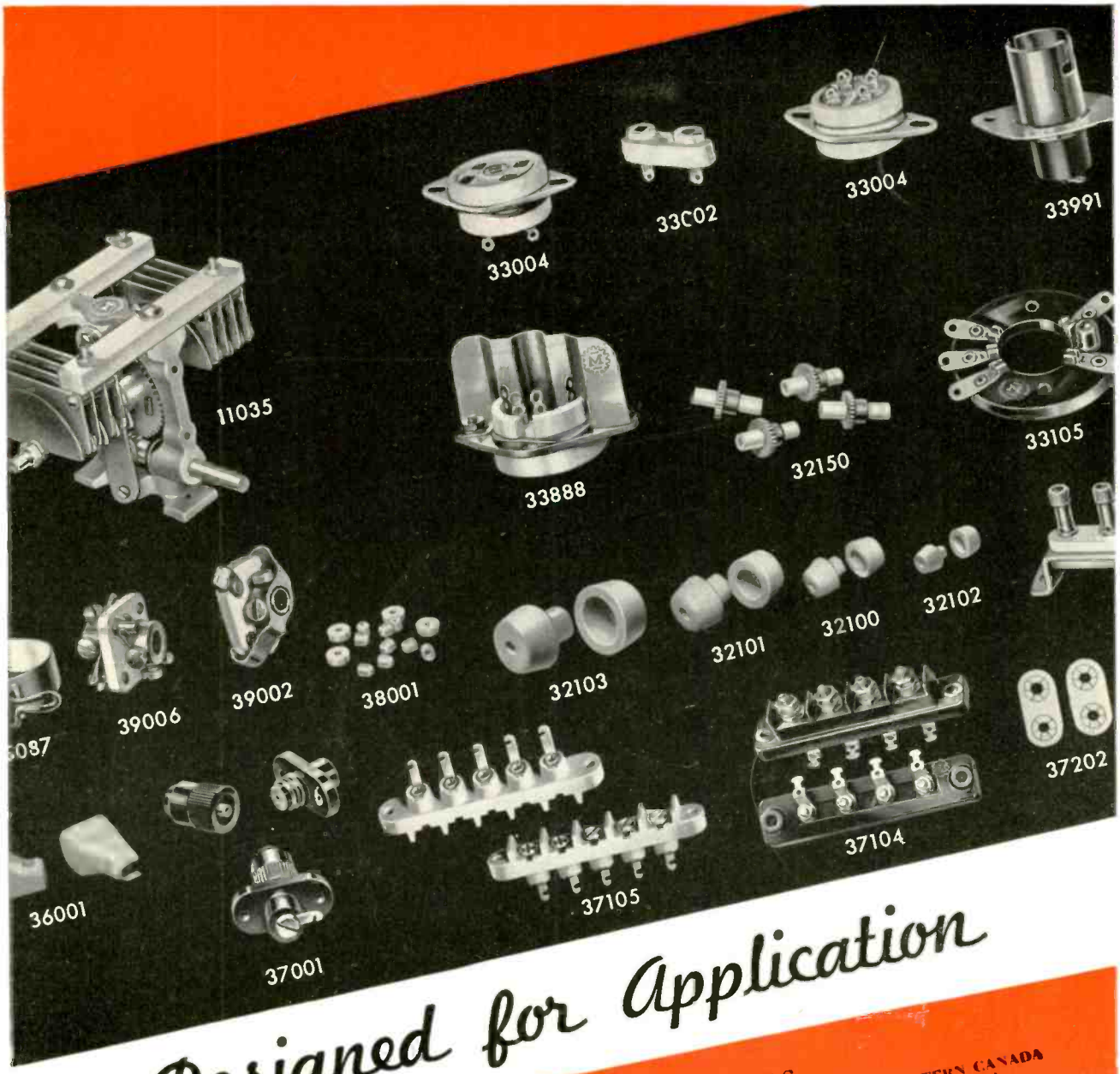
By considering the equivalent circuit of a crystal, it may be seen that if the static capacitance is reduced, positive reactance for higher harmonics would result. A circuit accomplishing a reduction in the effective static capacitance has been designed, and oscillators have been built for frequencies as high as 150 megacycles using crystals with fundamental frequencies below 10 megacycles.

Investigating Optical Wedges

M. H. Sweet (Journal of the Optical Society of America, April 1943)

An optical wedge is essentially any plate or sheet having systematically varying light transmission properties, e.g. photographic material on a transparent basis and of gradually increasing shading. It is of interest to establish the light transmission of the different shades for various colors, and a color densitometer for investigating the spectral characteristics of optical wedges was therefore built.

Light from an incandescent lamp is condensed, passed through a color filter and a section of the wedge, and is then incident on a photoelectric cell, the output of which is applied to a logarithmic amplifier and a meter. Adjacent sections of the wedge are measured successively and in combination with different color filters. The results obtained are given and discussed.



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LATEST

NEWS FROM WASHINGTON

Concerning the Electronic Industries

SIX-BILLION-DOLLAR ARMY-NAVY ELECTRONIC PROGRAM IN 1943-44—The manufacturing industry producing electronic and radio equipment, components and parts faces a very busy and heavy year of war production during the 1943-44 governmental fiscal year starting next July 1, on the basis of the new Army and Navy appropriations which are now being approved by Congress. The Navy plans on the expenditure of around $2,000,000,000 for electronic and radio equipment and parts, and the Army Signal Corps is projecting procurement of approximately $4,000,000,000. This means that the industry will be operating at quite full capacity although it is possible that a number of the small concerns for standardized parts and simpler types of components may not be called into the picture because the Army and Navy requirements are for the production of the highly specialized and more intricate types of electronic and radar and radio apparatus and equipment.

MANUFACTURERS WITH PRODUCTION KNOW-HOW WILL BE LOADED—Electronic manufacturers with competent engineering staffs, expert managements, and "know-how" in production will get the call for the lion's share of the Armed Services' procurement awards. The Navy program for the construction of 27,642 airplanes will be a major portion of the radar and radio procurement total. It is estimated that it costs about $20,000 to equip a large airplane with radio and about $30,000 for radar. The Bureau of Ships is receiving a budget of around $160,500,000 for radio and radar parts under the maintenance and repair program of the Navy. Naval Communications is to obtain about $3,500,000 for new shore stations and the Coast Guard is receiving $5,645,000 for communications equipment, including a substantial amount for telephone and telegraph facilities, besides radio equipment and parts.

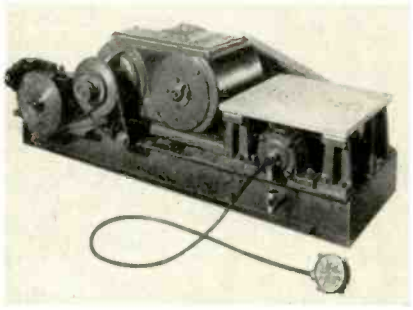
GENERAL OLMSTEAD LAUDS PERFORMANCE OF RADAR IN NORTH AFRICA—Citing that "the demands of this war upon military communications are something to stagger the imagination," Major General Dawson Olmstead, Chief Signal Officer of the Army, reporting on his recent 28,000-mile tour of inspection of the African, Middle Eastern and China-India-Burma theatres of operation, paid high tribute to the American designers and manufacturers of radio equipment which, he said, had stood up to an unprecedented degree under the conditions of desert warfare. The radar apparatus was to a large degree responsible for the high level of security of American troops from German air attacks and the effective results achieved by the Army Air Forces. General Olmstead, who traveled by plane for more than 165 hours, as well as by jeep and on foot, related that two of the Signal Corps mobile field headquarters radio stations, carried in one truck and trailer and which can transmit over long distances by Morse code and by voice, were used for the first exchange of messages between General Montgomery and General Alexander as the British Eighth and First Armies closed in on the Nazis from eastern and western Tunisia.

SIGNAL CORPS RADIO SETS PLAY NOTABLE ROLE—The product of the American radio manufacturing industry proved its worth to the highest degree and operated distinctly better under combat conditions in North Africa than in domestic maneuvers in the United States, declares another Signal Corps observer in North Africa, Lieut. Col. A. A. McCrary, Chief of the Procedures Coordination Branch under General Olmstead. The five-pound "walkie-talkie," originally demonstrated in 1942 for Prime Minister Churchill, has proved outstanding for infantry patrols and other front-line troops who find the set as easy to use as a telephone handset. Another important type of apparatus is the "cavalry guidon" set with its longer range which can be used by ground troops or motor vehicles. The system of static-free radio equipment, designed by the Signal Corps to overcome noise and interference of battlefield conditions, has come through with flying colors for the Armored Force and Field Artillery.

MISCELLANY—Captain Stanley F. Patten, who as Assistant Director of the Navy Bureau of Ships Radio Division contributed such a major share to the rapid growth of radio development and procurement for the Navy, has just gone to command duty at sea (the ambition of every regular Navy officer during war). Commander D. F. J. Shea, USN, and Lieut. Comdr. Ralph T. Brengle, USNR, are now the Assistants to Captain Jennings B. Dow, Head of the Division. . . . FCC Chairman James Lawrence Fly predicts that the new post-war radio technical planning body, now proposed by the IRE, will get under way within a few weeks. . . . Despite controversy with Congress, FCC is assured of next year's appropriations of $7,609,914 by its approval by the Senate. . . . WMC Chairman McNutt emphasizes potential reservoir of 4,000,000 women now registered with USES for war industries, including radio and electronics.

WHAT'S NEW

Devices, products and materials the manufacturers offer



Vibration Testing Machine

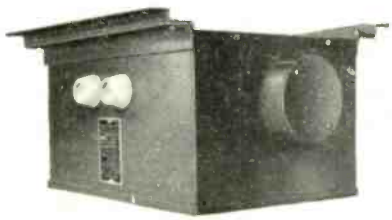
Waugh Laboratories, 420 Lexington Avenue, New York, have developed a unit designed to create vibrations of known characteristics. These vibrations are applied for breakdown testing of any apparatus that is normally subject to vibration failure. The machine is of a positive mechanical nature, uses no unbalanced weights and has full amplitude, frequency and wave form control. Frequencies as high as 6000 cycles per min. and amplitudes of 0 in. to 0.0625 in. are attainable. The frame is steel welded and the unit weighs 10 lbs.

Humidity Test Chamber

A low and high temperature test chamber manufactured by American Coils Co., 25-27 Lexington St., Newark, N. J., is now produced with automatic humidity control. The standard humidity range is ambient to 140 deg. F., ambient to 90 per cent relative. The unit embodies as an integral part, equipment for mechanical refrigeration and electrical heating with a temperature range of — 67 deg. F. to + 160 deg. F. Positive forced air circulation can be varied in volume and temperatures are thermostatically controlled.

Extruded Plastic Tubing

Unusually flexible and possessing both high dielectric and tensile strengths, Irv-O-Lite tubing manufactured by Irvington Varnish & Insulator Co., Irvington, N. J., is readily applicable as wiring insulation. One application prevents shorts and grounds on solderless terminals and connectors. The material is heat resistant and its dielectric strength both wet and dry permits the use of thinner-walled tubing than is ordinarily possible. Available in six easily distinguished colors.

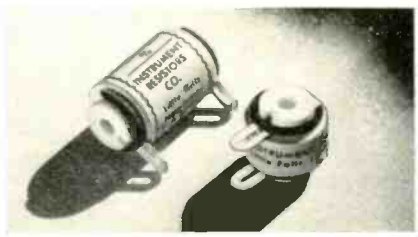


Cold Cathode Lighting Transformer

Cold cathode lighting, using a minimum of critical materials has been successfully tested in many war production plants throughout the country. Cold cathode tubes of 20 to 25 mm. diameter can be used in multiple parallel strips, and curved to follow the contour of a building or production line. The brilliant bright light can be color-mixed to make inspection work stand out in relief. Announced by Acme Electric & Manufacturing Co. of Cuba, New York, is a new style cold cathode lighting transformer especially designed for industrial applications. Capacity of 120 milliamperes in 3000, 4000, 6000, 9000, 12000, or 15000 volt secondaries. Strictly a heavy duty, vibration proof unit, with standard conduit box for primary connection and built-in parallel electrode housings for direct connection of cold cathode tubes. Installations under test have shown continuous operation of 20,000 hours and more without appreciable loss in light output or replacement of tubes.

3-in. Oscilloscope

Model 553, 3-in. cathode ray oscilloscope has been announced by Radio City Products Co., Inc., 127 W. 26th St., New York. Switching arrangement permits applying input either directly to deflection plates or to input of the amplifier. Position and stable locking of the image can be obtained with either the vertical signal or any external signal. The high gain amplifiers use television tubes for maximum sensitivity and have a response of ± 3 db between 20 and 100,000 cycles. The built in sweep has a range of 15-22,000 cycles with good linearity.



Precision Resistors

These slotted-terminal, high-accuracy resistors were designed to meet the requirements of precision apparatus where available area is at a minimum and weight important. Type P-2 has one-half watt rating with a maximum resistance of 500,000 ohms and measures 9/16 in. long with a diameter of 9/16 in. Type P-4, with a one watt rating, has a maximum resistance of one megohm, measures 1 in. long and 9/16 in. in diameter. Terminals on both types are .025 hot tinned copper, slotted to take stranded or solid wire. Products of Instrument Resistors Co., Little Falls, N. J.

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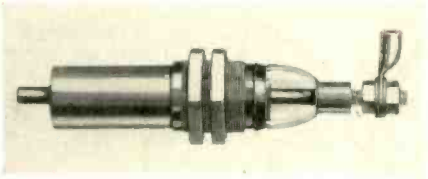


New Gas-Tight Terminal

This gas-tight terminal, developed for use on radio coaxial cables, is equally applicable in other places where an insulated terminal is required for equipment in a sealed container. The seal is obtained by fusion of glass to metal. A metal alloy of suitable coefficient of expansion is used.

The unit shown is installed on the end of a ⅞ in. coaxial cable, and is priced at $6. Other sizes are available. Product by Victor J. Andrew Co., 363 E. 75th St., Chicago.

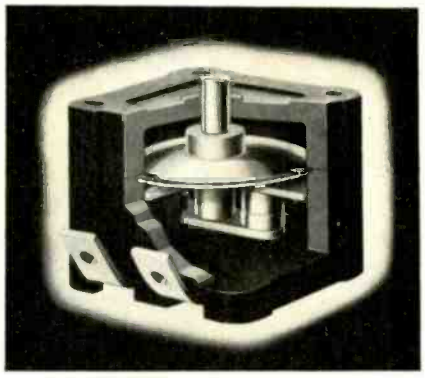
Model RFO-5 Oscillograph

The Hickok RFO-5 oscillograph has been developed to handle development and servicing problems in frequency modulated, amplitude modulated and television receivers. It has a self-contained wide band (100 to 900 kc sweep) frequency modulated oscillator (basic frequency 23 mc) for frequency modulated and television servicing, which can be modulated if desired from an external frequency source. It also has a narrow band (10-30 kc sweep) frequency modulated oscillator with a basic frequency of 1000 kc for visual alignment on amplitude modulated receivers, demodulators, etc. Provides a mixer circuit, demodulator—video amplifiers, signal tracer, etc. A design feature permits its use as a visual vacuum tube peak voltmeter having a range of 0.2 to 1000 volts at any frequency. Manufactured by The Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio.

Speedex Wire Stripper

The Speedex Wire Stripper is an effective tool for quickly stripping insulation from any type electric wire. It can be used as a production tool or for occasional spot stripping and cutting. 800 to 1000 wires per hour can be obtained. A special

model is available with "hold-open feature" for stripping fine stranded wires. It automatically holds jaws open until wire is removed, and strips without crushing. Manufactured by Wood Specialty Manufacturing Co., Rockford, Ill.



Sealed Switches

The Allied Control Co., 2 East End Ave., New York, is sealing its A3 and A5 switches in Bakelite cases to protect their contacts against dirt, dust, sand and oil, a great factor in switch failure. The contact arrangements are single pole single throw, non inductive, 50 amperes at 12 and 24 volts dc and 110 volts ac. Operate at a pressure of 1½ to 3½ lbs. The switches weigh but 5 ounces and measure $1\frac{15}{16}$ in. x $1\frac{15}{16}$ in. by $1\frac{19}{32}$ inches.

Feed-Through Terminal Block

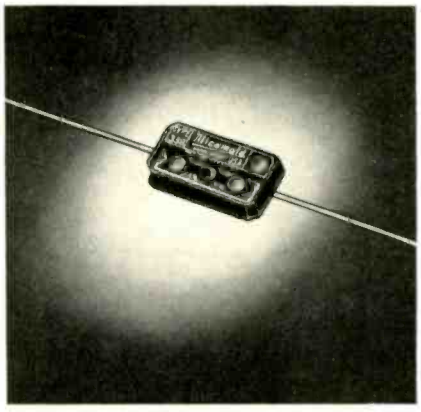
A new multiple terminal block, for sub-panel and chassis construction, with feed-through terminals, has just been announced. This terminal block is designed to meet present-day demands of electronic and electrical design, which require external terminals because of their wiring simplicity and other advantages. The terminal block consists of individual feed-through terminals mounted in Bakelite which are permanently held in a metal strip in any combination desired. Factory production now includes blocks having any number of units between 1 and 10. Terminals have ample clearances and leakage distances for circuits carrying up to 300 volts, 20 amperes. Curtis Development and Manufacturing Co., 1 N. Crawford Ave., Chicago.

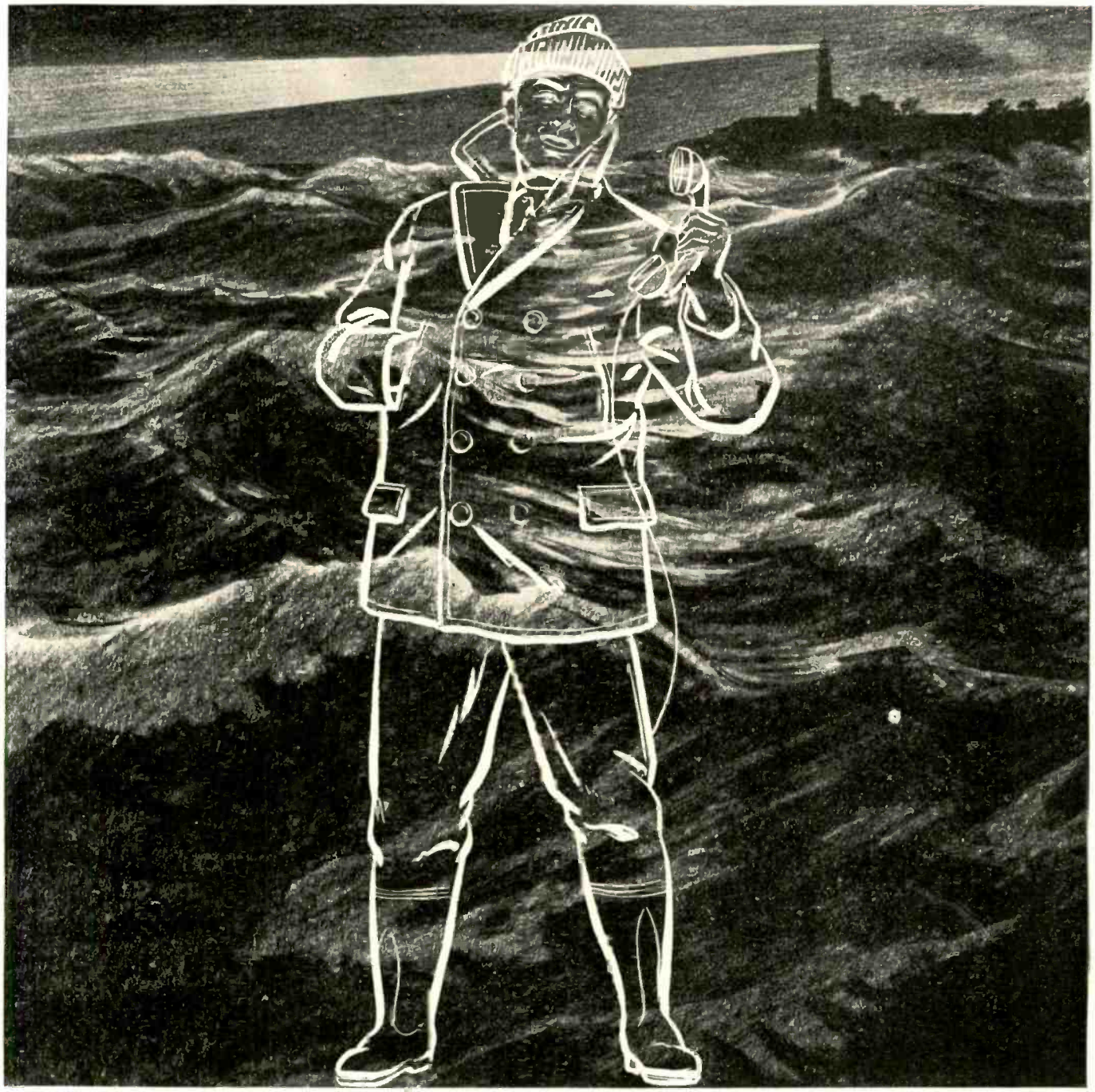
Polectron Synthetic

Polectron is the name of the new synthetic material which can serve as mica replacement, manufactured by General Aniline & Film Corp., 230 Park Avenue, New York. It is claimed to possess many of the qualities which mica possesses for electronic equipment and is obtainable in sheets that are uniform in thickness within 1/10,000 of an inch. It resists heat, moisture and oil and has the toughness which condenser processing requires. These properties together with low-loss characteristics provide one means for relieving the mica shortage situation.

Small-Size Capacitors

The Micamold Radio Corporation, 1087 Flushing Ave., Brooklyn, N. Y., announces a small-size capacitor which is destined to find widespread application in compact radio, sound and electronic equipment. This newly developed, small capacitor, known as the Type 338, has body dimensions ¾ in. long by $\frac{7}{16}$ in. wide and $\frac{7}{32}$ in. thick, and is available in capacities up to .01 mfd., with a rating of 120 volts dc working. Because it is hermetically sealed, the 338 will operate satisfactorily under highly humid conditions. It has been approved in a series of tests, including immersions tests, meeting rigid government specifications.





Wherever man goes • • • the two-way radiotelephone enables him to converse freely with those ashore. This medium of communication is new, conveys conversations clearly, quickly, certainly. After the war you will be using the two-way radiotelephone extensively both in your business and social activities on land, sea and in the air. So remember this name—*Jefferson-Travis.* We have pioneered in the radiotelephone field and have perfected this electronic device for use by the United Nations throughout the world.

JEFFERSON-TRAVIS

RADIOTELEPHONE EQUIPMENT

NEW YORK • WASHINGTON • BOSTON

NEW PATENTS ISSUED

Summaries of inventions relating to electronic uses

Note: Date application was Filed shown by (F). Date patent Issued, (I). For the reader's convenience, patents most recently issued are presented first within their specific classifications.

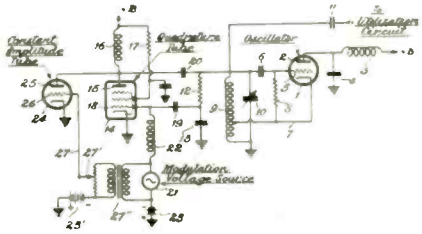
FREQUENCY MODULATION

FM Receiver—The band width of the resonant circuit in an FM receiver is increased with increasing signal strength by connecting energy absorbing means across the terminals of the resonant circuit. The energy absorbing means are directly responsive to the amplitude of the current in the resonant circuit but unaffected by the frequency thereof, and provide for automatic loading of the resonant circuit. E. H. Armstrong, (F) Jan. 12, 1940, (I) May 4, 1943, No. 2,318,137.

Eliminating Frequency Drift — In FM transmitters, small irregularities in oscillator frequency may cause considerable variations in the transmitted frequency because of the multipliers inserted there between. It is proposed to beat a frequency - modulated multiple of the original wave with an unmodulated multiple derived from the same oscillator so as to compensate for frequency changes in the oscillator. E. H. Armstrong, (F) Aug. 2, 1940, (I) March 30, 1943, No. 2,315,308.

Frequency Modulation System— To allow the modulation to properly fill the channel and not to exceed it on either side, the carrier is given a frequency shift in accordance with the dissymmetry of the peak voltage of an unsymmetrical modulating wave. Under these circumstances, the negative and positive peaks of the modulating wave hit the upper and lower frequency deviation limits at the same time, affording a higher percentage modulation. Suitable transmitter and receiver circuits are claimed. M. G. Crosby, RCA, (F) Sept. 26, 1940, (I) March 30, 1943, No. 2,315,050.

Compensating Amplitude Modulation— The amplitude modulation of a frequency modulator, introduced by variations of the resistive component of reactance tube 14, is compensated for, thus avoiding the necessity for a limiter. Tube 24 acts as a varying load on the oscillator tank circuit

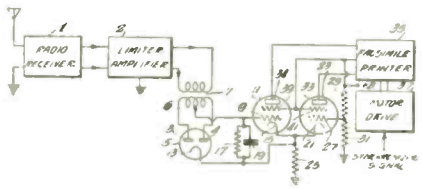


9, 10, and accomplishes the desired compensation if grid 26 is energized with properly phased audio voltage of suitable amplitude, causing the damping by tube 24 to be equal and opposite in phase to the damping caused by control tube 14. The desired effect may be obtained by inserting tube 24 so that it causes the plate voltage of the oscillator tube to vary at an audio rate. Also, one tube can be so connected as to perform both the functions of generating oscillations as well as compensating for amplitude variations. J. A. Rankin, RCA, (F) Nov. 19, 1940, (I) March 16, 1943, No. 2,314,161.

TELEVISION AND PICTURE REPRODUCTION

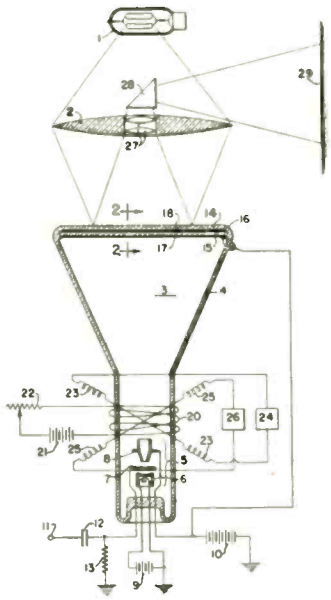
Image Reproducer—Organic vapor is generated in a cathode ray tube to deposit on its electrode a coating whose thickness depends upon the intensity of infrared rays impinging upon the electrode. An electron beam scans the electrode to produce a train of signals representative of the intensity of the infrared rays. G. A. Morton, RCA, (F) Sept. 28, 1940, (I) May 11, 1943, No. 2,319,195.

Facsimile System—The floating detector circuit 5 and 6 applies the signal to both tubes. Control electrode 27 is maintained at a prede-



termined potential, the signal being applied through resistor 25. W. R. Koch, RCA, (F) Sept. 30, 1940, (I) May 11, 1943, No. 2,319,139.

Television Projector — Cathode ray tube 3 is provided with an outer wall portion 14 and an inner wall portion 15, which latter is covered with a light reflecting silver layer 17. The evacuated space 16 between the two wall portions is filled with a thin layer 18 of paraffin, or of another substance, the light dispersion of which depends on its temperature. The light from source 1, upon passing through condenser 2, passes through paraffin layer 16, is reflected by silver layer 17 and again passes through the paraffin layer before reaching projection objective 27, prism 28 and viewing screen 29. The optical arrangement is so adjusted that the light intensity on viewing screen 29 is a maximum

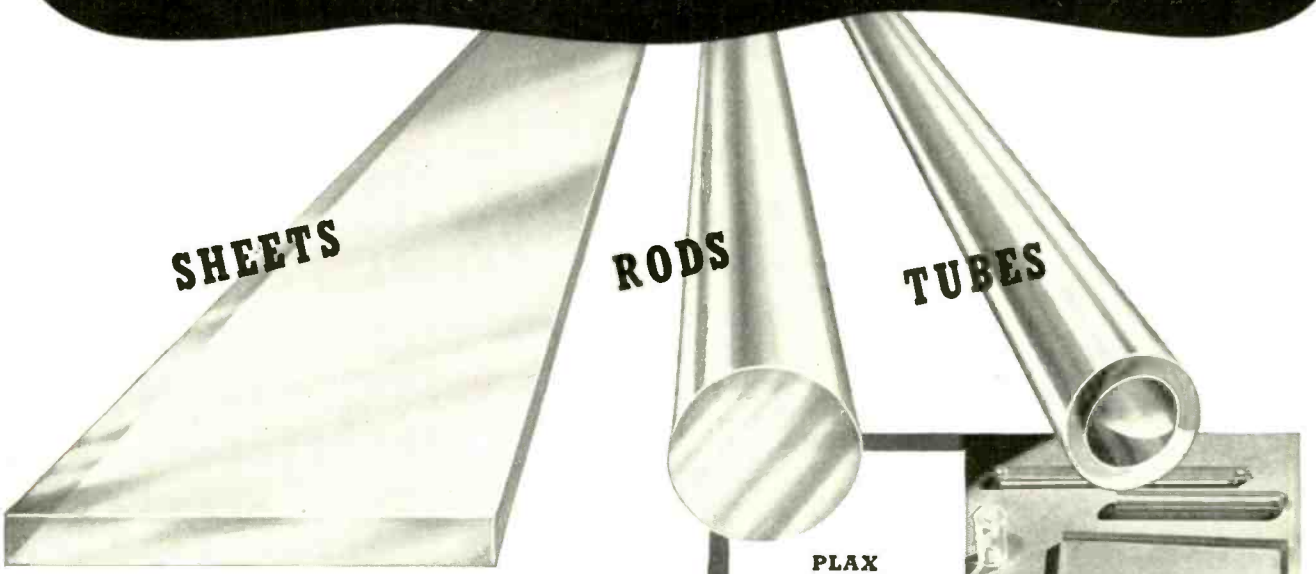


when the dispersion of the paraffin layer is a minimum and decreases with increasing dispersion. The dispersion of paraffin is dependent on its temperature which in turn is controlled by the amount of electrons impinging on the paraffin layer. The scanning beam is modulated with picture signals and deflected in a conventional manner. P. T. Farnsworth, Farnsworth Television and Radio Corp., (F) Sept. 7, 1940, (I) March 30, 1943, No. 2,315,113.

Supersonic Television Receiver —The effective part of the supersonic cell is made sufficiently long that at any instant there will be represented by the compressional wave in the cell as many elemental areas as there are in a scanning line. It is, therefore, possible to project as many elemental areas simultaneously as correspond to a scanning line. The optical system, consisting of two rotating mirror drums, is so constructed that a

PLAX POLYSTYRENE

IN SEVERAL OF ITS FORMS AND USES...



High-frequency circuits insulated with Plax Polystyrene have the highest efficiency. This has been proved in the field.

Zero water absorption . . . complete freedom from adverse effects by acids, alkalis, alcohol, stack gases, weather, etc. . . . the dielectric strength of high-grade mica . . . the low dielectric loss of fused quartz . . . all combine to make Plax Polystyrene in any of its various forms the best high-frequency insulation ever made.

Many companies buy Plax Polystyrene sheets, rods, and tubes to machine into antenna components, stand-off insulators, buss bars, windows, etc. Details regarding your own possible applications, and a bulletin on machining, are immediately available.

PLAX POLYSTYRENE SHEET, ROD, TUBE

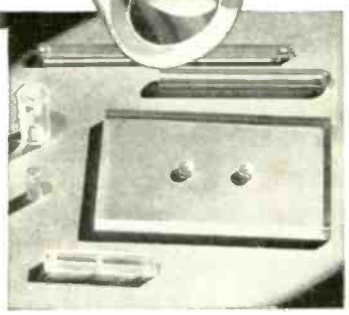
Sheets range in thickness from .010" to 1⅛", and in widths and lengths to order ranging from 4" x 48" to 12" x 16". Rods come in diameters from 1/16" to 4½". Tube inside diameters range from ⅛" to 2". Lengths as required. 4' lengths in stock.

PLAX POLYSTYRENE Electrical Properties

Arc resistance (ASTMD-495-38T) sec 240-250. Dielectric strength, volts/mil:

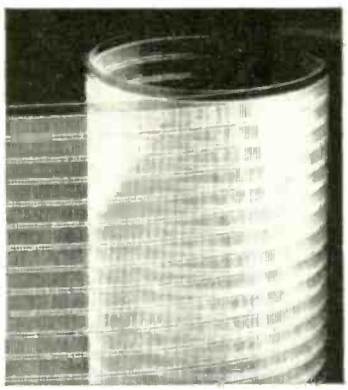
.005" thick = 3500
.010" thick = 2500
.015" thick = 2200
.125" thick = 500-700

Frequency Cycles	Dielectric Constant	Power Factor
60	2.5-2.6	.0001-.0002
1,000	2.5-2.6	.0001-.0002
1,000,000	2.5-2.7	.0001-.0004



PLAX POLYSTYRENE Machined Parts

Here are a few of the multitude of standard and special parts which Plax machines to order. Sizes are large to tiny. Production is rapid and accurate.



PLAX Polyflex Sheet

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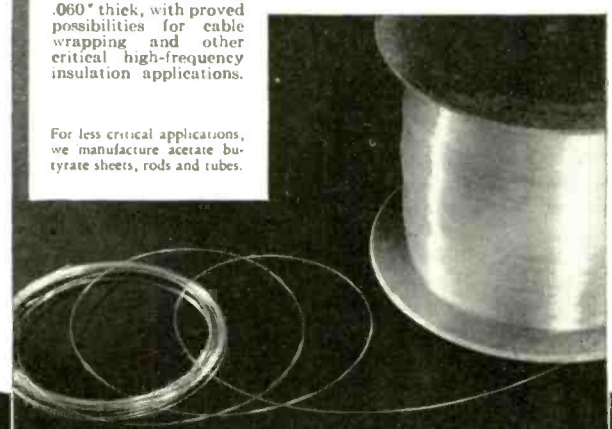
PLAX Polyflex Fiber

Another *new* Plax development is this *tough* and flexible fiber, produced from .10" to .060" thick, with proved possibilities for cable wrapping and other critical high-frequency insulation applications.

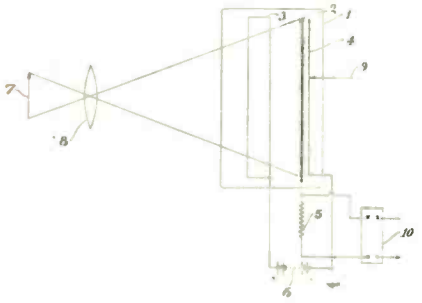
For less critical applications, we manufacture acetate butyrate sheets, rods and tubes.



