ELECTRONIC INDUSTRIES

★ New Type Military Noise Attenuating Microphone

★ IRE-RMA Rochester Meeting Report ★ FM in Industry

★ 50-Kw Radio Rio ★ Principles of Electronic Heating

DECEMBER

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.

For Hurry-Up Calls on Essential Electronic Parts Try the Mallory Distributor

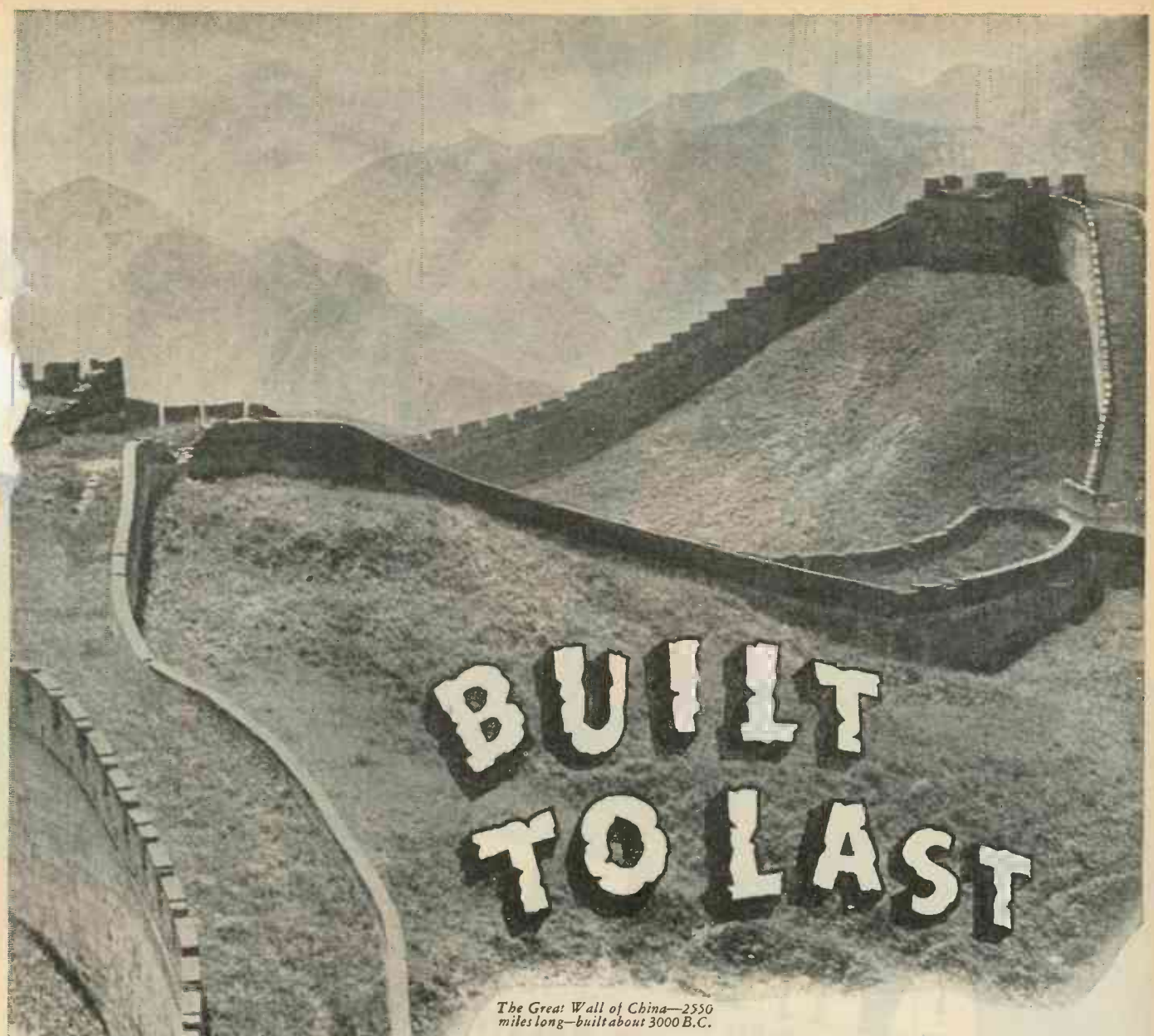
He is doing a good job—especially on small orders (proper allocations, of course) for parts needed in jig time. Like as not, he can provide the right part out of stock, when a call to the factory might mean interminable delay.

Such was the experience of the American Association of Railroads when installing an anti-sabotage alarm for a bridge in the southwestern desert. Suddenly the need developed for a number of Mallory rectifiers . . . needed quickly, too. Where to turn? Somebody thought of the local Mallory distributor. He furnished them on the spot—out of stock.

We could cite dozens of experiences like that—need for a small quantity of essential parts, lack of which would cause disastrous delay. Many anti-sabotage devices employ Mallory Precision Electronic Products . . . from simple burglar alarms that announce intruders as they break into an invisible light ray, up to apparatus powerful enough to guard 2000 feet of industrial fence at a crack.

If you require switches, rectifiers, jacks and plugs, resistors, dial light assemblies or any of dozens of electronic parts . . . for replacement in plant apparatus, laboratory and testing appliances, or for use in pre-production samples of war devices, call your Mallory distributor for help. You will find him a useful aid. Write us directly if you do not know his name—we will tell you promptly.

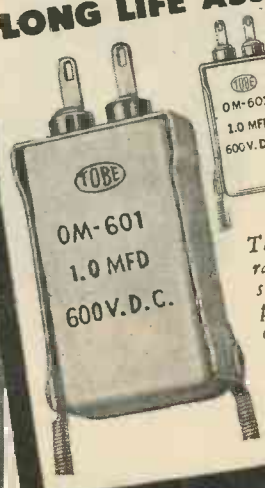
P.R. MALLORY & CO., Inc. **INDIANAPOLIS, INDIANA** • *Cable Address*—PELMALLO

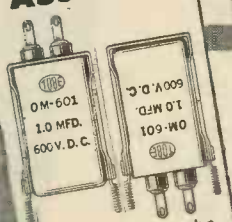


The Great Wall of China—2550 miles long—built about 3000 B.C.

THROUGHOUT EVERY STEP of manufacture, long life is built into Tobe Capacitors. And before manufacture begins, Tobe engineers have shown great ingenuity in pioneering new and advanced designs. The original capacitor with hold-down bracket (Tobe OM-601) is shown below. It has many outstanding advantages over certain other types and shapes of capacitors. This new capacitor is strong, compact and space-saving and the new hold-down bracket permits the use of either inverted or upright terminals, with wiring underneath or on top of chassis. Write us about your capacitor problems. They will have the best efforts of Tobe engineers.

LONG LIFE ASSURED





This new separate mounting is stronger and helps prevent leaks caused by breaks in can. This outstanding Tobe design takes the minimum amount of space.

SPECIFICATIONS
TOBE OM-601 CAPACITORS

TYPE	OM
RATINGS .05 to 2.0 mfd. 600 V.D.C.	
.05 mfd. to 1.0 mfd. 1,000 V.D.C.	
STANDARD CAPACITY TOLERANCE . . .	10%
TEST VOLTAGE . . . Twice D.C. rating	
GROUND TEST . . . 2,500 Volts, D.C.	
OPERATING TEMPERATURE	55° F to 185° F
SHUNT RESISTANCE	
.05 to 0.1 mfd.	20,000 megohms.
.25 to 0.5 mfd.	12,000 megohms.
1.0 to 2.0 mfd.	12,000 megohms.
POWER FACTOR	
At 1,000 cycles—.002 to .005	
CONTAINER SIZE	
Width 5/8", length 1 5/16", ht.	2 1/4"
MOUNTING HOLE CENTERS	1 1/2"

TOBE DEUTSCHMANN CORP.
TOBE
CANTON · MASSACHUSETTS

A small part in victory today

A BIG PART IN INDUSTRY TOMORROW

FOR EDITORIAL CONTENTS OF THIS ISSUE, SEE PAGE 4

WHY

One of a series showing ***AMPEREX*** *tubes in the making*

AMPEREX

WATER AND AIR COOLED

TRANSMITTING AND RECTIFYING TUBES

AMPEREX ... the high performance tube

Amperex is a scientific laboratory, on an enlarged scale, where rare and refractory metals, materials and gases are processed and combined into precise and delicate instruments. The meticulous construction of each tube is supplemented by a series of tough, pre-shipping tests. You receive a perfect product, fortified with the "Amperextras" which assure longevity, uniformity and dependability. All Amperex tubes may be interchanged with your present tubes without circuit readjustment.

ARMY E NAVY

GIVE A PINT OF BLOOD TODAY . . . SAVE SOME SOLDIER'S LIFE TOMORROW

AMPEREX ELECTRONIC PRODUCTS

"SUBMARINE....SURFACING ...5 POINTS OFF STARBOARD BOW"

The Powers Electronic staff is proud of its contribution to the development of the Electronic Megaphone and of its other communications systems which are serving our fighting men.

POWERS ELECTRONIC & COMMUNICATION CO.

GLEN COVE NEW YORK

FOR EDITORIAL CONTENTS OF THIS ISSUE, SEE PAGE 4

ELECTRONIC INDUSTRIES

DECEMBER, 1943

In this Issue

ANNUAL INDEX
Complete subject Index to all feature articles appearing in Electronic Industries during the past 14 months appears on pages 238 to 240.

IN THIS ISSUE

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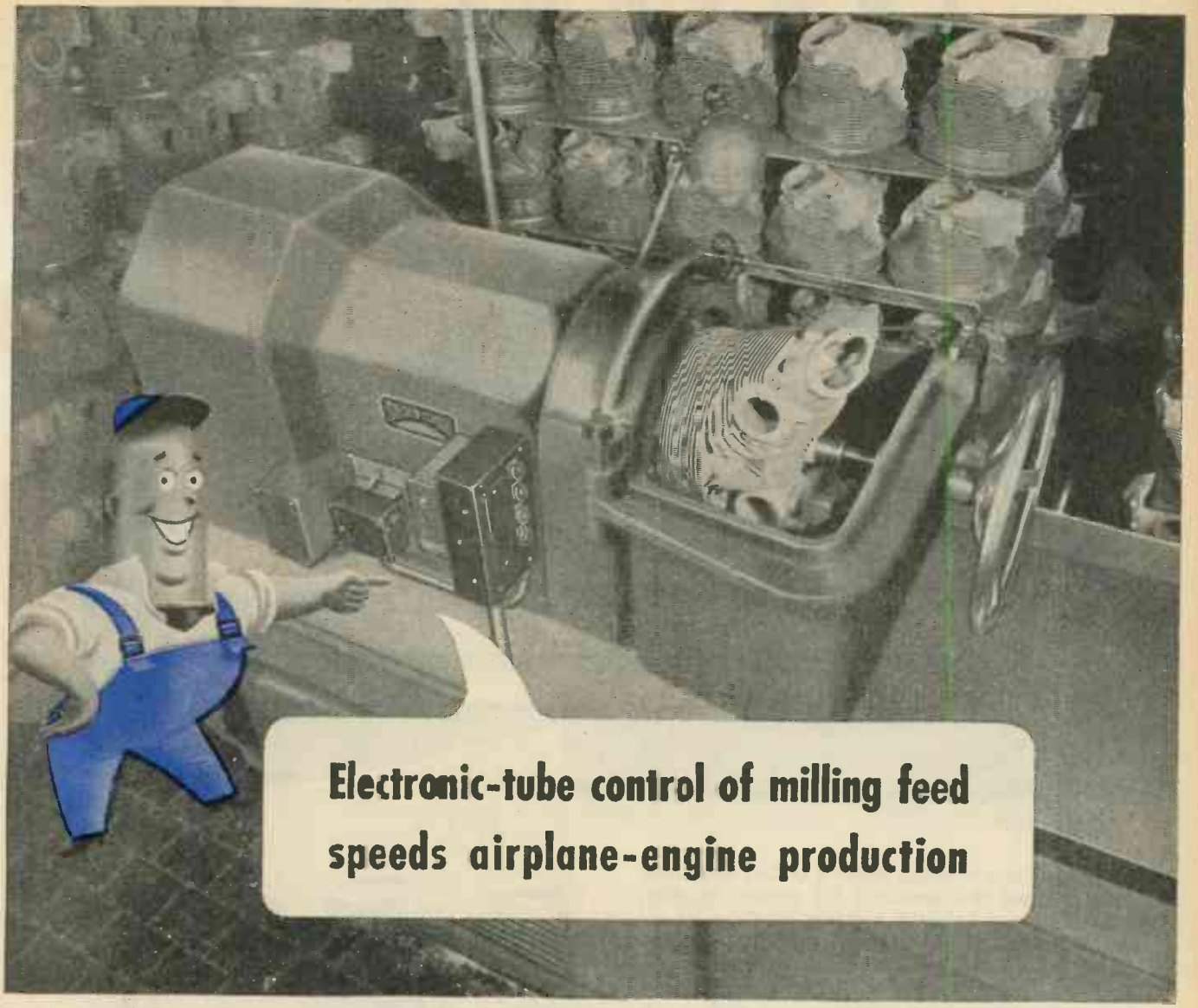


Electronic-tube control of milling feed speeds airplane-engine production

BACK THE ATTACK! – BUY WAR BONDS!

How the General Electric thyratron acts as a synchronous switch and a power rectifier

THE Plan-O-Mill is a versatile machine tool for milling external and internal, right and left hand threads and forms. Here you see this equipment cutting threads on aircraft cylinder heads.

The General Electric Thy-mo-trol is standard equipment on the Plan-O-Mill. Thy-mo-trol is an electronic motor control unit that gives separate control of feed-in and feed-around.

It is a General Electric electronic tube, the thyratron, which makes possible the operation of Thy-mo-trol. The thyratron acts as a lightning-fast automatic switch, responding to and correcting load variations so that cutter speed stays constant. It is also a rectifier, converting alternating current into direct current.

Change of gears and sheaves are unnecessary in this motor control operation. Feed changes are automatic, and cutter speed remains constant regardless of variations in load. If the load limit is exceeded, motor control shuts the power off, protecting the feed mechanism.

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

FREE BOOKLET ON ELECTRONIC TUBES

We would like to mail you, without charge, an illustrated book entitled "How Electronic Tubes Work," written in easy and understandable language, and showing typical electronic tubes and their applications. Address *Electronics Department, General Electric, Schenectady, N. Y.*

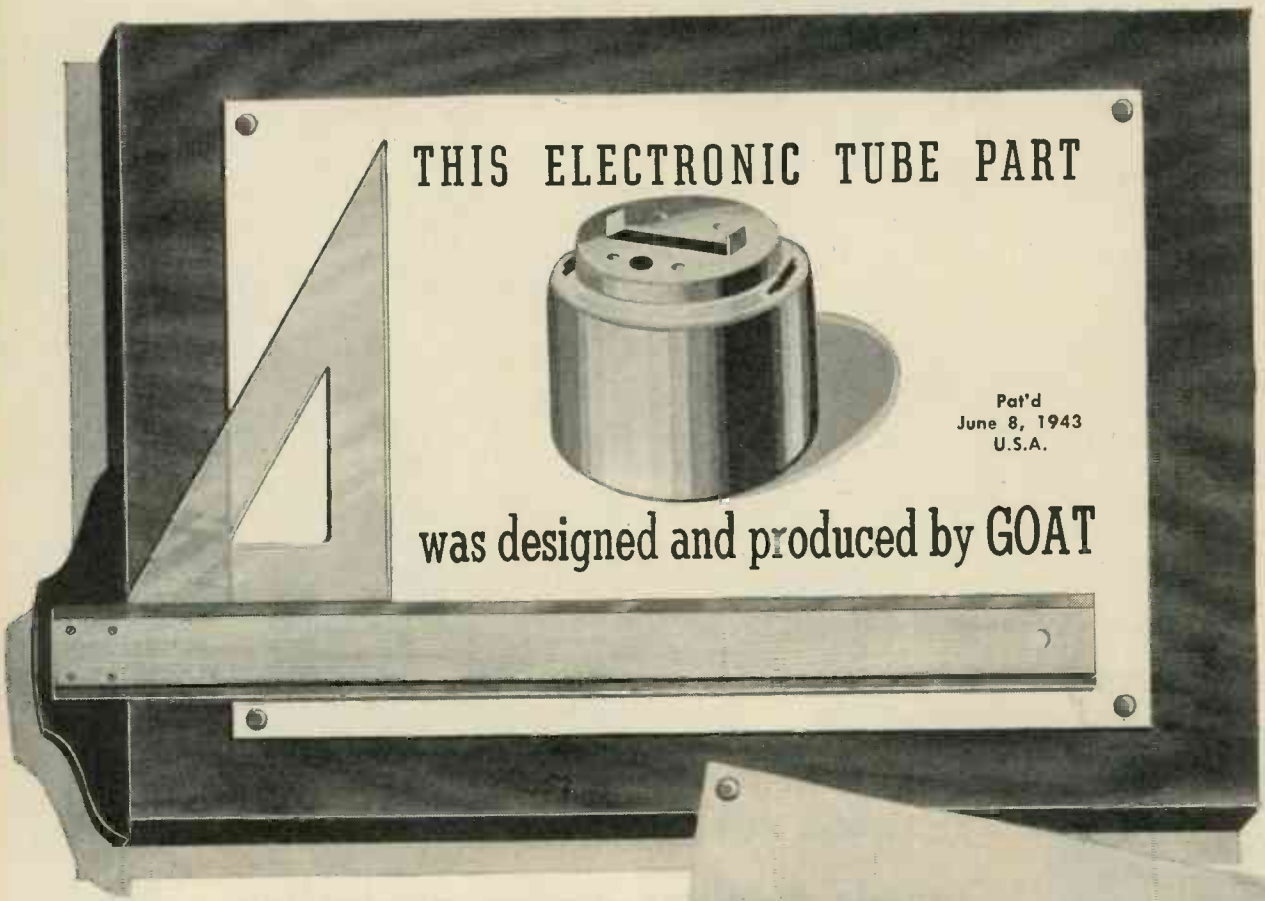
• Tune in "THE WORLD TODAY" and hear the news direct from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS. On Sunday listen to the G-E "All Girl Orchestra" at 10 P.M. E.W.T. over NBC.

THERE IS A G-E ELECTRONIC TUBE FOR EVERY PURPOSE

GENERAL ELECTRIC

162-B15-8850

INGENUITY?



Since the days of radio infancy GOAT has been able to meet the demands for greater quality, durability and quantity production. Throughout the years, GOAT has proved its ability to design and handle tough jobs requiring skill, precision and efficiency. Today GOAT serves almost every electronic tube manufacturer with a tremendous variety of stock and special parts made of any metal to any specified degree of accuracy.