PLAX CORPORATION 133 WALNUT ST. HARTFORD, CONN.

whole scanning line is illuminated, or parts of two successive lines making up the length of one line. Also, the light path is such that the tone value representing an elemental area of the field of view is projected onto a corresponding and stationary part of the viewing screen, though the compressional wave continuously moves through the liquid. G. W. Willard, Bell Telephone Laboratories, Inc., (F) March 11, 1941, (I) March 30, 1943, No. 2,314,960.

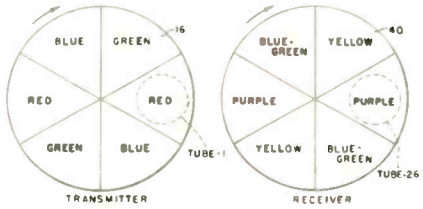
Television Screen Arrangement —An optical image is formed on the photo-electrically active surface of double-sided mosaic screen 2. The photo-electrons emitted are drawn off on to the positive annular electrode 3 and a positive electrostatic image of the object 7 is thus formed on screen 2. The side of the transparent, photo-electrically active screen 4 remote from the mosaic screen is scanned by a spot of light 9, and the electrons liberated thereby move towards the mosaic elements immediately opposite the point at which they are produced, neutralizing the charges on elements in turn and inducing potentials in the grid of wires constituting the signal plate



and capacitively connected to the mosaic elements. The signal plate is connected to resistance 5. Other embodiments are described, the essential feature being the provision of auxiliary electrode 4 cooperating with the mosaic screen by a transference of electrons brought about by a scanning beam of light, X-rays or other electro-magnetic waves. If a negative electrostatic image is produced, the scanning procedure will have to be suitably modified to reverse the direction of electron transfer. H. G. Lubszynski, Electric & Musical Industries, Ltd., (F) Sept. 10, 1936, (I) March 23, 1943, No. 2,314,648.

Two-Way Television and Speech Transmission—Television signals are transmitted over a single transmission channel in opposite directions during non-concurrent time intervals. Speech signals are transmitted over two additional transmission channels. One of the two subscribers controls switching means conditioning the system either for transmitting television images from one terminal station to the second, or vice versa. In a third position of the switching means the direction of transmission of the television signal is reversed under control of speech signals, and in a fourth position, the direction of signal transmission is automatically periodically reversed under control of a rotating commutator. S. B. Wright, Bell Telephone Laboratories, Inc., (F) Aug. 24, 1940, (I) March 23, 1943, No. 2,314,471.

Color Filter Arrangement—Two different color filters 16 and 40 are employed at transmitter and receiver, respectively. At the transmitter, a double interlaced scanning pattern is used, and the boundary line between different



colors closely follows the motion of the scanning beam. Consequently, the charge accumulated by a particular mosaic element before scanning is representative of two successive color components of the picture, and so are the picture signals transmitted. At the receiver, color disc 40 is so phased with respect to color disc 16 that the purple filter of disc 40 is effective when mosaic elements representing blue and red charges are being scanned, and similarly with respect to the other color components. It is shown that this system permits reproduction in natural colors due to the qualifications of the human eye to combine the stimuli of certain two colors to give the sensation of a third one. Other color combinations for the two discs may be chosen. M. Cawein, Farnsworth Television & Radio Corp., (F) Aug. 15, 1941, (I) March 9, 1943. No. 2,313,224.

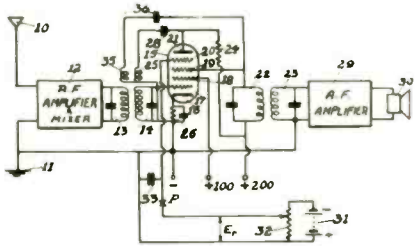
MISCELLANEOUS

Multifrequency Oscillator—A number of non-linear feedback channels are provided in an oscillator. These channels maintain one fundamental frequency each and at the same time, due to their non-linearity, generate an upper harmonic thereof. The channels include an element sharply resonant to the associated harmonic as well as amplitude limiting means, actuated only by oscillations having a harmonic relationship to those maintained by the particular channel. R. C. Fisher, (F) April 7, 1941, (I) May 11, 1943, No. 2,318,936.

Electron Discharge Device — A pair of aligned and suitably arranged electrodes for directing electrons in a discharge device along parallel paths throughout the region between the electron gun and a control electrode. A. L. Samuel, Bell. Tel. Labs., (F) Oct. 28, 1941, (I) May 4, 1943, No. 2,318,424.

HF Resonator — The excitation means of the hollow body resonator is mounted at a point in an off-centered relation to the total resonating space, so as to cause the resonator to oscillate at a predetermined multiple of its fundamental resonating frequency. A. H. Ryan, Westinghouse Electric & Mfg. Co. (F) Aug. 13, 1940, (I) May 4, 1943, No. 2,318,106.

Feedback Circuit—It is intended to vary the feedback in an amplifier circuit for audio or radio frequencies and at the same time keep the amplification constant, so that the effective band width or selectivity may be controlled independently of amplification. For this purpose two anodes 19 and 21 are so connected as to provide positive feedback and output potential, respectively. The variable potential on grid 20 controls the division of the electron current between the two anodes, and consequently the amount of feedback and output. In



such a way as to keep amplification constant. An inverse feedback circuit deriving its potential from anode 19 may be added. The potential of control grid 20 can be supplied by a rectified output signal, e.g., if pass range adjustment for control of background noise or needle scratch suppression is desired. H. Boucke, Patents Research Corp., (F) March 29, 1940, (I) March 30, 1943, No. 2,315,043.

Delay Circuit—A special circuit including an electron tube is described which delays a pulse for the time of its duration, so that the delayed pulse starts at the end of the original pulse. K. R. Wendt, RCA, (F) May 25, 1940, (I) March 16, 1943, No. 2,313,906.

(*Continued on page* 198)

DOESN'T DRINK!*

TYPICAL EXAMPLES OF MYKROY APPLICATIONS

Stand-off Insulators
Variable condensers
Tube and Crystal Sockets
Mounting strips
Structural supports for radio circuits
Plug-in bases
Insulated couplings
Lead-In insulators
Antenna reel insulators
Motor generator brush holders
Padding condenser supports
High voltage arc shields
Oscillator circuits
Fixed condensers
Impregnated resistors
Radio frequency coil forms
Radio frequency panel assemblies
Radio frequency switches
Relay bases and arms

One of the many reasons why MYKROY is a more efficient insulating material is that MYKROY is non-porous. Its superior mica and specially prepared glass are fused in intimate molecular contact. Hence, hydroscopic absorption and adsorption of oils, vapors or moisture are virtually nil. Surface treatment and impregnation are not needed.

This advance over old-style ceramics makes MYKROY a more dependable insulator under conditions of heat and humidity . . . whether in steaming jungle, dense ocean fog or the acid-laden vapors of a submarine.

MYKROY dissipates negligible electrical energy throughout the entire range of frequencies. It bonds inherently with metals, and will not warp. MYKROY combines extreme lightness in weight with mechanical strength comparable to cast iron. It can be machined or molded with great precision.

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***ABSORPTION FACTOR .02% IN 48 HOURS**

MYKROY IS SUPPLIED IN SHEETS AND RODS . . . MACHINED OR MOLDED TO SPECIFICATIONS

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ASSOCIATION NEWS

RMA War Production Conference

The Radio Manufacturers Association War Production Conference, set for June 10 at the Palmer House, Chicago, will bring together many principal business executives and engineers and top-ranking government officials for a consideration of immediate and future problems having to do with military and civilian electronic matters. Included will be the annual meeting of RMA at which president Paul V. Galvin will preside. Heading the government delegation at the War Production Conference will be Chairman James L. Fly of FCC. Other government officials who will participate include Director Ray C. Ellis, of the Radio and Radar Division of WPB; Chief Frank H. McIntosh of the Domestic and Foreign Radio Branch, WPB Radio and Radar Division; Kenneth Campbell, Trade Relations Advisor of the Board of Economic Warfare; Ralph D. Camp, in charge of exports under the WPB Radio and Radar Division, and others. Manpower and draft problems, maintenance of radio receivers of the public in wartime, export, postwar planning and many other important industry problems also will be discussed at division, committee and group meetings during the one-day, streamlined gathering.

Rochester Fall Meeting

The Rochester Fall Meeting Committee of the Institute of Radio Engineers and the RMA Engineering Department plans to hold another one-day War Radio Conference, November 8, at the Sagamore Hotel, Rochester, N. Y.

While the program and financing plans are not complete they are being formulated at this time and the committee invites suggestions.

Virgil M. Graham, P. O. Drawer 431, Emporium, Pa., is chairman of the Rochester Fall Meeting Committee, and H. J. Klumb, 89 East Avenue, Rochester, is treasurer.

Conventions and Meetings Ahead

Institute of Radio Engineers (W. B. Cowilich, 330 W. 42nd St., New York), June 2, Old Timers' dinner meeting, Riggs Restaurant, 43 West 33rd Street, New York.

Radio Mfrs. Assn., also **Assn. of Electronic Parts & Equipment Mfrs.**, June 10, Palmer House, Chicago.

Radio Club of America (11 West 42nd Street, New York), June 10, Columbia University, New York.

American Society of Mechanical Engineers (Ernest Hartford, 29 West 39th Street, New York), June 14-16, Los Angeles, Cal.

American Association for the Advancement of Science, 27 Washington Square, New York, June 14-19, Corvallis, Oregon.

American Mathematical Society, June 16-17, Corvallis, Oregon.

American Institute of Electrical Engineers (H. H. Henline, 29 West 39th Street, New York); National Technical Meeting, June 21-25, Cleveland, Ohio.

American Society for Testing Materials, June 28 - July 2, Pittsburgh.

Society for Measurement and Control, New York Section Meeting, June 29, New York.

Associated Police Communication Officers, Inc. (Buffalo, New York), July, Buffalo, New York.

Electrochemical Society (C. G. Fink, Columbia University, New York), Oct. 13-16, New York, Hotel Pennsylvania.

American Welding Society (Miss M. M. Kelly, 29 West 39th Street, New York), Oct. 18-21, Chicago.

Society of Motion Picture Engineers (Sylvan Harris, Hotel Pennsylvania, New York), Oct. 18-22, Hollywood.

National Electrical Manufacturers Association (W. J. Donald, 155 East 44th Street, New York), Annual Meeting, Oct. 25-29, Waldorf-Astoria Hotel, New York.

American Institute of Chemical Engineers (50 East 41st Street, New York), Nov. 15-16, Pittsburgh.

ELECTRONIC MARKETING—FEATURES IN THIS ISSUE

Postwar Industrial Planning. . . . Finding Markets that Will Grow as War Production Load Drops Off

AND SPECIAL COLOR SUPPLEMENT

War Production Chart of the Electronic Industries

With statistics of military and civilian production and uses

Shoemakers' lasts ...AND THE BATTLE OF PRODUCTION

"SHOEMAKER stick to thy last" may have been good advice once . . . but it doesn't apply in the Battle of Production, where the ability of American industry to enter new fields and make new things has amazed the world.

Take Rola, for example. Recognized for years as a leading maker of Sound Reproducing Equipment, Rola's principal war assignment became the manufacture of various types of transformers for the intricate communications systems of our Army and Navy Air Forces.

The specifications were unusually "tough" but Rola was equipped to do the unusual. Calling upon the skill and ingenuity of its people and upon an experience that dates from the very beginning of Radio Communications, Rola "tooled up". New machines were designed, new methods and processes devised, new tests and inspections employed, so that today the name "Rola" on a transformer is as much a hall-mark of quality as it is on the 25,000,000 radio loud-speakers that Rola has produced.

If transformers are a part of any product you are making, Rola solicits an opportunity to discuss your requirements with you. Many of the country's foremost prime producers of communications equipment have found our product and our performance eminently satisfactory. We are sure you would, too. The Rola Company, Inc., 2530 Superior Ave., Cleveland, Ohio.

★ ★ ★

RECEIVER OUTPUT • MODULATION • MICROPHONE
FILAMENT • AUDIO INPUT • RADIO STAGE • POWER • CHOKE COILS
HEAD SETS • RELATED ELECTRONIC ITEMS

★ ROLA ★

MAKERS OF THE FINEST IN SOUND REPRODUCING AND ELECTRONIC EQUIPMENT

At its April meeting the Electronic Parts Manufacturers (formerly Sales Managers Club, Western Group) formally presented to past-president, S. N. Shure, a large decorated cake commemorating the recent Army-Navy "E" production award to his company. The presentation was made by Jerome J. Kahn, chairman of the association.

Pictured in the group are—back row—left to right: Thomas H. Lisle, Kenneth C. Prince, E. G. Shalkhauser, C. L. Pugh, C. A. Carlson, Jerome Prince, F. D. Wilson, Oren H. Smith, Les A. Thayer. Front row—left to right: Helen A. Staniland, Ray C. Parowski, S. N. Shure, Jack Berman, Jerome J. Kahn, Kenneth McClelland, Paul H. Tartak, Alfred Crossley.

Now "Assn. of Electronic Parts and Equip. Mfrs."

The Sales Managers Club, Western Group, a trade association of radio - parts manufacturers which has been in existence for over ten years, has changed its name to the Association of Electronic Parts and Equipment Manufacturers, to be known in the trade as "E. P. & E. M." The Association, which has over fifty members, has made this change so as to be readily identified with the industry which it represents. There will be no change in the functions of the organization. The group meets on the second Thursday of each month in Chicago, and has been a potent factor in radio industry matters. It is currently rendering a service to its members on priorities problems, price controls, government contracts and regulations, and manpower problems.

OWI's Power Upped to 2475 KW

Setting a record for attendance, some 55 members attended the National Association of Broadcasters Convention Engineering Meeting in Chicago late in April, and listened to discussions of a variety of topics. James Lawrence Fly, chairman Federal Communications Commission and Board of War Communications told members that despite considerable material and parts shortages, "not a single station has been silenced by lack of replacement parts."

Reporting for the Office of War Information, Roy C. Corderman, assistant chief, Bureau of Communication Facilities, told of the tremendous expansion that has been made by OWI in its short wave facilities. He pointed out that from a nucleus of 14 transmitters available before Pearl Harbor, short wave broadcasting will soon be carried on over a total of 36 stations, representing an increase from 706 kilowatts which had been carrying the "Voice of America" to 2475 kilowatts which will then carry allied propaganda to the four corners of the earth. Completion of an eastern studio unit in New York will make possible the handling of more originating programs simultaneously than all of the four major U. S. broadcast networks combined. This represents growth from the original two-studio unit to one that now comprises an installation of sixteen complete studios equipped to handle recordings in every important language.

Radio Club Discusses Ultra-High Measurements

At one of its best attended meetings, held in Havemeyer Hall at Columbia University, members of the Radio Club of America on May 13 listened to two lectures on ultra high frequency phenomena. A. G. Kandoian, Federal Telephone & Radio Laboratories, explained and demonstrated a method of measuring very high frequencies by a reactance variation method heretofore used only for low frequencies; and Robert F. Lewis, Columbia Broadcasting Co., discussed high frequency tank coupling methods. He also demonstrated the use of a probe type detector for voltage, power and current measurements in the solution of problems having to do with solid dielectric transmission lines of coaxial and balanced type.

Motion Picture Engineers at New York

At the 53rd semi-annual meeting of the Society of Motion Picture Engineers, held at the Hotel Pennsylvania, New York City, May 4 to 6, an unusually large number of papers were read, covering broader subjects than in the past. These included thirteen papers on Tuesday, eight on Wednesday and sixteen on Thursday. Several of these papers referred to applications of electronics as a means of speeding up or accomplishing results.

E. M. Watson, Captain of Air Corps, Wright Field, Dayton, Ohio, advocated fast motion pictures as an aid to organized invention, with emphasis upon its application to any industry using electronic devices.

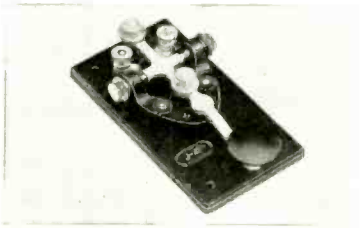
Dr. Walter Cutter, Center for Safety Education, New York University, discussing the handling of crowds in emergencies, visualized the use of electronic devices for the detection of smoke or the presence of excess heat in a theater or auditorium, even before an alarm of fire could be turned in, thus preventing an audience panic due to a sudden conflagration.

Wm. H. Offenhauser, Jr., of Precision Laboratories, New York, emphasized future possibilities of electronics in the motion picture industry.

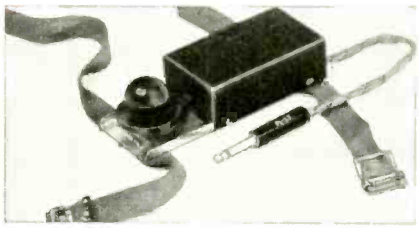
Dr. E. W. Kellogg, RCA Mfg. Co., Indianapolis, Ind., spoke upon the subject "Character of Waves Produced by Explosions" accrediting much of the success of his research

DIRECTORY of ALDEN PRODUCTS

The following parts are made to Government Specifications:



J-47



B-19

TELEGRAPH KEYS

built to Signal Corps Specifications. Continuous production on J-37, J-41A, J-44, J-45, J-47, J-48 and B-19. Excellent facilities for making all the parts of these keys. Consequently prompt delivery on most numbers. Check your requirements with us.

1A BURNISHER

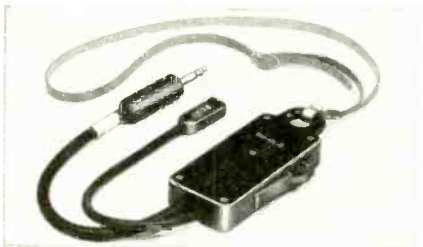
Signal Corps Type 1A relay contact burnisher.

TELEPHONE PLUGS

Signal Corps Types Style A, PL-55 (Navy Type NAF-310572) and PL-54, Style A for molded rubber plug assemblies.

TELEPHONE JACKS

JK-26 and JK-48. Supplied with cords attached if desired.



CORDS WITH PLUGS ATTACHED

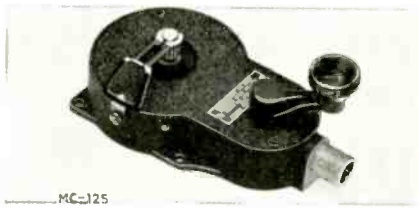
A complete line of all Signal Corps and Navy Types including 307A, CD-318, CD-264, CD-366 and CD-125.

SINGLE CONTACT CONNECTOR

Models PL-202 and JK-50 for use with single conductor shielded cables. Designed to fill the need for a compact, quickly detachable, quality connector.

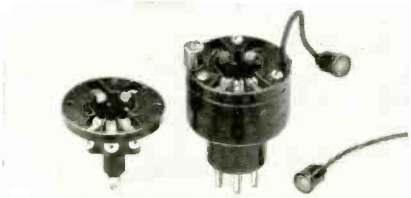
OTHER TYPES OF PLUGS

PL-50A, PL-58, PL-114, PL-P-103, PL-Q-103, SO-104 and SO-143.



TUNING UNITS

MC-125 and MC-127 illustrate a close tolerance, precision assembly in which our quality record was excellent.

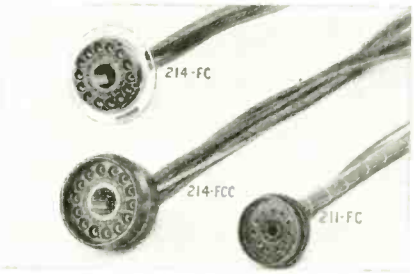


ACORN SOCKETS and ADAPTORS

Socket 455-V2 and Adaptor 966. Quality designed to handle the wide variations in these tubes. New contact tooling assures prompt delivery.

ANALYZER and ADAPTOR KITS

for all Government Test Sets. Prompt delivery.

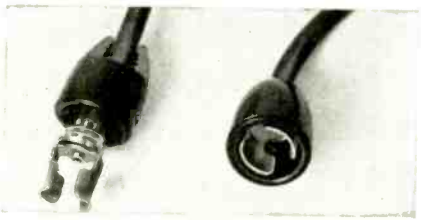


CATHODE RAY CONNECTORS and SOCKETS

A magnal type socket assembly with leads prepared to your specifications. Two new di-heptal connectors for panel mounting or for straight connector use. All sockets have individually insulated terminals and leads, providing a large safety factor at high altitudes and over a wide temperature range. Magnal 211-FC; Di-heptals 214-FC and 214-FCC.

FUSE HOLDER

designed to rivet direct to the panel to preclude any loosening under vibration. Made with ejector spring.



92-RL

TUBE CAP CONNECTORS

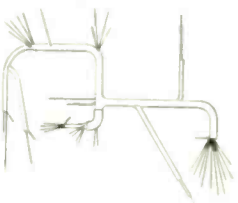
furnished with leads attached for every possible application from receiving tubes to high current radio frequency applications.

SPECIAL MOLDINGS

Knobs, condenser and relay bases, commutator and brush assemblies for RADAR applications. Special magazine method of phenolic molding for both large and small quantities. A single mold starts your order, additional molds step up production to any daily requirements. This method also permits any required changes and is particularly well-suited for government requirements.

CABLE ASSEMBLIES

Any type of cable assembly such as formed, laced, braided or shielded to your print, with wire of your choice, can be handled efficiently in large or small quantities.



CRYSTAL HOLDERS and ADAPTORS

made to government specifications and to meet special requirements.

SPECIAL QUALITY WIRE

Immediately available capacity for serving, braiding, lacquering and shielding.

MULTI-WIRE CONNECTORS

for every purpose from miniature hearing aids up. Particular attention given to compactness and complete insulation around each lead. Government and commercial types.

COIL FORMS, HOUSINGS and CASINGS

RF coil forms for iron core tuning. Molded from low loss material. Available in plain, ribbed, molded thread types.

Coil housings for iron pot and core applications designed for positive hermetical sealing.

Plug-in coil cases for moisture-proof sealing of small transformers.

SPECIAL ASSEMBLIES

Facsimile and picture transmission equipment.

The above is a representative collection of Alden Products. For costs, delivery estimates and samples write to Department B.

ALDEN PRODUCTS COMPANY, INC.

117 NORTH MAIN STREET — MAKERS OF NA-ALO PRODUCTS — BROCKTON • MASS.

to the utilization of electronic devices.

John A. Mauer of J. A. Mauer, Inc., New York City, in his discussion of "The Optics of Motion Picture Projection" offered interesting and timely ideas which could well be applied to some of the problems confronting the television engineer.

Major G. C. Misener, U. S. Army Signal Corps, Astoria, Long Island, New York, read an interesting paper, "Sound Recording Equipment used at the U. S. Army Signal Corps Photograph Center." During the talk, he showed numerous slides of photographs and detailed circuits of amplifiers used in research and practical work.

Meeting of the Acoustical Society of America

On May 14 and 15, the Acoustical Society of America held its twenty-eighth meeting at the Hotel Pennsylvania, New York.

The following papers were presented in the session on Friday morning:

The Vibration Characteristics of "Free-Free" Circularly Curved Bars, F. P. Bundy, W. A. Pliskin, and J. E. Edwards; The Overblowing of Organ Pipes, C. P. Boner and R. B. Newman; Observations on the Vibrations of Piano Strings, O. H. Schuck and R. W. Young, C. G. Conn, Ltd.; Inhibition of Auditory Nerve Activity by Acoustic Stimulation, Robert Galambos and Hallowell Davis, Department of Physiology, Harvard Medical School; Estimation of Percentage Loss of Hearing, Howard A. Carter, Council of Physical Therapy, American Medical Association, Chicago, Illinois; A Reinvestigation of the Relation Between Pitch and Intensity, Clifford T. Morgan and Robert Galambos, Harvard University; Acoustical Characteristics Apparent in a New Anatomy of the Human Voice, Claire Benedict, Chicago Musical College.

A complete session was devoted to a "Symposium on Music in Industry," in which the effect of music on production rates and employee morale was discussed by members of various groups who have been studying these problems.

On Saturday morning the session started with Exhibition of Force at the Entrance of a Resonator, R. L. Leadbetter, Burgess Battery Company, Chicago, Illinois.

This reactive force was demonstrated by attaching a number of resonators to the ends of spokes of

Electronic Corporation of America is now engaged exclusively in war work. Here, manufacturing ingenuity, modern mass production methods, engineering skill and highly trained workmanship are all focused on the one supreme job of turning out more and better electronic equipment to serve the men on the fighting fronts. All American industry is performing formerly unheard-of feats on the production lines . . . but we *can* do more! ECA is determined to do everything in its power . . . and then a little more . . . to insure a quicker Victory.

ECA

ELECTRONIC CORPORATION OF AMERICA

"Let's Win the War Now! . . . with the Utmost in Production"

To Manufacturers and Government Agencies

The Electronic Corporation of America is perfectly set up for the manufacture and assembly of electronic devices and equipment. ECA invites inquiries from manufacturers and government agencies who can make use of our facilities and experience to help win the war sooner.

Buy More—AND MORE—War Bonds!

ELECTRONIC CORPORATION OF AMERICA

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a wheel, and mounting the hub of the wheel on a spindle. The wheel spun when placed in front of a loudspeaker generating a tone pitched to the frequency of the resonators. With the aid of titanium tetrachloride vapor it can be observed that the air flows into the opening, around the perifery, and out again in the form of a jet.

Filtered Thermal Noise—Fluctuation of Energy as a Function of Interval Length, S. O. Rice, Bell Telephone Laboratories. (Reviewed in "Wide Reading," page 94.)

Conditions for Wide-Angle Radiation from Conical Sound Radiators, R. W. Carlisle, Consultant, Elmsford, New York.

The mathematics of the directional pattern of a corrugated cone shows that wide-angle radiation may be secured if there is a proper phase retardation between the center and the rim.

Recent Developments in Record Reproducing Systems, G. L. Beers and C. M. Sinnett, Victor Division.

Some of the more important factors in obtaining satisfactory reproduction of sound from lateral-cut phonograph records such as, vertical force of the stylus on the record, mechanical impedance of the pick-up, mechanical resonances were considered.

A New Frequency Selective Vibrometer, Earle L. Kent, C. G. Conn, Ltd.

This paper gives the design of a small instrument, useful in measuring the frequency, direction and amplitude of vibration. The instrument covers an amplitude range up to 0.010 in., peak to peak, and a frequency range from 800 c.p.m. to 2000 c.p.m.

An Acoustic Impedance Meter for Rapid Field Measurements, R. H. Bolt and A. A. Petrauskas.

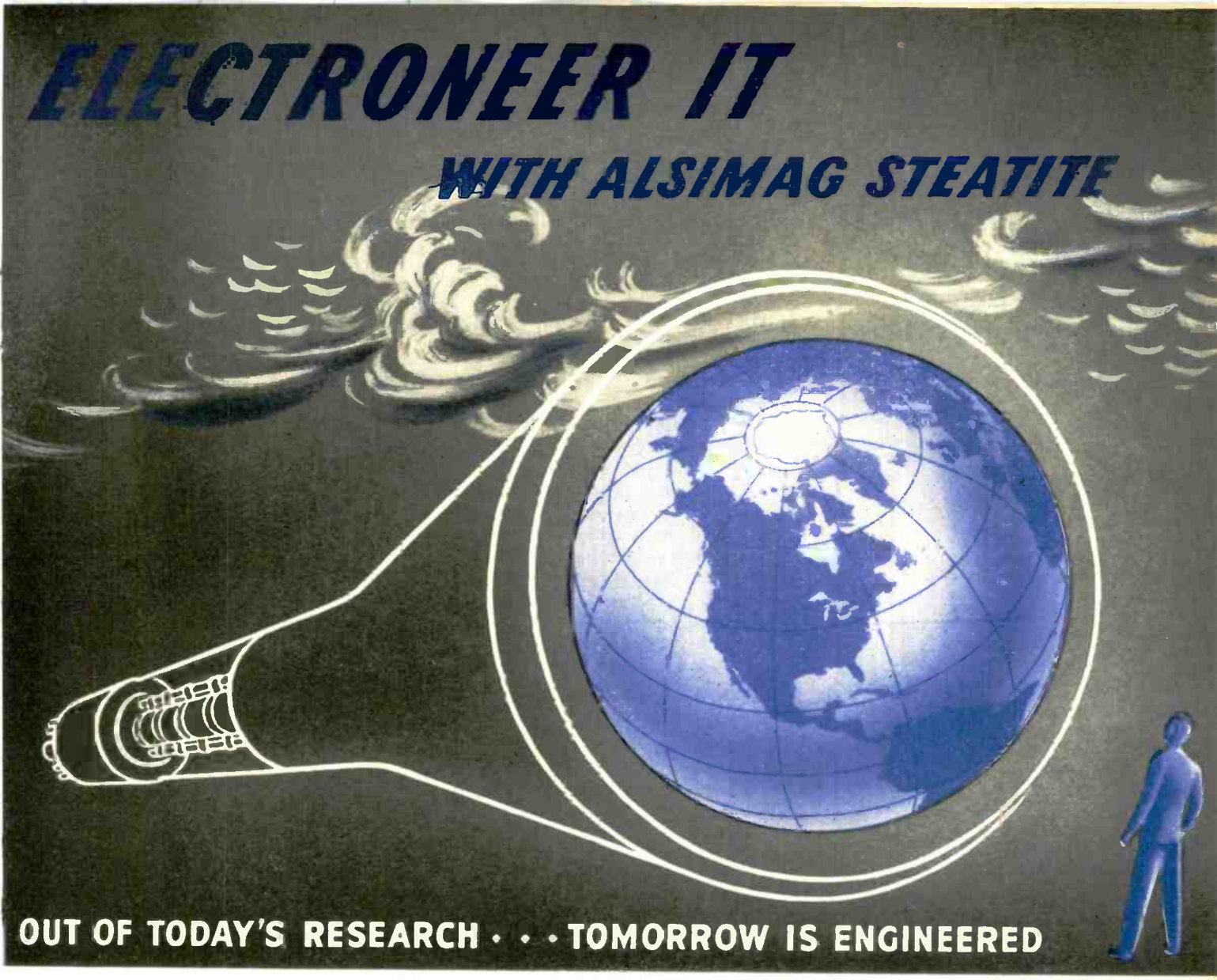
A method is developed for rapid, direct measurement of acoustic impedance. The pressure and pressure gradient are measured by two microphones near the surface, in a line normal to it.

A Mechanical Impedance Bridge, A. M. Wiggins, RCA Laboratories.

The mechanical impedance bridge consists of two identical cantilever reeds clamped to a driving mechanism which can be driven electrically at various frequencies. Microphone amplifiers measure the relative displacements of the reeds, so that one reed loaded with an unknown mechanical impedance is compared with a known impedance loading on the other reed.

ELECTRONEER IT

WITH ALSIMAG STEATITE



OUT OF TODAY'S RESEARCH . . . TOMORROW IS ENGINEERED

IN that *Better World* which you are Electroneering, substitute materials of lesser performance have no place.

It is a well known fact that the properties of steatite for high frequency insulation are not duplicated.

ALSIMAG lifts the properties of steatite to highest levels of dielectric and mechanical strength. ALSIMAG Steatite Ceramic insulators are custom made to your design.

* * *

Do your Electroneering . . . your planning, thinking and designing with ALSIMAG steatite in mind. Our research people will gladly cooperate in today's blueprint or tomorrow's production.

ARMY E NAVY

AWARDED JULY 27, 1942

41st YEAR OF CERAMIC LEADERSHIP

ALSIMAG

TRADE MARK REGISTERED U. S. PATENT OFFICE

AMERICAN LAVA CORPORATION

CHATTANOOGA, TENNESSEE

MORE ABOUT RADAR

Looking Back on Radar

A Summary of Early Press References to New Detector

July 30, 1935—With armed sentries guarding the road to the Navesink Lighthouse Station, the new mystery ray developed at the U. S. Signal Corps Laboratories at Ft. Monmouth, N. J., was tested for the first time last night, under actual working conditions. In a score of tests the ray, which is said to be able to detect enemy ships more than 50 miles off the coast, even though they are drifting without their motors running, successfully located an enemy ship five miles at sea. The ease with which the cutter was located is believed to have convinced army officers that a valuable adjunct to coastal protection has been developed. It was revealed the ray would next be tested on high-flying aircraft.—*N. Y. Times.*

June, 1941—In a speech to the House of Commons, Lord Beaverbrook gave credit to the invention of the radio locator for warning of the approach of the Luftwaffe in time for RAF to intercept and destroy enemy planes—*Cable reports.*

Feb. 10, 1942—At Pearl Harbor, before the Jap attack, Sergeant Lockard, in charge of an aircraft-detector unit, detected a signal on his instruments which in the opinion of Lockard, signified a number of airplanes in flight approximately 132 miles distant. After rechecking the distance and azimuth, Lockard furnished complete particulars of the readings.—*War Dept. Communique.*

February, 1942—Justice Roberts' report on the Pearl Harbor attack referred to an aircraft warning system for detection of water-borne and airborne craft, pointing out that certain mobile equipment (Lockard) discovered a large flight of planes at a distance of about 130 miles. The planes were tracked toward the island and then lost.—*Roberts Report.*

April 23, 1942—At his press conference today, the Secretary of War revealed that the Army was installing along nation's coastlines new "electric eye" detection devices for locating planes or ships more than a hundred miles away . . . developed by the Army Signal Corps. . . . It "works at night as well as day and through fog and clouds. . . . I saw the electrical indication of a plane which I believe was 60 miles away."

June 7, 1942—Dutch Harbor warned of Jap attack by Radio-locator which can detect planes more than 100 miles away. . . Back in 1925 scientists . . . were studying Kennelly-Heaviside layers by shooting up radio waves and analyzing them when they bounced back down to earth. . . . By 1939, experiments developed absolute altimeter for aircraft . . . spraying radio waves toward earth and gauging altitude by the time it required for the waves to bounce back.—*Boston Herald.*

February 2, 1943—Secret new anti-aircraft guns of terrific hitting power and uncanny accuracy, the fruits of months of careful scientific tests . . . were first used Jan. 17. . . . —*London cable INS.*

Radar History Told by Western Electric

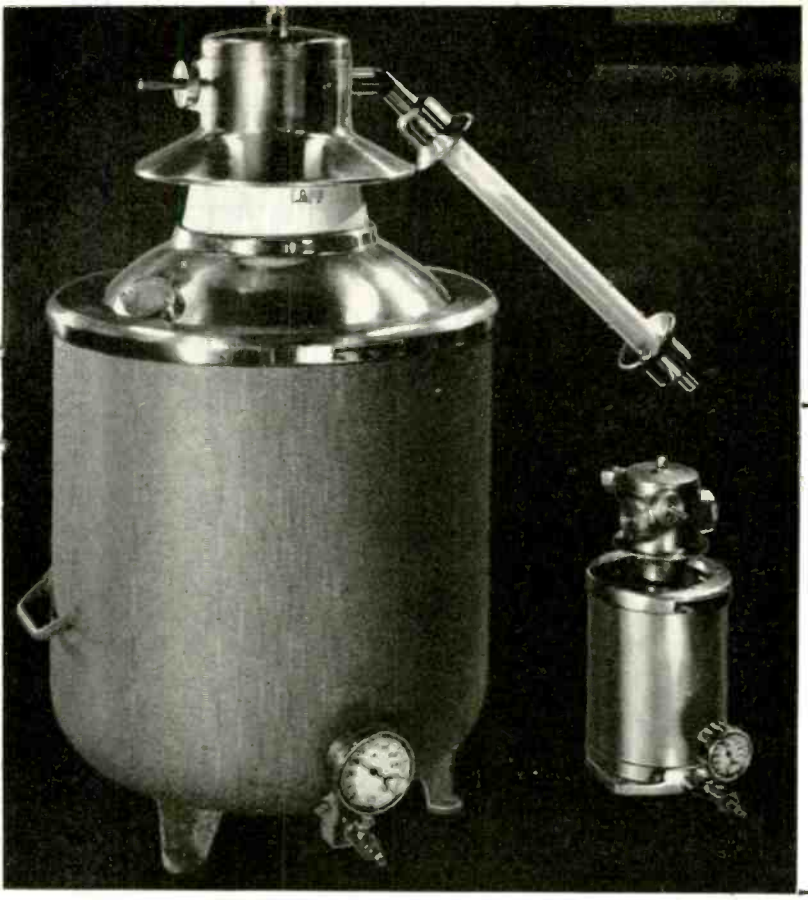
When trained on enemy planes, still so distant as to be beyond reach of anti-aircraft, Radar reports the three elements of their position necessary for exact plotting: (1) distance, (2) angle of elevation, (3) angle of azimuth. When the planes are within firing range, these data are then used to predict the precise point where shells should burst. Timing is of the greatest importance in these operations.

Radar was developed through years of research and experiment in electronics, independently in the United States and Great Britain. Here the research institutions of both the Navy and the Army were vigorously pursuing investigations leading to the perfection of radar as a military instrument.

Dr. A. Hoyt Taylor; Gen'l Colton

Leaders in these investigations were Dr. A. H. Taylor for the Navy and Major General Roger B. Colton for the Army. More than two years before Pearl Harbor the Army and the Navy enlisted the services of Bell Telephone Laboratories which had already embarked independently on researches in radio location.

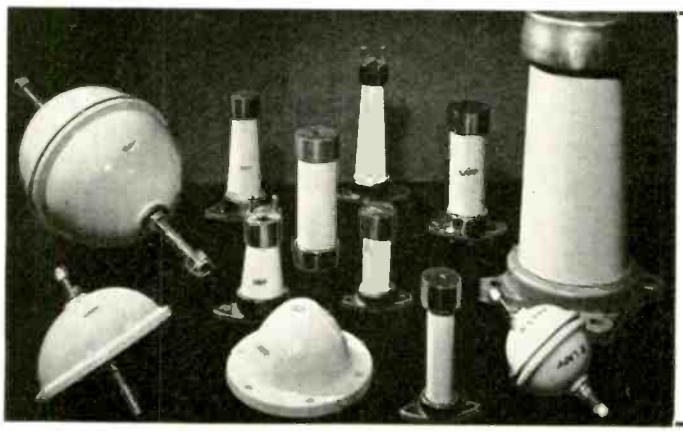
The fact that radio waves can be reflected just as light waves and sound waves, had long been known. The phenomenon had been used, for example, to measure the elec-



FOR HIGH-FREQUENCY POWER SOURCES

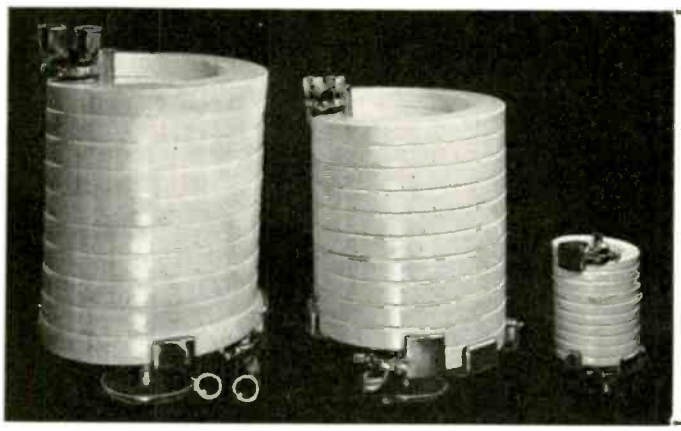
LAPP GAS-FILLED CONDENSERS

In any electronic circuit, wherever lump capacitance is needed, Lapp condensers will save space, save power and save trouble. Available for duty at almost any conceivably-useable voltage rating and capacitance, they bring to any application notable mechanical and electrical advantages: practically zero loss, smallest space requirement, non-failing, puncture-proof design, constant capacitance under temperature variations. *Shown, at left, Unit No. 25934, rated at 200 amp., 6500 volts, capacitance variable 4300 mmf. to 11000 mmf.; right, Unit No. 23722, rated at 50 amp., 7500 volts, capacitance 45 mmf. to 75 mmf.*



STANDOFF, BOWL, ENTRANCE INSULATORS

Standoff, bowl, entrance and other special-purpose insulators are available in wide range as standard Lapp catalog items. Other insulators of special design are easily produced by Lapp methods, either in porcelain or steatite. The wide choice of such insulators available from Lapp simplifies the design of high-frequency equipment. Also, Lapp is equipped for production of many special assemblies, of porcelain or steatite, and the associated metal parts.



LAPP PORCELAIN WATER COILS

For cooling of high-frequency tubes in radio transmitters and other electronic power sources, Lapp porcelain water coils have been widely used. With nothing about the porcelain to deteriorate, sludging is eliminated, and with it the need for cleaning and water changes. Porcelain pipe and fittings in any needed size are also available as catalog items. We welcome inquiry on any Lapp equipment for experimental or industrial electronic application.

Lapp

INSULATOR CO., INC.

LEROY, N. Y.

ARMY E NAVY

trical reflecting surfaces in the upper atmospheric layers, just as mariners sometimes use an echo of the ship's whistle to establish their distance from the face of a cliff. Only with the advent of the ultra-short radio waves in the early 1930's did it become possible to observe reflections from objects as small as an airplane. This was done by Bell Laboratories' engineers in 1932 when they observed that an airplane flying about 1,500 feet overhead produced a very noticeable "flutter" of about four cycles per second.

Espenschied, Newhouse, Martin

In 1938 Western Electric introduced the "absolute altimeter" commercially for use in aircraft. This instrument, based on development work by Lloyd Espenschied and R. C. Newhouse which began several years before, employed the principle of shooting radio waves against the ground and timing their return to give the exact height of an aircraft above the terrain. In the same year, D. K. Martin, also of the Laboratories, using a modification of the absolute altimeter enclosed in a hornlike directional antenna system of galvanized sheet iron, made a series of experiments at 15th Street in Brooklyn overlooking the Narrows leading into Manhattan's upper bay. He observed that radio waves directed against ships passing through the Narrows were thrown back into the receivers. This might be called a form of radar.

With the formation of the National Defense Research Committee, radar became one of the most active lines of investigation by a large group of scientists. A mission of British scientists to this country made a complete disclosure of the status of their art, with reciprocal disclosures by the N.D.R.C. group. One episode in the development was the sending to England in 1941 of Ralph Bown, one of Bell Laboratories' department heads, to study performance under actual war conditions.

In addition to manufacturing radar in quantity for the Armed Forces, the Western Electric Company has assigned a large number of radar engineers to act in an advisory capacity in the field. With the Air Force, Navy and Army, these engineers have been available for consultation during the installation of radar on many fighting fronts.

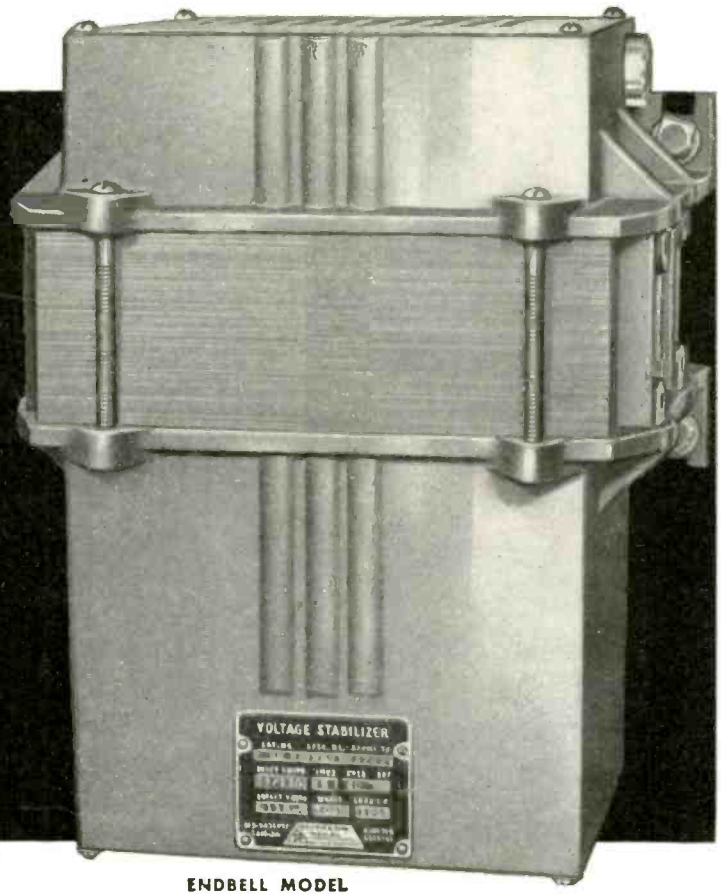
Raytheon

VOLTAGE STABILIZERS

(Manufactured since 1927. U. S. Patents 1,985,634 and 1,985,635)

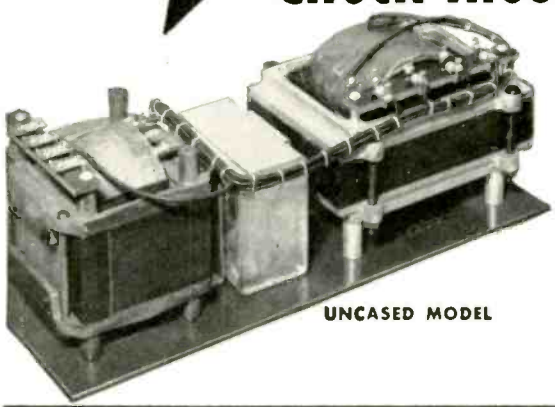
FOR

- Television
- Colorimeters
- Radar & Radio
- Signal Systems
- X-Ray Machines
- Sound Recording
- Electronic Devices
- Testing Equipment
- Photo-Cell Devices
- Production Machinery
- Constant Speed Motors
- Motion Picture Equipment
- Communications Apparatus
- Precision Laboratory Apparatus
- Other Applications Requiring Regulated Voltages.



ENDBELL MODEL

Check these Raytheon Advantages



UNCASED MODEL

Holds constant A.C. output voltage to ½%.

Stabilizes at any load within its rating.

Quick action—fluctuating voltage is stabilized instantly, variations can't be observed on ordinary volt meter.

Wide A.C. input voltage limits—95 to 135 volts.

Entirely automatic . . . No moving parts . . . Connect it and forget it.

Available in sizes from 30W. to 25KVA. Write for Bulletin.

The coveted Army-Navy "E", for Excellence in the manufacture of war equipment, flies over all four Raytheon plants where 12,000 men and women are producing for VICTORY.

RAYTHEON MANUFACTURING Company

190 WILLOW ST. WALTHAM, MASS.

GE Built Radars Before Pearl Harbor

General Electric engineers as early as the nineteen-twenties were actively engaged in the development of tubes, circuits, and apparatus for the very high frequencies which form the basis for present-day radar —the electronic device which locates planes and ships far beyond man's former "vision," even in fog, darkness, and other adverse conditions—according to Dr. W. R. G. Baker, G-E vice-president in charge of the company's Electronics Department.

"With such experience, added to manufacturing skill, General Electric was able to start building radars long before Pearl Harbor," Dr. Baker explains. "They are being made today in our factories for installations on ships and on the ground. General Electric is one of the large manufacturers of radar."

Training radar men

The United States has trained many thousands of men in the operation of radar, and will train many more thousands. Vital areas in the U. S. defense system have been equipped with the devices. Radar equipment is at work with our fighting forces on land, sea, and in the air.

In operation, radar sends out radio waves which are reflected back to sensitive receivers when a ship or plane enters the area which the radio waves cover. Returning waves are then plotted, and by a complicated system of calculations, officers determine the position, direction of travel, and speed of enemy planes or ships and then relay the information to Interceptor forces.

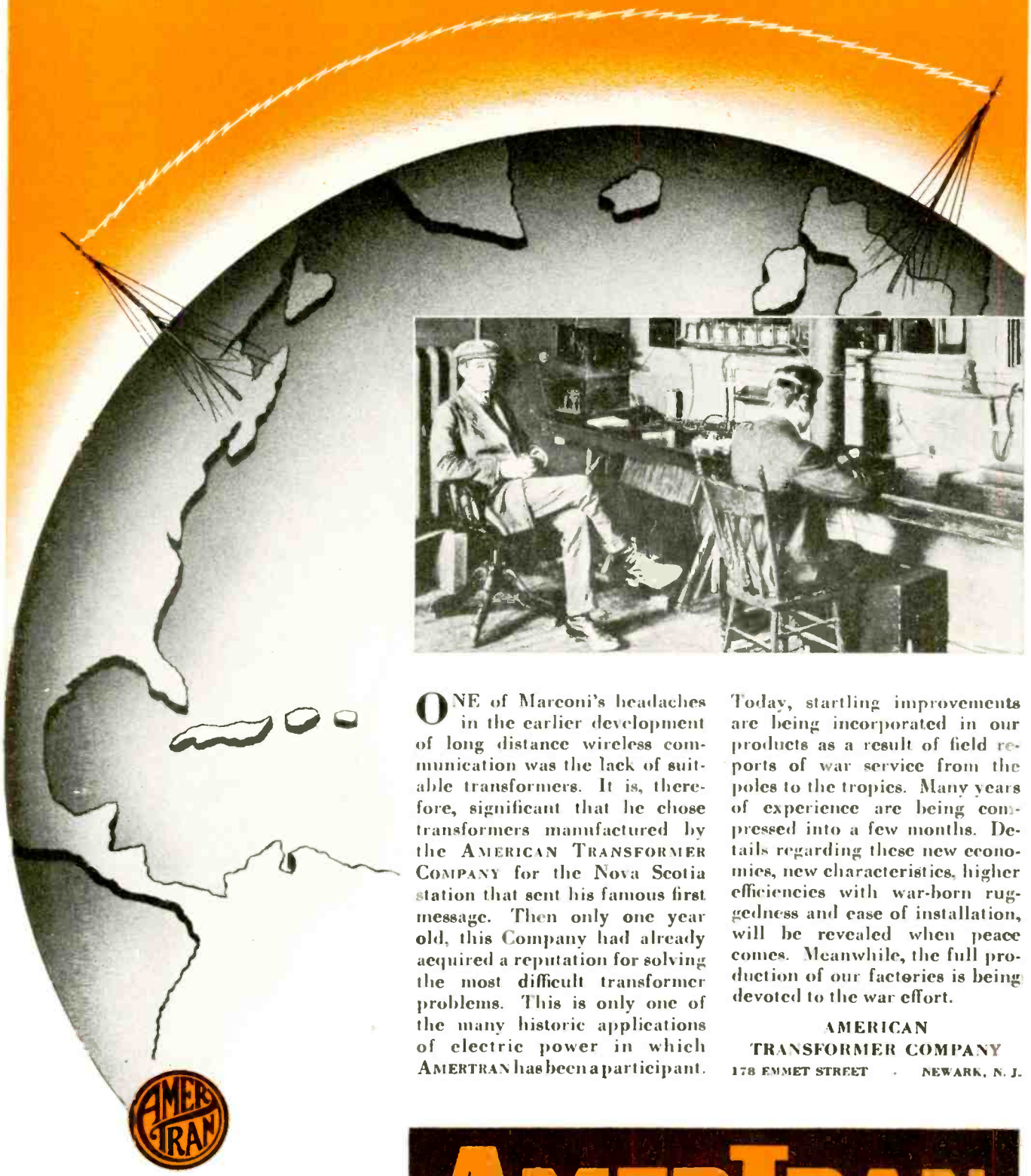
Germany and the other Axis nations know about the device, but the Allies were the first to use and perfect its operation. Radar is credited with having helped save the British Isles from invasion in 1940-41 after the fall of France.

"Radar New Dimension of Radio" — Sarnoff

"American inventive genius contributed much to the creation and perfection of the great offensive and defensive weapon known in the United States as radar," said David Sarnoff, addressing RCA stockholders, May 4.

"The word means radio detecting and ranging. I am happy to

AMERTRAN helped Marconi send his first message across the Atlantic!



ONE of Marconi's headaches in the earlier development of long distance wireless communication was the lack of suitable transformers. It is, therefore, significant that he chose transformers manufactured by the AMERICAN TRANSFORMER COMPANY for the Nova Scotia station that sent his famous first message. Then only one year old, this Company had already acquired a reputation for solving the most difficult transformer problems. This is only one of the many historic applications of electric power in which AMERTRAN has been a participant.

Today, startling improvements are being incorporated in our products as a result of field reports of war service from the poles to the tropics. Many years of experience are being compressed into a few months. Details regarding these new economies, new characteristics, higher efficiencies with war-born ruggedness and ease of installation, will be revealed when peace comes. Meanwhile, the full production of our factories is being devoted to the war effort.

AMERICAN
TRANSFORMER COMPANY
178 EMMET STREET · NEWARK, N. J.

PIONEER MANUFACTURER OF
TRANSFORMERS, REACTORS AND RECTIFIERS
FOR ELECTRONICS AND POWER TRANSMISSION

AMERTRAN
MANUFACTURING SINCE 1901 AT NEWARK, N. J.

report that RCA Laboratories have been at the forefront of radar research and development. The radio-electron tube was the key to its application.

"I believe it now can be said that with the use of radio, and especially radar, the United Nations have been able to avert many disasters, save precious lives, and inflict severe damage upon their enemies.

Peacetime radars

"Television and radar add new dimensions to radio; wireless telegraphy was its first dimension and broadcasting its second. Applications of these new developments of radio to peace, open new fields of service on land, at sea, and in the air.

"Radio instruments will emerge from the war almost human in their capabilities," Mr. Sarnoff continued. "They will possess not only a sense of direction, but a sense of detection that will open new avenues of service. The radio direction finder, which heretofore had only an ear, now also has an eye. The safety of aviation will be greatly enhanced, for the aviator will be able to see the ground through clouds or darkness. By the scientific application of the radio echo, the radio 'eye' will avert collisions, while the radio altimeter will measure the altitude and warn of mountains ahead, or structures below."

Radar Officers Wanted

"Many members of the American Institute of Electrical Engineers are now serving as Radar officers of the Navy, engaged in engineering this important locator equipment," writes Comdr. J. C. Latham, U.S.N. "The Navy requires assistance in recruiting several hundred more of these officers who are serving their country in one of the most vital roles of the whole war effort.

"To qualify, men should be between the ages of 19-43 years, and hold degrees in electrical engineering or physics, or in other branches of science, including a study of electricity and magnetism and higher mathematics.

"Engineers selected will take the Navy's course in ultra-high frequencies at Harvard or Bowdoin College, as commissioned officers, followed by a second course at the Massachusetts Institute of Technology.

"Upon completion of the M.I.T. course, some of the Radar officers

Photo, Courtesy Mid-Continent Airlines showing current Wilcox installations

Uninterrupted Service IS Vital to Safe Air Transportation

Dependable communications are the keynote. There must be no failure. For years, Wilcox has made radio equipment to help carry on flight control safely. Today, the "know-how" of Wilcox facilities is entirely devoted to manufacture for military needs. After peace is secured, the marvels of radio development will be working for better living.

WILCOX ELECTRIC COMPANY

Quality Manufacturing of Radio Equipment

14TH & CHESTNUT KANSAS CITY, MISSOURI

will be assigned to combat ships. Others will be employed at Naval shore stations in connection with the planning, installation, maintenance, and further developments of Radar equipment for ships and aircraft."

Radio-Radar Production to Increase

Latest information from Washington on radio war-production schedules, as we go to press, indicates that the overall curve is again ascending. Orders placed by the various government divisions during the latter part of April and the first half of May already assure a steady increase in radio production, which will probably be felt in full by all prime and sub-contractors during the last quarter of this year.

Military radio-radar production should reach peak capacity and hold it, according to present indications, at least during the first quarter of 1944.

Financiers Study Electronic Future

New York Institute of Finance is evincing considerable interest in electronic topics. Middle of last month members gathered in the Governors' Room of the Stock Exchange and listened to John Mills of the Bell Telephone Laboratories discuss "The Scientific Method and How it Applies to Electronics." This was the first of six lectures, held on successive Mondays. Other talks were: "Transmutation and Radioactivity," by Dr. K. K. Darrow, also of Bell Telephone Laboratories; "Chemistry and Electronics" by Dr. Willard F. Libby of the University of California; "Radio, FM and Television," by Dr. David Grimes of the Philco Corp.; "Electronics as Applied to Industry," by A. C. Montieth of the Westinghouse Electric & Mfg. Co., "Advance and Future Thinking," by Dr. W. R. G. Baker of the General Electric Co.

WPB Again Tightens Quartz Crystals

Marking the latest in a series of orders covering the import and conservation of quartz crystals used in critical electronic equipment, the WPB in May issued Conservation Order M-146 as amended. The amendment excludes from the operation of M-146 types of quartz which are not to be included under

TOOLS OF WAR...

and MESSENGERS OF PEACE

Coils in scores of designs, many made by Anaconda or wound with Anaconda magnet wire, in their own little way are helping the fight for victory. They also stand by in millions of radios ready to help bring the good news of peace.

When peace comes . . . let's get together

Perhaps we can talk about a coil problem . . . how thoroughly we're organized to help you on such a problem only military censorship forbids telling now. Or it may be that you manufacture your own coils and will be interested in discussing magnet wire—any shape —any insulation.

As a matter of fact, perhaps we can get together now, but if it happens we can't, remember we have a date in and for the future. When we both can keep it you can again take advantage of Anaconda service and the benefits derived from the single product control 'from mine to consumer' backed by years of continuous metallurgical experience.

43229

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Chicago Office: 20 North Wacker Drive
Subsidiary of Anaconda Copper Mining Co.
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ANACONDA
from mine to consumer

This familiar trade-mark symbolizes the best efforts of modern research and production.

Magnet wire and coils

ANACONDA WIRE & CABLE COMPANY

the order. Restored in M-146 is a provision requiring the purchaser of crystals to deliver to the fabricator a certificate stating he is familiar with the terms of the order and that the crystals are to be used only for specified purposes in the war effort, such as are allowed under M-146.

WPB Radio-Radar Division Personnel

The War Production Board announces the present lineup of its Radio Division as follows:

Ray C. Ellis, director; John Timmons, deputy director; William M. Anderson, deputy director for production; H. G. Morrison, executive assistant.

Sidney K. Wolf, chief, resources branch; Frank H. McIntosh, chief of domestic and foreign radio; Marvin Hobbs, chief, engineering and advisory section; Frank Horning, chief, field-services section; Gerald E. Miller, chief, program section; Frederick S. Boland, chief, scheduling and distribution section.

Captain William A. Gray, chief, vacuum-tube section; Ernest A. Capelle, chief, industrial instrumentation section; Elmer R. Crane, chief, components section; J. M. Lowenstein, chief, critical materials section, and Myron Whitney, chief, equipment section.

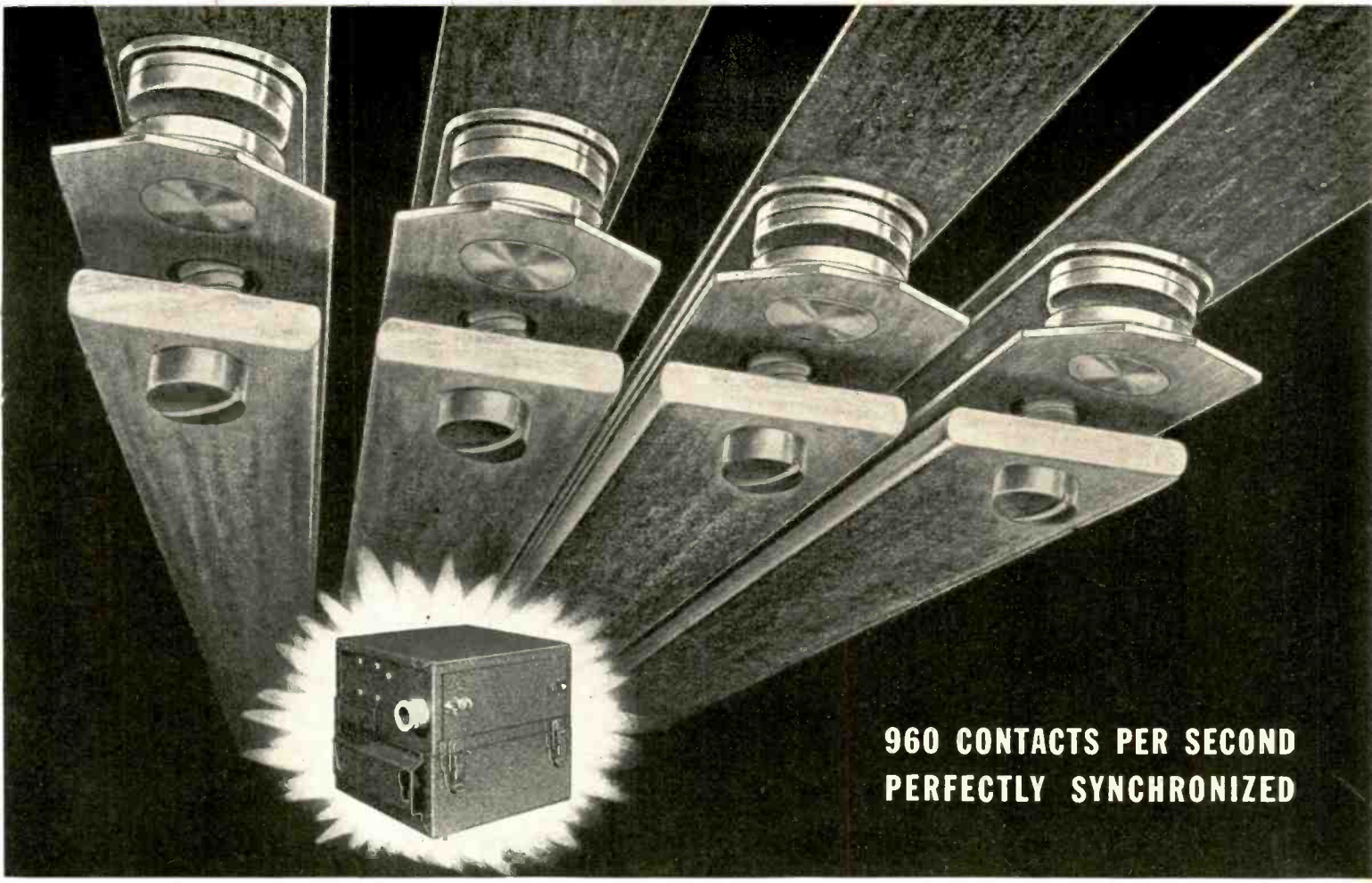
Wolf going abroad

Sidney K. Wolf, chief of the Resources Branch, is leaving on a three-month tour-of-duty abroad with the War Department, and during his absence Mr. Anderson will have charge of the Resources Branch.

The Radio Division, through Director Ray C. Ellis, reports to Charles E. Wilson, executive vice-chairman of WPB, himself an experienced electrical and radio manufacturer. Another WPB vice-chairman, Ralph J. Cordiner, is also experienced in the radio and electrical fields.

WOR's Exponential Studio

By the not altogether simple expedient of transforming a theater stage into a giant exponential horn as pictured on page 77, WOR's engineering staff at New York City has effectively licked a worrisome problem of reverberation and so greatly improved acoustics that a whisper from anywhere on the 1500



1/4 WATT OR 1,000 WATTS E·L VIBRATOR CONVERTERS

give higher efficiency . . . require no service

The vibrator is the most efficient means yet developed for changing DC current to AC.

This is an inherent characteristic of the vibrator, because electrical and mechanical losses as well as wear are negligible. Building on this fundamental, Electronic Laboratories have extended the vibrator's field of usefulness by developing vibrator type power supplies which provide extraordinary adaptability, for all types of current conversion, together with unusual efficiency and service life.

Ingenuity of design and precision of manufacture make possible load capacities up to 1,000 watts in *E·L* Vibrator Power Supplies. The 450-watt capacity, 120-cycle vibrator, illustrated above, for instance, has eight sets of contact points. Each of them must make 120 contacts per second, and each synchronized perfectly with every other contact. Adjusted and locked, that is exactly what they do—for life!

Growing use of *E·L* Vibrator Power Supplies in war equipment—land, sea and air—is evidence of their efficiency and reliability under the most severe operating conditions. Wherever you have a problem of current conversion, *E·L* engineers will be glad to work with you to meet it most effectively, and most economically.

Only *E·L* VIBRATOR POWER SUPPLIES Offer All These Advantages:

1. **CONVERSION**—DC to AC; DC to DC; AC to DC; AC to AC.
2. **CAPACITIES**—Up to 1,000 Watts.
3. **VARIABLE FREQUENCIES**—A power supply may be designed to furnish any frequency from 20 to 280 cycles, or a controlled variable output within a 5% range of the output frequency.
4. **MULTIPLE INPUTS**—For example, one E·L Power Supply, in quantity production today, operates from 6, 12, 24, 110 volts DC or 110 volts AC, and 220 volts AC, with a single stable output of 6 volts DC.
5. **MULTIPLE OUTPUTS**—Any number of output voltages may be secured from one power supply to suit individual needs.
6. **WAVE FORMS**—A vibrator power supply can be designed to provide any wave form needed for the equipment to be operated.
7. **FLEXIBLE IN SHAPE, SIZE AND WEIGHT**—The component parts of a vibrator power supply lend themselves to a variety of assembly arrangements which makes them most flexible in meeting space and weight limitations.
8. **HIGHEST EFFICIENCY**—E·L Vibrator Power Supplies provide the highest degree of efficiency available in any type power supply.
9. **COMPLETELY RELIABLE**—Use on aircraft, tanks, PT boats, "Walkie-Talkies," jeeps, peeps and other military equipment, under toughest operating conditions has demonstrated that E·L units have what it takes!
10. **MINIMUM MAINTENANCE**—There are no brushes, armatures or bearings requiring lubrication or replacement because of wear. The entire unit may be sealed against dust or moisture.

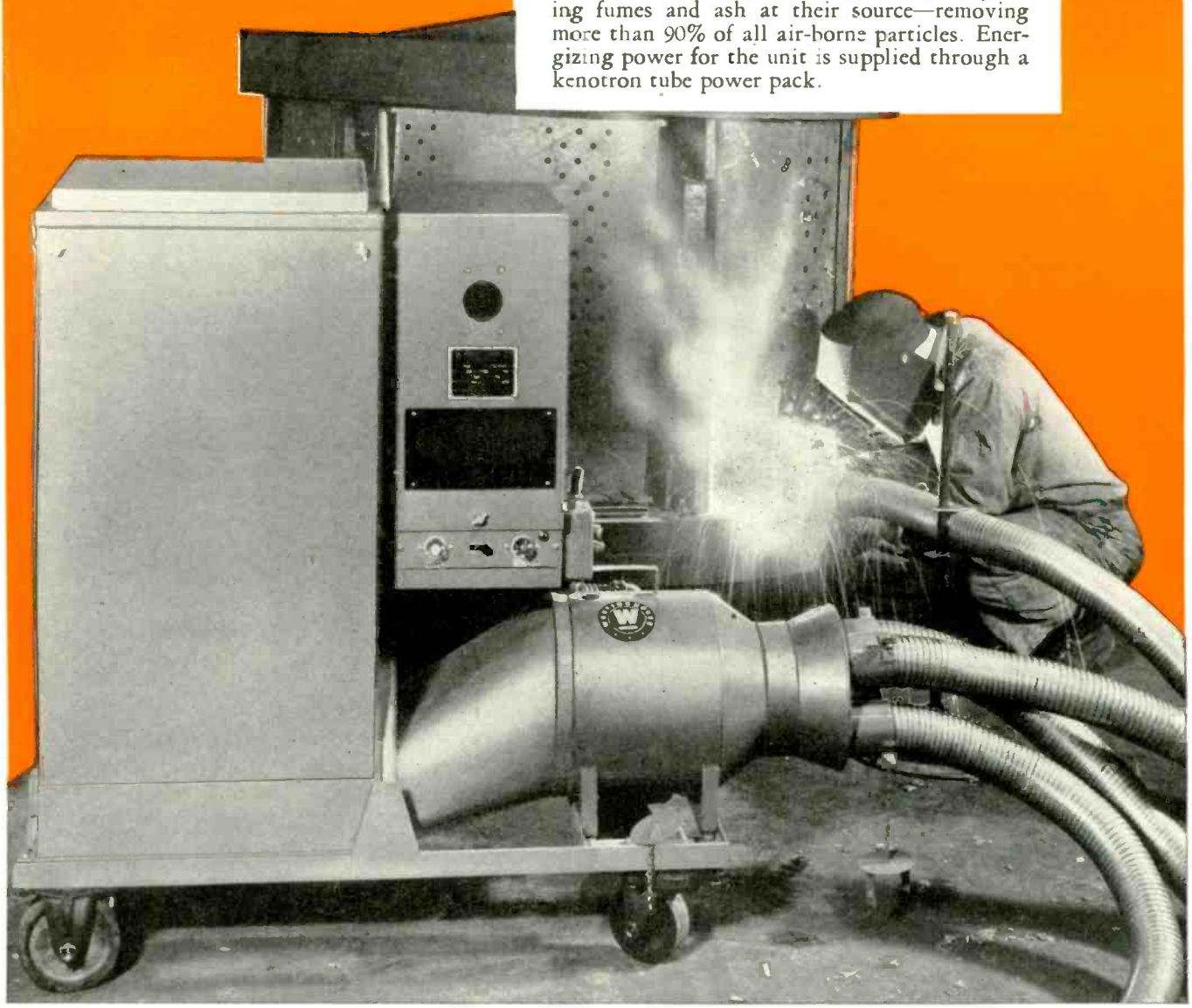
Electronic LABORATORIES, INC.