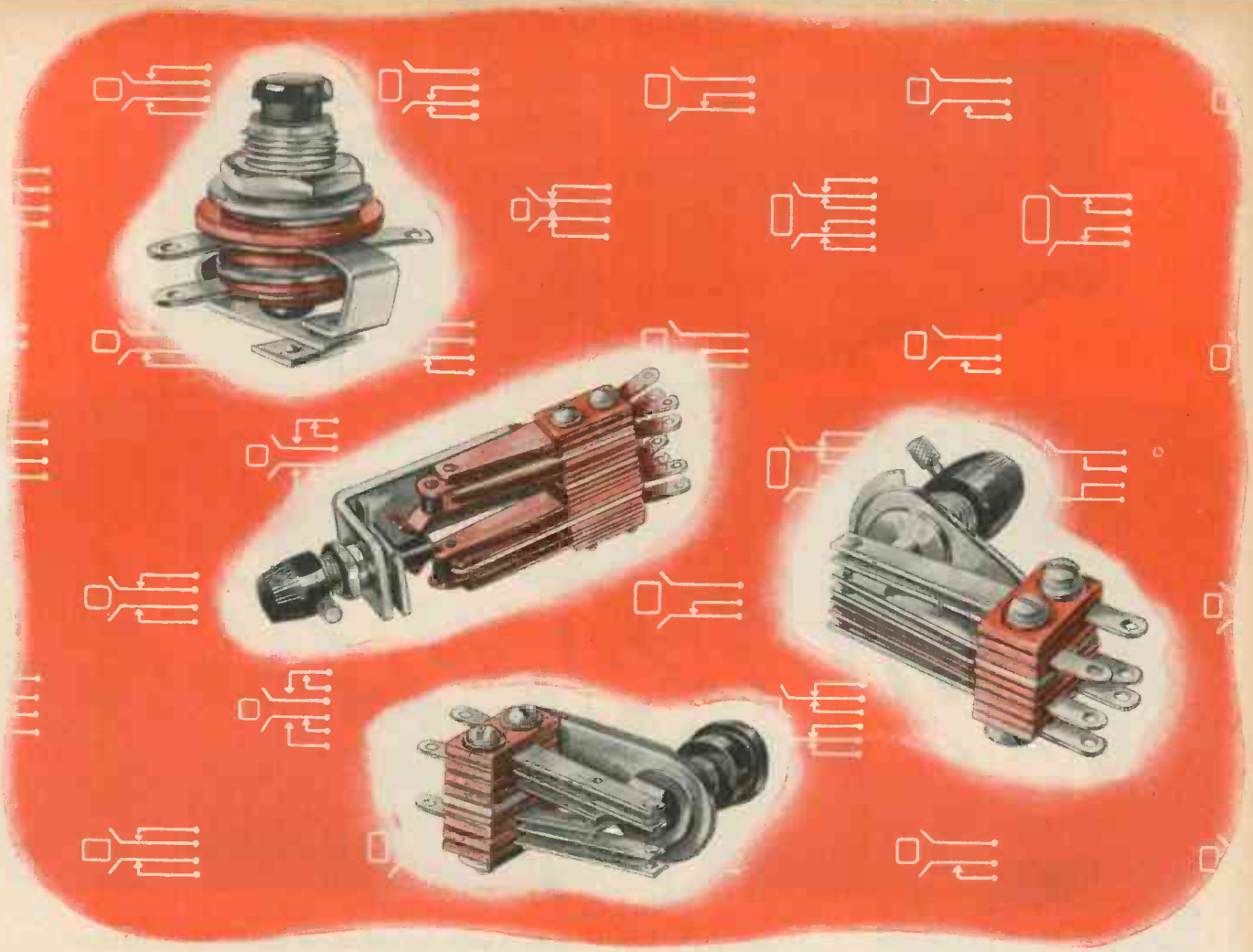
TYPICAL PARTS

Shown here are just a few GOAT electronic tube parts and shields that have been stamped, drawn and formed on GOAT machines, dies and presses.

GOAT METAL STAMPINGS, INC.

A DIVISION OF THE FRED GOAT CO., INC...EST. 1893

314 DEAN STREET • BROOKLYN, N. Y.



FOR TOP EFFICIENCY AT THE KEY-POINT IN A CIRCUIT

UTAH SWITCHES EVERY TIME!

Where the human element and mechanical perfection must combine to provide top performance, insist on Utah Switches. They are time-tested in hundreds of electrical applications in industrial plants and on far-flung battle-fronts.

There's a Utah Switch for virtually every circuit

UTAH Switches are made to fit your electrical and space requirements. Compact size, highest quality material and precision manufacture make Utah Switches everything a switch should be. Utah "Imp" push-button switches have the finest nickel silver or phosphorus bronze springs with integral contacts. Springs are fully insulated from the mounting bushing. High-grade phenolic insulation is used. They are available in three circuit arrangements: "single make," "single break," one "break make."

Also available are Utah Rotary and push-button jack switches, in long and short types. Small and compact in size, they are made to take minimum panel space. Full insulation is provided for all electrical parts.

Take advantage of Utah's extensive electrical and electronic experience. Write today for full information on Utah switches.

UTAH RADIO PRODUCTS COMPANY, 850 Orleans St., Chicago, Ill. Canadian Office: 560 King St. West, Toronto. In Argentine: UCOA Radio Products Co., S. R. L., Buenos Aires. Cable Address: UTARADIO, Chicago.

PARTS FOR RADIO, ELECTRICAL AND ELECTRONIC DEVICES, INCLUDING SPEAKERS, TRANSFORMERS, VIBRATORS, VITREOUS ENAMELED RESISTORS, WIREWOUND CONTROLS, PLUGS, JACKS, SWITCHES, ELECTRIC MOTORS

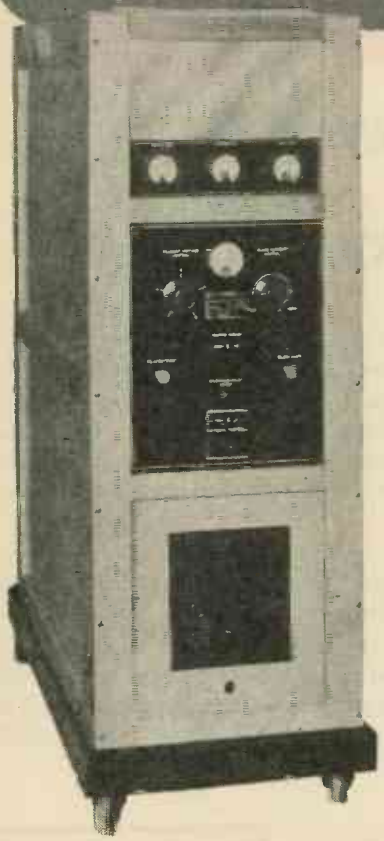
CABLE ADDRESS: UTARADIO, CHICAGO

utah

Increased advantages in

BOMBARDERS

Step-less Control



SCIENTIFIC'S high frequency units for industrial and scientific applications, offer multiple design and functional advantages in

ANNEALING–NORMALIZING–BRAZING
SILVER SOLDERING–DEGASSING–DEHYDRATING
EXPANDING–FORMING–HARDENING–MELTING

by high frequency ranges to 300,000, Kc. and power capacities up to 100 Kw. Compact, extremely efficient, SCIENTIFIC'S equipment minimizes maintenance and permits economical operation. Inquiries pertaining to this specialized line of high frequency generating and testing apparatus, are invited;

ELECTROMAGNETIC – ELECTROSTATIC HEATING

SCIENTIFIC ELECTRIC

S. E. D. LABSIKS

DIVISION OF

"S" CORRUGATED QUENCHED GAP COMPANY

DESIGNERS AND BUILDERS OF HIGH FREQUENCY CONVERTORS SINCE 1921 IN THE U. S. A.

119 MONROE STREET GARFIELD, NEW JERSEY

TYPE 5CP
CATHODE-RAY TUBE

a Product of the Pioneer

Type 5CP is a mighty popular cathode-ray tube in the present war effort. It is required in large numbers for oscillographic and special indicating purposes. And DuMont is indeed proud to be producing its full share of 5CP's as still another contribution to victory, on the all-important electronic front.

Here again the specialized skill of DuMont engineers and craftsmen is in evidence. While adhering rigidly to standard specifications governing this popular type, DuMont has introduced its own refinements, improvements and double-check inspection for more rugged, longer-lasting cathode-ray tubes.

Always remember, when it bears the DuMont seal it is a product of *the pioneer in the commercialized cathode-ray tube field.*

Be sure you have a copy of the new DuMont manual and catalog in your working library. Contains invaluable data on cathode-ray technique together with listings of DuMont tubes, oscillographs and allied equipment. Write on business stationery for your registered copy.

CHARACTERISTICS

5" electrostatic deflection and focus tube. Intensifier feature for maximum deflection sensitivity and brilliance.

Choice of four fluorescent screens: Green Medium (5CP1); Green Long (5CP2); White Medium (5CP4); Blue Short (5CP5).

Bulged envelope for greater mechanical strength. Tube base design provides adequate insulation between electrode leads for high-altitude installations.

Heater Voltage 6.3. Intensifier Electrode Potential 4400 v. max. Focusing Electrode Potential 1100 v. max. Accelerating Electrode Potential 2200 v. max.

Deflection Factor: D_1D_2, 36.5 d.c. volts/kv inch, plus-minus 20%; D_3D_4, 32.0 d.c. volts/kv inch, plus-minus 20%.

Grid bias: at 4000 v. total accelerating potential, cutoff grid bias -60 v., plus-minus 50%.

DUMONT

ALLEN B. DU MONT LABORATORIES, Inc.
Passaic • New Jersey
Cable Address: Wespexlin, New York

On Winning a Star . . .

They "Did the Impossible Ahead of Schedule." Group of Workers in the Hicksville Plant of Press Wireless, Inc., Rejoicing at Announcement The Plant Had Been Given Its Second Army-Navy "E" Award.

Press Wireless, Inc., takes pleasure in announcing that its plant at Hicksville, Long Island, has received a second Army-Navy award for outstanding achievement in the production of essential radio equipment for war purposes and has been given the starred pennant symbolizing this distinction.

To meet a certain standard such as is required to be eligible for the "E" award is one thing; to maintain that standard and improve upon it over a period of months is another. For accomplishing both, Press Wireless, Inc., is justly proud of the men and women of its Hicksville plant.

At this stage of the war, steadfast adherence to high manufacturing standards is vital. Press Wireless, Inc., pledges continuation of such standards along every sector of its production front.

PRESS WIRELESS, INC.

Sales Office, Manufacturing Division
1475 BROADWAY, NEW YORK CITY

Executive Offices
435 N. MICHIGAN AVENUE, CHICAGO

EVERYONE IS TALKING ABOUT THE NEW *Electro-Voice* ACHIEVEMENT

NICKNAMED THE "LIP-MIKE"

Officially known as the T-45, the

Electro-Voice
DIFFERENTIAL MICROPHONE

is also affectionately termed the "Schickelgruber"

Developed by Electro-Voice engineers in close collaboration with the Fort Monmouth Signal Laboratory, the T-45 marks the beginning of a new era in which voice transmission is unaffected by ambient noise or reverberation. It accomplishes such complete suppression of background that speech from a battlefield or from the deafening interior of a moving tank is accompanied by hardly a trace of noise.

The "Lip-Mike" is a Differential Microphone designed to fit under a gas mask without breaking the seal — small enough to allow an Armored Force respirator to slide over it — and has been standardized for all Army Ground Forces.

- *Frequency response substantially flat from 200-4000 cps.*
- *Low harmonic distortion*
- *Cancellation of ambient noise, but normal response to user's voice*
- *Self-supporting, to free both hands of the operator*
- *Uniform response in all positions*
- *Usable when gas mask, dust respirator or oxygen mask is required*
- *Unaffected by temperature cycles from −40° F. to +125° F.*
- *Ability to withstand complete immersion in water*
- *Physical strength to withstand 10,000 drops*
- *Weight, including harness, cord and plug, less than 2 ounces.*

WHEN PEACE COMES, THERE WILL BE DIFFERENTIAL MICROPHONES OF MANY TYPES FOR CIVILIAN USES IN WHICH THESE ADVANTAGES WILL BE OF REVOLUTIONARY IMPORTANCE. THUS, ANOTHER WARTIME DEVELOPMENT WILL FIND ITS GREATEST VALUE IN THE COMING OF PEACE.

Electro-Voice MICROPHONES

ELECTRO-VOICE MANUFACTURING CO., INC. • 1239 SOUTH BEND AVENUE • SOUTH BEND, INDIANA

Export Division: 13 East 40th Street, New York 16, N. Y. — U. S. A. *Cables:* ARLAB

Fog has suddenly closed in. Yet the big transport pokes its nose through the murk —and 21 passengers alight on schedule!

For radio beacons have kept this plane rigidly on its course. A friendly voice from the airport warned of the ugly weather ahead and suggested the best way to meet it. Then, as the plane roared in to the runway, the radio voice directed a perfect, unobstructed landing.

Aviation is only one of many fields in which radio is stimulating progress. While today radio manufacturers are all out for Victory, technical improvements developed in wartime will enable them to bring you new and better radio-electronic products when Peace comes.

Your purchase of War Bonds will help supply American fighting men with the world's finest equipment.

Pioneers in the field of radio-electronic research, RCA Laboratories, through fundamental study and endless experiment, serve America's great radio industry at war. When peace returns, RCA will continue to make available to American manufacturers of radio equipment new discoveries and inventions in radio and electronics. RCA research means greater progress for the industry, finer home radios and television.

RCA Laboratories

A SERVICE OF RADIO CORPORATION OF AMERICA

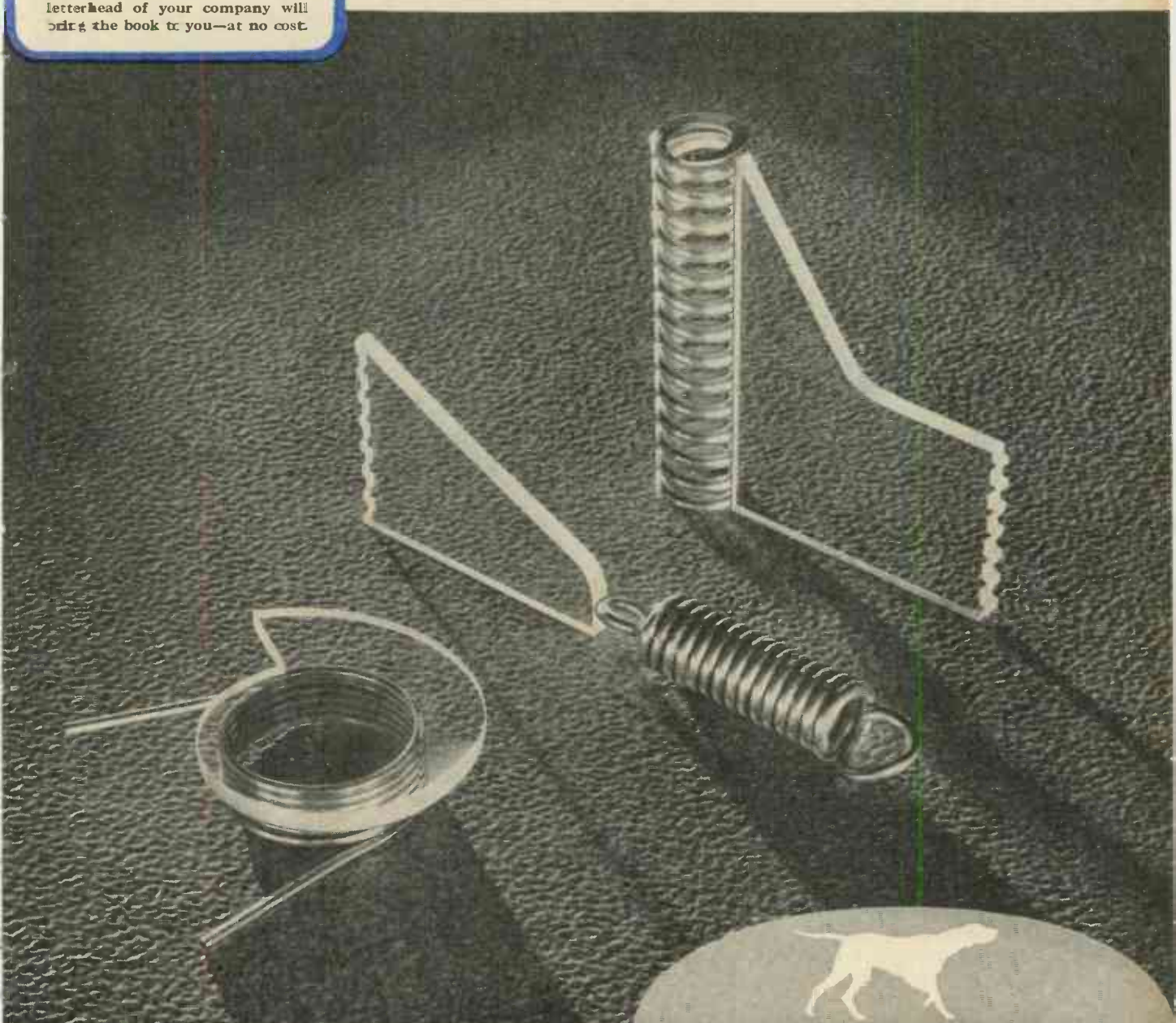
You Can't Build the Future on a Flaw!

THOSE PRODUCTS of yours which are being planned now to compete in a competitive future era are being planned with great care. But one flaw in the design or construction of any part of that product . . . and your plan can fail. Consider, for example, one of the smallest parts of any machine . . . a spring. You depend on that spring to do its job, yet, some people are willing to call any piece of coiled wire a spring. There's one flaw right there—a flaw that Hunter stands ready to correct. With Hunter and other good springmakers, the design and construction of a spring to do the job calls for an engineer's mind and experience, for knowledge of mathematics, chemistry, metallurgy, research, testing and inspection. It may involve the conception of new research instruments, or a detailed report like the one which Hunter prepared to cover the design and performance of a mechanism and a spring, the spring weighing only .000053 lb. These are some of the reasons why your springs, at least, *will* perform —if Hunter designs or makes them . . . why they won't let you down.

SMOTHER THE BUMS!

Right now most copies of "Science in Springs" are being used to develop war products. The manual is filled with helpful engineering data on the design and manufacture of springs—information that can be most helpful in planning your own products. Your signature on the letterhead of your company will bring the book to you—at no cost.