INDIANAPOLIS

***E·L* ELECTRICAL PRODUCTS**—Vibrator Power Supplies for Communications . . . Lighting . . . Electric Motor Operation . . . Electric and Electronic Equipment on Land, Sea or in the Air.

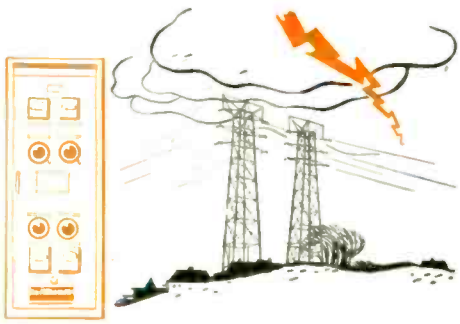
Electronics

Illustrated here is probably the most recent application of electronic equipment. Precipitron—the Westinghouse electric air cleaner—is being used to remove injurious welding fumes and smoke. It has been found that toxic welding fumes can cause serious illness for operators, but available mechanical equipment is ineffective for cleaning the air. Small, portable Precipitron units are now doing the job efficiently—capturing fumes and ash at their source—removing more than 90% of all air-borne particles. Energizing power for the unit is supplied through a kenotron tube power pack.

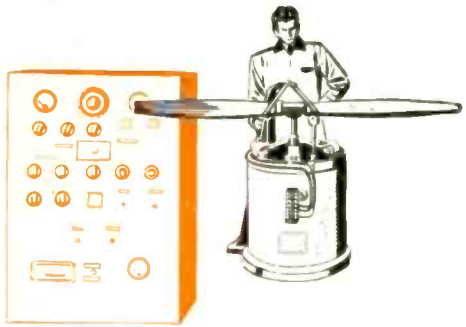


. . at Work

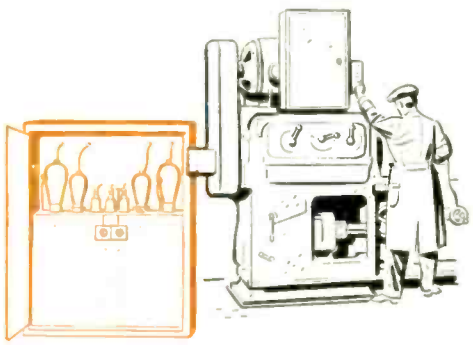
Industry has electronics to thank for many of the results now being secured on war production lines. It is saving time—cutting costs—improving products. Typical examples of Westinghouse Electronic Equipment at work, are:



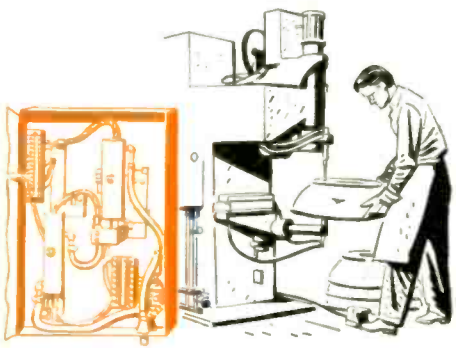
Carrier-Current Relaying—One of the most important electronic applications in the power transmission field. Carrier signals permit simultaneous high-speed tripping of both circuit breakers in from one to three cycles. This high-speed clearing of faults by electronic methods improves system stability and increases loads that can be carried safely.



Vibration Fatigue Tests—Only through electronics has it been possible to build vibration testing equipment that will deliver from 10 to 10,000 cycles per second. Employing the principle of the dynamic radio speaker, Westinghouse engineers have developed vibration fatigue equipment that has opened the way for tests that could not be made with existing mechanical methods.



Speed Control—By converting a-c power to direct current with thyratron tubes, Westinghouse has developed small, compact speed control units for d-c motors without using rotating equipment for current supply. Direct current is supplied by the tubes to the armature and field of the d-c motor. Both armature and field circuits are controlled by one dial on the Westinghouse Mot-O-Trol.



Accurate Welding Control—The use of small Ignitron tubes has practically eliminated mechanical contacts for resistance welding. In the Westinghouse power switch, Weld-O-Trol, action is instantaneous. Speed of current interruption is 600 or more times per minute. The two Ignitron tubes in each Weld-O-Trol are guaranteed for a year and have consistently held up for much longer periods.

J-91031-A

For additional information about Westinghouse Electronic Equipment now available to industry, write for booklet B-3264. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania.

Westinghouse ELECTRONICS

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

square foot stage is heard with equal intensity, clarity and brilliance in any part of the theater. Not only has this desirable result been achieved, starting with a theater of known tonal defects, but in achieving it the engineers have also evolved an ingenious mechanical means of fitting the size of the "horn" to the size requirements of the entertainment being broadcast.

Through a combination of convex curved walls and ceiling, proportioned to form an immense horn of true exponential design, coupled with the use of hard surfaces, sound reflection has been boosted to 97 per cent at 4000 cycles, with but 3 per cent absorption; at 128 cycles, side walls and ceiling flats have an approximate absorption of 20 per cent with 80 per cent reflection.

The effect of this unusual construction is to put the entertainers on the stage virtually within the throat of the horn, with the audience, occupying the 890 seats in the body of the theater, located, in effect, at its mouth. The result is that all sounds originating on the stage are reflected into the audience.

The complete stage is large enough to accommodate a full symphony orchestra of 125 musicians. However, when smaller groups of entertainers must be accommodated, a huge convex "drop" normally retained in place above the stage and weighing some two tons, may be lowered into position. With the "drop" lowered, the size of the stage is halved without changing its reflective and acoustic properties. Even the control room at the left has been shaped into the general contour of the stage sidewall so as not to destroy the true exponential effect of the stage.

Mutual's new studio was designed and installed by J. R. Poppele, chief engineer of WOR, Edward J. Content, assistant chief engineer, and Harry Miller, supervisor of theater activities.

Recent Army-Navy "E" Awards

Electronic Laboratories, Indianapolis, Ind.

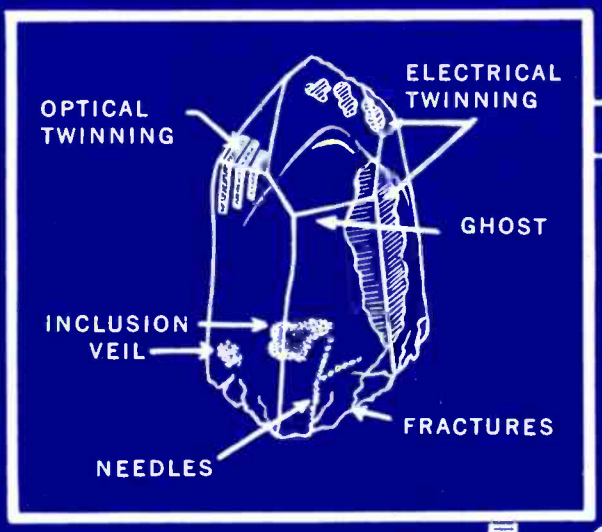
Farnsworth Telev. & Radio Corp., Marion, Ind.

Western Electric Co., 195 Broadway, New York, N. Y. (Added star).

The Hallicrafters Co., 2607 S. Indiana Ave., Chicago, Ill. (Added star).

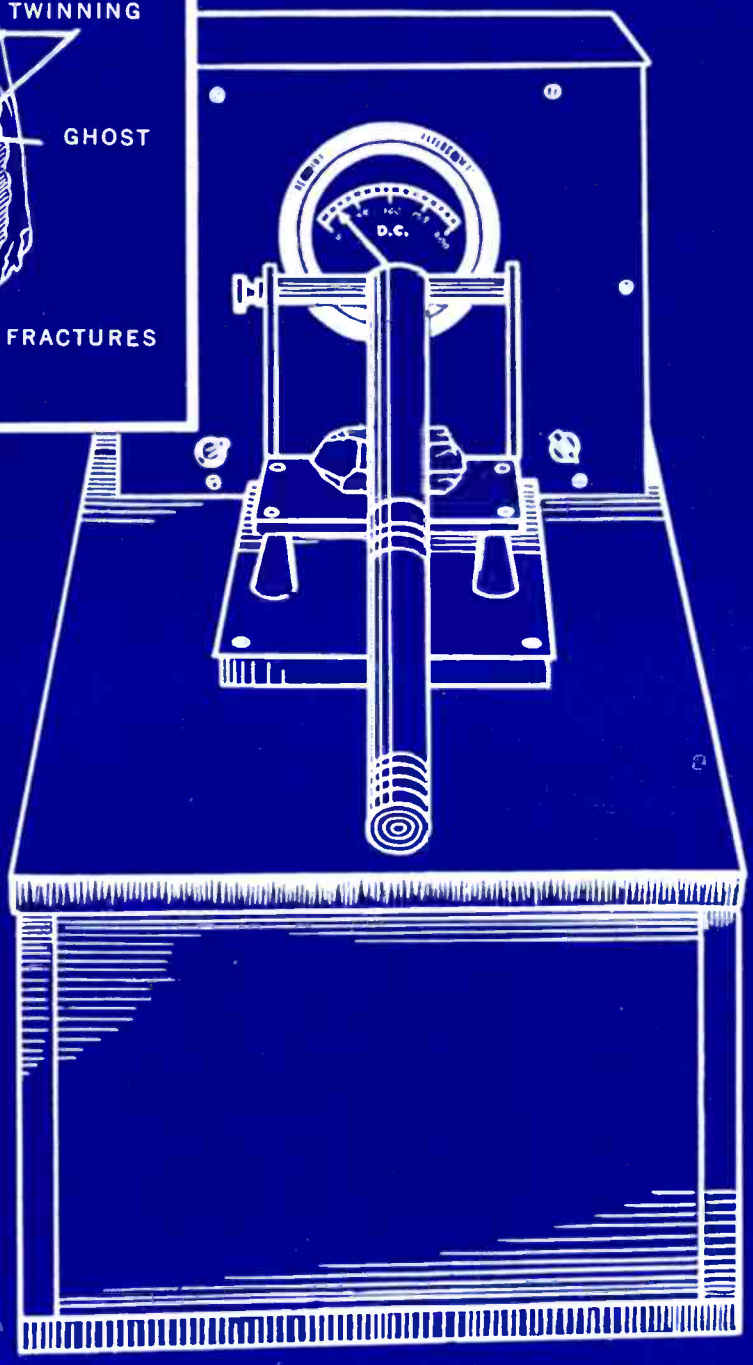
F. W. Sickles Co., Chicopee, Mass.

DETERMINING THE POLARITY OF THE X-AXIS OF A CRYSTAL



COMMON IMPURITIES IN THE MOTHER OR NATURAL CRYSTAL CAN BE DETECTED WHEN A LIGHT IS PASSED THROUGH THE CRYSTAL.

FOR DETERMINING THE POLARITY OF THE X-AXIS, AN ELECTROMETER IS USED. THIS IS THE GUIDE TO THE DIRECTION AT WHICH TO ACCURATELY CUT THE MOTHER CRYSTAL.



THE ELECTROMETER

Crystal
PRODUCTS COMPANY
1519 McGEE STREET, KANSAS CITY, MISSOURI

Producers of Approved Precision Crystals for Radio Frequency Control

Press Wireless, Inc., Hicksville, L. I., N. Y.

Thordarson Elec. Mfg. Co., 500 W. Huron St., Chicago, Ill.

International Resistance Company, Philadelphia, Pa. (Added star).

Shure Bros., 225 W. Huron St., Chicago, Ill.

Boonton Radio Corp., Boonton, N. J.

Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

Raytheon Mfg. Co., Waltham, Mass.

SPECIFIC INFORMATION

(Continued from page 76)

Counting, Recording, Timing

189. Improved Photoelectric Recorder. C. W. LaPierre. "General Electric Review," June, 1933; Vol. 36, pp. 271-274.

190. Applications of the Photoelectric Recorder. W. L. Carson. "General Electric Review," April, 1936; Vol. 39, pp. 189-193.

191. Hints on Uses of Photo-Electric Counting. H. A. Delius. "Elec. Wld." March 13, 1937; Vol. 107, pp. 886-887, 958.

192. Photoelectric Time-Interval Meter. T. M. Berry. "General Electric Review," March, 1940; Vol. 43, pp. 137-138.

In Specific Manufacturing Operations

193. Photoelectric Control in the Printing Arts. "Electronics," November, 1932; Vol. 5, pp. 334-335.

194. Application of Photoelectric Register Control. D. R. Shoults. "General Electric Review," April, 1934; Vol. 37, pp. 170-174.

195. Electric Eye Controls Position of Bag Design. J. H. Richmond and C. P. Bernhardt. "Elec. Jour." May, 1934; Vol. 31, pp. 203-204, 206.

196. Photoelectric Width Gage. E. H. Alexander. "General Electric Review," November, 1941, p. 615.

197. Phototube Controls Punch Press. Ralph A. Powers. "Electronics," July, 1937; Vol. 10, pp. 21-23. (Used as safety device.)

198. Photoelectric Weft-Straightener Control. C. W. LaPierre and A. P. Mansfield. "A.I.E.E. Transac.," 1938, 513-519.

Miscellaneous Applications

199. Traffic Control by Light Beams for Major-Minor Intersections. R. C. Hitchcock. "A.I.E.E. Transac.," 1931, 708-713.

200. Precision Photoelectric Controller. C. W. LaPierre. "General Electric Review," July, 1932; Vol. 35, p. 403. (A device for close temperature control.)

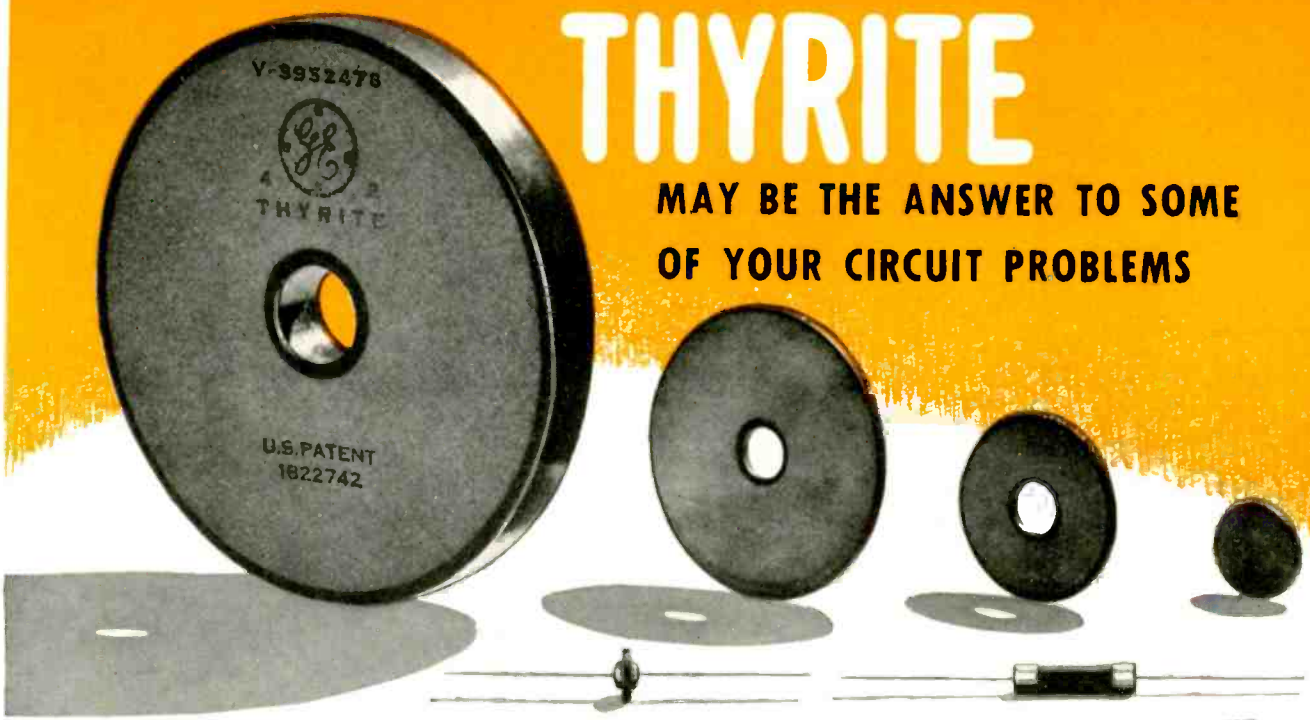
201. Light Beam Opens Mine Door. H. S. Littlewood. "Elec. Jour.," April, 1933; Vol. 30, pp. 163-164.

202. Matching Ceramic Colors with the Electric Eye. A. W. Rogers. "Ceramic Ind.," March, 1935; Vol. 24, pp. 170-172.

203. Progress in the Use and Application of Photoelectric Cell Control. Aksel J. C. Knudstrup. "Illum. Engng. Soc. Trans.," September, 1936; Vol. 31, pp. 785-788.

DESIGN ENGINEERS

CAN YOU USE A RESISTANCE MATERIAL IN WHICH I varies as E^4?



THYRITE

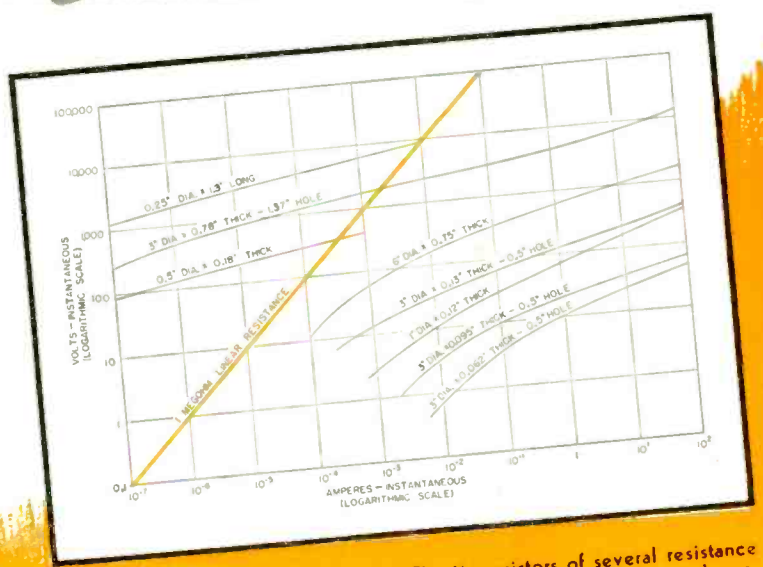
MAY BE THE ANSWER TO SOME OF YOUR CIRCUIT PROBLEMS

THYRITE* is a silicon-carbide ceramic material, dense and mechanically strong, having nonlinear resistance characteristics—the resistance varying as a power of the applied voltage. Its resistance characteristic is stable, and substantially independent of polarity or frequency. Thyrite has been used for many years in many important applications, including electronic. Thyrite can be produced in various shapes and sizes (those which can be successfully molded).

Here are some of its
MANY APPLICATIONS

- For protective purposes (to limit voltage surges)
- As a stabilizing influence on circuits supplied by rectifiers
- As a potentiometer (The division of voltage can be made substantially independent of load current)
- For the control of voltage-selective circuits, either independent of or in combination with electronic devices

*Reg. U.S. Pat. Off.



Typical volt-ampere characteristics of Thyrite resistors of several resistance levels and power ratings. Note that the nonlinear voltage-current characteristic extends over an extremely wide current range. Compare it with the characteristic (orange line) of a 1-megohm linear resistor.

The nearest G-E office can tell you what data should be submitted as a basis for a quotation. Or write direct to General Electric, Section 16-250, Pittsfield, Mass.

GENERAL ELECTRIC

406-12-5600

(Methods used in the control of artificial lighting in the typical school classroom.)

204. The Photoelectric Pyrometer. W. R. King. "General Electric Review," November, 1936; Vol. 39, p. 526.

205. New Photoelectric Hysteresigraph. R. F. Edgar. "Elec. Engng.," July, 1937; Vol. 56, pp. 805-809.

INDEX

Important Notice

To All Users of

STEATITE INSULATORS

About a year ago—there was a drastic shortage of Steatite insulators and a serious lack of adequate manufacturing facilities. Consequently, there was a clamor for substitutes. Government officials took immediate steps to remedy the situation by urging those with years of engineering experience and a thorough knowledge of Steatite manufacturing processes to expand their production.

Today—there is no shortage of Steatite or of manufacturing facilities. Steatite insulators are available for prompt delivery in all sizes, shapes, and quantities. The production capacity of the industry as a whole has expanded far beyond the critical state, and now there is no longer reason to consider substitute materials.

Stupakoff engineers can help you solve your problems now. Stupakoff production facilities are available to fill your requirements now. Inquiries are given immediate attention.

STUPAKOFF
Steatite
INSULATORS

The Army-Navy "E" Flag "for great achievement" flies over the Stupakoff plant.

STUPAKOFF CERAMIC AND MANUFACTURING CO., LATROBE, PA.

Ceramics for the World of Electronics

THE LONGEST MEMORY ON RECORD

The man in the tower loses not a syllable of the instructions he speaks to homing pilots . . . nor of their replies.

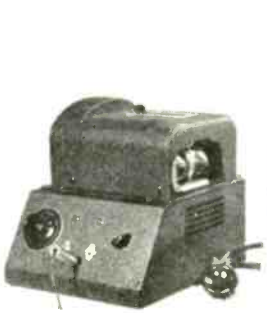
Every word is caught indelibly on the plastic recording belt of the Dictaphone Electricord Belt Recorder. These belts are inexpensive, tough and practically unbreakable. A great many of them may be filed flat in a small space.

Dual recording and reproducing units provide continuous operation. Since the sound track speed is constant on the entire recording surface, it is possible to listen back at any point, while the machine continues to record.

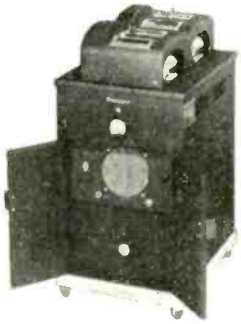
Developed to meet requirements of the Civil Aeronautics Authority, these Electricord units also serve the U. S. Army Signal Corps and other services.

These new developments are the results of continuing Dictaphone research. They are a portent of what will come when the Dictaphone plant is once more converted from ordnance production to the making of sound recording equipment.

Dictaphone Corporation, 420 Lexington Avenue, New York, N. Y.



The Dictaphone Portable Belt Reproducer, with variable speed control



The Dictaphone Electricord Belt Recorder—Reproducer

DICTAPHONE

ACOUSTICORD DICTATING EQUIPMENT
ELECTRICORD RECORDING EQUIPMENT

The word DICTAPHONE is the Registered Trade-Mark of Dictaphone Corporation, Makers of Dictating Machines and Accessories to which said Trade-Mark is applied.

CRYSTALS

Any TYPE OF CUT AND FREQUENCY

Should you need special crystal types we are ready to produce them *now*—in small or large quantities. And the crystals we produce to your temperature coefficient and absolute frequency specifications, will *be exact!* If you are rushed:

PHONE CRYSTAL SERVICE DIVISION
PLYMOUTH THREE THREE

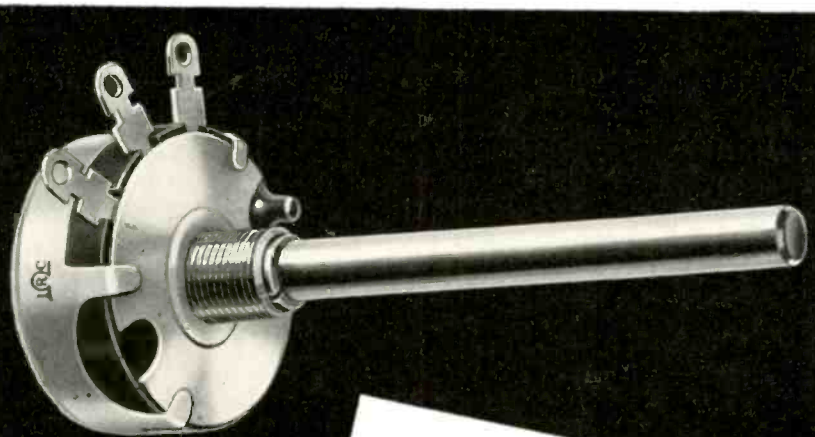
JOHN MECK INDUSTRIES
PLYMOUTH, INDIANA

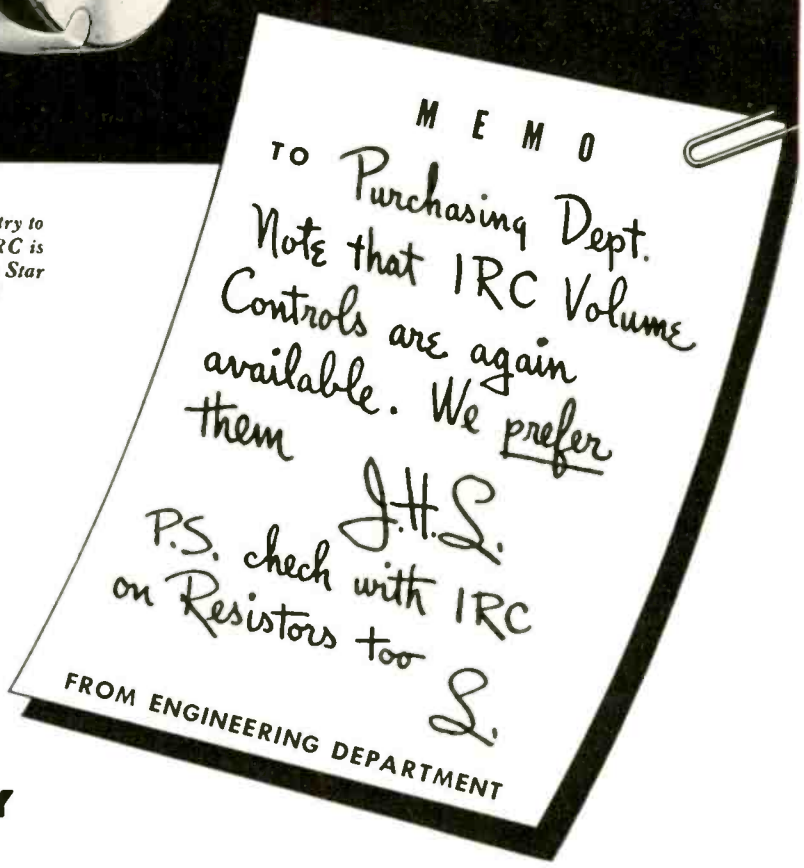
EXCELLENCE IN MUSIC AND VOICE RECREATING INSTRUMENTS

IRC VOLUME CONTROLS HAVE *All* THE FEATURES

No single attribute is responsible for the definite preference so often expressed by electronic engineers for IRC Volume Controls. Rather the fact that each unit embodies *all* the important factors which make for dependable operation has earned the regard of many of the largest users of potentiometers. . . . For preferred performance under severe conditions, for accuracy, stability and long life—specify IRC Volume Controls.

1—Metallized Element
2—Spiral Spring Connector
3—5 Finger Positive Contact
4—2 Sizes—1⅛" and 1¼" diam.
5—2 Ratings—½ and 1½ Watts
6—Available for Salt Spray, Sealed, and High Altitude Performance.





First in the industry to win an E flag, IRC is first also to win a Star for sustained production

INTERNATIONAL RESISTANCE COMPANY

425 N. BROAD STREET • PHILADELPHIA

ENGINEERS AS MARKETING "EXECS"

(*Continued from page* 83)

edge and ability to adapt equipment to needs of others is a very important part of his training. A typical example of this might be furnished by the operation of radio-frequency power in wood gluing. The knowledge and experience of wood-working people are perhaps generally confined to that which has developed out of the techniques and equipment which they have employed heretofore. In hot gluing methods the wood-working man using hot-plate presses knows that he can utilize certain steam temperatures under a given set of conditions. He may not, however, be

In peacetime, Waters Conley is America's oldest and largest manufacturer of portable phonographs, maker of the famous Phonola line. Today, our engineers and craftsmen are building equipment that links our armed forces—communications devices, code signal converters, and telephonic systems for tanks.

Waters Conley COMPANY

Tomorrow, when a whole new world of electronic wonders stands revealed . . . Waters Conley will be ready to serve home and industry with many new devices—converting knowledge and experience gained in the stress of war to the enrichment of life in peace.

Phonola

WATERS CONLEY COMPANY
ROCHESTER, MINNESOTA
17 E. 42nd St., New York • 224 S. Michigan Ave., Chicago

familiar with factors such as the internal temperatures of the pile, the details concerning the characteristics of the glue employed, etc.

Must know factors

If heating by radio-frequency power is substituted for hot platen presses in such plants, the engineers associated with the manufacturers of the radio-frequency equipment must have a thorough understanding of all these factors. They must be able to consider the expedients which have been incorporated into the former process and anticipate the compensation and limitations which may have to be introduced into the new method to avoid the same difficulties and reactions which had to be avoided by the former method.

Radio-frequency heating is taken only as an illustration. Marketing in other fields of electronics must go through the same steps. In some cases little time will be spent in the intermediate steps and packaged selling will be reached early. In other cases the services of trained engineers may always be required for the proper installation and operation of electronic equipment.

In general, this may be summed up by stating that skillful electronic engineers, possessing a broad engineering knowledge, will play a most important part in future electronic marketing. And the successful development and the use of electronic equipment will depend largely on good engineering.

FOOD INDUSTRIES

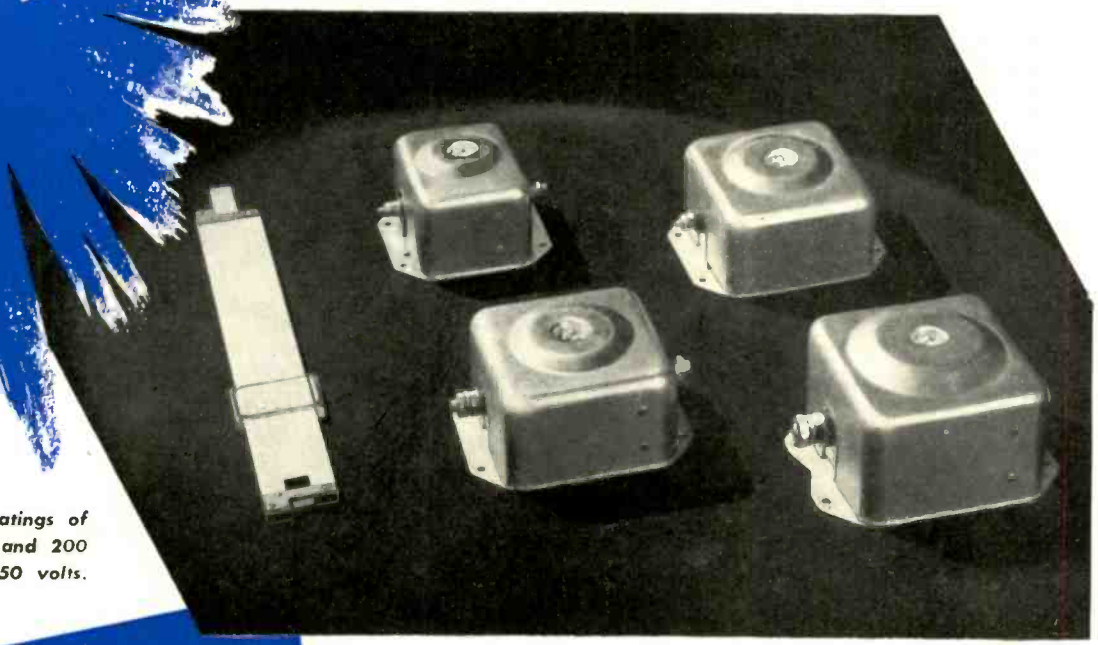
(*Continued from page* 57)

tries seem to depend on this cost factor. Supersonics for sterilizing, for bug-killing, for homogenization of milk are possibilities. Process controls, program timers, temperature, pressure, humidity, pH recorders and controllers, continuous automatic weighing equipment, dust and smoke precipitators, electrostatic separation apparatus, and such electronic methods as stepless motor control, seem to offer much wider future sales possibilities than the extent of their present use would indicate.

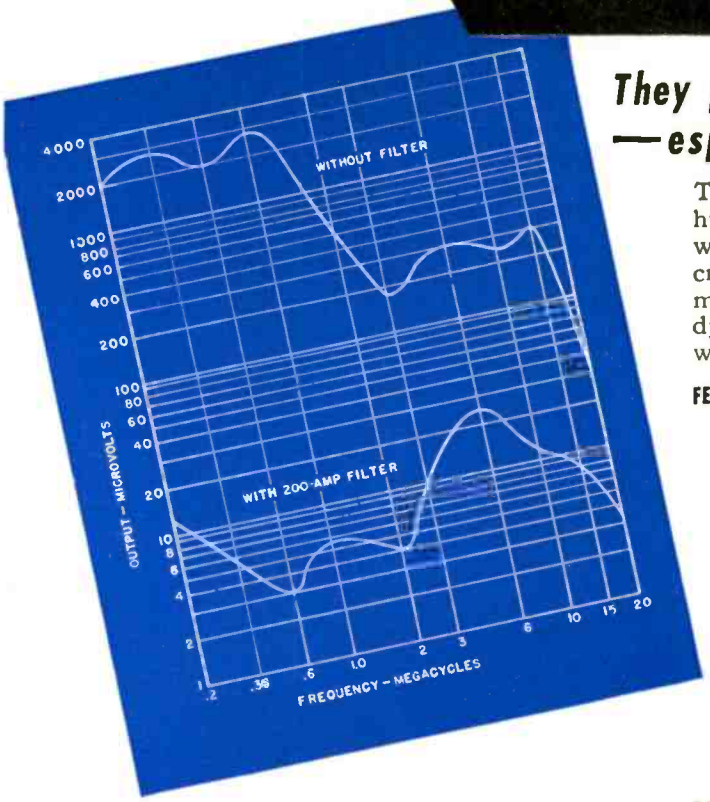
Tube-uses in allied fields

In looking squarely at the food processing industries themselves, one is likely to underestimate the potential market existing in the countless associated industries

NEW G-E RADIO-NOISE FILTERS for Aircraft



Available in ratings of 20, 50, 100, and 200 amp, d-c, at 50 volts.



Radio-noise voltage measured on aircraft generator with and without G-E 200-amp filter

They provide excellent noise suppression —especially from 200 to 20,000 kc

These filters help immeasurably in providing the high-fidelity radio reception so important in aerial warfare. They attenuate radio-noise voltage on aircraft electric systems (on circuits with such equipment as generators, amplidynes, inverters, and dynamotors) They are particularly helpful in systems where open wiring is used to save weight.

FEATURES

- **High attenuation characteristic results in excellent noise reduction**
- **Compact and lightweight (For 100-amp rating, shown in left foreground above, approx 2 1/5 lb, measuring approx 5 by 4 by 2 1/2 inches)**
- **Can be mounted readily in any position**
- **Operate efficiently over a wide temperature range (—50 C to 50 C)**
- **Comply with U.S. Army Air Forces specifications, including the stringent requirements as to vibration and acceleration**

FOR FURTHER DATA on these filters ask your G-E representative for Bulletin GEA-4098, or write to General Electric Company, Schenectady, New York.

GENERAL ELECTRIC

407-58-5700

TO HIT 'EM H-A-R-D-E-R

THE year 1943 promises to be the grimmest, hardest year this country has ever faced. Every effort, and every dollar of national income not absolutely needed for existence, should go into war work and War Bonds.

In the Pay Roll Savings Plan, America finds a potent weapon for the winning of the war—and one of the soundest guarantees of the preservation of the American way of life!

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. *Great as this sum is, it is not enough!* For the more dollars made available now, the fewer the lives laid down on the bloody roads to Berlin and Tokio!

You've undoubtedly got a Pay Roll Savings Plan in your own plant. But how long is it since you last checked up on its progress? *If it now shows only about 10% of the gross payroll going into War Bonds, it needs jacking up!*

This is a *continuing* effort—and it needs *continual* attention and *continual* stimulation to get fullest results.

You can well afford to give this matter your close personal attention! The actual case histories of thousands of plants prove that the successful working out of a Pay Roll Savings Plan gives labor and management a common interest that almost inevitably results in better mutual understanding and better labor relations.

Minor misunderstandings and wage disputes become fewer. Production usually increases, and company spirit soars. And it goes without saying that workers with substantial savings are usually far more satisfied and more dependable.

And one thing more, these War Bonds are not only going to help win the war, they are also going to do much to close the dangerous inflationary gap, and help prevent post-war depression. The time and effort *you* now put in in selling War Bonds and teaching your workers to save, rather than to spend, will be richly repaid many times over—now and when the war is won.

You've done your bit Now do your best!

This space is a contribution to victory today and sound business tomorrow by ELECTRONIC INDUSTRIES

which serve as suppliers. The matter of tinplate fusing by induction heating is a case in point. The vast printing orders placed daily by the thousands of food processers could support many more photoelectric and other electronic methods in printing than are now in use. Last, but by no means least, is the tin can industry itself, annually converting nearly three million tons of steel into food containers. There is a distinct possibility that tube-controlled resistance welding may replace, to a large extent, soft soldering processes. Large all-welded cans have indeed been in commercial use for a number of months.

To sum up, although the food industries may already be considered reasonably "electronized," the sheer dollar-volume resulting from supplying two hundred million persons with three meals a day very definitely places this in the first rank of current and postwar markets for electron tubes and electronic devices.

(Another article to be published in a forthcoming issue of "Electronic Industries" will deal with the X-rays for examination of food products, for germ-killing, and for genetic changes in plants, and with the widespread application of ultra-violet for vitamin D irradiation of milk, yeast, cereals, etc., as well as for destruction of air-borne and surface bacteria and mold.)

UHF AFTER THE WAR

(Continued from page 59)

the more field it will intercept. There is a confusion of terms here which engineers will have to agree on. In the broadcast band we always use an antenna shorter than a quarter wavelength, and we all know what we mean by effective height. In uhf we always use an antenna a quarter, half, etc., of a wavelength, set at a certain height above ground. We may have a quarter wave antenna set on the roof of a car, and the car in the middle of George Washington Bridge. The effective height of the antenna is six-tenths of a quarter wave, and it is zero distance above the ground furnished by the car roof, yet it is several hundred feet above ground as regards line-of-sight to the transmitter. We may call the latter the height above ground.

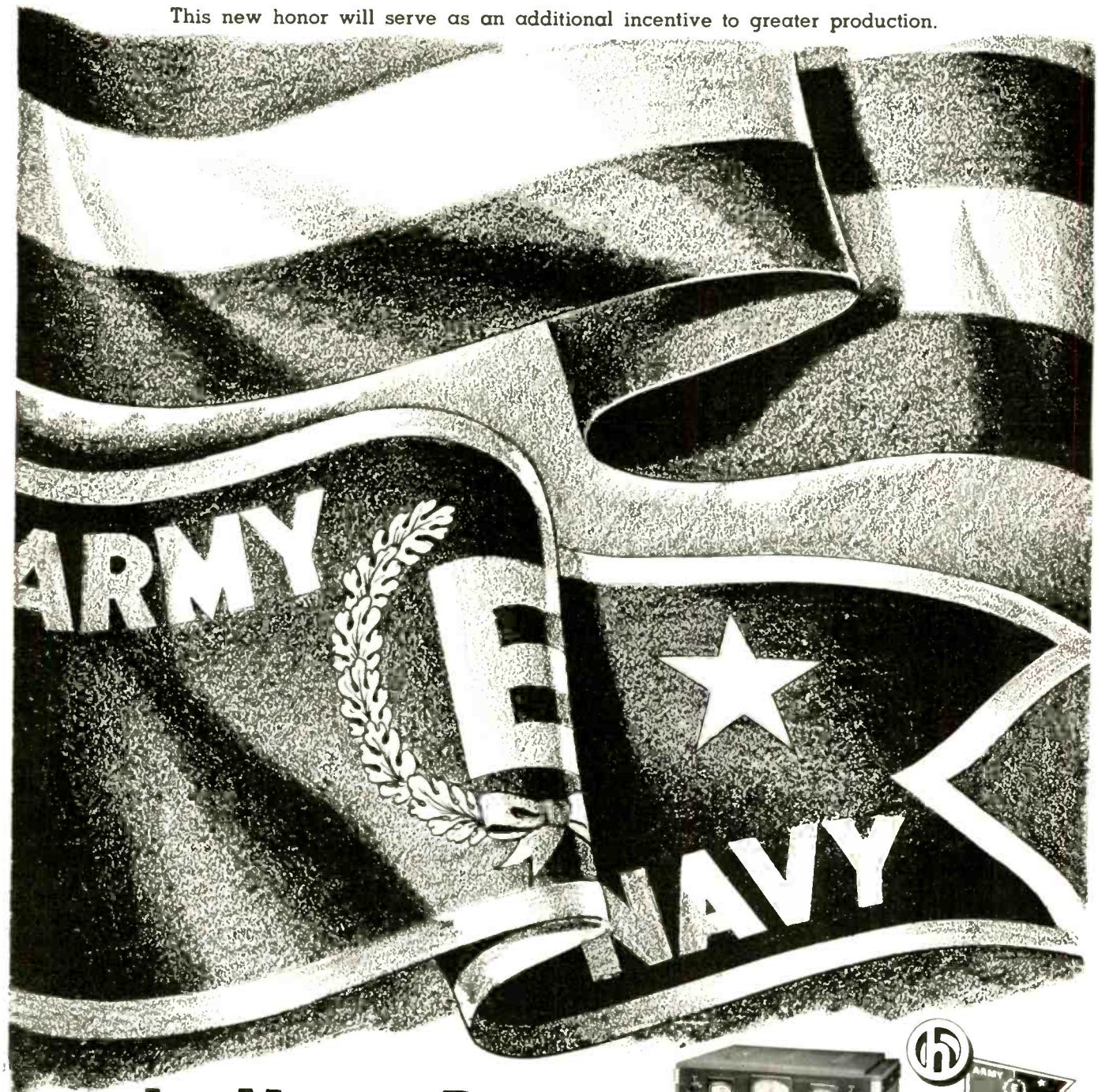
An antenna must have a length dimension, whether it is vertical or horizontal, and the greater the length the more lines of force it intercepts. This is a severe handi-

To Preserve the FOUR FREEDOMS!

. . . freedoms that are uppermost in the heart of every American. Workers in industry have toiled unceasingly to build peak production to enable their country to be the world's best equipped fighting forces to protect these freedoms.

The Hallicrafters employees have twice been cited by their country for excellence in production . . . once with the Army-Navy "E" Burgee . . . and now the addition of a star to this Burgee for continued excellence in producing communications equipment so vitally needed by our boys on all fronts.

This new honor will serve as an additional incentive to greater production.



hallicrafters

CHICAGO, U.S.A.

BUY
MORE
BONDS!

cap to the higher frequencies, as the antenna becomes too short to pick up much energy. This dimension can be almost indefinitely increased by the use of reflectors and arrays, but not very well in mobile and general coverage broadcasting.

Transmission beyond line-of-sight

These waves have clear cut characteristics as to distance if the point where they are tangent to the earth is a large body of water. The phenomena then is almost exactly optical—that is the curvature of the earth causes a very deep shadow to be thrown, with almost no signal in the shadow. Power is practically useless to increase range substantially beyond line of sight.

The normal situation on land, however, is the exact reverse. Almost everything reflects these waves, and an optical analogy is very apt: suppose you are on the opposite side of a hill from a powerful light. You could look at the top of the hill and tell the light was on by noting the dim illumination on the bottom of the leaves of the trees, and perhaps catch a gleam from some glass insulator on a telephone line running along the top of the hill. The light reaching you would be extremely weak, and you would see it, not by refraction, but by scattering, and the level of the light reaching you would be extremely low. In this case the power of the source is everything. In general then, in this frequency region, for line-of-sight operation a rather few watts in the transmitter will suffice, but for beyond line-of-sight kilowatts are very desirable.

We thus find that a hill some distance from the transmitter may increase the range of transmission in that direction, since its top will intercept a good field strength by virtue of being in line-of-sight, and will scatter the signal over a considerable area. The signal may be weak, but it will be there.

The thought occurs that we may find another use for the Empire State Building by putting a large inverted cone on its top, and we people with low power transmitters could aim our signal at this cone and have it scatter from there, thus in some degree adding its height to that of our transmitter antenna.

It is cheering to report, in the writer's experience, that the additional range obtained at these frequencies by scattering is quite consistent. If you go out in a test car

UNFAILING SELECTIVITY

On the fighting fronts, a tank's success often depends upon instant and sure communication—over crystal-selected channels. Terrific shock, constant vibration: corroding humidity of desert heat or paralyzing arctic cold must not interfere. Produced to meet all temperature and use conditions, and checked to absolute frequency specifications, Gentleman FREQ-KC Crystals are overcoming these obstacles of the war's proving ground. *On the home front* our electronic engineers are at your service to help design and specify crystal-controlled applications for essential products, or ahead-of-competition post-war products.

Gentlemen Products Division of
HENNEY MOTOR COMPANY
Home Office at FREEPORT, ILLINOIS—Factory at Omaha, Nebraska

and find a nice signal in rolling country at a spot 35 miles out, you can go back next time and find the same signal waiting for you, independent of day or night, summer or winter.

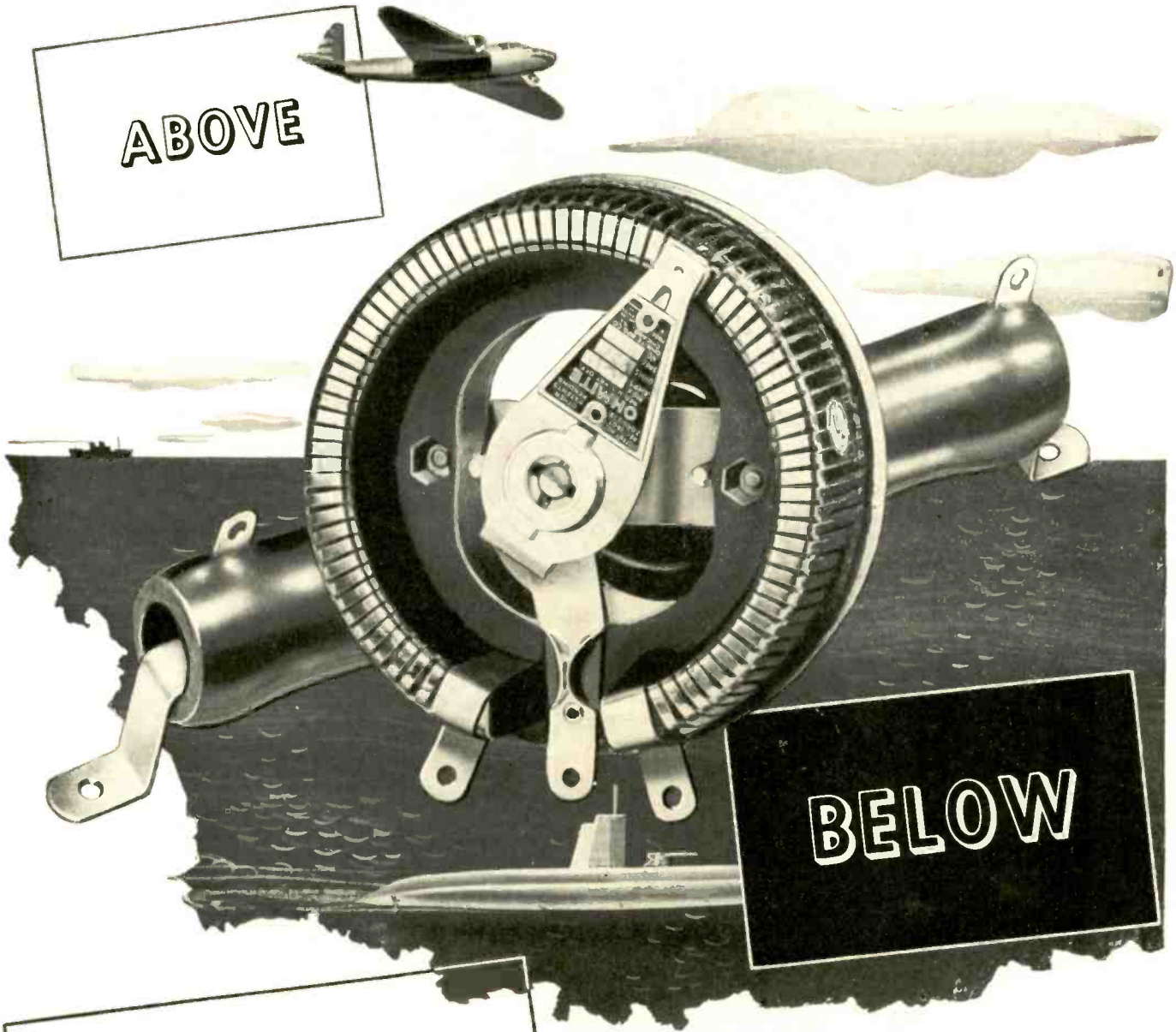
A less cheering observation is that brick walls are such a good reflector in this range of frequencies that reception indoors is inherently rather poor, as a rule, and outside antennas are almost a necessity. However, many transmitters will be in the midst of densely populated areas, so if the station is close enough we can, of course use indoor reception. Receivers will have to be rather sensitive, as so many of the stations being received will be by reflection.

Television will be severely limited as to number of stations in a given area, as they eat up channels in 6 mc gulps, and theoretically 33 stations can be placed in that band width. If frequency modulation is very generally used, a lot of stations with only 25 kc swings might be used to economize on channels (after all, every kind of service does not have to have perfect fidelity—the home telephone gives adequate service with somewhat less).

Tieing your car into the telephone system

Any discussion of the future of radio must include the forecast of telephone service to the automobile. On analysis this turns out to have some rather difficult points. Due to the rather poor coverage to a car in city traffic, a reliable service would necessitate several transmitters scattered around a large city. The question of peak load would be very pertinent, as you must obviously provide a separate channel for each conversation going on at one time. Since the transmitter on the car would have to know which channel is unused at the moment, the receiver must have a channel finder, hunt along a row of adjacent channels, find the first one not in use, and set the transmitter to that channel.

Calling the car is even more difficult. Cars could be grouped in "Exchanges," but each exchange would have to have more than one channel. A single channel might be used for calling the receiver on the car, and a tone on the call might be used to indicate which channel to transfer to in the receiver to set up the communication channel for that car at that time. The receiver would then retune



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and do it well!

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Write on company letterhead for 96-page Catalog and Engineering Manual No. 40. Gives helpful data on the selection and application of rheostats, resistors, tap switches.

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Handy Ohm's Law Calculator

Helps you figure ohms, watts, volts, amperes—quickly. Solves any Ohm's Law problem with one setting of the slide. All values are direct reading. Send for yours—enclose only 10c in coin for handling and mailing.

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both itself and its transmitter to that unoccupied channel.

There is little hope that such a system will be free of complexity and have a low cost, and besides this servicing requirements could easily be excessive.

Requirements for ingenuity

It will take all the skill and ingenuity the engineer can muster to open up this field. The antenna system alone will require much thought to take advantage of favorable circumstances in building into the car or plane structure, for instance.

To illustrate the point with an example we might consider a case where it is desired to talk between the locomotive and caboose of a freight train. The ordinary 142 cycle track control voltage that is used in signaling systems would not work, as between the ends of a train there may be 100 cars with four axels each, forming 400 perfect shorts to any transmission. However, these wheels and axels are highly standardized as to dimensions and at about 132 megacycles they are quarter wave-length long, and consequently form rather good insulators, or rejector circuits, which prevent them from being short circuits to current of this frequency introduced into the track circuits.

The front bumpers on all cars might be standardized as to wavelength to allow picking up uhf traffic control signals. The list of uhf applications for future consideration is endless.

Summary

We can thus foresee an average uhf installation for broadcast reception with an omni-directional antenna on the roof, of some all-wave type of receiver still to be developed, a lead-in of twisted pair (the concentric line is better but costlier), an ultra-sensitive receiver with highest attainable stability, and with a yet-to-be-developed dial, new styles of vacuum tubes in the front end which may be a modification of the Acorn type, but much less fragile and costly (perhaps the rf stage will be of the electron-multiplier type), very simple and sturdy tuned circuit assemblies of the variable condenser or core tuned types (tuned lines and cups are too clumsy and thermally unstable for general use), all assembly forms of ceramic or glass for the uhf circuits for maximum stability, and some rather nice mechanisms for the tuning controls.

SERVICING

(*Continued from page* 89)

products and number of such customers available.

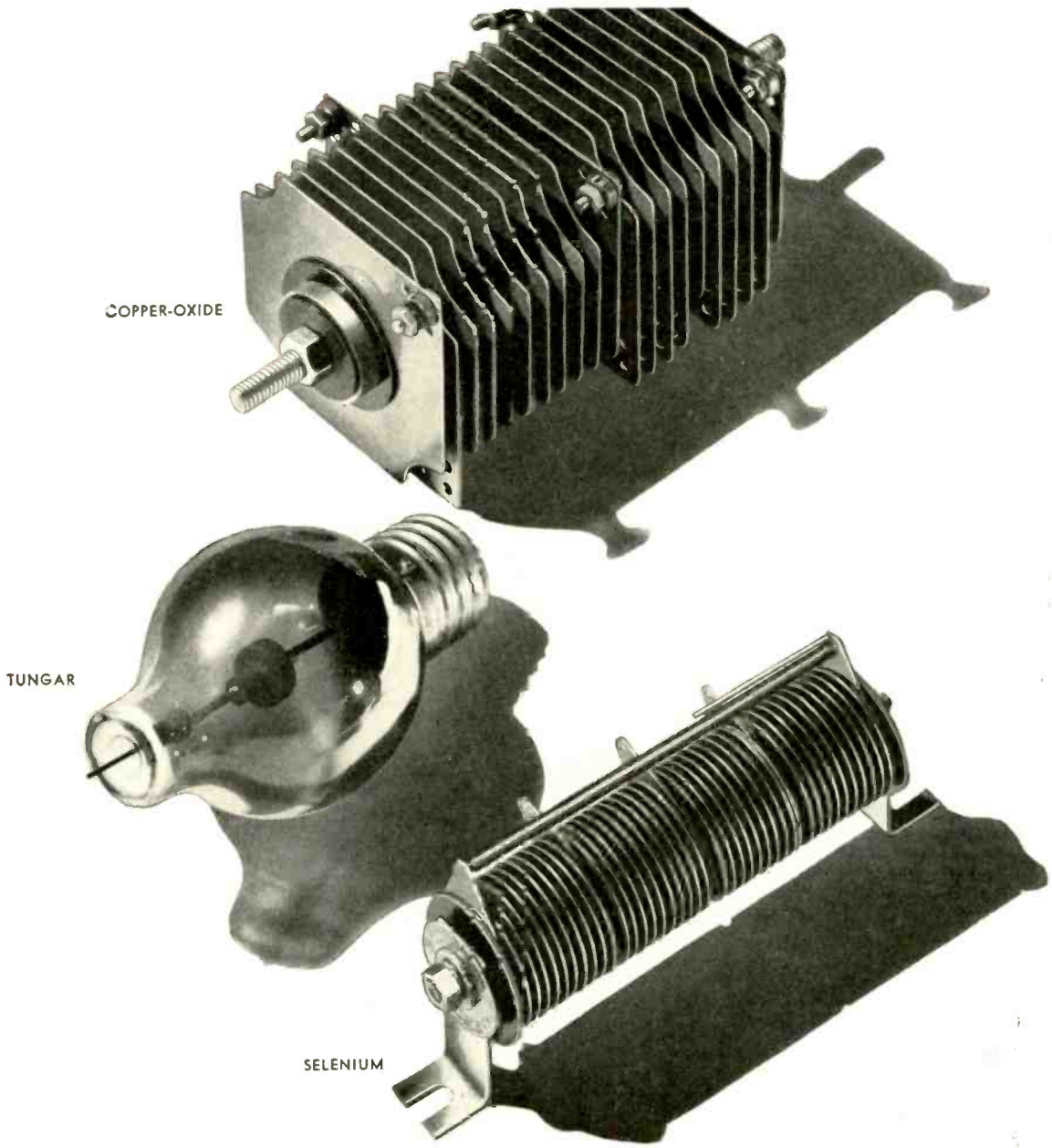
7. Plug-in service

An interesting possibility for nationwide sales, offering service without any type of field organization, is available to certain classes of products. The question to ask: Can those parts of our equipment which are subject to failure be supplied as completely self-contained "plug-in" units? If so, the customer in Maine or Arizona can be supplied with a few replacement units to be used only in case of the necessity for shipping a defective portion of the equipment back to the factory. Considerable success for this "plan" has been claimed by manufacturers of certain types of rather intricate photoelectric equipment and military radio receivers.

8. Laboratory repair

It is probably true that a few types of very delicate or very specialized electronic measuring, recording, or controlling equipment whose economic importance does not justify field service organizations will always require return to the plant or laboratory of the maker for adjustment or repair. If this is true, and the device is essential to the user's production processes, there is an opportunity to sell two units instead of one, provided such sales can be made with sufficient tact not to put the product under a cloud in the user's mind. An alternative arrangement would be to have spare equipment stored where it would be readily available to any one of several nearby users in an emergency.

If this description of possible service policies has raised more questions than it has answered, it will have served its purpose. Setting up or expanding a policy for servicing industrial electronic equipment must always, like diagnosing a disease, depend on many variables and scattered bits of evidence surrounding each individual case. Only one thing is certain: If the dream of the electronic industries is to come true—the dream of having important quantities of vital electronic equipment in constant use in every factory in the land—it will be partly due to confidence in electronic methods inspired by satisfactory operation and satisfactory service.



Need a Rectifier?

Then you will want to know which type is best for your specific requirements—Copper Oxide, Selenium or Tungar.

General Electric can give you an impartial answer because General Electric manufactures all three.

When next you need a rectifier you can get a valuable consulting service (no obligation, of course) through G-E Tungar and Metallic Rectifier Engineers. Address inquiries to Section A636-124, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

NBC's NEW FM TRANSMITTER

(*Continued from page 63*)

One of the features which contribute to the effectiveness of this station in noise reduction is the system whereby any traces of amplitude modulation which may have appeared in the rf amplifier system are reduced to very low values through the use of a feed-back amplifier.

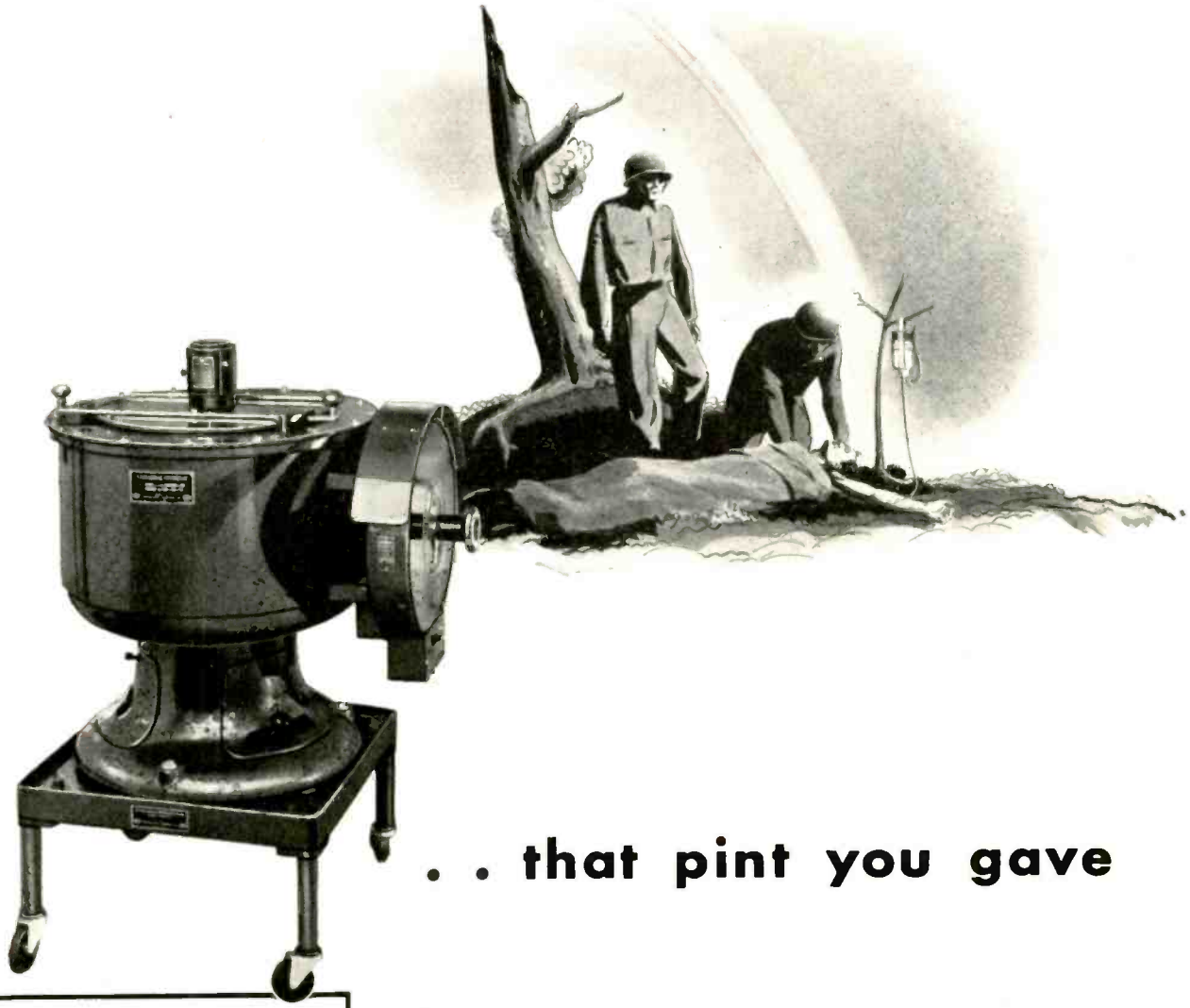
To accomplish this the antenna output is continuously sampled for amplitude modulation. Any audio signal that appears is amplified sufficiently, and injected back into the final power amplifier (with proper phase and amplitude relations) to neutralize AM effects. This injection is accomplished in the high voltage plate current supply lead to the power amplifier stage. The complete circuit for doing this, as will be noted referring to the diagrams, uses a diode rectifier, two voltage amplifier stages and a power amplifier stage operating into a transformer whose secondary is in series with the plate current supply lead. The same carrier signal sample from the antenna also controls a carrier indicator and a carrier alarm system.

The W2XWG cooling system is designed for a minimum of 1500 CFM of air. It can be increased as required to maintain the desired anode operating temperatures.

The field intensity survey map shows the approximate service ranges of W2XWG as it operates under the wartime condition of somewhat reduced power.

The audio frequency and video frequency control room at Empire State contain all of the low level equipment for the "UHF Center." This control room is a most interesting place. It includes the most advanced type of wide band high fidelity amplifiers, measuring equipment, and monitoring facilities. Our picture of the control room was photographed through a double-glass observation window from the supervisory office. Another identical observation window gives full view of the frequency modulation transmitter.

The equipment described was planned and constructed by NBC radio engineer, John L. Siebert.



. . that pint you gave

RHEOSTATS

Rheostats of the type shown on the International Blood Plasma Centrifuge are available in a wide range of sizes for multi- and single-mounting, for manual and motor driven operation. Ward Leonard also manufactures laboratory rheostats with and without micro drive and ring type rheostats. Send for bulletins describing Ward Leonard Rheostats of interest to you.

It may be that many months will pass before the blood you so generously gave will save a life . . . the place may be thousands of miles away.

The preparation of plasma from donor's blood is a meticulous process in which a special type centrifuge plays an important part. Centrifugal force developed at enormous speed, with smooth acceleration, packs down the red cells and increases the yield of blood plasma. This calls for sturdy equipment, built for continuous duty; for when blood is coming in, the centrifuges are working day and night.

The Ward Leonard pressed steel rheostat was selected as the motor controller because of its absolute dependability and its large number of accurate steps. An electric interlock designed by Ward Leonard assures a slow start irrespective of when the switch is closed. The centrifuge will not operate until the rheostat is in minimum speed position.

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) *devices since 1892.*

WARD LEONARD ELECTRIC COMPANY, 61 SOUTH STREET, MOUNT VERNON, NEW YORK

NEW LITERATURE

Greater Speed in Crystal Orientation

To permit the fullest utilization of new manufacturing techniques and also to increase the speed of test procedure, the Philips Metalix Corporation, 419 Fourth Ave., New York, is offering an X-ray quartz analysis machine equipped with two goniometers, with a newly-designed natural face orientation table as optional equipment. This arrangement succeeds the former combination of a single goniometer and a natural face orientation table. The use of two goniometers almost doubles the volume of crystals that can be handled by one analysis machine. Machines already in use can have their usefulness increased by replacement of the natural face orientation table with a goniometer designed for use on the left side of the machine. Bulletin No. 202 describes the new apparatus.

Alloy "C" Resistance Wire

Price list and engineering data on its Alloy "C" resistance wire has been released by the C. O. Jelliff Mfg. Co., Southport, Conn. Alloy C contains 60 per cent nickel, 15 per cent chromium and balance iron. It has a high resistance to oxidation or corrosion, and is extensively used as a heating element at temperatures up to 1700 deg. F. It is widely used in fixed and variable resistors, potentiometers, etc.

High Temperature Lubricant

A 4-page illustrated bulletin, No. 423-DD, on "dag" colloidal graphite as a high temperature lubricant has just been released by the Acheson Colloids Corporation of Port Huron, Michigan. This bulletin discusses the limitations of liquid and semi-liquid lubricants of the conventional type in high temperature applications and the properties of colloidal graphite which make it suitable for such applications.

Marine Type Dead Front

A 16-page booklet on marine type dead front built to government requirements is published by the Square D Company 6060 Rivard St., Detroit, Mich. This bulletin 3100 describes and lists switchboards, generator boards, power and light distribution panelboards and drip-proof switches for marine use. The advantages of dead front control equipment are described as simplified maintenance, interchangeability, safety to personnel and minimum ship space required.

Brazing With Phos-Copper

How to braze with Phos-Copper, brazing alloy which saves time, machines and manpower and can be used with gas, incandescent carbon, electric furnace and dip brazing methods is discussed in a new booklet announced by Westinghouse Electric and Manufacturing Company. The new 12-page booklet contains hints on good brazing and proper joint designs. Butt, scarf, shear and lap joints are considered, and diagrams show proper designs.

Phos-Copper is free-flowing at 1382 deg. F., so heating time is shortened. Machining of the finished joint is not necessary in most cases. Among the advantages of Phos-Copper listed in the booklet are its low melting point, uniformity of brazing material, high tensile strength and stress cycle, 98 per cent electrical conductivity of joint.

HIGH VOLTAGE PAPER CAPACITORS

to Stand 5,000 to 15,000 Volts at 110° C.

Sprague has the answer to the problem of finding paper capacitors that will handle high voltages at high temperatures.

Typical of many other Sprague developments, these Type PX-25 units, with their exclusive "Vitamin Q" impregnant, have proved their dependability under the most rigorous war conditions. Voltages now available run from 5,000 to 15,000 volts and ambient temperatures are on the order of 110° C. Used at low and ordinary temperatures, these capacitors give a tremendously increased safety margin over the ordinary commercial types.

ARMY E NAVY

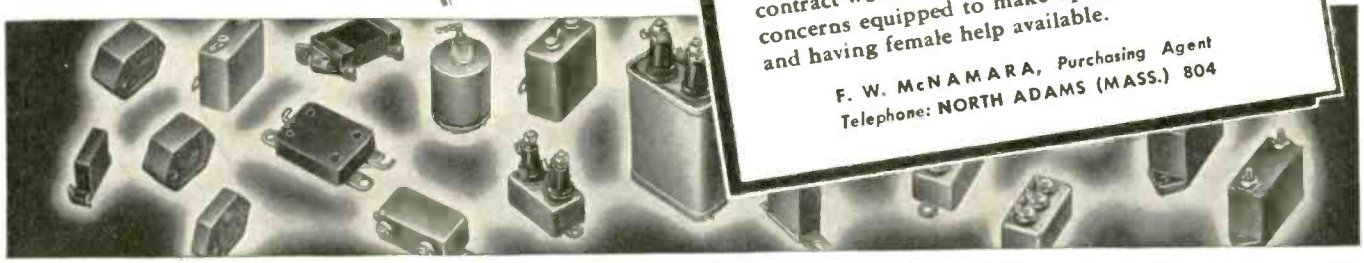
Sprague engineers welcome the opportunity to cooperate in solving your capacitor problems. An exceptionally broad background of engineering experience in designing and producing dozens of highly specialized capacitor types for ultra-exacting war uses is freely at your disposal.

SPRAGUE SPECIALTIES COMPANY
North Adams, Mass.

SUB-CONTRACTORS, ATTENTION!

Sprague Specialties Company will be glad to hear from reliable firms having screw machine and metal stamping facilities available for sub-contract work on high-priority orders; also from concerns equipped to make up jigs and fixtures, and having female help available.

F. W. McNAMARA, *Purchasing Agent*
Telephone: NORTH ADAMS (MASS.) 804



MANUFACTURERS OF A COMPLETE LINE OF RADIO and INDUSTRIAL CAPACITORS and KOOLOHM RESISTORS

NEW BOOKS

Electrical Counting

By W. B. Lewis, M.A., Ph.D., published by The Macmillan Company, New York, 1943, 144 pages, $2.50.