FORCE DEFLECTION CHARACTERISTICS OF 3 BASIC TYPES OF SPRINGS *In designing springs (in this case an extension, a compression, and a torsion spring) Hunter has long recommended the drawing of a pressure diagram in order to record the specifications graphically, and to reveal simple errors which may represent serious faults in performance. The force deflection characteristics of these three springs are represented by the plexiglass curves. Note that in the case of the torsion spring, a polar diagram is represented instead of the usual linear diagram commonly employed. Construction and use of these diagrams are explained in detail in the Hunter Data Book.*



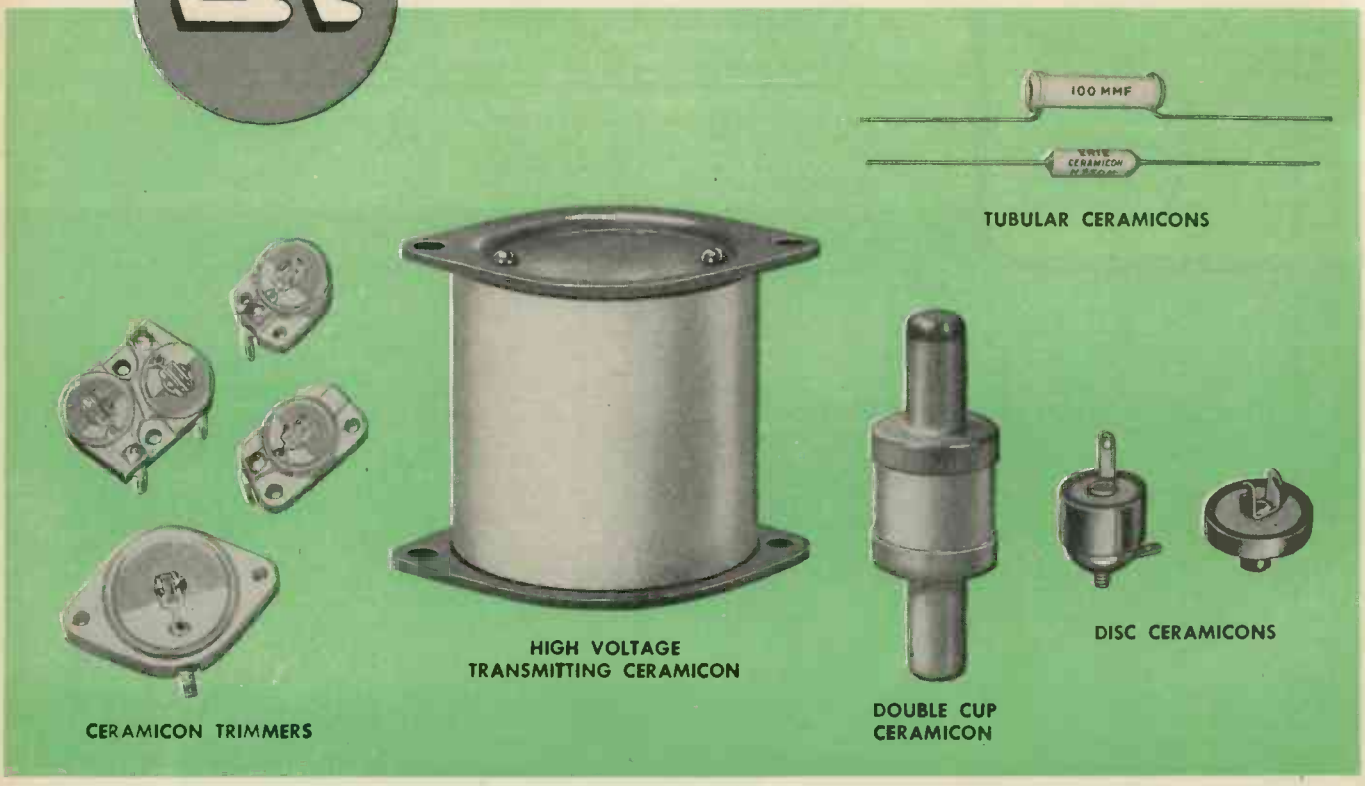
HUNTER

Science in Springs

HUNTER PRESSED STEEL COMPANY, LANSDALE, PENNA.

FIRSTS in Ceramic Condenser Design

by Erie Resistor



HERE are illustrated five types of ceramic condensers that are playing a vital part in today's wartime electronic apparatus and that will greatly effect the functioning of future electronics. Each is built around a basic design first created by Erie Resistor.

The first silver-ceramic condenser made in this country was an insulated tubular unit designed and produced by Erie Resistor over seven years ago. These popular temperature-compensating Ceramicons have fully proved themselves under severe wartime conditions. A few years later Erie Ceramicon Trimmers gave the U. S. radio industry an entirely new type of padder with hitherto unobtainable characteristics.

For obtaining relative high capacities in compact, low-loss units for high frequency applications, Erie Resistor engineers originated disc-type Ceramicons.

The original Erie double-cup design for high voltage applications has overcome many problems that formerly limited the expansion of ceramic condensers for high voltage, high KVA applications.

Large, high voltage transmitting condensers are now a reality with the characteristic stability of silvered ceramic construction, thanks to another pioneering Erie Resistor Ceramicon design.

We believe that existing Erie Ceramicons, and other Erie Ceramicon designs to come from our development laboratory in the future will play an important part in the progress of the electronic industry.

ARMY E NAVY
FOR HIGH ACHIEVEMENT IN WAR PRODUCTION

Back The Attack—With War Bonds

ERIE RESISTOR CORP., ERIE, PA. LONDON, ENGLAND · TORONTO, CANADA.

Don't Open until . . . ?

Pre-War Model

EXCERPTS :

Dear Bill:

The answer is " YES ". Record Changers have top billing in our Post-war plans. After all, what

realistic about it. You're right again. There will be an unprecedented demand for Record Changers in Post war home phonographs. And we will have the capacity to handle it. Glad you remember our Pre-war Changer did make a hit back in '40 and '41.

Dear Russ:

Your letter bothers me because you have known us for years and must know that we don't talk until we are ready. We'll be happy to talk Post War Record Changers with you but don't ask us to show our hand right now... Don't worry... the new one will be a honey... our enthusiasm is unbounded and we won't be late. Please be patient. You will find

in the period immediately following the end of the war. What do you mean... WE are hoarding ideas ? We have asked you for your ideas and you know it takes time to adapt them.

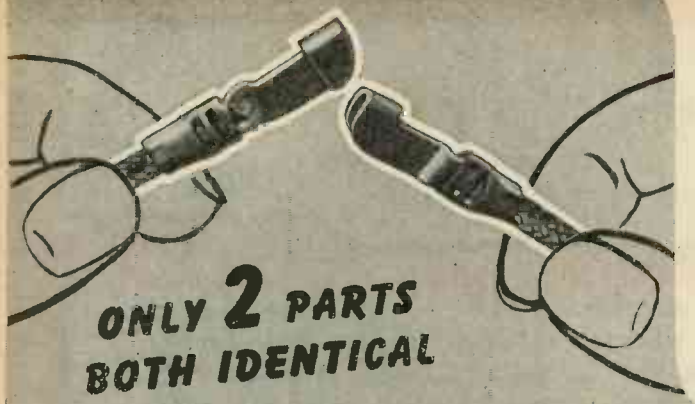
you've got to hand it to the radio manufacturers. They know a good thing when they see it. And they don't forget. Like yourself they know about G.I.'s pre-war record changer.

Just wait til you see our new one. If your enthusiasm doesn't match ours I'll eat your hat. Sorry we can't unwrap the package for you right now. We've got to get on with the war. Army and Navy contracts

WAR BONDS—An Investment in Your Country's Future

General Instrument CORPORATION

EXECUTIVE OFFICES • 829 NEWARK AVENUE • ELIZABETH 3, N. J.



ONLY 2 PARTS BOTH IDENTICAL

Eliminates stocking more than one item. Incorporates AMP Diamond Grip Insulation Support features.

QUICK POSITIVE SPLICE

Knife-Switch principle affords 4 surfaces of direct contact to assure maximum conductivity through the coupling.

STAYS TOGETHER UNTIL INTENTIONALLY TAKEN APART

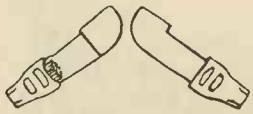
Tensile strength of splice is greater than that of the wire itself, yet assembly is easily and quickly uncoupled when desired.

CONTOUR OF ASSEMBLY FIRMLY HOLDS INSULATION TUBING

With the tubing in place the splice cannot be accidentally disconnected.

A-MP

Solderless



SPLICING TERMINAL

With Diamond Grip INSULATION SUPPORT

1. Unique locking principle using only 2 identical parts — no third part to stock or lose.

2. Four-point "Knife-Switch" wiping action assures minimum contact drop through the coupling, and gives a perfect electrical connection even under adverse conditions.

3. AMP Diamond Grip insulation support gives maximum protection for insulation at wire end of connection.

"PRECISION ENGINEERING APPLIED TO THE END OF A WIRE"

4. Cannot be uncoupled by pull on the wire — tensile strain on the wire tends to further engage the coupling.

5. Visual inspection after assembly. Wire goes through the barrel of the splicing terminal, insuring against possibility of wire being only partly inserted in the barrel.

6. Makes a connection which will withstand any but the most excessive abuses in service. Flexible copper and simple construction permit easy return to original shape if distorted in service.

7. Insulation sleeving slips over entire assembly with ease. A fairly loose insulation sleeve expands to clasp oval formation of entire assembly — to remain firmly in place until removal.

8. Offset tongue acts as wire stop, preventing the insertion of the wire to a point where it would interfere with the coupling.

9. AMP crimping tools make all three crimps in one operation.

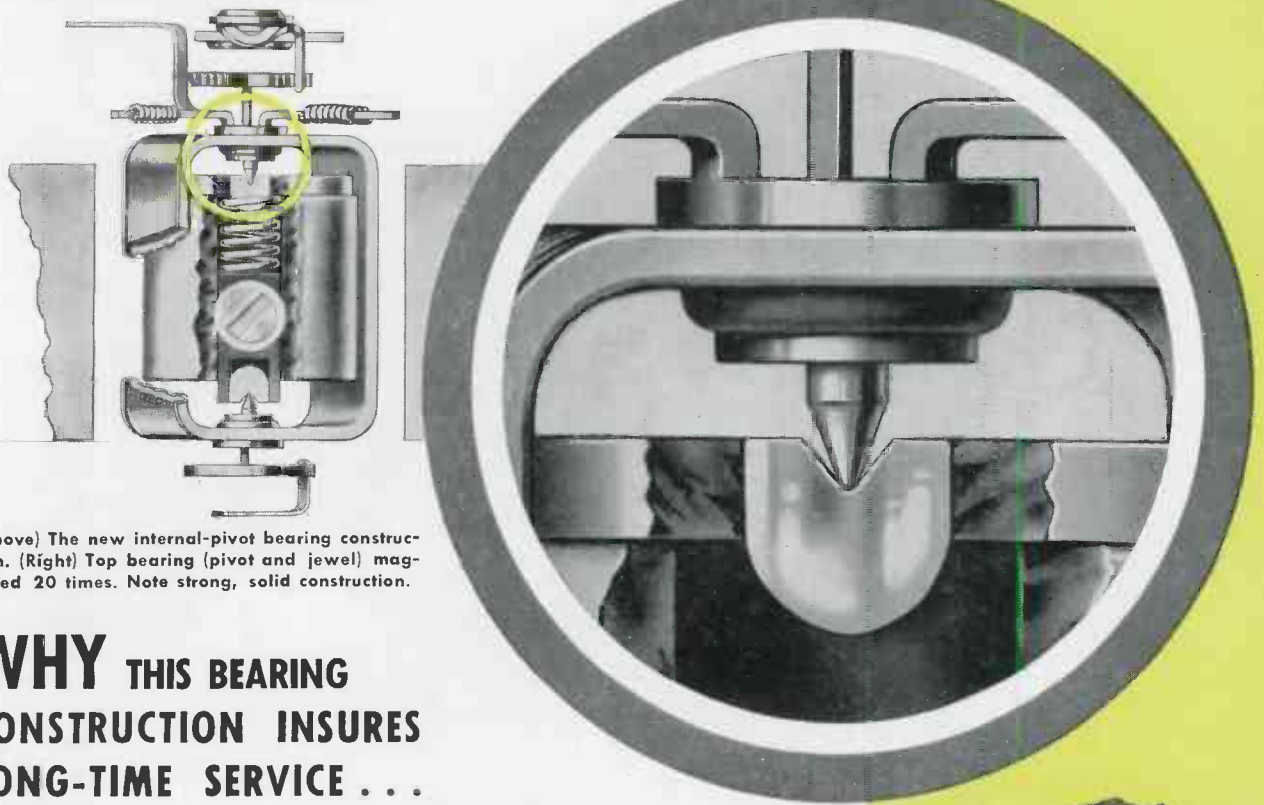
AIRCRAFT-MARINE PRODUCTS INC.

1525-31 N. FOURTH ST.
HARRISBURG, PENNA.
TELEPHONE: HARRISBURG 4-0101

AIRCRAFT-MARINE PRODUCTS INC
A-MP
SOLDERLESS WIRING DEVICES

New INTERNAL-PIVOT ELECTRIC INSTRUMENTS 2½-inch - - - 1 inch deep

For radio and other communications service; d-c voltmeters, ammeters, milliammeters, microammeters, and radio-frequency ammeters and milliammeters (a-c thermocouple type). Cases are brass or molded Textolite.



(Above) The new internal-pivot bearing construction. (Right) Top bearing (pivot and jewel) magnified 20 times. Note strong, solid construction.

WHY THIS BEARING CONSTRUCTION INSURES LONG-TIME SERVICE . . .

IN THESE new G-E instruments, the pivots are solidly mounted on the *inside* of the armature shell instead of being cemented to the outside of the armature winding. The result is a rigid construction that helps to maintain accurate alignment.

The steel pivots, highly polished, are of the aircraft type, larger than normal. This means less stress on the bearing surfaces and a construction that will stand rough treatment and shock.

The pivots rotate in low-friction, highly polished, glass vee jewels—one mounted rigidly in the top of the frame-and-core assembly, and the other mounted in a movable lower jewel sleeve located in the soft-iron core.

This combination—accurately formed, hard-glass jewels and large-radius steel pivots—provides a co-ordinated bearing that has proved, by field tests, to be excellent from the standpoint of long life and ability to withstand vibration.

Thin, Strong, Accurate Instruments

1. *Thinness* is obtained by solidly mounting the pivots on the inside of the armature shell. Most instruments are approximately one inch deep.
2. *Strength* is obtained by short, solidly mounted, large-radius pivots and the extra-strong over-all case.
3. *Sustained Accuracy* is insured by the featherweight moving element, combined with high torque and permanent alignment of all parts.

For ratings, prices, and dimensions, ask our nearest office for Bulletin GEA-4064, which covers instruments for use in radio and communications equipment; or Bulletin GEA-4117, which describes those suitable for naval aircraft. *General Electric Co., Schenectady, N. Y.*

D-c voltmeters, volt-ammeters and ammeters are specially designed to measure voltage and current in battery and battery-charging circuits on naval aircraft. They meet applicable Navy specifications.

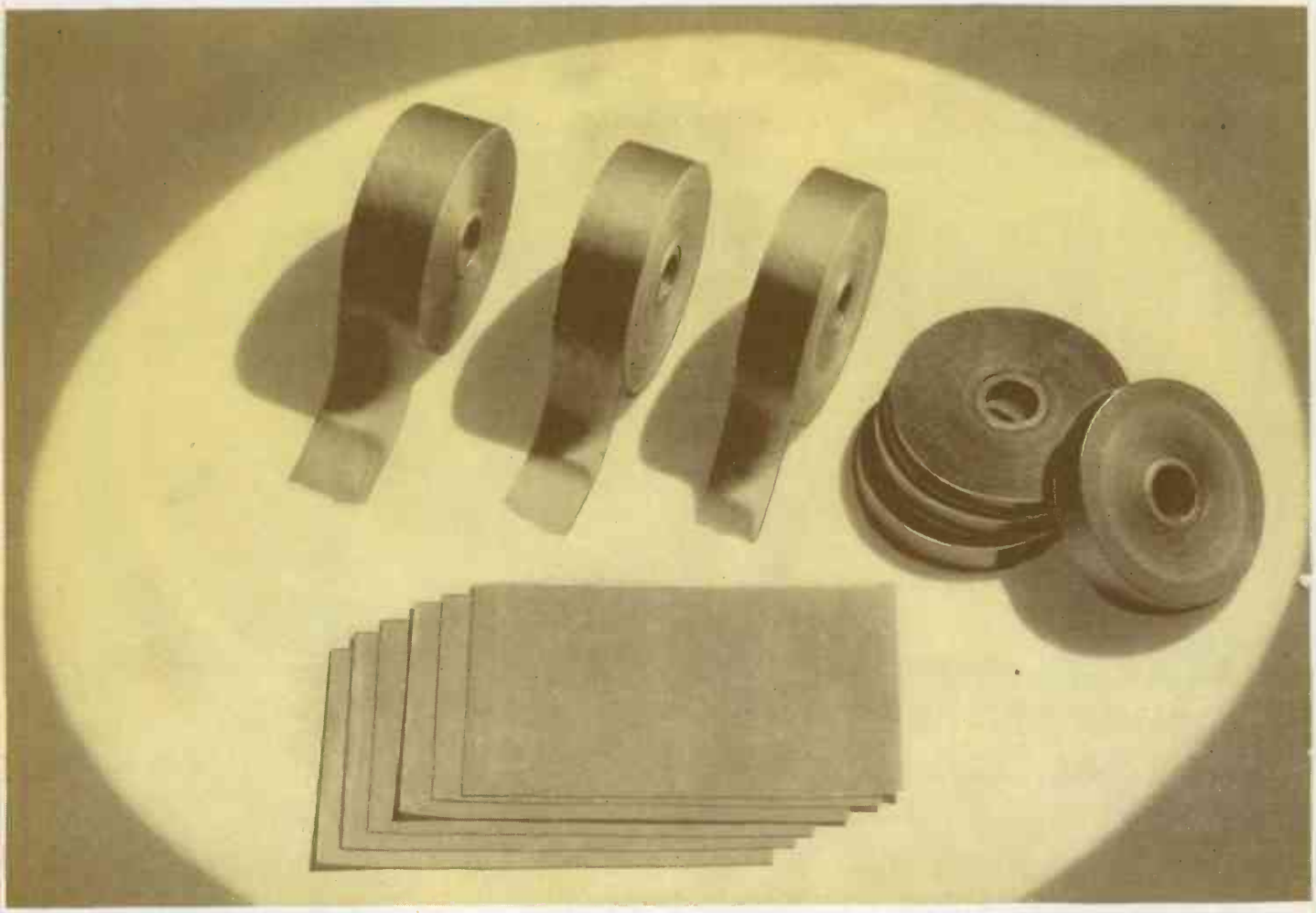
GENERAL ELECTRIC

602-44-6200

SMALL PANEL INSTRUMENTS

Announcing

A NEW Dielectric Material for Capacitors--



LECTROFILM—a new product developed by the General Electric Laboratories—is a synthetic dielectric made from raw materials that are available in large quantities in the United States.