Though the subtitle of the book reads "with special reference to counting alpha and beta particles," the text will be useful to many who have occasion to use tube circuits, but who may not be concerned with nuclear physics. It covers design, testing and limitations of amplifiers, voltage stabilization, feedback, trigger circuits, counters, statistics of random distribution, and other related subjects of general interest. Many useful details as to the construction of special circuits are included.

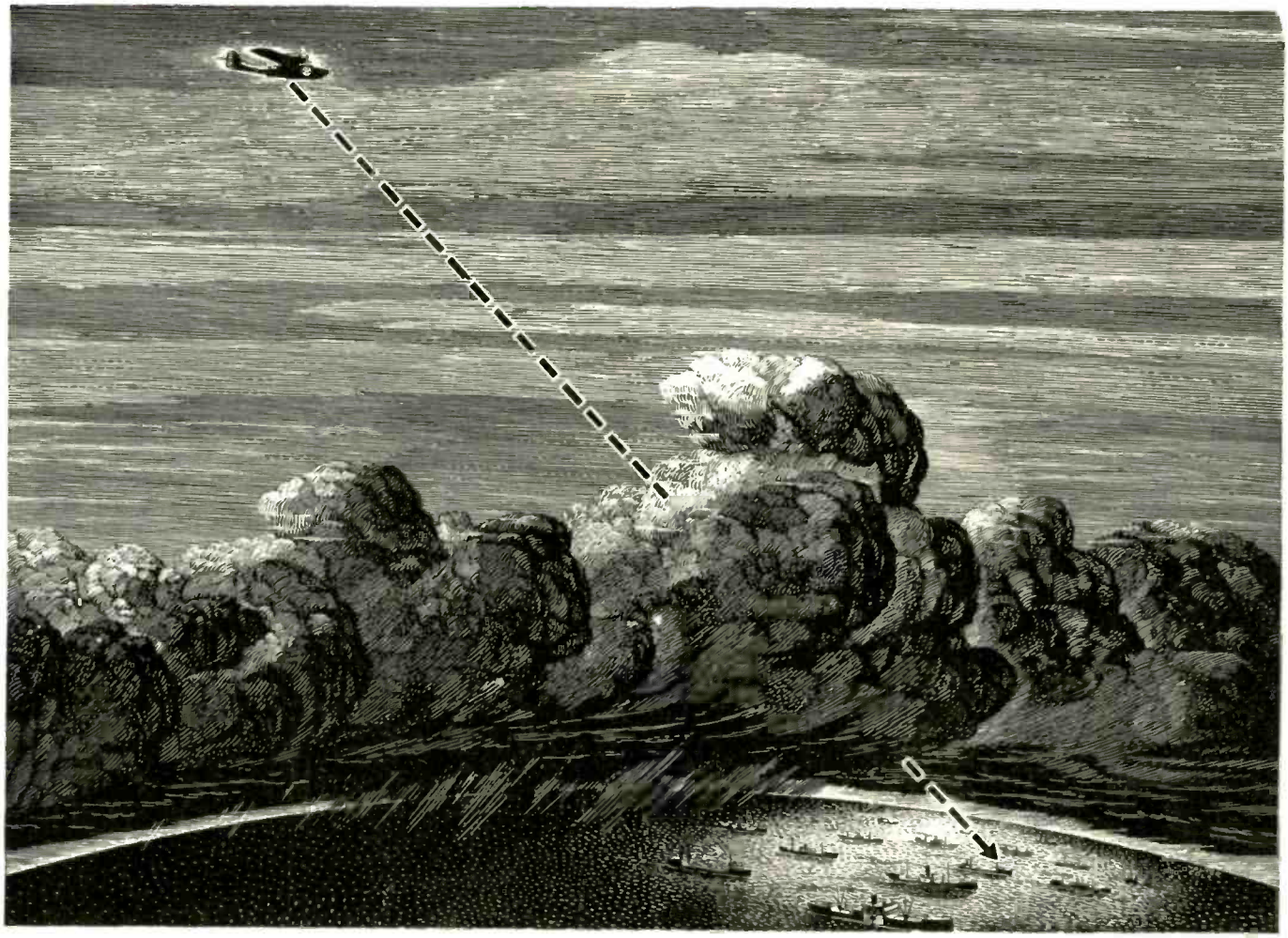
The treatment is clear and logical, the problems are carefully stated, and performance, advantages and disadvantages of the devices are explained in a readily understandable, straightforward style which makes it a pleasure to read the book.

Transients in Linear Systems

By Murray F. Gardner, Assoc. Professor, Electrical Engineering, M.I.T., and John L. Barnes, Professor, Applied Mathematics, Tufts College, published by John Wiley & Sons, Inc., New York City, 389 pages, illustrated, 6″ x 9″, $5.00

This is the first of two volumes prepared mainly as a textbook on the Laplace transformation concepts, as applied to transients in electrical and mechanical problems. Vol. I concerns circuits and devices that contain lumped parameters. The approach to most problems is from electrical concepts.

As a textbook, the book may serve admirably, since the style is understandable. An excellent introduction reviews and compares the transform concept with other systems of analysis, such as by differential equations, operational calculus or Fourier integral analysis. There follows numerous chapters of definitions, and examples taken from all phases of engineering design. Emphasis is placed upon a systematic presentation of the methods of setting up physical



RADAR, the secret weapon, tells the story of PHILCO at war!

When the Army and Navy released the secret of *Radar*, the sensational story of Philco's vital contribution to victory was officially revealed. Radar, the fabulous weapon that pierces fog, storms and darkness and seeks out the enemy beyond the range of human eyes and ears, is one of Philco's major war assignments.

Throughout its overwhelming leadership in radio, Philco laboratories *pioneered* in the science of ultra-high frequency radio waves, upon which Radar is based. When the Jap struck, Philco was ready to answer the call of our fighting forces for *"impossible"* deeds of Radar development and production. Today, theirs is the most dramatic story that has yet been told from the annals of war production.

Even more important will be the peacetime sequel to these Radar achievements. Wherever Radar and electronic principles may be applied, Philco research and experience will be ready, again, to serve the field of industry. And in home appliances, only the future can reveal the untold progress that will appear under the famous Philco name.

PHILCO CORPORATION

ARMY E NAVY

OUR WAR PRODUCTION PLEDGE: *MORE • BETTER • SOONER*

problems as equations under the transform system.

As a reference design handbook however, the book does not provide an easily used "tool" because of the large amount of definitions and concepts that explain the "subject," but are of minor importance to the practical design engineer. The individual worker studying the book without the assistance of an instructor will probably wish for a greater number of complete solutions to help in checking the accuracy of his own problem set-ups. However, the examples used are so intriguing, in that they seem to parallel problems that so frequently come in engineering design, that the majority of those to whom the review copy was shown decided to own a copy of their own.

An extensive bibliography of several hundred references is included to permit the reader to follow up any particular subject at greater length. The style is such that a working knowledge of differential equations will permit a circuit engineer to follow the concepts presented.

Radio Circuit Handbook

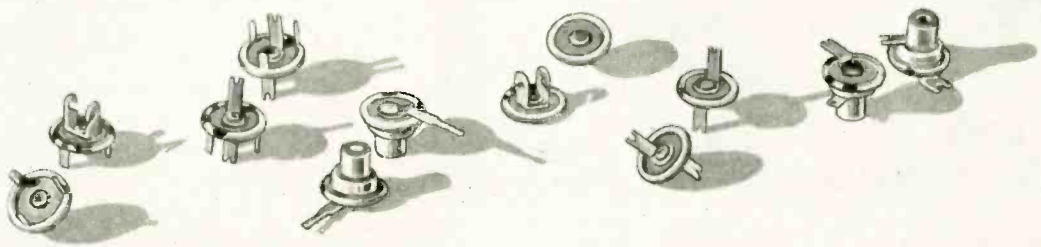
Published by Allied Radio Corporation, 833 West Jackson Boulevard, Chicago, Illinois. Price, 10c.

This is a 40 page 8½ x 11 inch book, containing radio and electronic circuits especially planned as a text for the classroom, for home study, and as a guide for experimenters and builders. Fundamental principles of radio are illustrated and explained in sixteen basic circuits, followed by twenty-five application circuits of conventional radio and electronic units. Since both the schematic and pictorial diagrams are shown for each unit, which range from simple one-tube sets to superheterodynes, the student is able to correlate typical circuit diagrams with their actual equipment counterparts, and so easily bridge the gap between theory and practice.

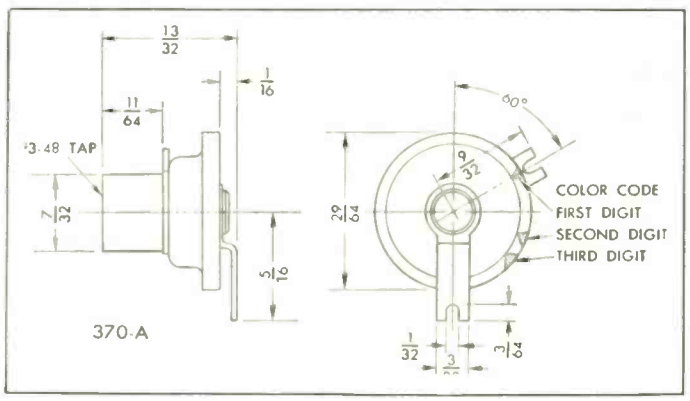
Linear-Frequency Condenser Development

The equation which appeared in the third column of the article "Linear-Frequency Condenser Development," page 88, May issue, should have read: $X = \frac{Cm}{Co}$.

Erie Button Mica Condensers



Compact Silver Micas for **U. H. F.**



Characteristics	
Capacity Range:	15 to 500 mmf.
Power Factor:	.08% max. for capacity tolerance of ± 5% or less .12% max. for capacity tolerance of over ± 5%
Max. Working Voltage:	500 Volts D. C.

FOR U.H.F. and V.H.F. applications where short leads, high resonant frequency, and compactness are essential, Type 370 Erie Button Mica Condensers are ideal.

These small capacitors consist essentially of a stack of silvered mica sheets encased in a silver plated housing. The housing forms one terminal, the other terminal being connected at the center of the stack, thus providing the shortest possible electrical path to the capacitor. A wide selection of terminal and mounting designs is available to provide both feed-thru and by-pass connections.

Erie Button Mica Condensers have been thoroughly proven in large scale production quantities since 1941. Capacity ranges and electrical characteristics are given above.

Samples of Erie Button Mica Condensers and complete technical information will be sent to interested engineers on request.

INVEST TODAY IN BONDS FOR VICTORY

ERIE RESISTOR CORP., ERIE, PA. LONDON, ENGLAND · TORONTO, CANADA.

MILESTONES TOWARD THE ELECTRONIC ERA

How deForest's Audion Came Into Being

How Dr. Lee deForest's famous audion, predecessor of all modern electronic development, was born in a tiny one-room "laboratory" during a torrential rain; how the "grid" came to be so named; how a "local" battery, afterwards known as the "B" battery first was used in any wireless receiver, and many other little known features of the travail that accompanied the birth of the three-element vacuum tube were related by Frank E. Butler, formerly chief assistant to Dr. deForest, and at present associate editor of "Electronic Industries," in a statement prepared for the June 2 meeting of the New York section of the Institute of Radio Engineers.

The audion was born in the attic of the old Parker Building (later destroyed by fire) at the corner of 4th Avenue and 19th Street, New York City. The first tubes, made by hand of glass tubing about 1⅛ inches in diameter, were made by a Mr. McCandless, a maker of Christmas-tree lamps, in a small shop in a six-story building on 14th Street between 5th and 6th Avenues. The life of these tubes, evacuated with a hand pump and containing a carbon filament, was a matter of only a few minutes.

First tube with a grid

The night the first tube ever to contain a "grid" was made, was stormy and the rain fell in torrents. After two tubes were finished—about midnight—deForest and Butler carried them cradled in cotton in an old shoe box, through the rain to their own "lab," arriving drenched to the skin but with the precious tubes in order. The first tube tested burned out immediately, before any observation could be made. The second tube survived about 30 minutes, which was time enough for tests which indicated the importance of the discovery.

Later, after more tubes were made and experimentation was in progress it became necessary to adopt a name for the "grid," till then unnamed, and the christening came about in this wise. Dr. deForest was experimenting with various hook-ups and observing the varying results, excitedly giving

"PRECISION ENGINEERING AMP APPLIED TO THE END OF A WIRE"

AIRCRAFT-MARINE PRODUCTS INC
A-MP
SOLDERLESS WIRING DEVICES

A-MP Solderless WIRING DEVICES FOR AIR-BORNE RADIO EQUIPMENT!

Top Performance In Low Voltage and High Frequency Requirements

The AMP Diamond Grip Solderless Insulation Support Terminal is daily maintaining the highest quality electrical and mechanical connections under the severe conditions required in gun control, aircraft communications, and electronic use. This pure copper terminal, which is 1/32" shorter and approximately 32% lighter in weight, has been engineered for the aircraft industry to meet every requirement of production as well as actual service.

Exceptional production efficiency is the result of special terminal design, and AMP Precision-Die Installation Tools, illustrated below.

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Canadian Representative: A & M ACCESSORIES, LTD., TORONTO, CANADA

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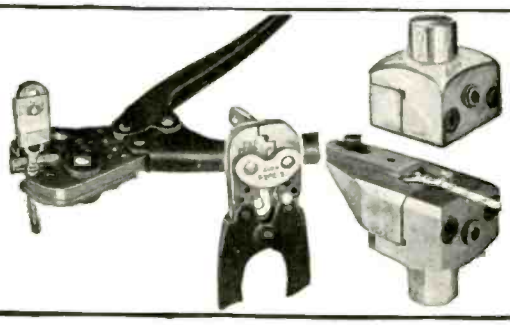
A-MP
SOLDERLESS WIRING DEVICES



THREE PERFECT CRIMPS AT ONE TIME

Diamond Grip Precision-die hand, foot and power operated installation tools materially reduce production time and assure uniformity of application without the necessity of worker pre-training. These self-gauging tools make three perfect crimps at one time —every installed terminal is the exact duplicate of all others in the line.

THE AMP SYSTEM OF SOLDERLESS WIRING

Unbiased laboratory tests of AMP Diamond Grip Terminals show no significant change in resistance even under the severest operating conditions, including a multiplicity of circuits, variations in current, voltage, temperatures and corrosion.

Write today for Bulletin No. 19.

orders: "All right now, hook this over there . . . then that over there . . . then those two to these. . . ." This proved so confusing and indefinite that one of the assistants remarked: "Doc, why not name some of these 'things'? We know that this square of metal is the wing (since changed to plate) but what is this thing," pointing to the zig-zag wire. "Oh! call it a grid," quickly remarked deForest, "that's what it looks like, a roaster grid." Then he added, "Make a sign. Tack it on the wall so you won't forget. Say this: 'REMEMBER, RED TO WING . . . GREEN TO GRID . . . ALWAYS.'" To this day in all countries of the world wherever radio circuits are designed and color code is used, the leads to the grid circuits are always specified as green.

As soon as possible a small mahogany cabinet with a peep window to note whether the filament was still lighted, was built and one of the first sample tubes was taken to Washington to demonstrate the improved "wireless detector" to the Navy. However, the device was promptly turned down as being impractical, untried, and too expensive. It was reasoned that the use of a storage battery was out of the question because it might run down in the middle of a message.

Sought relay action

Mr. Butler's IRE talk, augmented by about 30 lantern slides which included photographs of a series of 18 replicas of the original experiments showing the major steps followed by Dr. deForest in the development and discovery of the audion, pointed out that from the start of his research, deForest sought to produce a relay action in a receiver, and not merely a valve or rectifier.

Contrary to popular belief, the invention was not the outgrowth of another person's idea, but was conceived and progressed along radically different lines of reasoning. This was along the line of heat or ionization of gases within a given area, all of which led into the field of vacua, which was quickly discovered and taken advantage of once that path was shown. "It is along these lines that the significance of originality of the invention must be viewed, if unbiased opinion desires to grant entire credit for the invention, where it unquestionably belongs," said Butler.

Electronic Gunsmith

• Her job is to assemble the complex gun of a cathode ray tube – a precision electronic gun that shoots billions of electrons a second with unerring accuracy.

That makes her an "electronic gunsmith." Here she is shown welding a "no tolerance" gun part held in perfect alignment by a specially designed jig.

To the making of cathode ray tubes and other important electronic elements, Sylvania brings long and specialized radio tube experience. You know what the Sylvania reputation for painstaking craftsmanship is in the radio field.

You can confidently specify Sylvania Radio Tubes as replacements for wartime radios – and Sylvania Cathode Ray Tubes for television sets and many other purposes when victory is won.

QUALITY THAT SERVES IN WAR

ARMY E NAVY

RADIO DIVISION

SYLVANIA

ELECTRIC PRODUCTS INC.

Emporium, Pa.

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

INDUSTRY NEWS

RCA's Finn Tells How Tubes Serve Industry

Speaking before the National Conference of Business Paper Editors in Philadelphia on April 30, D. J. Finn, of the Radio Corporation of America, Camden, N. J., listed ten broad ways in which electronic devices and methods are serving industry today:

1. Power rectification and inversion
2. Communications
3. Extending the senses
4. Detection, inspection
5. Safety and protection
6. Calculating
7. Measurement — physical, electrical, and chemical
8. Control
9. Welding, processing, and miscellaneous applications
10. Heating and drying

Mr. Finn confined his remarks chiefly to No. 10, radio-frequency induction and dielectric heating in industry. He pointed out that operating cost comparisons between older electrical, gas, and other methods of heating with the new radio-frequency techniques involved many factors besides the bare fact that a given amount of heat at present costs six or seven times more. Speed-up of industrial operations, localization and efficient use of heat, savings in labor and space, and improvement of the product frequently more than offset the increased cost per unit quantity of heat.

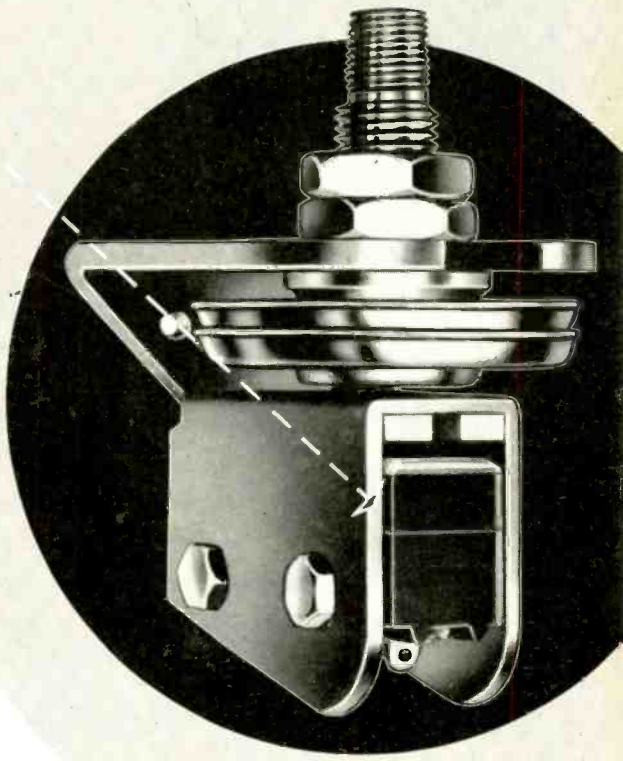
D. E. Foster Vp of Engineering for Majestic

Dudley E. Foster has been named vice-president in charge of engineering and Arthur W. Freese vice-president in charge of production of the Majestic Radio & Television Corporation, announces E. A. Tracey, president and general manager of the corporation.

Said Mr. Tracey, "The Association of Mr. Foster and Mr. Freese with Majestic is part of an organization program started in the Spring of 1941;—a long-range well-planned program that we believe will secure for Majestic an important position in the radio industry in the not too distant future."

Mr. Foster has had a long association with the radio industry, beginning in 1913. He is a graduate

MICRO SWITCH
the "Heart" of Cook Bellows Switch



Micro Switch precision and rugged dependability has never shown to better advantage than in the uses to which it has been put in the Cook Bellows Switch, manufactured by the Cook Electric Company of Chicago. This bellows switch has been found valuable in such applications as industrial processing, water and oil pumping systems, gas filled cable alarms, etc. Operated with air, gases or fluids, the Cook Bellows Switch is a custom engineered unit of rugged dependability for operation on pressure differentials ranging from as low as an ounce to over 100 pounds.

Micro Switch with its small size, precise action and absolute dependability is a "natural" for difficult switching problems, operating at the same point through millions of operations . . . actuated by minute changes of movement or energy. Micro Switch is helping to solve hundreds of other difficult design problems.

Micro Switch is thumb size—measures only 11/16″ x 27/32″ x 1 15/16″, weighs only an ounce, operates on force as low as 1¼ ounces and movements as low as .0002″. Listed by Underwriters' Laboratories with ratings of 1200 V.A. loads, from 125 to 600 volts A.C.

Supplied in a wide range of types and housings, Micro Switch can be adapted to meet a variety of operating conditions and requirements. The experience and skill of Micro Switch engineers is available to help you find the best possible answer to your precision switching problems.

SEND FOR THESE CATALOGS

The two catalogs illustrated here will give you the complete details—Number 60 which covers Micro Switch in general and Number 70 which deals with Micro Switches for aircraft.

Micro Switch Corporation, Freeport, Illinois
Branches: 43 E. Ohio St., Chicago • 11 Park Place, New York City
Sales and Engineering Offices: Boston • Hartford • Los Angeles

MICRO SWITCH

Made Only By Micro Switch Corporation . . . Freeport, Illinois

Dudley E. Foster

of Cornell University in electrical engineering and was formerly chief engineer of the Case Electric Company of Marion, Ind., and later the U. S. Radio & Television Corporation. In 1934, he joined the R. C. A. License Laboratories as division engineer in charge of the engineering division of those laboratories. Since 1941, and until his association with Majestic, he was executive vice-president of Rogers-Majestic Ltd.

Mr. Foster holds over 40 patents in the radio and television field and in 1940, was given the Modern Pioneer award by the National Association of Manufacturers for his inventive contributions to the electronic field.

Mr. Freese has spent his entire business career in production. He was general works manager for Zenith Radio Corporation from 1930 until 1940 and recently, just prior to his association with Majestic, was vice-president and general works manager of the Automatic Instrument Corporation.

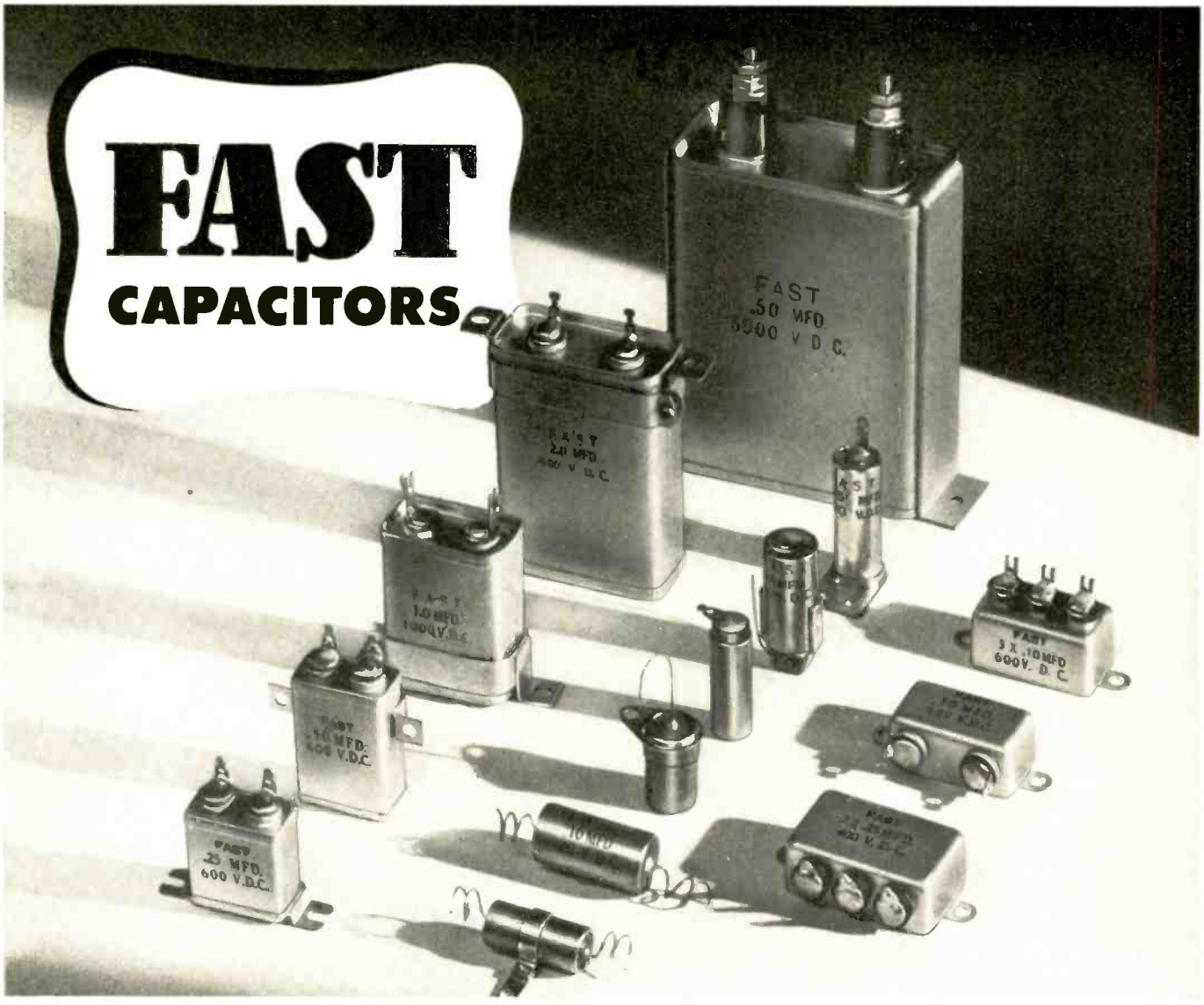
Willis Gen'l Sales Manager Sperry

Hugh Willis has been appointed to the position of general sales manager of the Sperry Gyroscope Company, Inc., according to an announcement made recently by R. E. Gillmor, president of the company. The Sperry Company is said to be one of the world's largest designers and producers of marine and aircraft instruments for the armed services. According to the announcement, Mr. Willis fills the post vacated by M. Lynn Patterson, who died in an airplane crash last year.

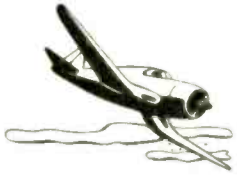
Mr. Willis joined the Sperry organization in 1931. Previous to his new assignment, he was Chief Research Director in complete charge of the company's laboratory, which employs more than 1500 technicians.

Hugh Willis

In announcing the new appointment, Mr. Gillmor said: "The responsibilities of the sales department are no longer confined within conventional boundaries. In these high-speed war days the sales department's first function is to recognize, even anticipate, the needs of the armed services. They must get new ideas and improvements on present products through the laboratories and into production without delay."



Known for the Service They Give!



Back of FAST capacitor service lies a quarter of a century of engineering skill and manufacturing technique. Back of FAST capacitor performance is intense scientific research in the chemistry of raw materials and in dielectrics. From such a background flows FAST quality, precision exactness, product uniformity ... so vital in every phase of the war.

And just as FAST engineers are today bending every effort for military victory... so, too, they will be ready to serve peacetime needs tomorrow ... fortified with the *plus*-experience born of war. FAST engineering aid is at your service...whenever capacitor problems trouble you.

☆ STANDARD OR SPECIAL UNITS TO MEET EVERY NEED . . .

FAST Condensers and Capacitors are produced in many types and sizes, in standard and special designs, for a great variety of electronic and electrical applications in war and industry. Paper Capacitors—Oil or Wax impregnated—Rectangular or Tubular—in sizes from the smallest to the largest. Units specially engineered or built to government specifications including thermal cycle and salt water immersion tests.

JOHN E. FAST & CO.

Capacitor Specialists for 23 Years

3129 North Crawford Avenue, Chicago

Canadian Representatives: Beaupre Engineering Works Reg'd.
2101 Bennett Avenue, Montreal, for Power Factor Correction
J. R. Longstaffe, Ltd., 143 Berkeley Street, Toronto, for Special Applications

Utah Elects Three

Austin Ellmore, who has been chief engineer of Utah Radio Products Co., Chicago, since 1938 has been elected vice-president in charge of engineering. He has been connected with Utah for the past 14 years. At the same time, Oden F. Jester, for the past 6 years Utah's general sales manager, has been made vice-president in charge of sales; and Remy Hudson, formerly vice-president of Mitchell-Faust Advertising Agency, has been elected vice-president in charge of postwar planning.

Two Promoted at Leland Electric

Two promotions in the executive set-up of the Leland Electric Co., 1501 Webster St., Dayton, Ohio, are announced by Thomas B. Fordham, president. W. F. Lisman is promoted to vice-president and general manager. E. B. George, who also has been associated with the company for several years is named vice-president and director of engineering. Mr. Fordham becomes chairman of the executive committee and continues as president of the company.

Webster Products Expands

Webster Products, 3825 Armitage Avenue, Chicago, has purchased the business of the Armitage Avenue Plant of Webster-Chicago Corporation. Operation of the plant will be continued, as will the manufacture of dynamotors, generators, small motors, inverters, voltage regulators, and small instruments. Webster-Chicago Corporation will continue the manufacture of tools and dies, metal stampings, machine parts and special apparatus, as heretofore.

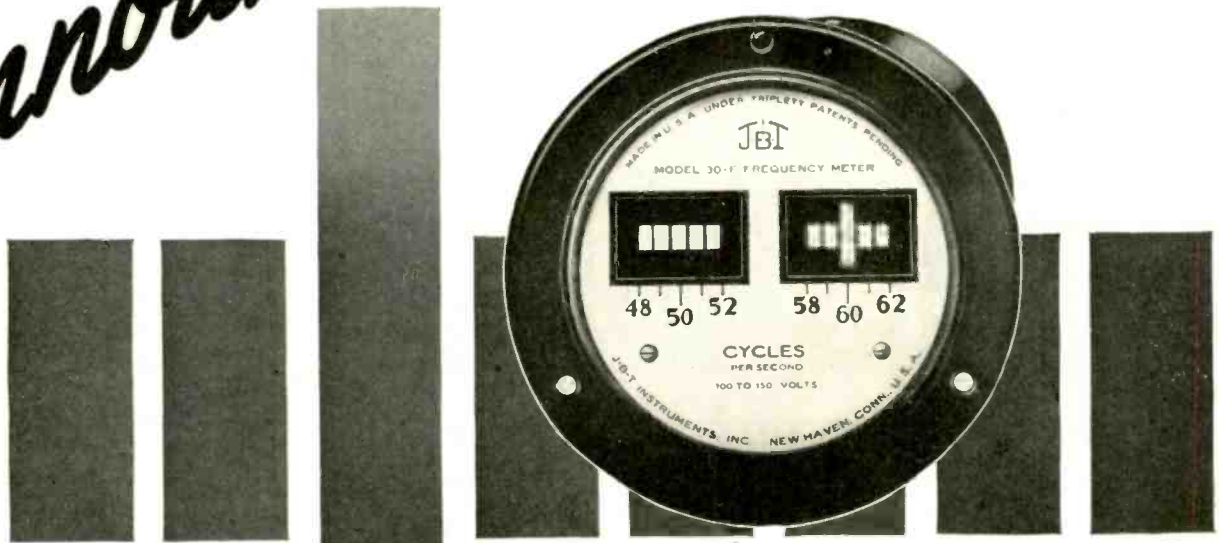
That Porocel Infra-red Spectrometer

In view of the interest shown in the small infra-red spectrometer illustrated on page 53 in our April issue, we have obtained more information about the instrument.

It was designed by American Cyanamid Co., Stamford, Conn., for the Porocel Corp., 260 South Broad St., Philadelphia, Pa., who have applied infra-red spectroscopy to their industrial problems.

The instrument has not yet been produced commercially, but due to

Announcing A NEW LINE



VIBRATING REED FREQUENCY METERS

Sturdy and Simple in Design, Permanently Accurate

Important new features of this line are—simplified construction, with fewer parts—individual reed activation so that the whole bank does not vibrate—great variety of cases and sizes. Vibrating reed type of frequency meter offers these advantages:

- **easy to read**
- **needs no adjustment in service**
- **low in power consumption**
- **exceptionally accurate**
- **not affected by wave form**
- **not affected by normal temperature change or external magnetic fields**

Available in full range of frequencies—full range of types and sizes—full or half-cycle increments —sharp or broad response—wide voltage range.

{Manufactured under Triplett Patents and/or Patents Pending}

Bulletin VF-43 just off the press. Write for your copy now.

J-B-I **INSTRUMENTS, INC.**

441-L CHAPEL STREET • NEW HAVEN, CONNECTICUT

the interest shown in this particular design, discussions are being held regarding the possibility of one of the instrument companies offering for sale a spectrometer constructed according to American Cyanamid's design.

IRC Gets Star Award

Harry Ehle, vice-president, and Dan Fairbanks, jobber sales manager, International Resistance Company, Philadelphia, accept additional star under Army-Navy "E" award for continuing production records.

Fouches Head Universal Microphone

James R. Fouch, who founded the Universal Microphone Co., Inglewood, Cal., in 1928 and who has been its president since that time, has just become chairman of the board.

The presidency will be filled by James L. Fouch, former vice-president, who has been with the organization practically since its inception.