Capacitor manufacturers will find it ideal for use in most radio-frequency-blocking and by-pass, fixed capacitors that for years have been built with mica. These capacitors are of the type used in communications and other electronic equipment.

Lectrofilm has a greater combination of desirable mechanical and electrical properties than any other one capacitor dielectric material. It is available in both rolls and sheets, and can be used in present capacitor production lines, little or no change being required in equipment or manufacturing methods. Its strength and flexibility make it well suited to handling by automatic means.

Best of all, lectrofilm has uniform characteristics; it requires little if any grading, sorting, or inspection. Therefore, it is economical as well as easy to use, and when properly applied, will cut down the number of finished capacitors that are rejected in test. Users of lectrofilm can expect increased capacitor production with present facilities without any increase in man-hours.

Lectrofilm is available for use by manufacturers making capacitors for the armed forces.

LECTROFILM

TYPICAL CHARACTERISTICS

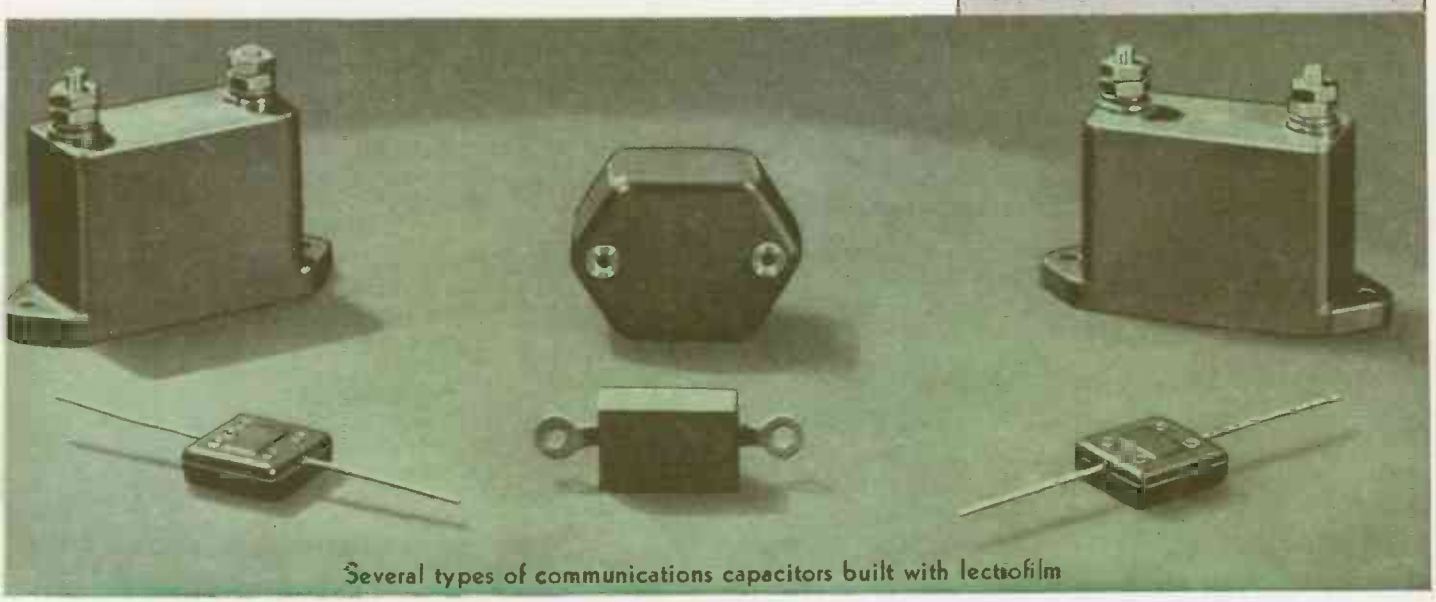
	Lectrofilm in Rolls, No. 2681	Lectrofilm in Sheets, No. 2682
D-c breakdown strength	1900 volts per mil (Two or more thicknesses)	2500 volts per mil
Dielectric constant	4.0 or more	5.5 or more
Tensile strength	Equal to Kraft capacitor paper	Equal to Kraft capacitor paper
Power factor at 1,000,000 cycles* Per cent at 25 C Per cent at 100 C	3.5 or less 1.75 or less	2 or less 1 or less
Capacitance temperature coefficient, per cent per degree C*	0.05 to 0.15	0.05 to 0.15
Maximum recommended operating temperature	100 C	125 C

**These characteristics, determined by actual test results on capacitors built with lectrofilm, will depend on the type of capacitor construction.*

For information on

- **sizes**
- **thicknesses**
- **weights**
- **additional characteristics**

...write for Bulletin GEP-217A. Address: Section 16-216, General Electric Company, Pittsfield, Mass.



Several types of communications capacitors built with lectrofilm

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

407-69-5700

These are the BENEFITS of a CLOSELY HELD VOLTAGE SUPPLY

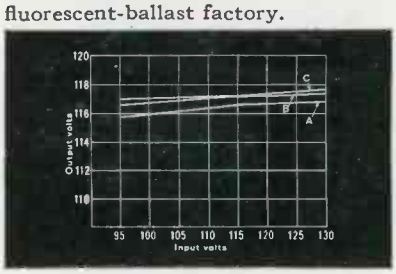
Better performance, greater reliability, and longer life of electronic devices

Protection of delicate instruments and machines, precision tools, and electronic tubes against sudden overvoltages

More accurate test results, fewer rejects

And manufacturers—don't forget:
A product's salability can be increased when voltage stabilization is a built-in feature.

EXTREMELY CLOSE VOLTAGE REGULATION, so essential to speedy, accurate production-line testing, is automatically maintained by a 500-volt-ampere G-E stabilizer on a test bench in a fluorescent-ballast factory.



▲ **LOOK AT THIS PERFORMANCE**—Practically constant voltage for several typical conditions (A—Open circuit; B—Full load, unity power factor; C—Full load, 0.8 power factor lagging). Stabilizing action practically instantaneous, taking place in less than three cycles.

...and Here's the Way to Get It

IMPROVES THE PERFORMANCE OF EQUIPMENT LIKE THIS:

Radio transmitters and testing equipment
Photoelectric equipment and other electronic-tube apparatus
Motion-picture projectors and sound equipment
Telephone apparatus
X-ray machines
Precision photographic equipment and photometers
Color comparators
Calibration of meters, instruments, relays
Laboratory precision processes and testing equipment

FOR DETAILS on this stabilizer's unique circuit, write for Bulletin GEA-3634. *General Electric Company, Schenectady, N. Y.*

VOLTAGE STABILIZERS

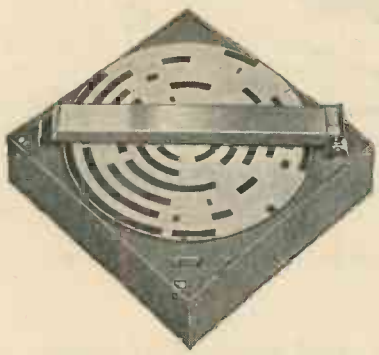
GENERAL ELECTRIC

403-53-5205

The best investment in the world is in this country's future—BUY WAR BONDS

Electronics Specialists

IN RESEARCH, DESIGN, APPLICATION ...and Service!



AUTOMATIC PROCESS CONTROL

This new development by the research laboratories of General Electronics Industries provides automatic control of chemical processes and also of production machinery, by means of printed charts which may be replaced or interchanged as readily as phonograph records.

● Jacks-of-all-trades have their place . . . but *not* in General Electronics Industries. Everyone in this organization, from top-flight research engineers to service men and their assistants, is an electronics specialist.

We have no miracle gadgets nor mysterious cure-alls for sale. Our business is the proper application of electronics to solve individual production problems. This begins with diagnosis, *follows through* with research, perhaps special design, and includes expert service before and after completion of the job.

To assist you in your post-war production planning, one of the largest organizations specializing in Electronics offers the skill, experience and unsurpassed facilities that have successfully met the most exacting tests of war.

Write to Engineering Department, General Electronics Industries, 342 West Putnam Avenue, Greenwich, Connecticut.

Other products manufactured include: ELECTRONIC CONTROLS • VACUUM TUBES • HYDRAULIC SERVOS COMMERCIAL RADIO EQUIPMENT • ELECTROMECHANICAL DEVICES • ELECTROSTATIC HEATING UNITS UP TO 250 KW.

ARMY-NAVY "E" WITH STAR awarded to Auto-Ordnance Corporation for continued excellence in production of "Tommy" Guns.

GENERAL Electronics INDUSTRIES

Division of Auto-Ordnance Corporation

GREENWICH • STAMFORD • BRIDGEPORT • NEW MILFORD • NEW YORK

A SOLDIER'S FIRST CONCERN IS FOR HIS EQUIPMENT

. . . and TUNG-SOL's first concern is to build sturdiness into Electronic Tubes to withstand the rigors of war service.

TUNG-SOL "Vibration-Tested" tubes are giving a good account of themselves in radio sets and other electronic devices in fighting equipment of all kinds. The work done in TUNG-SOL laboratories long before the war is the reason. Many of the causes for early tube failure were found and these weaknesses corrected by improvements in design and construction.

The wide experience gained in developing and producing Tung-Sol "Vibration-Tested" Electronic Tubes for war will be available when the war is won. Manufacturers of electronic devices and controls, who are now planning post-war products, will find TUNG-SOL research engineers ready and able to assist in designing circuits and selecting the correct "Vibration-Tested" tubes.

TUNG-SOL

vibration-tested

ELECTRONIC TUBES

Every TUNG-SOL tube of new design and tubes picked at regular intervals from the production line, are subjected to severe vibration while current, introduced through the various circuits, is carefully measured. Tubes that pass this exacting test are truly "Vibration-Tested."

TUNG-SOL LAMP WORKS INC., NEWARK 4, NEW JERSEY

Sales Offices: ATLANTA, CHICAGO, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK

ALSO MANUFACTURERS OF MINIATURE INCANDESCENT LAMPS, ALL-GLASS SEALED BEAM HEADLIGHT LAMPS AND CURRENT INTERMITTORS

Most far-sighted airport plan yet developed for the Southwest is this Oklahoma City project.

What is missing in this picture?

Missing to the eye . . . but a vital part of this super airport, and every other modern airport and airline . . . is the radio traffic control equipment without which the landing and take-off of planes would become a hopeless jumble. Missing, too, are the radio navigational aids—ranges, markers and communication transmitters and receivers so necessary to the guidance of flight.

In peacetime, RADIO RECEPTOR, in conjunction with the Civil Aeronautics Authority, played an important role in equipping airlines, and airports such as the La Guardia and Washington National Airports. In wartime, we have supplied the Signal Corps with equipment which is now in use in more than 180 airfields in the United States . . . and we don't know how many in foreign lands.

Send for a copy of our non-technical booklet, "Highways of the Air"—you'll find it interesting.

> ***"Laymen are inclined to think of an air route as simply a corridor of air through which planes commonly fly. But it is more than that. It is, first, a system of air fields, each of which, wherever it may be,*** **must have** ***runways and*** **radio** ***and other communications. In laying out an air route and the fields along it, a complete system of communications, from point-to-point and from*** **ground-to-air, along with radio beacons and other navigational aids, must be set up."**
>
> —MAJOR GENERAL HAROLD LEE GEORGE
> *Commanding General, Air Transport Command*

ARMY E NAVY

Awarded for Meritorious Service on the Production Front

Radio Receptor Co.
INCORPORATED
251 WEST 19th STREET NEW YORK 11, N. Y.

★ SINCE 1922 IN RADIO AND ELECTRONICS ★

the amateur is still in radio...

All through the development of radio communications you'll find the mark of the radio amateur. His desire to accomplish the seemingly impossible and the rough treatment he gave his "ham rig" helped create and develop better radio technique. Thus the radio amateur is directly responsible for much of the superior radio and electronic equipment being used by the military services today. Eimac tubes, created and developed in the great amateur testing ground are a good example. They had to possess superior performance capabilities in order to become first choice of the leading radio amateurs.

Their ability to withstand momentary overloads of as much as 500% and their unconditional guarantee against premature failures due to gas released internally are two potent reasons why they are today first choice of the leading electronic engineers throughout the world.

Today the radio amateur is off the air as an amateur but he's still in radio as a professional. And wherever he is... in the army, navy and marine corps... in the great electronic laboratories and factories .. he's still using Eimac tubes.

Follow the leaders to

Eimac REG. U. S. PAT. OFF. **TUBES**

Eimac 250T

EITEL-McCULLOUGH, Inc., SAN BRUNO, CALIF.

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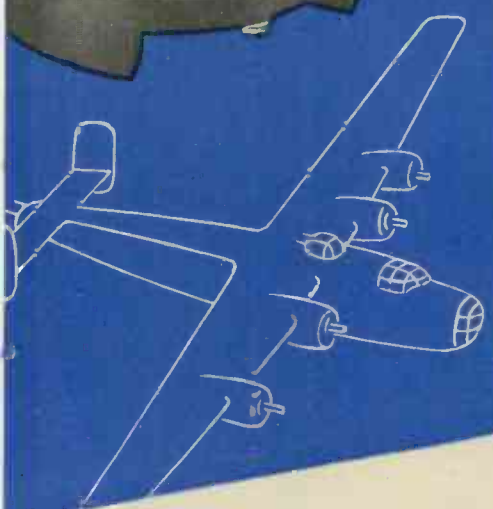
VOLTAGE REGULATORS

by WEBSTER



OFFERING A WIDE RANGE OF RESISTANCES and WATTAGE RATINGS

Improved performance over wide temperature variants characterizes Webster voltage regulators—particularly valuable for air-borne applications. Both field-control and series-line types are available. We would welcome an opportunity of discussing with you the advantages of relying on Webster Products for your carbon pile voltage regulator requirements.

Webster Products also makes
Dynamotors, Generators, Inverters, Small Motors and Special Instruments.

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TOMORROW'S "Cat Whisker"

Radio channel selection has come a long way since the cat-whisker-and-crystal era. Recent developments may make today's equipment just as obsolete. Busy with production for the present and engineering for the future, our electronic engineers are ready to work with you—to help design FREQ-KC crystal unit applications for war machines, essential civilian products or post-war models—that will give you the jump on competition.

Gentleman Products Division of
HENNEY MOTOR COMPANY
Home Office at FREEPORT, ILLINOIS—Factory at Omaha, Nebraska

MYCALEX
THE INSULATOR

". . . is the most nearly perfect electrical insulator known today"

— an opinion subscribed to by leading engineers in radio, television and industry.

THERE IS ONLY ONE MYCALEX

Adaptability in any climate . . . adaptability in the number of methods in which it may be utilized . . . adaptability in every way — this is the characteristic quality of MYCALEX. Since its introduction twenty-five years ago, the capacity to "work" where performance and efficiency are the major requirements has made the name MYCALEX synonymous with insulation.

Extremely versatile in application, MYCALEX can be cut, drilled, tapped, machined, ground, and polished . . . and if you have a special job where moulded parts are needed, your specifications are invited. Moreover, MYCALEX meets all standards for close tolerances. It has a low power factor, low loss, negligible moisture absorption, and high dielectric strength . . . and it is leadless. Summing up, MYCALEX may be considered as superior to other types of glass-bound mica insulation. In the words of respected engineers, it's the "most nearly perfect electrical insulator known today."

Remember — MYCALEX is not the name of a class of materials, but the registered trade-name for low-loss insulation manufactured in the Western Hemisphere by the *Mycalex Corporation of America*. Sheets and rods immediately available for fabrication by us or in your own plant.

MYCALEX
THE INSULATOR

Trade Mark Reg. U. S. Pat. Off.

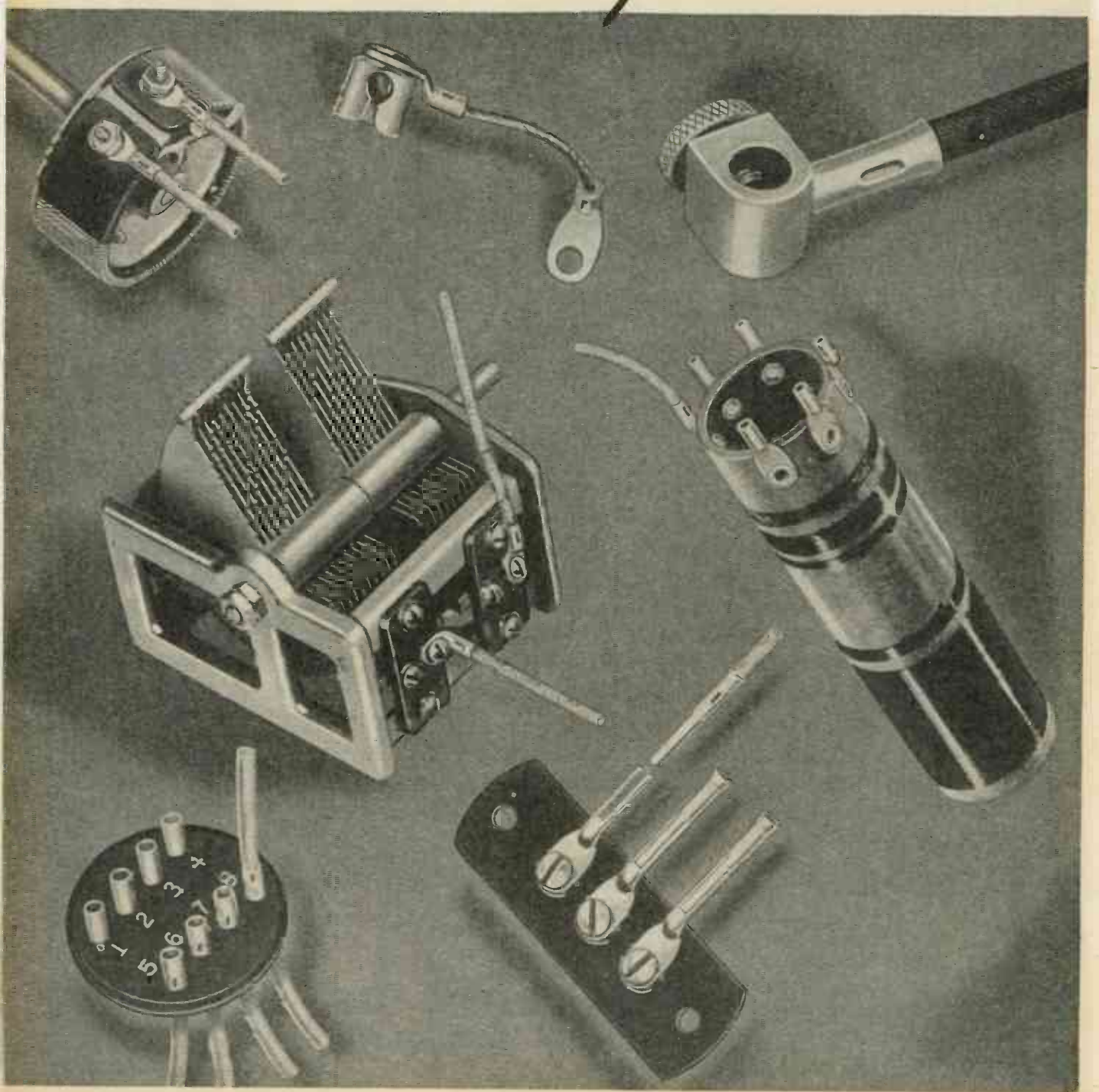
Back the Attack . . . Buy More War Bonds

MYCALEX CORPORATION OF AMERICA

Exclusive Licensee under all patents of MYCALEX (PARENT) CO., Ltd.

60 CLIFTON BOULEVARD — CLIFTON, NEW JERSEY

Eliminate Soldering... WITH Burndy HYDENT



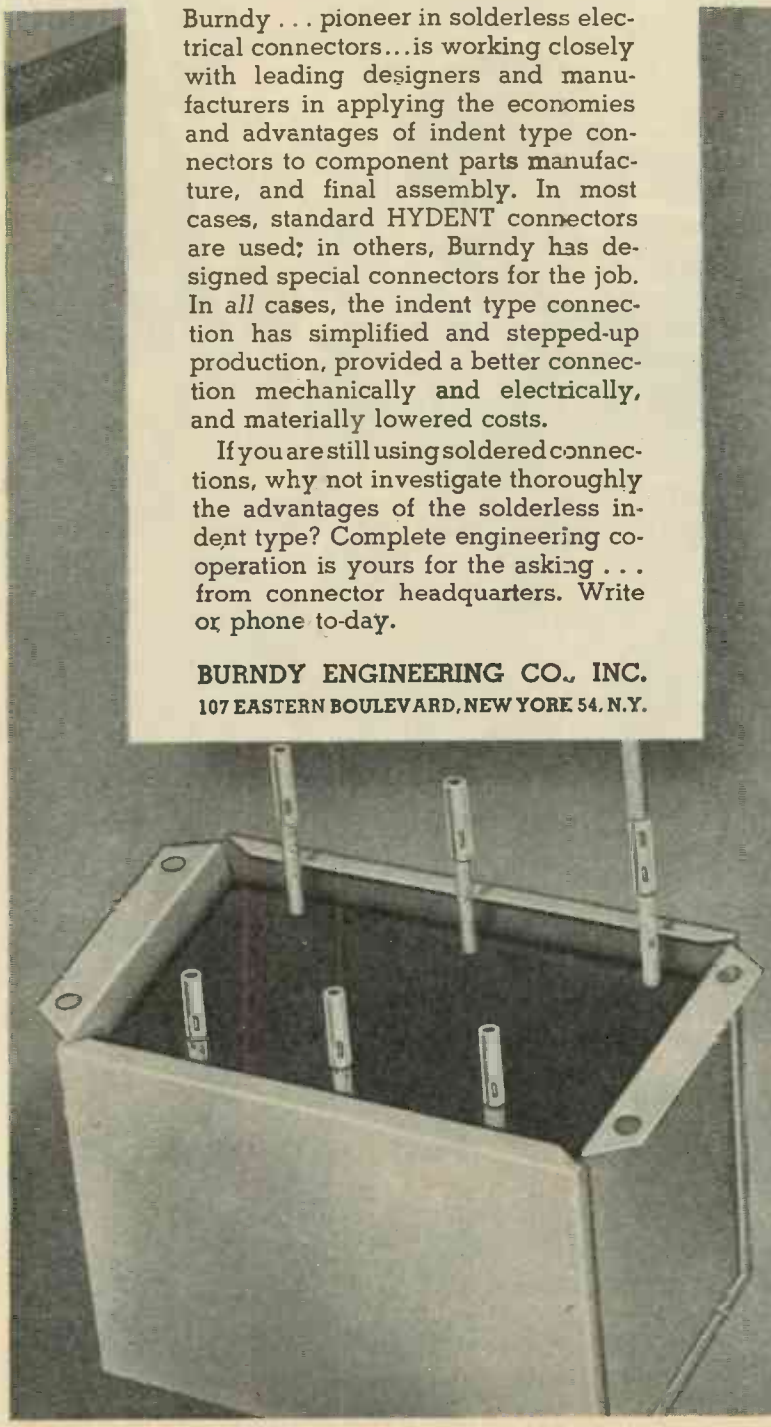
Speed Work-flow...Cut Costs

Connectors

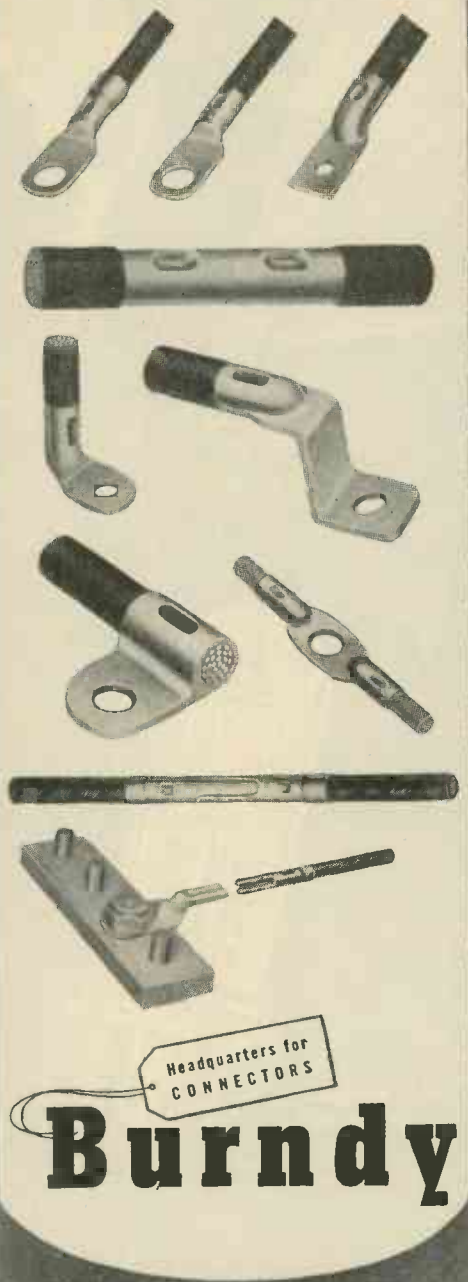
Burndy . . . pioneer in solderless electrical connectors...is working closely with leading designers and manufacturers in applying the economies and advantages of indent type connectors to component parts manufacture, and final assembly. In most cases, standard HYDENT connectors are used; in others, Burndy has designed special connectors for the job. In *all* cases, the indent type connection has simplified and stepped-up production, provided a better connection mechanically and electrically, and materially lowered costs.

If you are still using soldered connections, why not investigate thoroughly the advantages of the solderless indent type? Complete engineering cooperation is yours for the asking . . . from connector headquarters. Write or phone to-day.

BURNDY ENGINEERING CO., INC.
107 EASTERN BOULEVARD, NEW YORK 54, N.Y.



A few of the many types of
Burndy HYDENT CONNECTORS



Headquarters for CONNECTORS

Burndy

Not Only a Part, But a Part of Important Parts...

BUY ALL THE THE BONDS YOU CAN

Micro Switches also play a vital role in the Dependable Functioning of the Barber-Colman Aircraft Controller

The thumb-size, feather-light Micro Switch is not only an important part of aircraft, tanks, ships, machine tools; but it is a vitally important part of other parts which go into many important production items today.

They are important as limit switches in the Barber-Colman Aircraft Controller which controls dampers for the governing of cabin temperatures and flow of air through superchargers, inter-cooling equipment, engine cowl flaps and tab control, and as actuating means for the control of valves on various liquid-carrying lines. In fact, Barber-Colman has long used Micro Switches in Barber-Colman machine tools.

Practically every manufacturer who has once used Micro Switch in one product invariably extends the use of it to other products which they manufacture. This is significant to you. Not only now when Micro Switch's precision, speed, long life and absolute dependability are so important in war work, but equally significant when small size, light weight, and dependable performance will be equally important for new designs.

With Micro Switch it is just a matter of naming your requirement. Micro Switch can meet it. The basic Micro Switch requires a space of only 11/16" x 27/32" x 1-15/16". Special housings with a variety of actuators are available for all types of applications.

If you have a design that calls for the unusual in precision switching, you can count on help from Micro Switch. Write for Micro Switch Handbook Catalog No. 60 for full information on Micro Switch. If you happen to be specializing in aircraft design, you should also have Handbook Catalog No. 70.

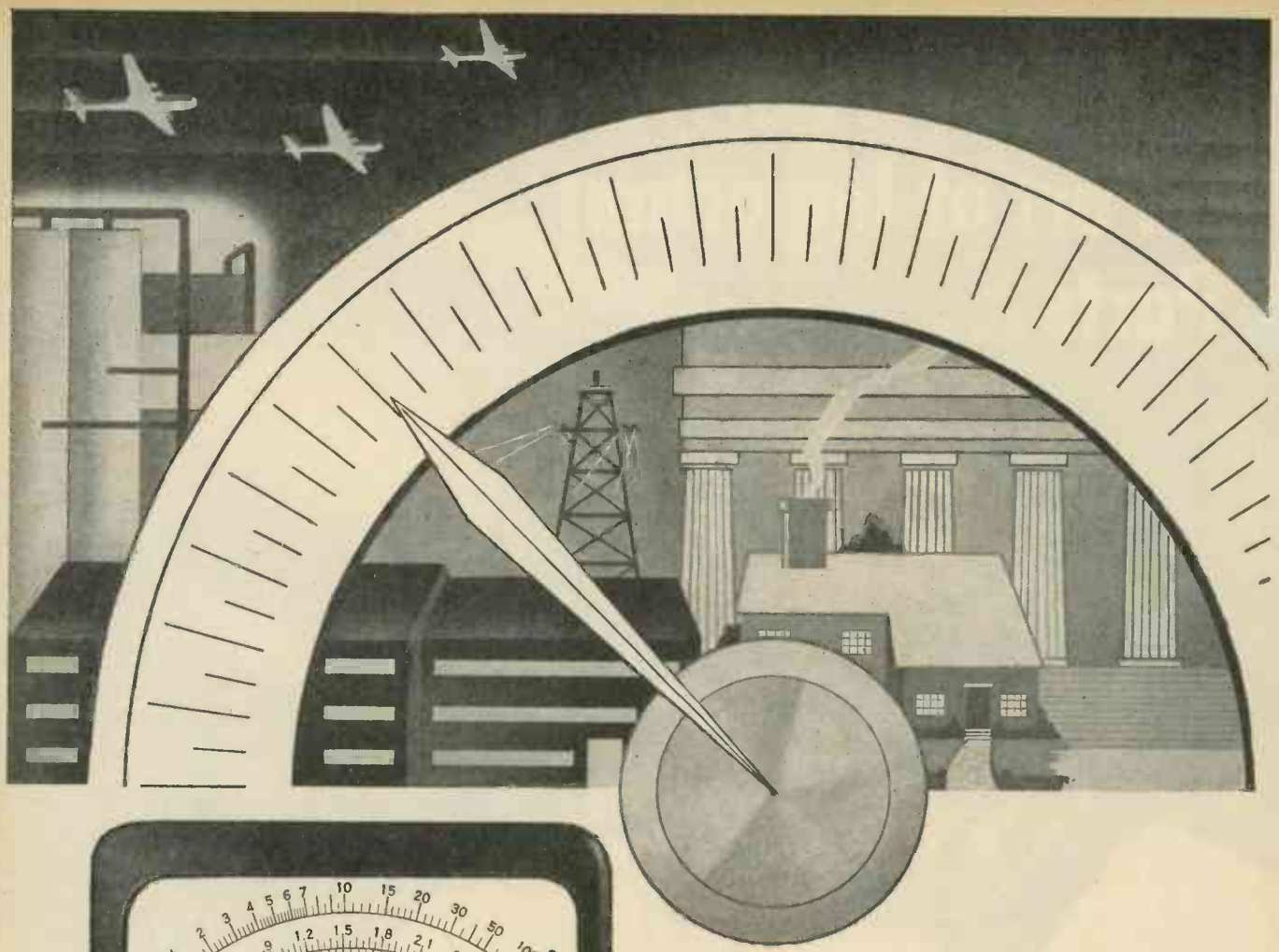
The basic Micro Switch is a thumb-size, feather-light, plastic enclosed, precision snap-action switch that operates on force differentials as low as ¼ ounce and movement differentials as low as .002". It is listed by the Underwriters' Laboratories with ratings of 1200 V.A. loads from 125 to 600 volts A.C. It can be supplied in a wide variety of housings and a broad range of actuating mechanisms.

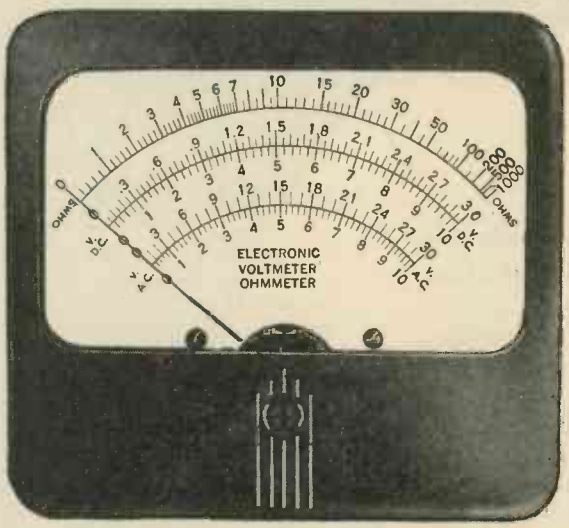
Micro Switch Corporation, Freeport, Illinois • Branches: 43 East Ohio Street, Chicago (11) 11 Park Place, New York City (7) • Sales & Engineering Offices: Boston • Hartford • Los Angeles

The trademark MICRO SWITCH is our property and identifies switches made by Micro Switch Corporation

MICRO SWITCH

Made Only By Micro Switch Corporation, Freeport, Illinois, U. S. A.





THE ACCURATE WAY

There is only one way to take a measurement . . **and *that* is the accurate way. In military, industrial, public service and home front applications, DeJur precision meters have proven themselves to be trustworthy instruments of measurement and control. Illustrated is an example of the many types of DeJur meters . . . specifications for individual requirements are invited.**

Insure a Better Postwar World by Buying More War Bonds Today

Awarded for Excellence in Production and Quality of Material

DeJur-Amsco Corporation

SHELTON, CONNECTICUT

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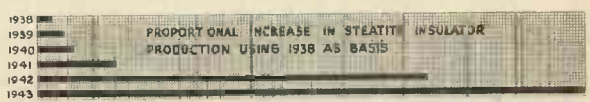
WHEN THE ELECTRONIC ENGINEER NEEDS HELP...

General Ceramics is at his beck and call to help with his insulator problems. In nine cases out of ten the solution will be STEATITE.

Electronic Engineers know that there is a very sound reason for the extensive demands made on the Steatite Industry, demands that are clearly portrayed by the almost astronomical increase in the production of Steatite insulators since 1938 (see graph).

During the course of this unprecedented progress, General Ceramics has been in the foreground both in regard to increased productive capacity and engineering skill in the development of new methods and products — meeting the strict specifications of the United States Army and Navy for the best and only the best in Steatite insulators.



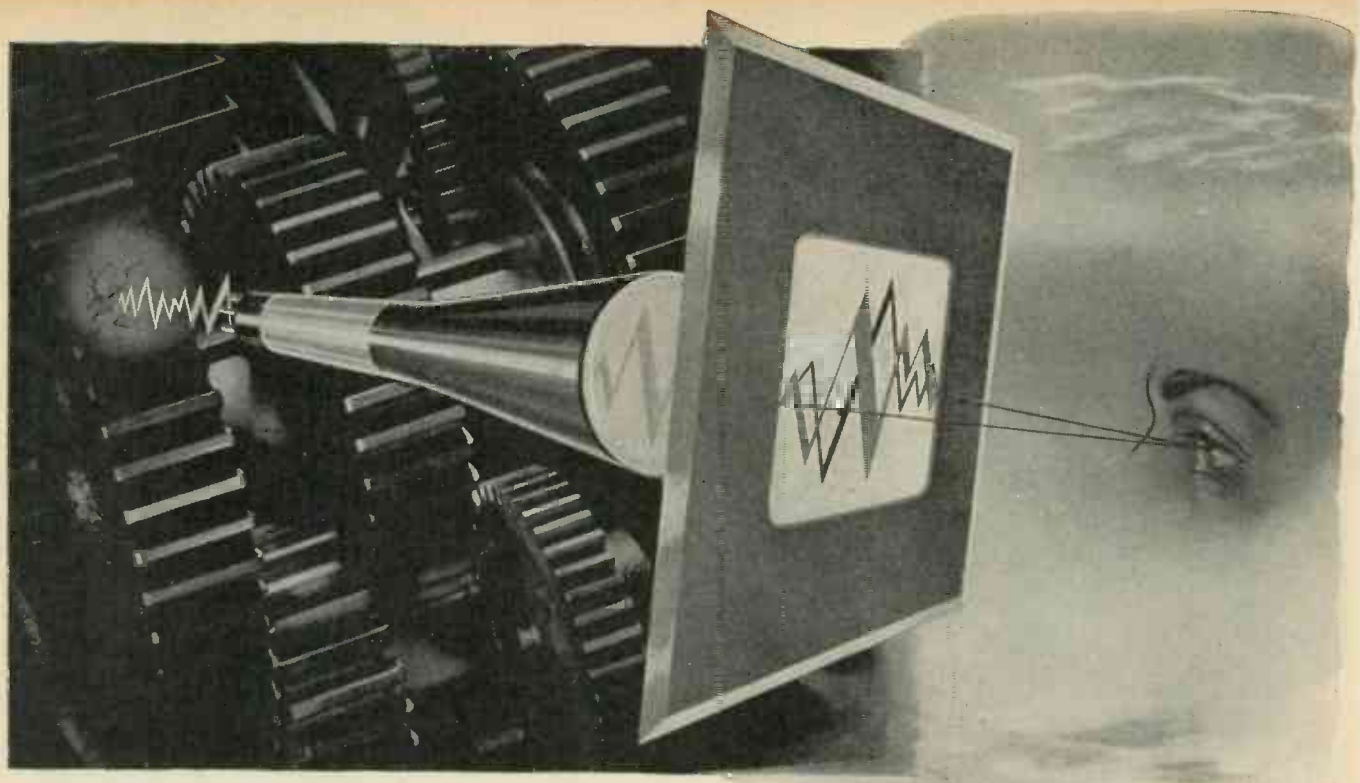
For all your insulator problems whether specialized or standard, our Engineering Department is always at your service.