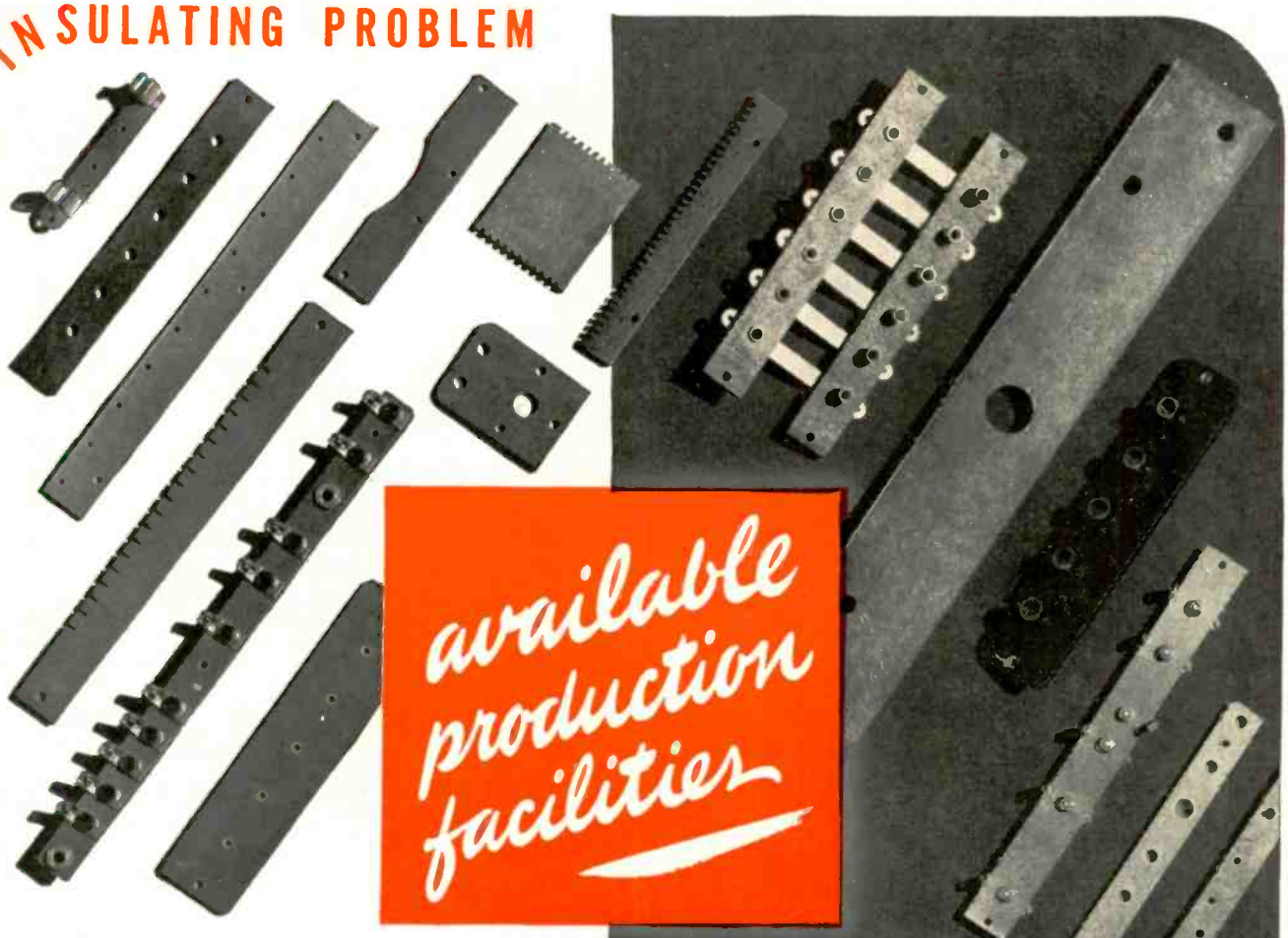
The new vice-president and treasurer will be Cecil L. Sly, former secretary-treasurer, who joined the company two years ago as controller.

The new secretary will be Durwood (Jack) Allen, with the firm the last three years in accounting control capacities.

In the early days of broadcasting, James R. Fouch owned radio stations in Inglewood and Pomona. Microphone repairs were so expensive, slow and often unsatisfactory, that Mr. Fouch started to service his own microphones and make new ones for the use of his stations.

INSULATING PROBLEM

MYCALEX MAY BE THE ANSWER TO YOUR



available production facilities

It is a well warranted assumption but heretofore unadvertised fact that the finest of Mycalex* machining facilities are available at the E. F. JOHNSON COMPANY. While not a new material it is enjoying a boom demand borne on the wings of widepread military specification. Its many advantages include the best of high frequency insulating qualities, great mechanical strength, and the ability to withstand high temperatures well. In addition it may be machined to any size or shape and held to close tolerances.

It is only natural that the home of the nation's most complete radio insulator line should provide complete and modern facilities for machining Mycalex. As pioneers in the art we solicit an opportunity to quote on your requirements and offer you our years of experience as effective insurance against the difficulties and delays that beset the uninitiated. We are prepared to quote you on Mycalex machined to your specifications, and if you wish, complete with standard or special hardware of our own manufacture. Send us your inquiry attention department "O" today!

*Registered trade name of the Mycalex Corporation of America. Competitive materials available from several other manufacturers.

JOHNSON

a famous name in Radio

E. F. JOHNSON COMPANY
WASECA, MINNESOTA

A MARKET PICTURE FOR ADVERTISERS

Showing why

ELECTRONIC INDUSTRIES

restricts its 14,300 circulation on the basis of professional activity and buying power.

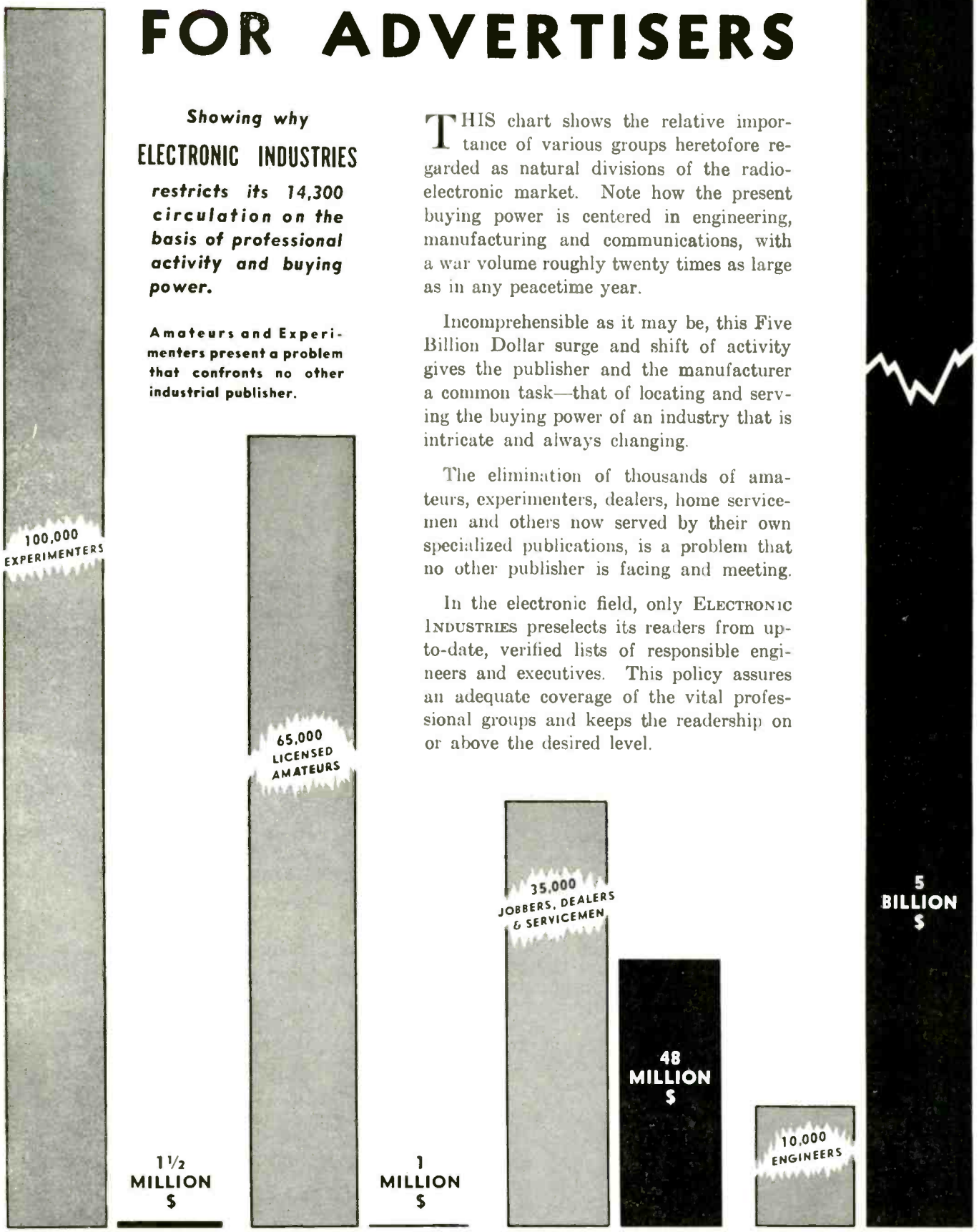
Amateurs and Experimenters present a problem that confronts no other industrial publisher.

THIS chart shows the relative importance of various groups heretofore regarded as natural divisions of the radio-electronic market. Note how the present buying power is centered in engineering, manufacturing and communications, with a war volume roughly twenty times as large as in any peacetime year.

Incomprehensible as it may be, this Five Billion Dollar surge and shift of activity gives the publisher and the manufacturer a common task—that of locating and serving the buying power of an industry that is intricate and always changing.

The elimination of thousands of amateurs, experimenters, dealers, home servicemen and others now served by their own specialized publications, is a problem that no other publisher is facing and meeting.

In the electronic field, only ELECTRONIC INDUSTRIES preselects its readers from up-to-date, verified lists of responsible engineers and executives. This policy assures an adequate coverage of the vital professional groups and keeps the readership on or above the desired level.



EXPERIMENTERS
Those who are not in war work or drafted are inactive because unable to buy necessary parts. This group is served by a "fan" magazine.

AMATEURS
Operation suspended for the duration. Purchases now at a minimum. This group is served by QST and other specialized publications.

THE TRADE GROUP
Present volume consists mainly of parts, tubes and service to homes and war plants. The primary market of RADIO RETAILING TODAY.

ELECTRONIC ENGINEERING, MFG. AND OPERATION
10,000 engineers in 3,000 factories and 3,000 communications services—the primary market of ELECTRONIC INDUSTRIES.

HORN-TOOTING

We have never boasted of our accomplishments. We knew we were doing a good job . . . our customers knew it, too.

The smaller, but paradoxically more publicized division of our organization, was devoted to the manufacture of **FEDERAL ENLARGERS** . . . precision optical and mechanical instruments for the photographic market. The major portion of Federal facilities has been serving the Signal Corps and leading radio equipment manufacturers for more than fifteen years.

Came Pearl Harbor . . . and our **entire** productive capacity immediately was placed at the disposal of the Armed Forces. With justifiable pride we can say that we were among the first to receive the coveted Army-Navy "E".

With production efficiently geared, we are now sufficiently far ahead of all current schedules to permit us to solicit additional contracts. We invite orders for the manufacture of large and small assemblies to precise tolerances . . . electrical and mechanical.

At this time, would an occasional "horn toot" be excusable?

★ ★ ★ ★ AWARDED TO FEDERAL MANUFACTURING & ENGINEERING CORP. FOR HIGH ACHIEVEMENT

FEDERAL

Electronics

Division of

FEDERAL MANUFACTURING AND ENGINEERING CORPORATION

Manufacturers of FEDERAL ENLARGERS

209 Steuben Street Brooklyn, New York

Components of Home Receivers Standardized

After careful study by the WPB Radio and Radar Division and the American Standards Association's civilian radio committee, the WPB has standardized several leading components of home-radio sets, to permit their manufacture to commence July 1 under conditions which will mean the minimum use of critical materials.

WPB Domestic Radio Chief Frank H. McIntosh was the prime moving factor in bringing about this standardization, but he has kept uppermost the aim of the WPB Division which is driven home by its Director Ray Ellis, that military requirements must be served first and that radar and radiocommunications equipment of the armed services must command the bulk of the manufacturing facilities.

Under the recent Limitation Order L-293, starting July 1 dry electrolytic and fixed paper-dielectric condensers and power and audio transformers and reactors will be produced under standards fixed by the order. The standard parts will carry brand names.

Tube shortages

At the same time, the WPB Radio and Radar Division has counteracted press reports about a famine in receiver tubes of home sets which Washington officials claim exists in shortages of only a few types, likely to be corrected within a few weeks. The shortages of tubes are now present in the types used in the cheaper sets and are low-profit items abandoned by manufacturers during the war, but are now going into production at WPB's suggestion. A review of the tube situation was held during the last week in May at a meeting of the Vacuum Tube Advisory Committee which also planned production for the remainder of 1943.

Zottu on HF Heating

"Operating on a principle entirely different from that employed in high-frequency induction heating, electrostatic heating has now paved the way for many new design possibilities," Paul D. Zottu, engineer of The Girdler Corp., Louisville, Ky., tells industrial readers of "Product Engineering."

In high-frequency induction heating, Zottu writes, the high-frequency magnetic field creates eddy currents in the metal being heated. The eddy currents are dissipated and converted into heat at or near the surface of the metal. High-frequency induction heating can be applied only to electrical conductors.

The limitations imposed by the impossibility of applying the necessary heat throughout thick sections of plastic or plywood materials are removed by high-frequency electrostatic heating.

The product being heated, which may be plywood, plastic molded parts, rayon filaments, or other non-conducting material, serves as the dielectric of a condenser. The electrodes of the condenser may be two conducting surfaces, one on either face of the material.

A voltage of some thousands at a frequency of 1,500,000 to 10,000,000 cycles is applied.

When power is applied the heat is generated as a result of the agitation of the molecules when subjected to the high-frequency field. One explanation is that the effect of the high frequency is such as to make the molecules repeatedly change their shape.

Because the material is heated uniformly throughout, practically any thicknesses of laminated plywood can be made and all of the glue layers will be cured uniformly.

This process is not limited to the molding of parts such as boards and slabs having plane surfaces.

Others include propellers, keels for boats, thick sections of high density masonite and similar material bonded with phenolic resin. Waste fibres from rope factories are impregnated with phenolic resin and subjected to heat and pressure to form slabs, a six inch layer of fibre being reduced to a half-inch thickness. Cork granules mixed with urea or phenol resin are pressed and heated by this process to form

cork boards of unusual strength, heat resistance, heat insulation. They are unaffected by moisture.

A table of materials that could be heated by electrostatic heating would include all types of cellulose, paper, textiles, powders, felts, leather, wools and cottons, ceramic clays, oxides, tobacco, rubber, celluloid, glass, fibre glass and granulated cork. Undoubtedly, there are many further applications which have not yet been investigated.

Dr. Slack's Lenard-Ray Tube

Dr. Charles M. Slack, noted research physicist, has been appointed assistant director of research at the Westinghouse Lamp Division, Bloomfield, N. J. Dr. Slack is well known in the field of electronic research and for his contributions to the development of an ultra high-speed X-ray machine that is making possible the wartime studies of bullets as they crash through armor plate. In his new position as assistant to Dr. Harvey C. Rentschler, research director, Dr. Slack will direct experimental work on various lamp and electronic problems.

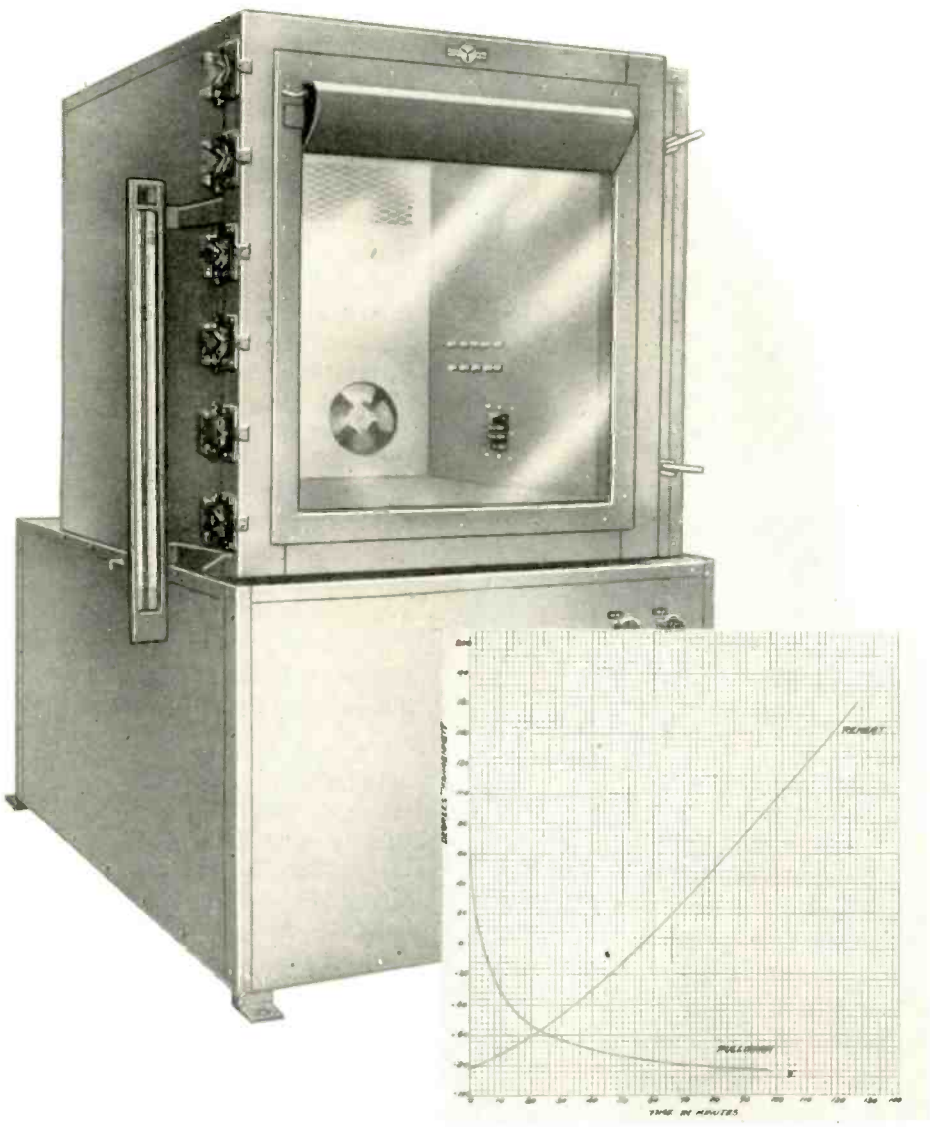
Dr. Slack's Lenard-Ray tube is the most practical tube known to science which allows a stream of electrons traveling at nearly the speed of light to shoot out into the air. Once passed into the atmosphere through a glass "window" as thin as a soap bubble, the electrons can be used to treat local skin infections by instantly killing living cells, whereas X-rays may require minutes to do the same job. The Lenard Ray tube also makes possible for experimental purposes the turning of certain oils into solids or reforming the crystal structure of table salt. Another weapon to be used against skin disease is a new tube which provides "soft X-rays" that penetrate only a thin surface of the skin.

Signal Corps Gets "Carrier" Cable System

To aid the Army Signal Corps in establishing communications wire lines to advance combat posts in minimum time, the Western Electric Co. and the Bell Telephone Laboratories have developed and made available a new communications system known as "Spiral-4."

EXPERTS . . . REFUSE TO BE STUMPED

When a possibility seems an improbability, call in a MOBILE engineer. Over the wide range of requirements for high altitude test and calibration chambers, our men have overcome many of the difficulties which gave instrument manufacturers a headache. Unusual specifications have been successfully met, production test times substantially lowered, greater efficiency effected. All MOBILE units incorporate positive means of refrigeration and control, with an indicating recording controller. Wherever standard models are not suitable, we will build to individual needs.



☆

HIGH ALTITUDE DEVELOPMENT CHAMBERS

Temperature: —125° F. to +180° F., accuracy ±2° F. of setting.

Vacuum: to .15" Hg absolute.

Time: complete cycle within 90 minutes.

Size: minimum of 12" x 12" x 12", to any greater capacity.

Humidity: 20% to 95% R. H. manual or automatic control.

☆

COLD CHAMBERS

Specifications are identical with those listed above for altitude chambers, except that cold chambers have no vacuum provision.

☆

HOT AND COLD BATH CALIBRATION STANDS

Temperature: —85° F. to +600° F.

Control: constant temperature control ±1° F.

Size: 1 pint to 50 gallons; also available with multiple vat units.

Automatic mechanical refrigeration (no dry ice).

☆

FLIGHT CHAMBERS

Temperature: to —100 F. or without refrigeration.

Vacuum: to 80,000 ft. with automatic control of temperature compared to pressure for dive and climb similitude.

Size: 6' x 4' x 4' to as large as 10' x 10' x 50'.

Humidity: manual or automatic control in range between 20% and 95% R. H.

☆

ACCESSORY INSTRUMENTS

Special Recording Pyrometers
Manometers and Altimeters
Vertical Speed Indicators
Oximeters
Instrument panels and switchboards

May we work with you?

MOBILE REFRIGERATION, INC.

630 FIFTH AVENUE NEW YORK, N. Y.

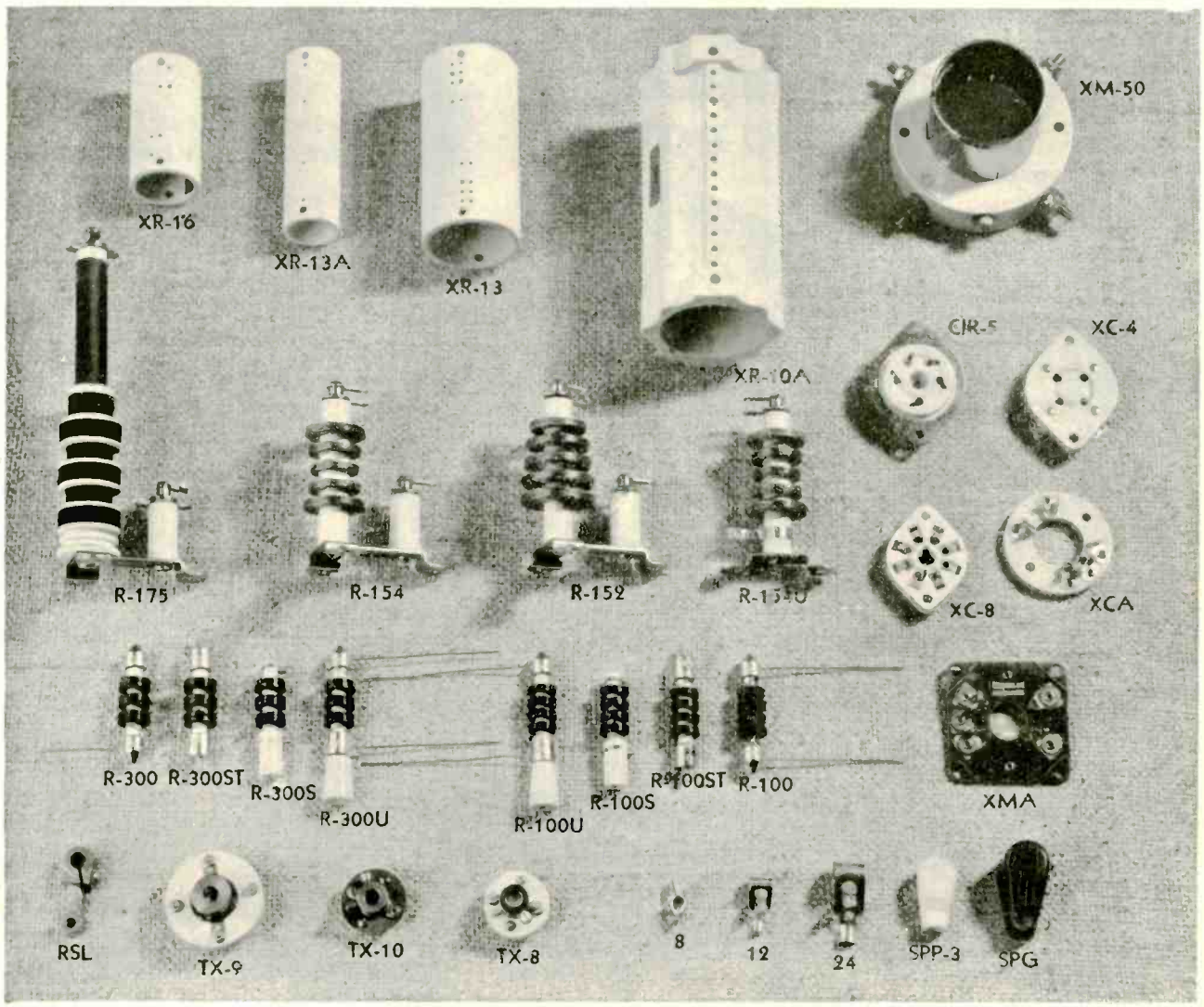
The basic idea behind the Spiral-4 is borrowed from "carrier" telephony, by which several long-distance messages can be transmitted simultaneously over a set of conductors. The Spiral-4 system provides three telephone and four telegraph circuits over a single rubber-covered cable about the thickness of a lead pencil. The cable contains four spiralling wires — hence the name. It is made in quarter-mile lengths, the ends of which are fitted with weather-proof connectors, and each length may be snapped to a companion section as rapidly as the cable can be payed out by a moving Army truck. Distances up to 150 miles may be spanned with intermediate amplifiers spaced along the way to compensate for loss in the strength of the current.

The seven telephone and telegraph messages cannot be piped directly into the cable, because if this were done they would be hopelessly mixed and garbled. An electronic instrument at either end of the line generates "carrier" currents to guide the signal into its own pair of telephone wires. Unless equipped with a highly-complex device of special design an enemy cannot tap the Spiral-4 ahead of the terminal point and if he did so would only get an unintelligible mixture of squeaks and squeals.

GE's 18 Industrial Electronic Specialists

To help industry with electronic application problems, eighteen General Electric industrial electronic specialists in G-E offices throughout the country have been appointed, according to an announcement by J. E. N. Hume, commercial vice-president of the company. These specialists will be responsible for all industrial electronic applications in their territories.

The new General Electric industrial electronic specialists include: I. C. Diefenderfer and D. C. Hierath, New York City; J. F. Getz, Philadelphia; A. J. Moore, Boston; W. B. Frackelton, Chicago; L. E. Donahue, Los Angeles; J. A. Setter, Denver; I. F. Conrad, St. Louis; A. D. Boardman, San Francisco; L. B. Parsell, Detroit; L. R. Elder, Portland, Oregon; Frank C. Neal, Jr., Dallas; R. H. Jackson, Atlanta; K.



AVAILABLE FOR REASONABLY PROMPT DELIVERY

Enlarged manufacturing facilities have enabled National to offer reasonably prompt delivery on many small parts to those who have the necessary priorities. The sockets, coil forms, RF chokes, grid grips, couplings and rotor shaft locks shown in the photograph above are available on especially good delivery schedules, and in the case of a few items, limited quantities may even be shipped from stock.

NATIONAL COMPANY, INC. MALDEN, MASS.

H. Keller, Cleveland; R. C. Norris, Cincinnati; A. M. Dawson, Pittsburgh; B. Cogswell, Buffalo; L. F. Stone, Newark, N. J.

Oxford-Tartak Elects Two Vice-Presidents

Paul H. Tartak, president of Oxford-Tartak Radio Corp., 3911-3929 South Michigan Ave., Chicago, Ill., announced the election of Alexander M. Arnt and Karl A. Kopetzky as vice-presidents.

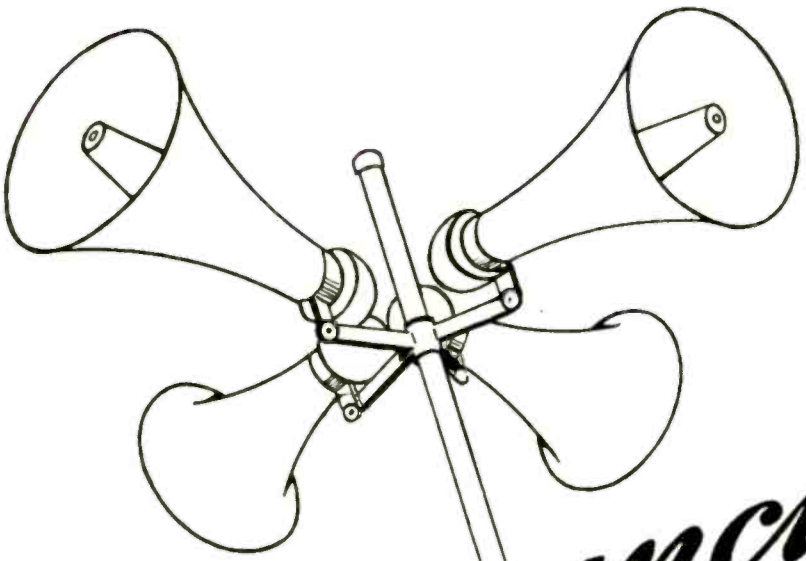
Mr. Arnt is in charge of production, while Mr. Kopetzky, besides continuing his executive duties, will take charge of electronic developments occasioned by the firm's war conversion and expansion.

Craven Heads International BC Committee

The Board of War Communications has approved the establishment of the International Broadcasting Coordinating Committee, composed entirely of government representatives and headed by FCC Commissioner T. A. M. Craven, which will advise the Board through the latter's Coordinating Committee in that field.

Besides Commissioner Craven, the other members of the Committee are Brigadier General Frank E. Stoner, Chief of the Signal Corps Operating Services, for the Army; Lieutenant Commander A. B. Chamberlain, former CBS Chief Engineer of the Radio Division of he Bureau of Ships for the Navy; Roy C. Corderman, Assistant Chief of the OWI Overseas Branch's Bureau of Communications Facilities, for the OWI and CIAA; and Frank H. McIntosh, Assistant to the Director of the WPB Radio Division, for WPB. Philip F. Siling, chief of the FCC International Division, is secretary of the committee and is alternate on the committee for Commander Craven, both as representatives of the FCC.

The duties of the new committee include the study of methods of making available necessary physical equipment to provide adequate international broadcasting service for psychological warfare purposes. The committee, holding the requirements of the military services as primary consideration, will consider the problem of manufacturing new shortwave broadcasting equipment



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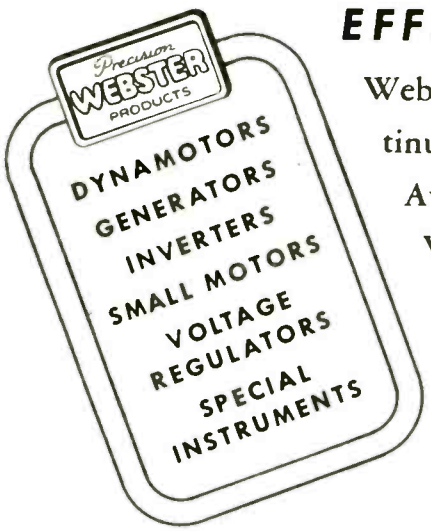

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as compared with the practicability of diverting required equipment from other sources and services. It will be charged with making recommendations desirable in light of the successful prosecution of the war to the BWC.

Philco Sales Chiefly Radar

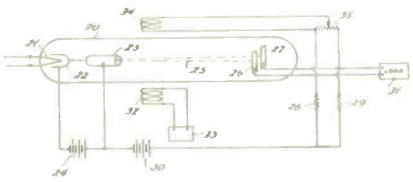
Net income of Philco Corporation in the first quarter of 1943, after estimated Federal and State income and excess profits taxes, amounted to $770,890, or 56 cents per share of common stock, of which $178,000, or 13 cents per share is the post-war refund provided for by the revenue act of 1942, John Ballantyne, president, announces.

"Sales of Philco Corporation, consisting principally of radar equipment, in the first quarter of 1943 were substantially ahead of the same period last year," Mr. Ballantyne said. "Present indications are that production and sales will increase further in coming months as engineering work is completed on additional new equipment for the Army and Navy."

NEW PATENTS

(*Continued from page* 112)

Translating Device — Magnetic deflection coil 32 is energized by the signal current and deflects electron beam 25 so that a change in the number of electrons impinging on plates 26 and 27 results. An oppositely directed magnetic field is established by deflection coil 34, energized by the output current. In case a steady signal current is supplied to coil 32, the beam 25 will assume a position in which the deflecting actions of coils 32 and 34 are in a state of equilibrium and, under this



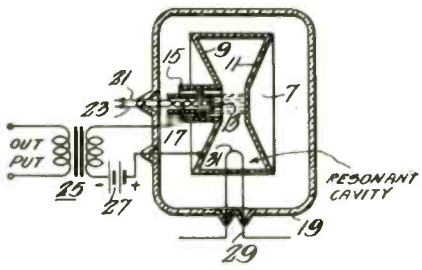
condition, the potential difference existing between plates 26 and 27 will be directly proportional to the signal. With this arrangement, no variation from the controlled means is reflected back into the signal source and comparative independence of any change in the components of the device are obtained. Other deflecting means

may be used. H. Ziebolz, Electronbeam, Inc., (F) Nov. 4, 1941, (I) March 16, 1943, No. 2,314,302.

Volume Control—At the transmitter, volume control signals are obtained by rectifying and frequency modulating a wave of about 40 cycles, which modulated wave is transmitted together with the signal. The transmitted signal percentage modulation is held substantially constant. At the receiver, the two different intelligences are separated and detected, and the volume control signal is used to control the amplitude of the other signal. M. Katzin, RCA, (F) March 7, 1941, (I) March 23, 1943, No. 2,314,707.

UHF Wattmeter—The wattmeter is designed to measure uhf power applied to a load without absorbing an appreciable amount of power. It consists of transmission lines of such lengths and so connected as to provide two currents, one proportional to the voltage across the line under investigation and the other current proportional to the current in the line. By a special arrangement of two thermocouples and a micro-ammeter, the product of the two derived currents is determined. G. H. Brown, RCA, (F) April 26, 1941, (I) March 23, 1943, No. 2,314,764.

Resonant Chamber—The electron emission of the cathode is controlled directly. A detector is claimed, the cathode 13 of which is capacitively coupled to walls 9 of the resonant cavity by means of sleeves 15 and 17, and the emitting surface of the cathode is so mounted that it is directly affected by the standing waves. In the embodiment



shown, the cavity electrode is maintained at a positive potential and serves as anode. Distance between cathode and effective anode must be such that the electron transit time is less than a half period. E. G. Linder, RCA, (F) June 25, 1940, (I) March 23, 1943, No. 2,314,794.