General Ceramics

GENERAL CERAMICS AND STEATITE CORPORATION
STEATITE INSULATORS

Ⓡ 3573

AND STEATITE CORPORATION
KEASBEY • NEW JERSEY



Key to a world within a world

To inspect metal, judge its inner worth with the aid of electronics, is to add a vital chapter to war industry's book of knowledge. More, it is to write a preface to the mightier book of the future.

This same science of electronics, which finds the structural flaw in war metal, holds great possibilities whose commercial use awaits only the welcome day of peace.

Infinite additions to the knowledge, the safety, the comfort of modern man continuously reveal themselves in the quick flutter of the electronic tubes.

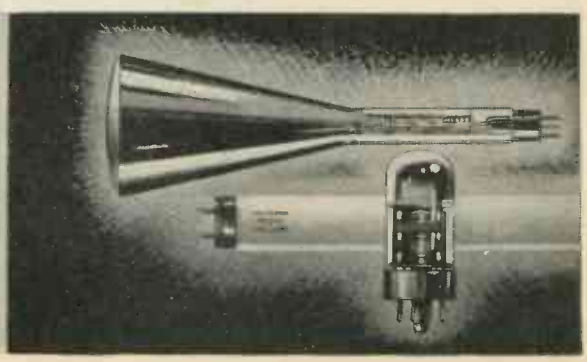
This is an inspiring reason why at Sylvania, in our work with electronics, as in everything else we do to widen the range of the eye and the ear, we set for ourselves a single goal — the highest standard known.

SYLVANIA **ELECTRIC PRODUCTS INC.** formerly Hygrade Sylvania Corporation

EXECUTIVE OFFICES: 500 FIFTH AVENUE, NEW YORK 18, N. Y.

RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES, INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES

AIDING THE HOME FRONTS "KNOW-HOW"—Sylvania Fluorescent Lamps and Fixtures give war workers the light they need to produce their armament miracles. Sylvania Radio Tubes bring the news of the world to the American family, keep our people mentally alert. Sylvania Incandescent Lamps economically protect the eyes of the American family. Indeed, the Sylvania name now, as always, means the ultimate in product performance.



HAVE YOU CHECKED THESE FACTS ABOUT HIPERSIL*

...the new electrical steel?

Here are illustrated six of the more important advantages of Hipersil . . . the new electrical steel that frees designers from the limitations of ordinary silicon steel. Of course, these advantages vary with the application.

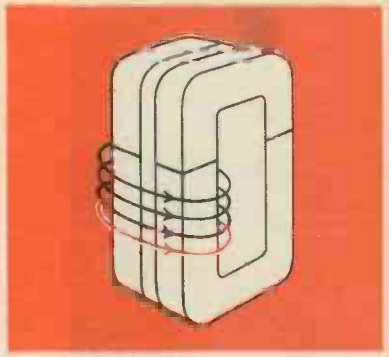
Today, for example, two features of Hipersil, more than any others, are solving many high-frequency problems. These are:

1. Hipersil makes available laminations as thin as .003 . . . thinner than ordinary paper. This is required for the best ultra-high-frequency performance.
2. Hipersil cores are wound from continuous strips . . . bonded together . . . and then cut into *only* two pieces. This feature alone eliminates all of the painstaking work and long time required to stack "tissue-thin" laminations.

GET ALL THE FACTS ABOUT HIPERSIL . . . Write for B-3223, a data book crammed with application and performance facts about Hipersil. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-70418

*Registered trade-mark, Westinghouse Electric & Manufacturing Company for HIgh PERmeability SILicon Steel.



⅓ More Flux-Carrying Capacity

. . . provided by this grain-oriented magnetic steel produced by a new Westinghouse-developed rolling and heat-treating technique.

Reduces Weight 30% to 50%

By increasing flux-carrying capacity ⅓, Hipersil reduces weight of unit as much as 30% to 50%.

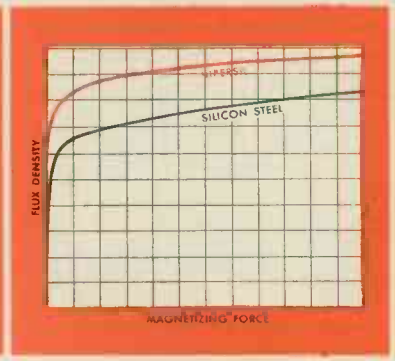
It is ideal for aircraft application.

Simplifies Transformer Assembly

Hipersil cores are wound from one strip . . . then split into two pieces. Easy assembly. No laminations—just 2 or 4 pieces to handle.

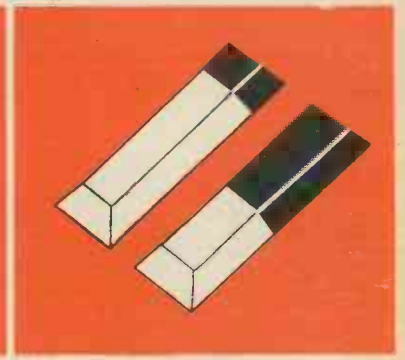
Smaller Size Core Cross Sections

...and coils possible with Hipersil are ideal for airplane, tank, submarine, walkie-talkie applications and where space is at a premium.



Wide Range of Linear Response

Knee of saturation curve for Hipersil is higher than for ordinary silicon steel. Approximately ⅓ greater straight-line response for winding and core cross section.



Saves Critical Materials

It is possible to save 10% of copper in radio transformers . . . 50% of nickel used in alloys for transformer laminations.

Westinghouse HIPERSIL

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

A Few

FERRANTI PRODUCTS

- ✓ Transformers
- ✓ Rectifiers
- ✓ Reactors
- ✓ Filters
- ✓ Equalizers
- ✓ Plate-Filament Transformers
- ✓ Aero Transformers
- ✓ Electrostatic Voltmeters
- ✓ Clip On Ammeters
- ✓ Industrial Voltmeters
- ● Engineering Service

Until the armed forces of the United Nations get all of the Ferranti Products they need civilian requirements must take second place!

Our capacity is now more than ten times what it was a few years ago—and is still increasing.

We are in a position to offer reasonable delivery schedules on most products—exceptionally prompt delivery on many items—plus many worthwhile improvements growing out of our own wartime engineering program.

We therefore suggest:

Before making your commitments — find out what Ferranti can do.

FULL FACILITIES FOR WIRING AND ASSEMBLY OF COMPLETE EQUIPMENTS

FERRANTI

FERRANTI ELECTRIC INC., R.C.A. Bldg., NEW YORK 20, N. Y.

To All Our Friends in The Electronics Field Lots of Good Wishes for Christmas

. . . and this
happy holiday reminder that
we also have

LOTS OF MYKROY

For today's more critical standards in high frequency insulation, there is nothing more practicably perfect than MYKROY. . . . MYKROY is the last word in low-loss dielectrics. It is glass-bonded mica in its most advanced form. . . . MYKROY molds readily and bonds well with metals. It can be machined to close tolerances . . . is virtually impervious to moisture. . . . There is no longer any shortage of MYKROY. With greatly increased facilities, our Clifton plant can fill orders for any amount of stock (sheets and rods) or manufacture component parts to your specifications. Ample stocks are available at our Chicago plant.

Write for detailed information. Bring us your insulating problems.

*MYKROY has such good structural qualities that it can be formed into a wide range of shapes, such as these block letters.

EXCLUSIVE MANUFACTURERS

ELECTRONIC MECHANICS INC.

70 CLIFTON BOULEVARD
CLIFTON, NEW JERSEY

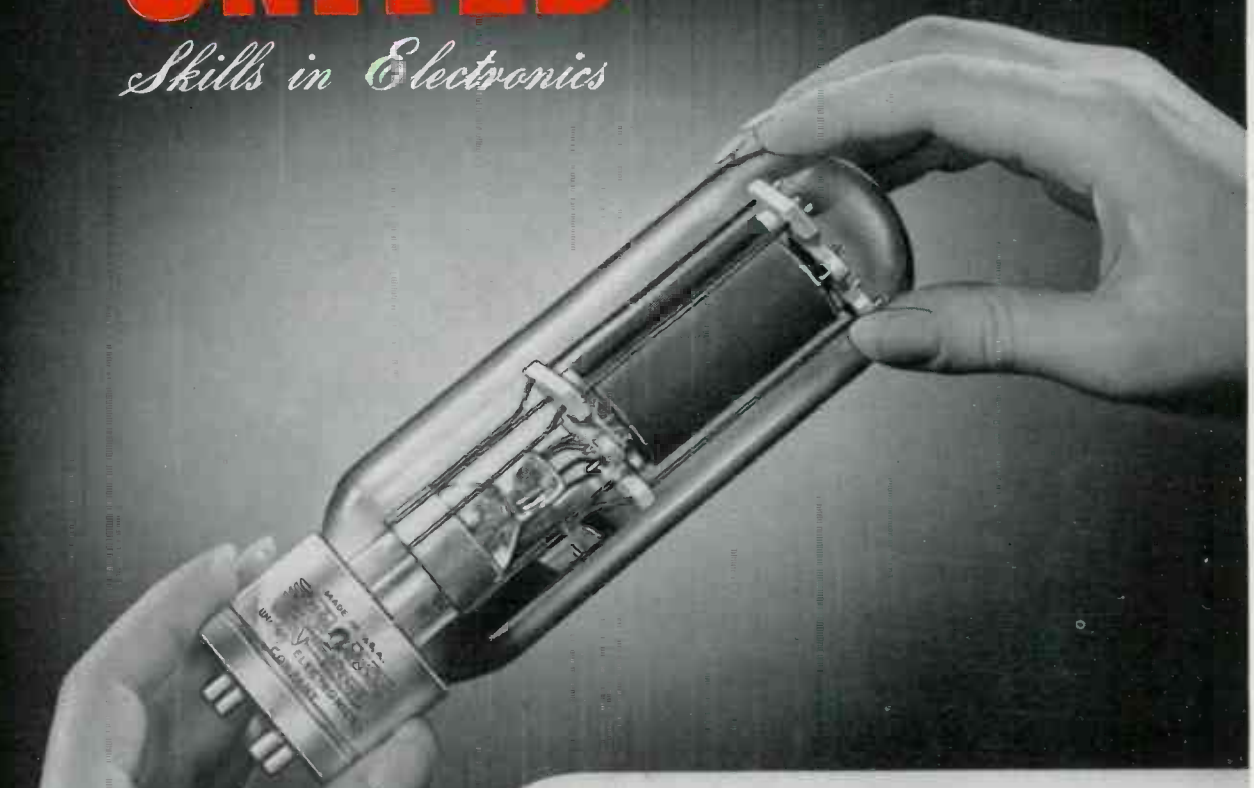
Chicago 47
1917 No. Springfield Ave.—Tel. Albany 4310

Export Department
85 Broad Street, New York 4, N. Y.

Product of

UNITED

Skills in Electronics



"UNITED" electronic power tubes cannot be spun out on swift, automatic assembly lines. The painstaking manufacturing of these sensitive devices requires the skill of human hands.

Here at the "United" Plant, incredibly accurate hands perform under a system of personal supervision by electronic engineers. One by one, the steps of forming and fitting the stems, leads, plates, grids, wires and rods combine to produce transmitting tubes of such flawless precision that they consistently win top rating for performance. Never before were the hands of craftsmen and the brains of scientists so superbly "United" in advancing the scope and purpose of electronics.

Consistent technical advances in tubes, now required for war, some day will be more readily available to you for radio communication, physiotherapy and industrial electronics. Remember to look for "United" on the tubes.

UNITED ELECTRONICS COMPANY

NEWARK, NEW JERSEY

ADLAKE *Plunger-type* MERCURY RELAYS

Snap Action

That Stays "Snappy"!

Adlake Model 1040
For panel mounting. This relay can be supplied with either quick or time delay action; normally open or closed; and for a.c. or d.c. energization. Contact ratings up to 100 amperes a.c. with proportional d.c. ratings.

MERCURY moves *fast.* You know that because you've seen it in action. Due to this inherent characteristic of mercury, Adlake plunger-type *mercury* relays provide the *snap action* so desirable in a relay when contact is made—or broken.

There is positively no tendency toward "molasses in January" operation in these relays. Their action is "snappy" and it *stays "snappy"!*

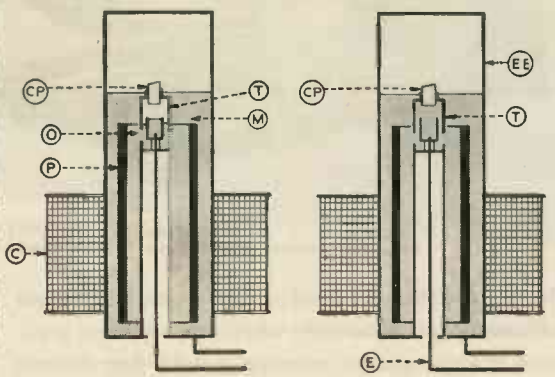
Hermetically Sealed Contact Mechanism

Contact mechanism of Adlake plunger-type mercury relays is hermetically sealed in an *armored* glass or metal cylinder. Dirt, dust, moisture, or oxidation cannot interfere with operation—*in any way or at any time.*

The *liquid* metal mercury contact is positive in action, chatterless, silent, and impervious to burning, pitting, and sticking.

For many kinds of service, no other type of relay provides equal *stamina* and *dependability.* Request complete bulletin.

HOW THEY WORK



ENERGIZED—*Coil C pulls plunger P down into mercury. Mercury thus displaced enters thimble T through orifice O. Inert gas in thimble gradually escapes through ceramic plug CP—thus producing time delay.*

ENERGIZED—*Mercury now fills thimble T, is completely leveled off and mercury-to-mercury contact established between electrodes E and EE. Degree of porosity of ceramic plug CP determines length of time delay.*

Adlake TRADE MARK

THE ADAMS & WESTLAKE COMPANY

ESTABLISHED IN 1857 — ELKHART, INDIANA — NEW YORK · CHICAGO

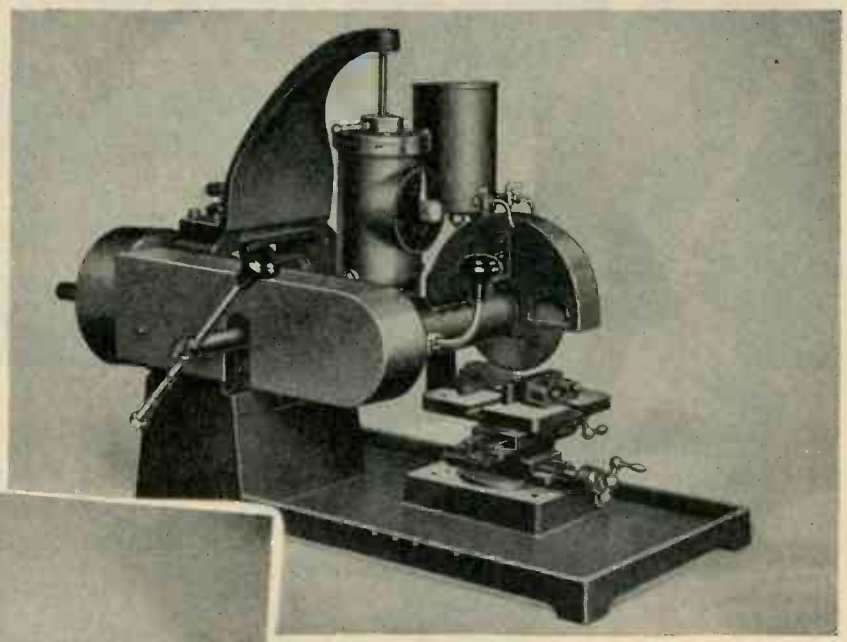
MANUFACTURERS OF ADLAKE SPECIALTIES AND EQUIPMENT FOR RAILWAY, AIRWAY, HIGHWAY, AND WATERWAY

DI-MET QUARTZ CUTTING MACHINES

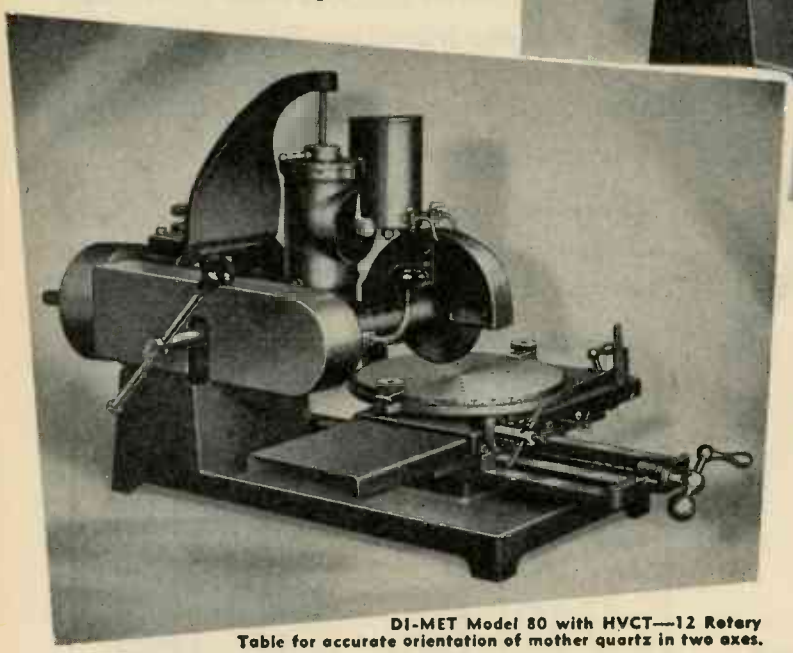
INCREASE QUARTZ CUTTING EFFICIENCY!

Quickly pay for themselves in

time saved
quartz saved
increased production



DI-MET Model 80 Basic Unit.



DI-MET Model 80 with HVCT—12 Rotary Table for accurate orientation of mother quartz in two axes.

HERE ARE TWO variations of the versatile DI-MET Model 80 machine, not just *adapted* to quartz cutting but *especially designed* for quartz cutting and its attendant problems! Both models incorporate the Felker hydraulic retardant, which provides many operating benefits of more importance today than ever before because of limited quartz supplies.

Tests prove that diamond abrasive wheels cut more efficiently and accurately when only sufficient pressure is employed to maintain a light, firm contact with the work. Excessive pressure does not increase rate of cut but causes buckling, deviation from a true cut, wafer breakage and shortened blade life.

The Felker hydraulic retardant overcomes these difficulties. It controls down-feed to any desirable rate, maintains a UNIFORM cutting speed from start to finish, limits cutting pressure, and prevents crowding and buckling of blades with their accompanying faults. Furthermore, by using the retardant, blades slide smoothly into and out of the quartz, eliminating frequent wafer breakage upon completion of the cut and greatly increase the cutting life of blade!

If you want smoother cutting, minimized vibration, MORE PRODUCTION, MORE ECONOMY, get complete information on the DI-MET Model 80* quartz cutting machine! Fully described and illustrated in our catalog—write for your copy!

*Model 120 is comparable to Model 80 in design and characteristics but has increased capacity for extremely large quartz and for special work. Both Models 80 and 120 are available (1) as basic units, (2) with Rolling Tables for fast through-feed operations, (3) with Rolling Tables and HVC-12 Rotary Tables, (4) with HVCT-12 Rotary Tables.

FELKER DI-MET ARMY (E) NAVY

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

MANUFACTURERS OF DIAMOND ABRASIVE WHEELS

An Award and An Acknowledgment

The Employees of The Rola Company Inc., now wearers of the Army-Navy "E", wish to acknowledge a debt... and express a word of appreciation... to certain people outside the Rola organization. They are far too numerous to mention by name but they include:

The Personnel of the Army and Navy Air Forces with whom we have worked.

The Prime Contractors who have entrusted us with orders.

The Suppliers of our equipment and materials.

The Transportation Companies who have handled our shipments.

The many others on whom we have had to depend.

To all those at home who have *helped* us, and to our former associates, now in the armed services, who have *inspired* us, we express our deep gratitude... and with them we proudly share the honor of this Award. The Employees of THE ROLA COMPANY INC., Cleveland, Ohio.

ROLA

MAKERS OF THE FINEST IN SOUND REPRODUCING AND ELECTRONIC EQUIPMENT

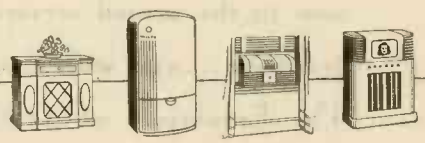
TWO-MAN TORNADO!

THE BAZOOKA . . . ANOTHER SPECTACULAR AMERICAN "SECRET WEAPON" . . . ANOTHER DRAMATIC STORY OF PHILCO AT WAR

TWO MEN AND A BAZOOKA . . . more than a match for sixty tons of steel! Yes, that's the latest story of American ingenuity and productive skill.

A single soldier carries and fires it, his teammate loads it . . . and 60 ton enemy tanks, concrete pill boxes, brick walls and bridges wither under the fire of its deadly rocket projectile. It's an amazing achievement of ordnance design, conceived and developed by the Ordnance Department of the United States Army. And it's another stirring chapter in the fascinating story of Philco at war.

The men and women of the Philco *Metal* Division, whose huge presses produce the metal parts of peacetime Philco radios, have played a leading part in the final perfection and production of the Bazooka. With their colleagues in the Philco *Radio* Division, they are turning out miracles of war equipment. After victory, their new knowledge and skill will bring you the newest achievements of modern science in radio, television, refrigeration, air conditioning and industrial electronics under the famous Philco name.



After victory Philco peacetime products will offer the highest achievements of modern science for the homes and industries of America.

PHILCO CORPORATION

QUAKE-PROOF CONSTRUCTION

In a few cubic inches of space National Union tube designers plan and build their electronic skyscrapers. Many fragile parts of these intricate mechanisms are precisely balanced, buttressed and welded fast.

For N. U. engineers well know the *rough sailing* that's ahead for these tubes—the shocks, concussion, vibration—relatively far more shattering than the impact of an earthquake on a modern steel and masonry building. So their war job is to build tubes which will stand up and take what comes—whose parts will *stay* in precise alignment—whose exact clearances will not be altered—whose air seal will not be broken.

To master this complicated construction problem calls for precision engineering of the first order—and a minute knowledge of the strength, rigidity and other characteristics of many metals. The point is—modern electronic tubes are scientific instruments. And to be sure of getting the tubes which will best handle your post-war work—you'll want to seek sound technical advice. Call on National Union.

NATIONAL UNION RADIO CORPORATION, NEWARK, N. J.
Factories: Newark and Maplewood, N.J., Lansdale and Robesonia, Pa.

NATIONAL UNION

RADIO AND ELECTRONIC TUBES

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

War's Only Gift...

War has but one gift to offer . . . the gift of an amazing progress in science and engineering. The greater use of electrical control devices in place of manual and mechanical controls is a striking example. Electrical control replaces numerous working parts . . . eliminates friction drag and lost motion . . . gives instantaneous response . . . saves time and materials.

One of the most versatile circuit control devices of the war is the Series 345 Relay used to drop bombs, control auxiliary generators, switch radio circuits. Contact combinations range from single pole to three pole double throw. Contact capacity up to 15 amps. at 24 Volts D.C. for aircraft applications. Quick acting or time delay. Write for Bulletin 345 for complete details.

GUARDIAN ELECTRIC

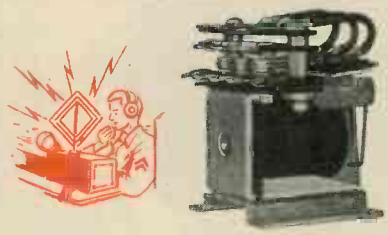
1622-N W. WALNUT STREET CHICAGO 12, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY

FOR WAR—FOR PEACE— *Relays* BY GUARDIAN

Relays by GUARDIAN

FOR EVERY CONTROL NEED

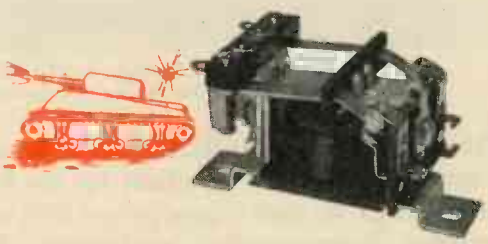


SERIES 345 RADIO RELAY

A general purpose radio relay designed for aircraft use. Contact combinations up to three pole, double throw. Coil resistances range from .01 ohm to 15,000 ohms. Standard voltage: 16-32 volts D.C. Available with delayed release or delayed attract. Weight: 6½ oz. Also built for A. C. operation (Series 340).

SERIES 195 MIDGET RELAY

One of the smallest of all relays. Built for aircraft and radio applications where space and weight are at a premium. Contact rating: 2 amps. at 24 volts D.C. Switch capacity up to double pole, double throw.



SERIES 165 VIBRATION RESISTANT

Counterbalanced armature and sturdy construction throughout give this relay an unusual resistance to vibration. Silver contacts are rated at 12½ amperes in combinations up to double pole, double throw. Rating for aircraft is 8 amperes at 24 volts D.C. Available with ceramic insulation for HF and UHF applications.

BULLETIN O-F—112

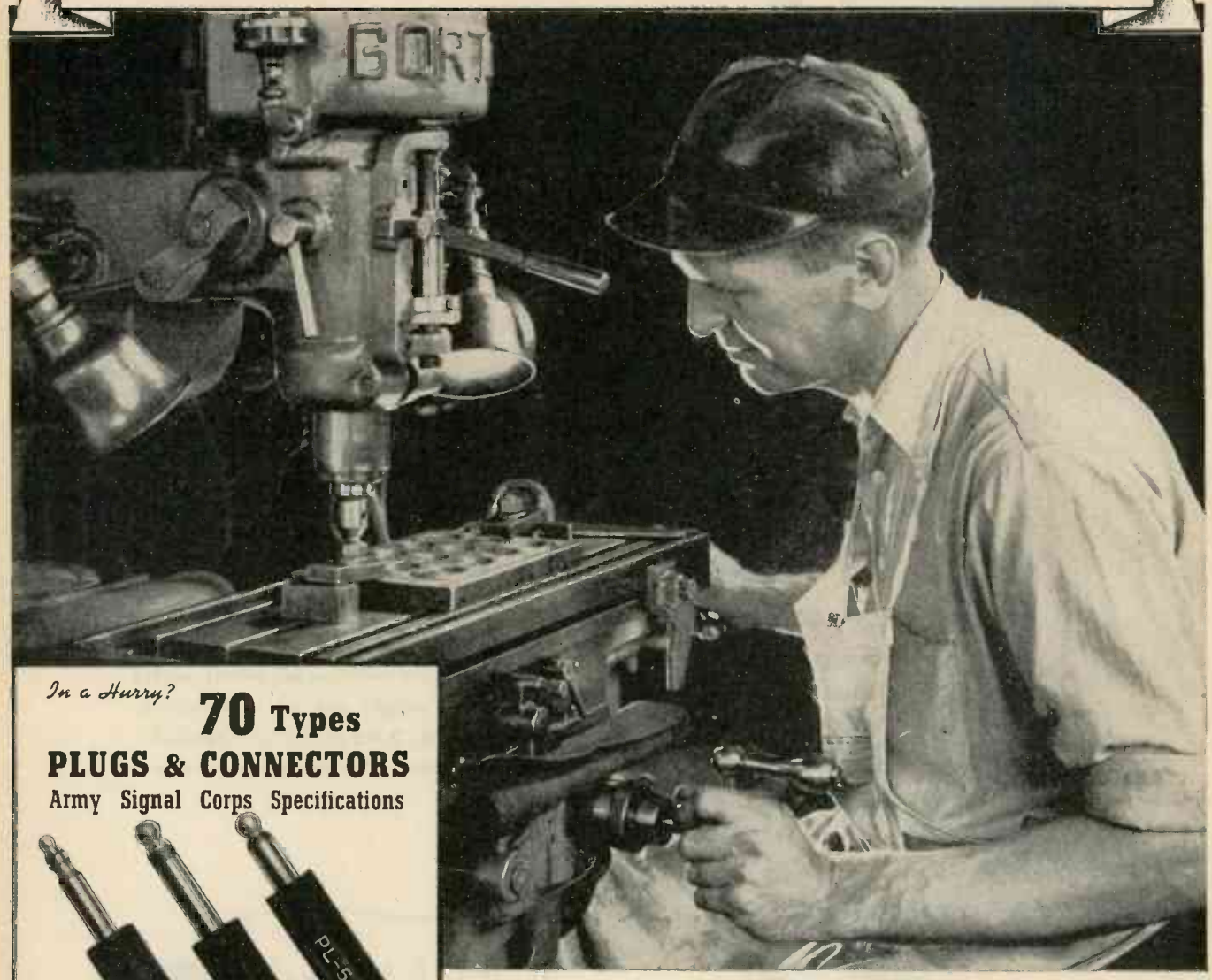
for a quick reference to standard relay types. Describes 17 relay models for war and post-war applications. Write for it today . . .

GUARDIAN ELECTRIC

1622-N WEST WALNUT STREET CHICAGO, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY

REMLER *Precision* FOR WAR AND PEACE



Remler craftsman die-sinking a mutiple mold for Signal Corps Connectors

In a Hurry?

70 Types PLUGS & CONNECTORS

Army Signal Corps Specifications

Types:	PL			
50-A	61	74	114	150
54	62	76	119	159
55	63	77	120	160
56	64	104	124	354
58	65	108	125	
59	67	109	127	
60	68	112	149	

PLP		PLQ		PLS	
56	65	56	65	56	64
59	67	59	67	59	65
60	74	60	74	60	74
61	76	61	76	61	76
62	77	62	77	62	77
63	104	63	104	63	104
64		64			

OTHER DESIGNS TO ORDER

REMLER DESIGNS AND MANUFACTURES tools and dies, plastic moldings and screw machine products for the trade and combines these products of its own manufacture into electronic devices and complete communication equipment. The skill, experience and services of this firm, which date back to the infancy of these industries, is available to those engaged in war production and peace-planning. Remler facilities and production techniques frequently permit quotations at lower prices.

Wire or telephone if we can be of assistance

REMLER COMPANY, LTD. - 2101 Bryant St. - San Francisco, 10, California

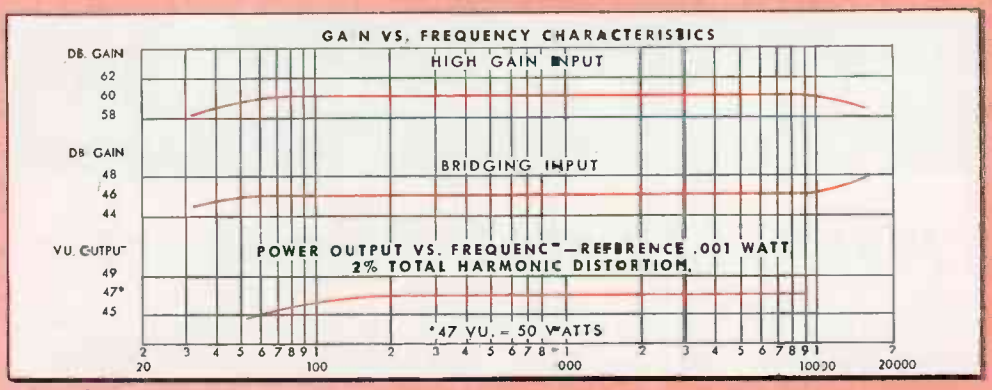
REMLER

SINCE 1918

Announcing & Communication Equipment

In Production Now!

Input impedance 600 ohms and bridging. Gain 60 db in the former case, 46 in the latter. Output impedance adjustable 1 to 1000 ohms.



THE LANGEVIN TYPE 101-A Amplifier is a good amplifier. Its most outstanding virtue is excellent low-frequency wave form at high output levels, as shown in graph above. In this regard it is unique among commercial amplifiers. Its volume range is also excellent, inherent noise level being 68 db unweighted below full output of plus 47 VU at 2% RMS harmonic distortion. The frequency characteristic leaves nothing to be desired in the reproduction of music. Electrically and mechanically it is as good a product as we know how to build after more than 20 years experience in the sound field. Specification upon request.

The Langevin Company

INCORPORATED

SOUND REINFORCEMENT AND REPRODUCTION ENGINEERING

NEW YORK	SAN FRANCISCO	LOS ANGELES
37 W. 65 St., 23	1050 Howard St., 3	1000 N. Seward St., 31

PAINTED FOR ELECTRONIC LABORATORIES, INC., BY BENTON CLARK

NOT HERE, Hirohito!

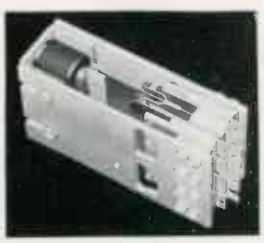
● **So sorry, son of heaven, but the answer is "NO! You can't land here!"** . . . Not with these gallant little sluggers, the PT boats, on the job. They're tough. They're fast. They never sleep. And whatever the occasion demands, they've got what it takes.

As a concentrated package of poison for the Axis, the PT boats are an outstanding example of the way American engineers, workers and management are teaming together to produce the deadliest weapons the world has ever known. And naturally, we're proud that *E·L* equipment is giving a good account of itself on PT boats.

The widespread use of *E·L* Vibrator Power Supplies as standard equipment—on land, sea and air—for radio, lighting, communications, etc.—wherever electric current must be changed in voltage, frequency or type—is evidence of the efficiency and rugged dependability of *E·L* products.

Electronic
LABORATORIES, INC.
INDIANAPOLIS

E·L ELECTRICAL PRODUCTS — Vibrator Power Supplies for Communications . . Lighting . . . Electric Motor Operation . . . Electric, Electronic and other Equipment . . . on Land, Sea or in the Air.



***E·L* Tandem Type Vibrator** — For changing DC to AC in Vibrator Power Supplies. Delivers as much as 750 watts DC or AC. Input Voltage: 4-220 volts; Input Wattage Rating (max.): 125-1000 watts, depending upon input voltage; Frequencies: 60, 100, 120 standard; 20-120 available range; effective life: 1500 hrs.

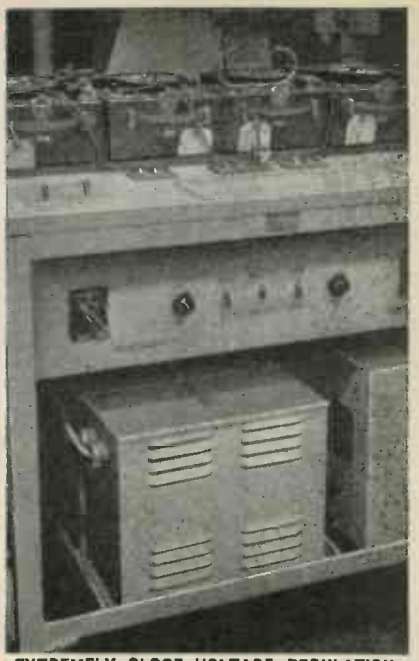
These are the BENEFITS of a CLOSELY HELD VOLTAGE SUPPLY

Better performance, greater reliability, and longer life of electronic devices

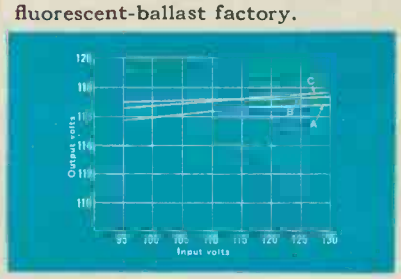
Protection of delicate instruments and machines, precision tools, and electronic tubes against sudden overvoltages

More accurate test results, fewer rejects

And manufacturers—don't forget:
A product's salability can be increased when voltage stabilization is a built-in feature.



EXTREMELY CLOSE VOLTAGE REGULATION, so essential to speedy, accurate production-line testing, is automatically maintained by a 500-volt-ampere G-E stabilizer on a test bench in a fluorescent-ballast factory.



▲ **LOOK AT THIS PERFORMANCE**—Practically constant voltage for several typical conditions (A—Open circuit; B—Full load, unity power factor; C—Full load, 0.8 power factor lagging). Stabilizing action practically instantaneous, taking place in less than three cycles.