Radio Range—The device is intended for identification of the courses and quadrants of a four-

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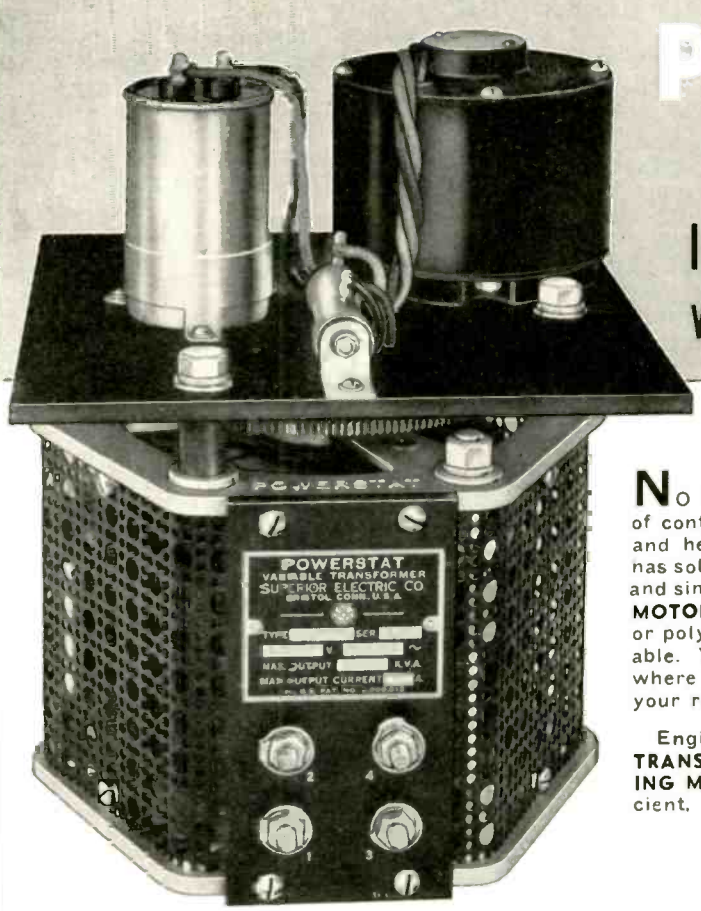

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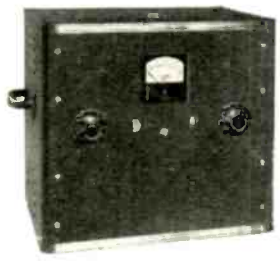

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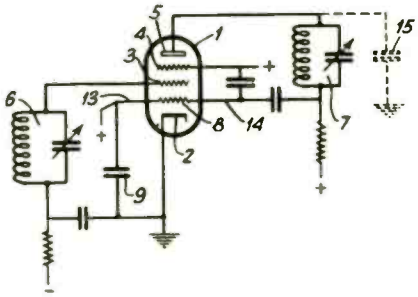
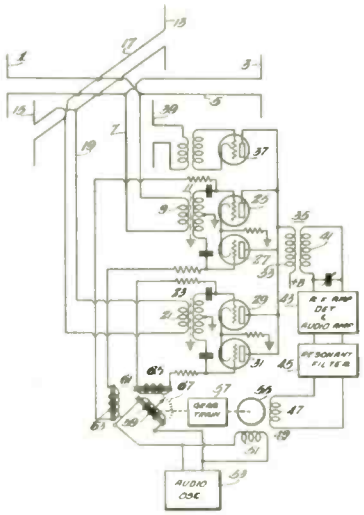
course radio range. For this purpose a reference phase or tone is transmitted from the range and applied to indicate the course or quadrant in which the receiver is operated. D. G. C. Luck, RCA, (F) May 5, 1939, (I) March 23, 1943, No. 2,314,795.

UHF Amplifier and Frequency Converter—To reduce conductor damping and transit-time damping in a uhf tube, space charge or suction grid 8 having a positive potential is provided intermediate control grid 3 and cathode 2. To further decrease the input damping, suction grid 8 is connected to cathode 2 and control grid 3 for high frequencies by means of condenser 9,



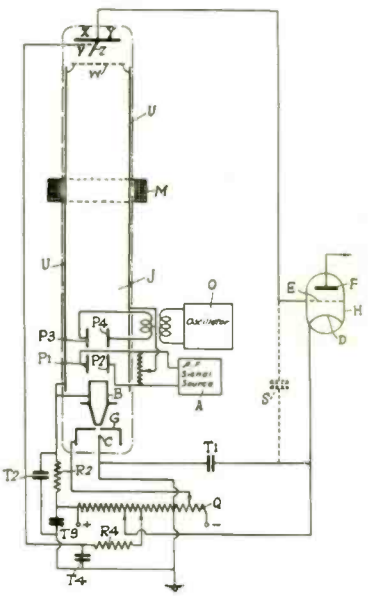
and to the output electrode via lead 14. In a preferred embodiment, cathode 2 is connected to the anode side of suction grid 8 instead of to its control grid side. G. H. P. Alma, M. J. O. Strutt and A. van der Ziel, Alien Property Custodian, (F) May 9, 1941, (I) March 30, 1943, No. 2,314,916.

Self-Orienting Direction Finder—If the movable coil 59 is inducing equal audio currents in the fixed coils 63, 65 and if antennas 1, 3 and 13, 15 are receiving waves of equal strength, the modulation signals applied to the received waves will be equal and opposite, and will therefore balance out leaving only the carrier component in receiver 43. Rotor 55 of the motor will not move. If the received waves do not apply equal currents to the antennas, unequally modulated components will modulate the carrier and will be applied to the receiver which, upon demodulation, will cause rotation of rotor 55 until equal and opposite modulation components are produced in the pairs of balanced modulators 25, 27 and 29, 31. The bearing of the waves will be indicated by pointer 67. V. D. Landon, RCA, (F) June 28, 1940, (I) March 16, 1943, No. 2,314,093.

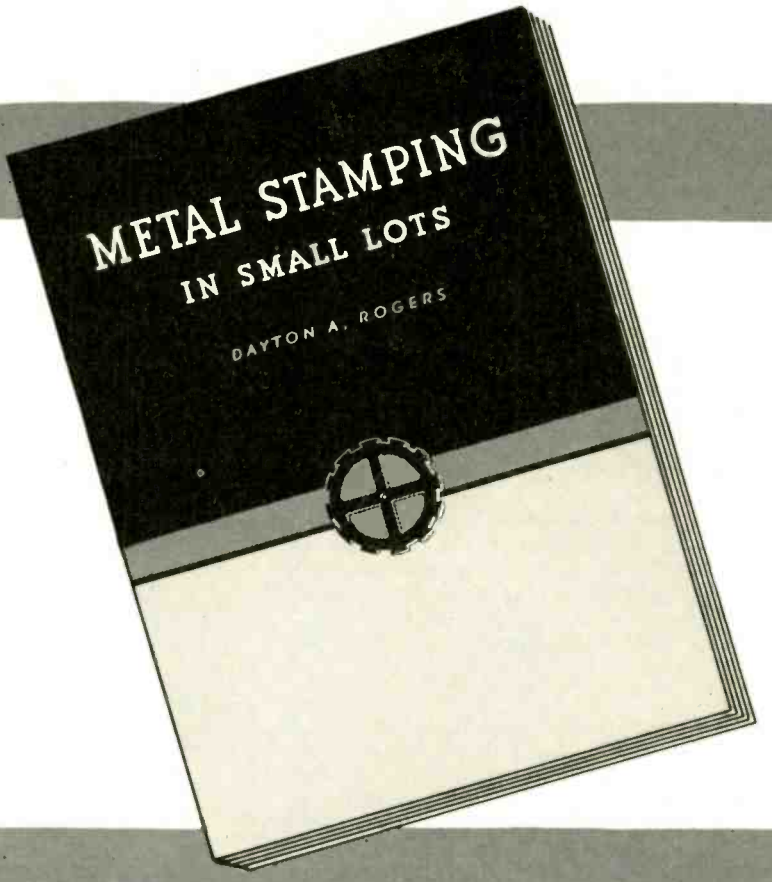


Rotating Saw-Tooth Wave Pattern—The plane of deflection of a cathode ray beam is rotated about the axis of the tube by impressing upon each of the beam deflecting means a saw-tooth wave signal whose amplitude varies sinusoidally and wherein the sinusoidal variations on each of the beam deflecting means differ in phase by 90 degrees. A particular arrangement to realize the deflecting voltages is described. W. J. Poch, RCA, (F) March 31, 1941, (I) March 16, 1943, No. 2,313,966.

Deflection-Method Amplifier—Parts X, Y and Z of the output anode have a secondary electron emission coefficient greater than unity. Secondary electrons emitted by parts Y, Z are collected by electrode W, kept at a high potential, so that the potential of the output electrode rises if electrons impinge



on these parts. The secondary electrons from part X, however, are prevented from leaving the output electrode by electrode V, kept at a low potential. The electron beam is focussed at the tip of member Z. A constant input carrier voltage variation of frequency higher than



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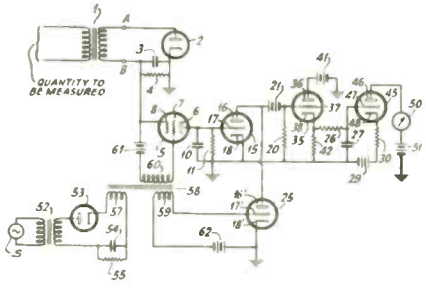
any frequency in the signal which requires amplification is generated by oscillator O and applied to deflection plates P3 and P4. An alternating current potential is thereby impressed on the output electrode, which is modulated by deflecting the mean position of the electron beam across the output electrode by means of signal voltages applied to plates P1 and P2. Several ways of obtaining different rate of charging of the two parts of the output electrode are described, as well as various methods of modulating deflection or intensity of the beam. P. Nagy and M. J. Goddard, (F) July 24, 1941, (I) March 16, 1943, No. 2,313,886.

Crystal-Coupled Antenna — The four electrodes of a crystal in an oscillator are connected to grid, plate and, two of them, to the antenna. G. Usselman, RCA, (F) Feb. 8, 1941, (I) March 16, 1943, No. 2,313,850.

Logarithmic Instrument — It is frequently desired to register the logarithm of a quantity as a function of time. This is obtained by charging condenser 10 for a brief interval of time with a current proportional to the quantity to be measured, and allowing the charge



to be dissipated through constant resistor 11, which discharge is a logarithmic function of time. When the voltage on condenser 10 has dropped to a predetermined value, tube 15 starts to conduct, causing a voltage drop in resistor 20 which cuts off tube 34. It will be seen that only during the period in which condenser 10 is discharging until the beginning of operation of tube 15, tube 35 draws a fixed amount of current through resistance 42. Network 26, 27 provides a relatively steady average voltage across condenser 27 which is proportional to the above period of time. H. O. Peterson, RCA, (F) Jan. 26, 1940, (I) March 9, 1943, No. 2,313,666.

Facsimile Modulator—The output of the photo-electric cell is applied to the grid of a tube, causing variations in its plate resistance. The steady component of plate resistance is balanced by the con-

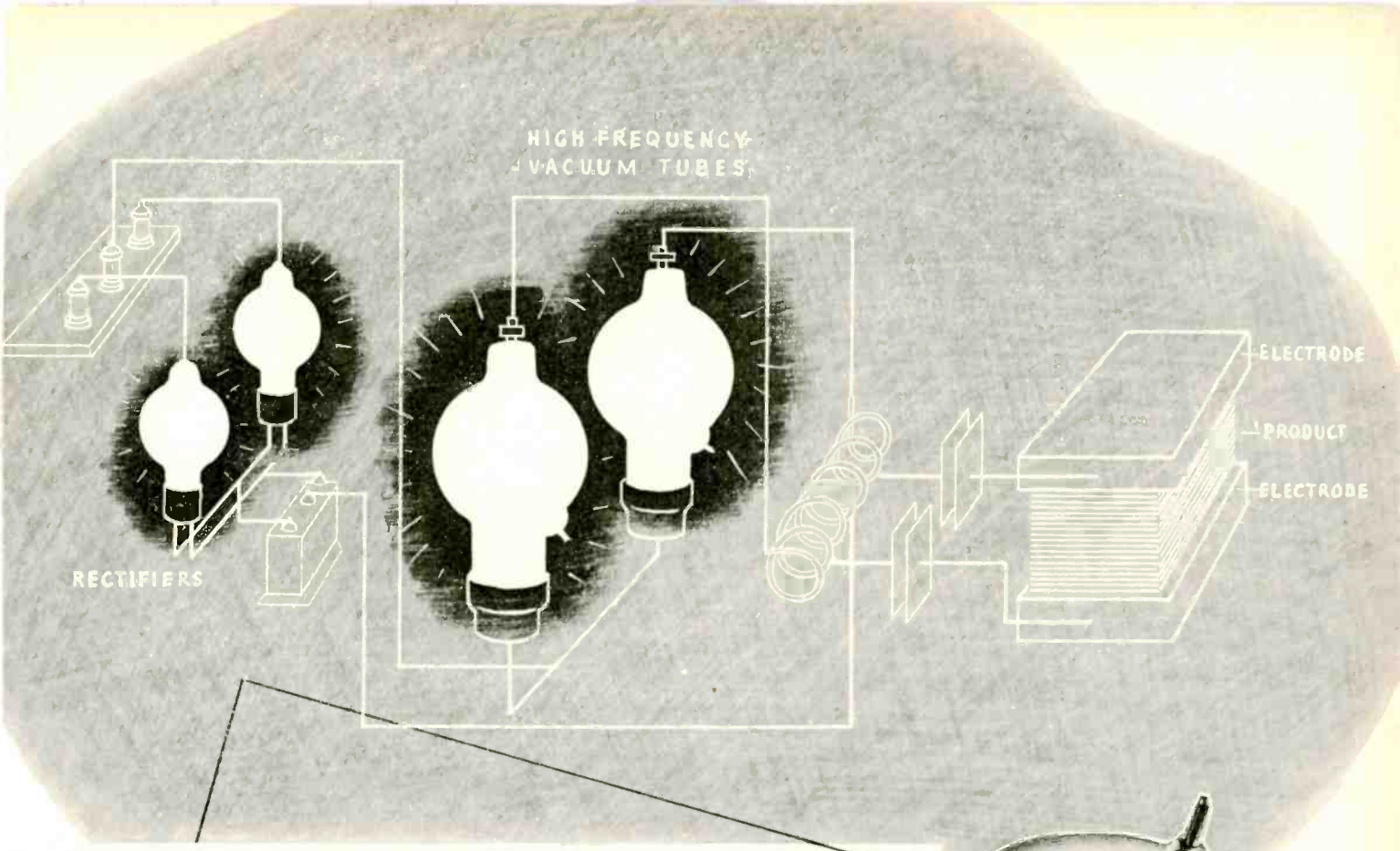
trolled plate resistance of a second and similar tube. The sub-carrier to be modulated is fed into a balanced rectifier circuit and the modulation accomplished by unbalance between the tubes connected to two points in the circuit. Balance may be produced for white or black subject matter or at any intermediate point. H. C. Ressler, Faximile, Inc., (F) Sept. 14, 1940, (I) March 9, 1943, No. 2,313,583.

Dipole Antenna—The antenna consists of conductive parts so arranged as to strengthen the structure and at the same time provide the required electrical characteristics. G. H. Brown, RCA, (F) Jan. 31, 1942, (I) March 9, 1943, No. 2,313,513.

Directional Receiver—Two loop antennas are mounted at right angles to one another and their output is fed to the grid of two tubes, respectively, the arrangement constituting two identical directional receiving stages. Both tubes are coupled to the same point in the receiver circuit. The biases of the tubes are continually adjustable, and the control is such that if one tube is biased to cut-off the other tube is at maximum output and vice versa. Intermediate positions allow both tubes to work at complementing amplification. Thus a continuously varying directional characteristic is obtained without the necessity for turning a loop. H. C. Forbes, Colonial Radio Corp., (F) Sept. 24, 1941, (I) March 9, 1943, No. 2,313,231.

Variable Selectivity Circuit—The circuit is intended for an intermediate frequency stage and comprises a crystal bridge network. The input and output impedance for the crystal may be adjusted by variable resistors, whereby the degree of selectivity of the network can be controlled between relatively wide limits. L. E. Thompson, RCA, (F) April 30, 1941, (I) March 9, 1943, No. 2,313,182.

Oscillator—It is intended to prevent coupling due to the feedback connection of the plate circuit to the grid or oscillating circuit, because this coupling may result in change of oscillator frequency upon variations in the reactance of the output circuit. This object is accomplished by using a multi-grid tube V and obtaining feedback from grid 2, thus avoiding any substantial coupling between output circuit 9, 10 and frequency-determining circuit 5, 6. The voltages on grids 1 and 2 are 180 deg. out of phase, and to prevent one grid from inducing voltages on the plate, neu-



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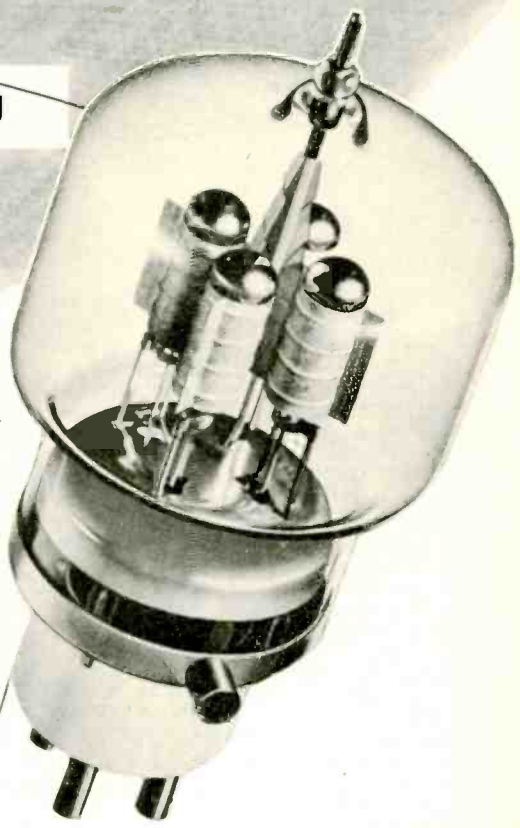

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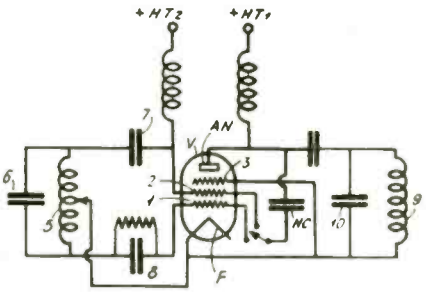
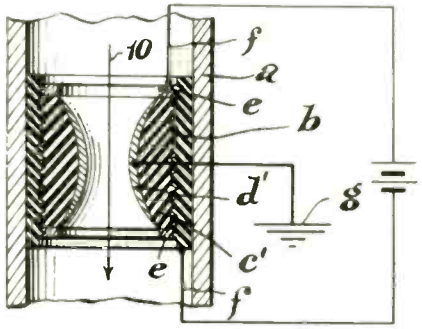


tralizing capacity NC may be inserted. The oscillations generated may be modulated by applying potentials to grid 1, grid 2 or to plate AN. Alan D'Arcy Hodgson, RCA, (F) Oct. 10, 1931, (I) March 9, 1943, No. 2,313,071.

Electron Tube—The electron tube is intended for short wave amplification and consists of a pentode combined with a resonant chamber in one unit. H. Berger et al, Alien Property Custodian, (F) Oct. 23, 1940, (I) March 2, 1943, No. 2,313,008.

Electrostatic Electron Lens—The inner periphery of bushing c' is coated with a conducting varnish d' having a relatively high resistance. Voltage is supplied through wires f and rings e, and a continuously varying potential in the



varnish is obtained. 10 indicates the electron path. Bushing c' and coating d' may be of suitable shape and thickness to provide a desired electric field. F. Krause, Alien Property Custodian, (F) Dec. 2, 1940, (I) March 2, 1943, No. 2,313,018.

Oversea Communication Method—Fading and distortion effects increase with modulation frequency, due to the increase in time delay for different paths at higher frequencies. Taking advantage of this fact, the program is first recorded, the record reproduced at reduced speed and transmitted by frequency or phase modulation. The total modulation frequency band will thus be reduced; a ratio of one to ten is proposed. Carrier wavelengths from 10 to 200

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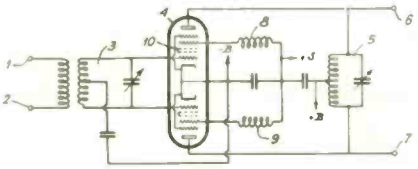
meters may be used. The received signals are again recorded, reproduced at greater speed, and transmitted by a conventional broadcasting station. C. W. Hansell, RCA, (F) March 4, 1941, (I) March 2, 1943, No. 2,312,835.

Aircraft Landing Receiver—The receiver affords indication of glide path, runway course, and heading of the aircraft with respect to the runway. For the last indication, a directional antenna output is combined with the non-directional antenna output actuating the other two instruments. D. S. Bond, RCA, (F) April 12, 1939, (I) March 2, 1943, No. 2,312,747.

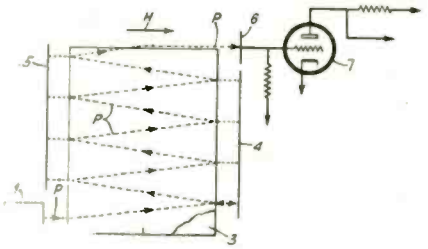
UHF Amplifier—In the circuit shown, which was claimed in a previous application, inductances 8 and 9 are so proportioned—of the order of 10^{-7} henries—that the input-damping of tube 4 is zero or negative so that circuit 3 is not damped or even undamped by the tube. In this arrangement, the signal current to distribution—noise current ratio in the plate circuit is



very unfavorable. According to the invention this drawback is obviated by connecting the plate of each of the amplifying systems through the corresponding part of the output impedance for high frequencies 5 either to the respective screen-grid or to a point of inductances 8 and 9, respectively. An explanation of the effect is given by considering phase shifts and compensations in screen-grid and plate circuits. A. Ziel et al, Alien Property Custodian, (F) May 9, 1941, (I) March 2, 1943, No. 2,312,510.

Polarized-Carrier Transmission—Two modulated carrier waves having the same frequency but different direction of polarization are transmitted. The two waves being in phase quadrature relation, a circular or elliptic wave results, which is received by a rod antenna at any angular position of the latter with respect to the directions of polarization. To avoid interference with another plane polarized wave, the receiving antenna is adjusted until its axis is perpendicular to the plane of polarization of the interfering wave. Alternatively, the relative phase of the two polarized carriers may be changed for modulating purposes. Suitable circuits for telegraphic transmission and reception of these signals are described. J. H. Hammond, RCA, (F) March 27, 1941, (I) Feb. 23, 1943, No. 2,312,093.

Delayed Discharge—The device shown, which is arranged in a vacuum, comprises electron gun 1, deflecting electrodes 2, 3, reflecting

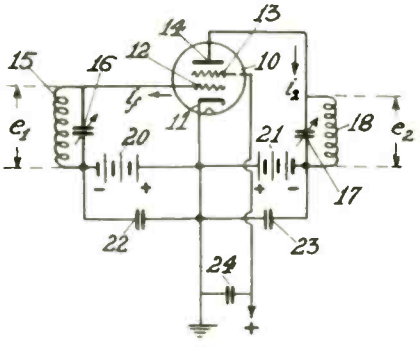


electrodes 4, 5 and collecting plate 6. A uniform magnetic field having a direction indicated by arrow H is provided. Under these circumstances, the electrons move along track P and a time delay dependent on the potential difference between deflecting electrodes 2, 3 is obtained. It is possible, with the device, to mix signals with varying time delay. G. S. P. Freeman, Electric & Musical Industries, Ltd., (F) July 5, 1941, (I) Feb. 23, 1943, No. 2,312,033.

X-Ray Tube—The tube is designed for high voltage and high current operation. An auxiliary electrode, besides cathode and anode, is pro-

vided in close proximity to the cathode. A circuit for the tube is also described. C. N. Slack, Westinghouse Electric & Mfg. Co., (F) May 25, 1940, (I) Feb. 23, 1943, No. 2,311,705.

Space-Charge Oscillator — Potential e_1 will cause the electron stream to screen grid 13 to be modulated. Most of these electrons will pass through the meshes of the accelerating grid 13 and form a space charge in front of decelerating plate 14. Fluctuations of density of this space charge will induce a displacement current in plate 14, having a 90 deg. phase shift with respect to voltage e_1. Circuit 17, 18 being tuned to the input frequency, a voltage 90 deg. out of phase with e_1 will be developed in the plate circuit. The relationship between grid 12 and plate 14 may be reversed, and a voltage e_2 will establish a voltage in the grid circuit due to a second space charge set up in the vicinity of control grid 12 by the electrons after having been repelled and passing the positive grid in inverse sense. However, the phase shift will be 90 deg. in the opposite direction, and, provided circuits 15, 16 and 17, 18 are tuned to the same frequency, positive feedback will result. In this way oscillations may be generated by space charge coupling. No current is drawn by electrodes 12 and 14. It is shown that the frequency of the oscillator may be controlled by varying the bias potential of either electrode 12 or



14, or, under certain provisions, by modulating the screen grid voltage. Various applications of this principle to beat-frequency oscillators, superheterodyne receivers and transmitters are described. H. M. Bach, Patents Research Corp., (F) Aug. 22, 1940, (I) Feb. 23, 1943, No. 2,311,631.

Antenna Coil Arrangement—It is sometimes convenient to locate the antenna coil or coils at a place distant from their electric connection to the antenna. The series impedance may be located at the most suitable place if it is electrically connected to the desired point of the antenna lead by a rf two-wire

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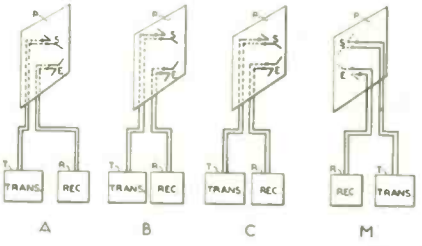
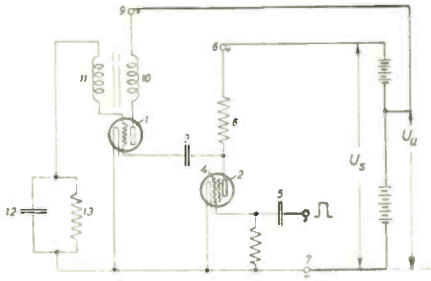
line within the hollow antenna lead. One conductor of the two-wire line may consist of the antenna lead itself. Several inductances may be connected at different points by a corresponding number of lines. The change in reactance by the addition of the line to the coil used must be taken into account when dimensioning the coil. The parts of the antenna are attached to one another by short lengths of insulators. H. O. Roosenstein, Alien Property Custodian, (F) June 4, 1941, (I) Feb. 16, 1943, No. 2,311,472.

Two-Way Communication — The transmitting antennas S of the satellite stations A, B and C and the receiving antenna E of the master station M are arranged in parallel planes, and so are the receiving antennas E of the satellite stations and the transmitting antennas of the master station. The two sets of planes are at right angles to one another, and present a slope of 45° or 135° with the horizontal. In this way, the master station may communicate with any of the satellites. For stations A and B to communicate with one another, it is only necessary for station B to rotate its antennas 180° about a vertical axis. E. Gerhard, Alien Property Custodian, (F) May 31, 1941, (I) Feb. 16, 1943, No. 2,311,435.



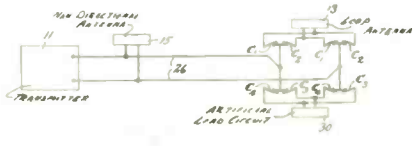
Sound Records—A sound record for direct reproduction is produced in the recording apparatus, no negative being required. Use is made of a recently developed film which possesses high resolving power and comparatively few transparent spots. The records are of the variable area type, and are produced by vibrating suitably shaped light beams in accordance with modulation signals and noise reduction signals, respectively. Upon passage through a slit, the light signals are recorded. In this way, it is possible to record the noise production signal on the film at a position in advance of the modulation signal and avoid clipping of the modulation signal peaks. The method is parparticularly recommended for re-recording, and this type device is shown. G. L. Dimmick, RCA, (F) Oct. 9, 1937, (I) Feb. 16, 1943, No. 2,311,159.



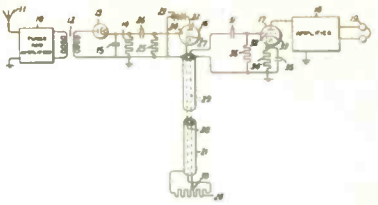
Saw-Tooth Generator—As will be seen from the drawing, the voltage Us applied to condenser 3 is higher than plate voltage Uu of generator tube 1. By this provision a high negative grid-potential is obtained, blocking the generator tube immediately upon discharge of condenser 3 through synchronizing tube 2, and correct synchronization is effected. H. Baehring et al, Alien Property Custodian, (F) March 20, (I) Feb. 2, 1943, No. 2,310,198.

Electronic Beacon Modulator—Ordinarily, electronic modulation of a beacon is objectionable because of the varying intensity caused by partial failure of a modulator. This disadvantage is overcome by means of a bridge network so connected that, upon any change in signal strength, both antennas will radiate the same amount of energy. Thus, a change in signal amplitude causes a decrease in signal strength and a broadening of the course line, but no shifting of the guiding course occurs. A. Alford, Federal Telephone & Radio Corp., (F) March 1, 1941, (I) Feb. 9, 1943, No. 2,310,202.

Load Compensation—During transmission of a directional radio beacon, a change in load of line 26 is caused by the coupling and decoupling of condensers C_1, C_2 effecting the phase shift. This change in load affects the intensity of the signal emitted by the nondirectional antenna 15 and thus impairs comparison of the two signals. According to the invention, an artificial load circuit 30 is connected to line 26 in such a way as to keep the load constant. Specially designed condensers are used. A. H. Hermansson, Aga-Baltic Radio Akt., (F) Dec. 11, 1940, (I) Feb. 2, 1943, No. 2,310,079.

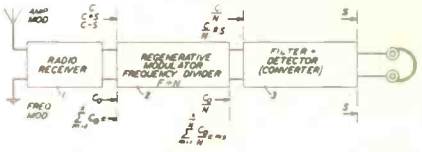


Attenuation Equalizer—The reactance of the shielded cable connecting voltage divider 20 with the amplifier introduces distortion. To compensate for the frequency de-



pendence of attenuation in the cable, tube 16 is connected to act as degenerative amplifier. The degenerative voltage is derived from resistor 20 and coupled through the cable. Upon reduction of output voltage due to higher frequency and consequent lower capacitive impedance of the cable, the degenerative voltage also will be reduced, causing increased amplification and, thus, effecting the desired compensation. J. E. Maynard, General Electric Co., (F) Jan. 17, 1941, (I) Feb. 2, 1943, No. 2,310,198.

Frequency Dividing Receiver— In case of amplitude modulation, indicated in the figure by the row of symbols above the boxes, a regenerative modulator type frequency divider produces an output the carrier frequency of which is an exact submultiple of the original carrier, the spacing between side frequencies and carrier in frequency is preserved and the relative amplitudes of side frequencies and carrier are preserved. For frequency modulation, indicated by the row of symbols below the boxes, the instantaneous frequency being divided, a lower mean frequency as well as lower side band frequencies result and a narrower band width is obtained. It may be converted by a circuit of half the range than



would be required for the original wave. If overloaded, the regenerative modulator will also act as limiter. It is claimed that, by the use of a regenerative modulator frequency divider with frequency modulation, an unwanted component of at least two decibels less than the wanted component may be suppressed, even though both components may change in frequency so that it would be impossible to separate them by filtering. According to the invention the unwanted component will constitute a modulation of the wanted component and will maintain the original frequency spacing while the band of the wanted component will have shrunk. R. L. Miller, Bell Telephone Labs., (F) April 24, 1941, (I) Feb. 2, 1943, No. 2,309,705.

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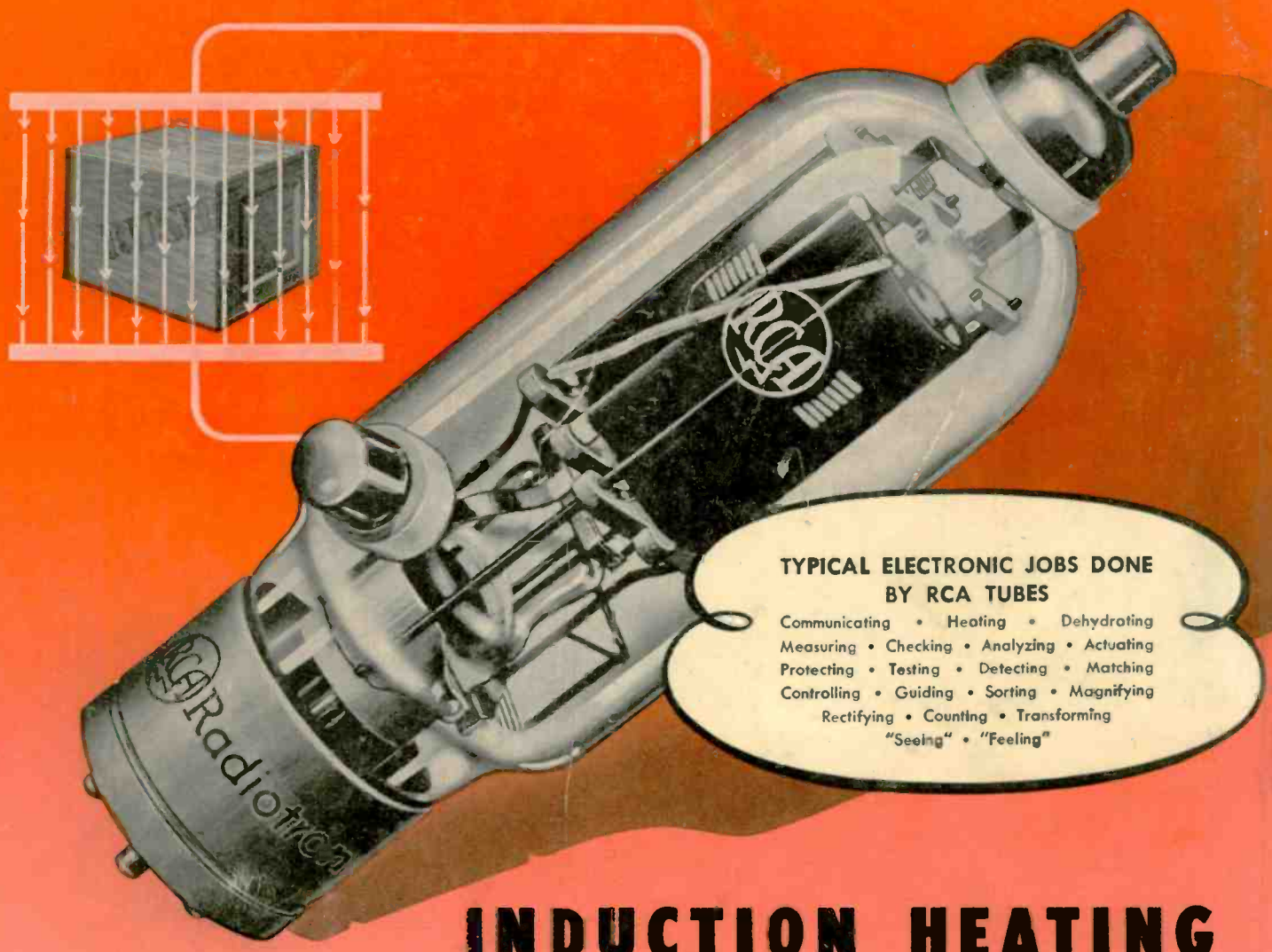

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