...and Here's the Way to Get It

IMPROVES THE PERFORMANCE OF EQUIPMENT LIKE THIS:

Radio transmitters and testing equipment
Photoelectric equipment and other electronic-tube apparatus
Motion-picture projectors and sound equipment
Telephone apparatus
X-ray machines
Precision photographic equipment and photometers
Color comparators
Calibration of meters, instruments, relays
Laboratory precision processes and testing equipment

FOR DETAILS on this stabilizer's unique circuit, write for Bulletin GEA-3634. *General Electric Company, Schenectady, N. Y.*

VOLTAGE STABILIZERS

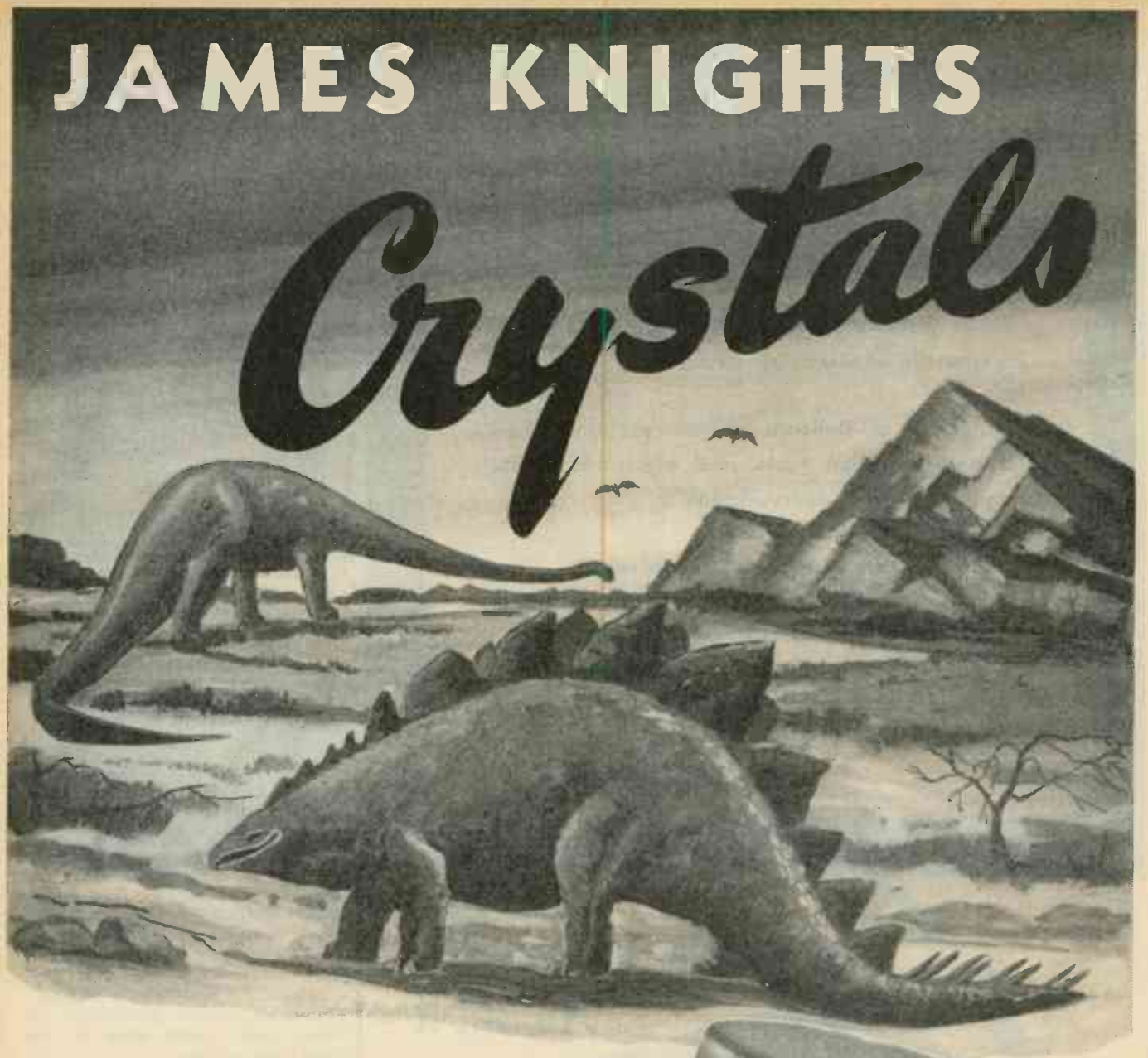
GENERAL ELECTRIC

403-53-5206

The best investment in the world is in this country's future—BUY WAR BONDS

JAMES KNIGHTS

Crystals



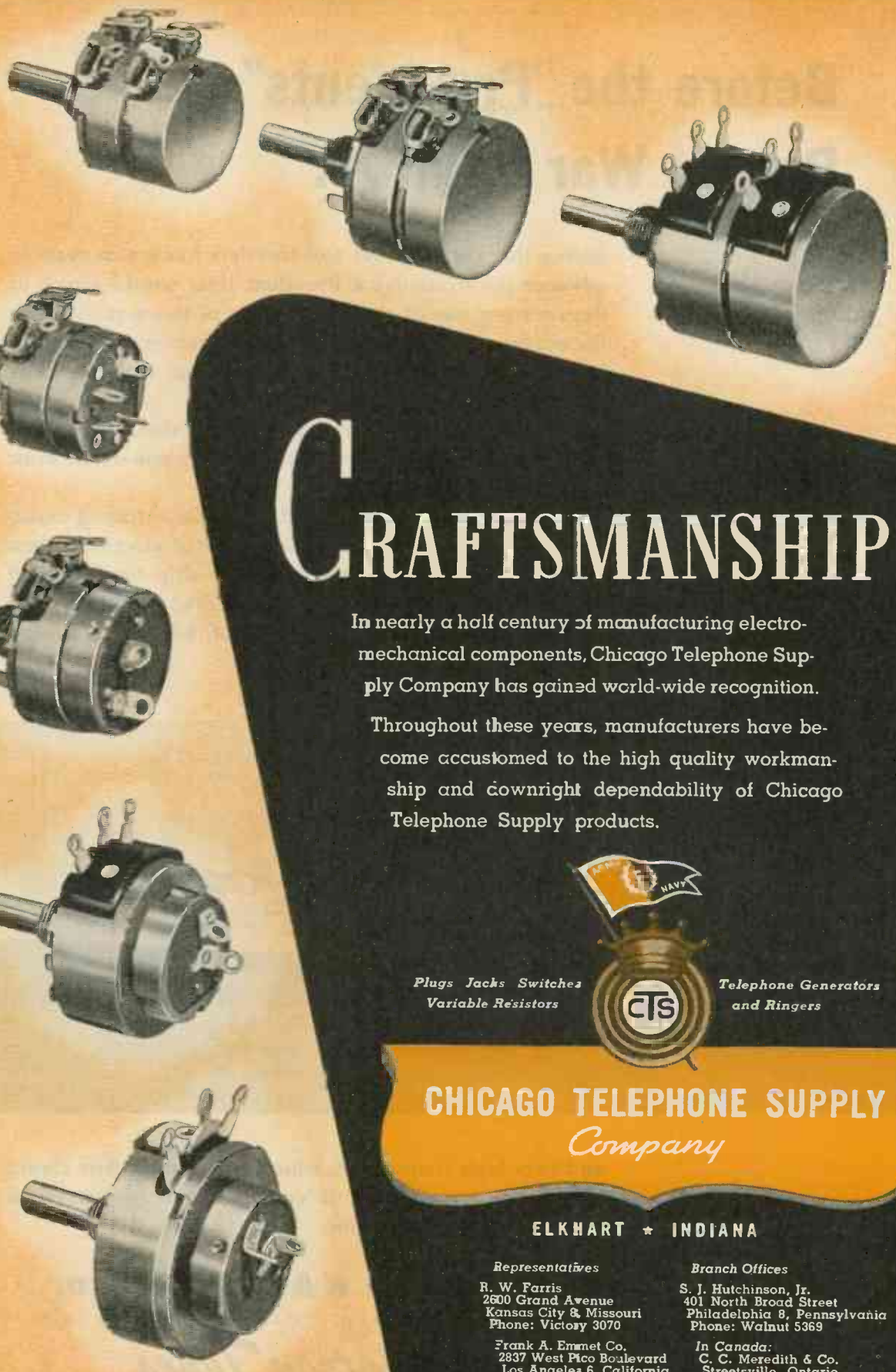
Quality crystals once formed, may last unchanged for millions of years — to the day the important "first cuts" are taken to make them useful to man. It is in these first steps of precision fabrication, and in those that follow, that the skill of James Knights craftsmen plays its part. Every James Knights Crystal is designed and cut to exacting specifications by America's most modern methods. No wonder, with the finest of raw materials and advanced manufacturing techniques, James Knights can produce, in volume, dependable crystals of every type, cut and frequency. Why not let James Knights specialists help with your requirements?

BUY WAR BONDS FOR VICTORY!

The JAMES KNIGHTS Co.

SANDWICH, ILLINOIS **Phone 65**

PRECISION CUTTERS OF QUARTZ FOR COMMUNICATIONS AND OPTICAL USES



CRAFTSMANSHIP

In nearly a half century of manufacturing electro-mechanical components, Chicago Telephone Supply Company has gained world-wide recognition.

Throughout these years, manufacturers have become accustomed to the high quality workmanship and downright dependability of Chicago Telephone Supply products.

Plugs Jacks Switches
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Manufacturers of Quality Electro-Mechanical Components Since 1896

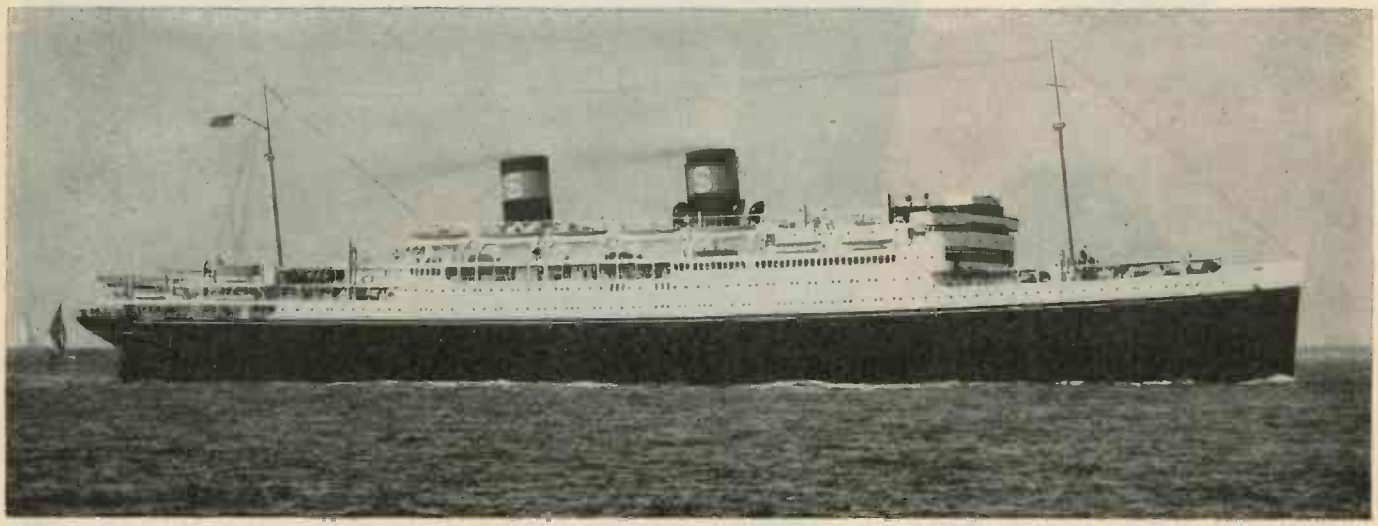
Before the "Presidents" Put on War Paint...

Before the war, shippers and travelers knew two years in advance the exact day a President liner would arrive or depart from any of the major ports of the world! Today the movement of these gray-clad transports is strictly hush-hush... but they continue to ply the seas with the same remarkable dependability.

For many years Heintz and Kaufman transmitters and Gammatron tubes have made these liners one of the most cohesive networks afloat.

Today Heintz and Kaufman Ltd. is concentrating exclusively on the design and manufacture of electron tubes.

The experience of our engineers in ship-to-shore and ship-to-ship communication is embodied in Gammatron tubes. The efficiency and reliability of these tubes at high



and very high frequencies, which makes them first choice for marine transmitters, is equally advantageous in all types of radio transmission.

HEINTZ AND KAUFMAN LTD.

SOUTH SAN FRANCISCO • CALIFORNIA, U. S. A.

Gammatron Tubes

LEADERS IN ELECTRONICS • YESTERDAY • TODAY • TOMORROW

THE WALLS OF JERICHO LISTENED...AND FELL

The fabled walls of Jericho find counterpart today in every moving machine and vibratory structure. Each is vulnerable to vibration. Each in time will be its victim.

INSTRUMENTS RENTAL LIST provides complete information regarding instruments, machines and equipments that are for rent.

Our service manual describes instruments and applications.

Write for RENTAL LIST and service manual . . .

"ENGINEERING THINGS TO COME"

Waugh Laboratories specialize in vibrations. **WAUGH-JOHNSON VIBRATION MACHINES** and **BERNHARD OSCILLATORS** provide the means of making "shake down" tests to determine the strength or weakness of untried equipment and of forecasting the failure of structures. Equipment for sale or rent.

Engineering field services available where desired.

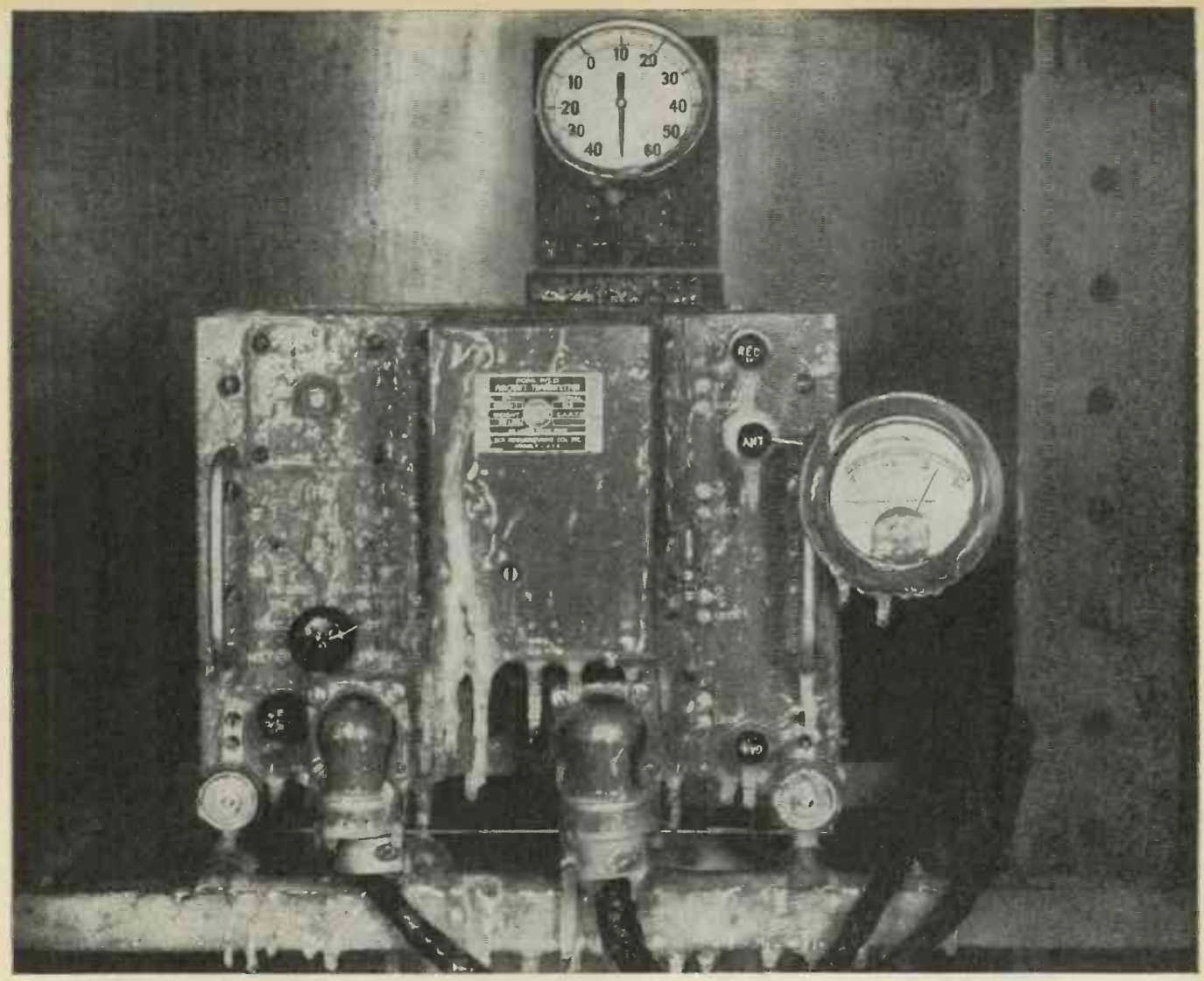
WAUGH *Laboratories*

Pacific Coast Branch: 180 East California St., Pasadena 5, California · **422 LEXINGTON AVE., NEW YORK 17, N. Y**

The men and women of National Company take grect pride in the reception of the Army-Navy "E" Award far excellence in production. To us it brings a special satisfaction, for twenty-five years ago we received a similar award for service to the Nation in World War I. Old timers have set the pace in winning both awards, but new hands have joined with old skills in putting our difficult job across. It is our pride and our pledge that we of National Company shall keep our record of service bright.

NATIONAL COMPANY, INC.

MALDEN, MASS., U. S. A.



ARCTIC REHEARSAL...AT 76° BELOW

Today's demands on men and planes and equipment are the most severe the world has ever known. Battlegrounds have advanced into the sub-stratosphere—where even over the equator temperatures are scores of degrees below zero.

No radio equipment could remain operative under such conditions until scientific research solved the problems of tuning controls freezing, sensitive relays jamming, electrical adjustments changing and wires snapping. Without research, radio and electronic systems fail in these frigid temperatures where our men and planes are fighting in their conquest over cold and altitude and the enemy.

To permit accurate scientific investigation of these problems, RCA recreates this intense cold in its laboratories, cold that is 9° lower than the stratosphere temperature, cold that equipment such as the ice-sheathed transmitter shown above must withstand for endless hours. In these icy chambers RCA engineers are looking ahead to the future, solving the problems that will be encountered as our fighters and bombers operate higher and higher into the stratosphere.

Daily these engineers patiently work, subjecting equipment to temperatures as low as —76°, testing and retesting until operation is satisfactory—until dependability is assured. Thus RCA research helps to make our aviation radio equipment more efficient, more powerful, and more reliable in performing its vital tasks.

That's one reason, too, experts say: "For results in aviation radio performance, consult RCA research."

RCA AVIATION RADIO

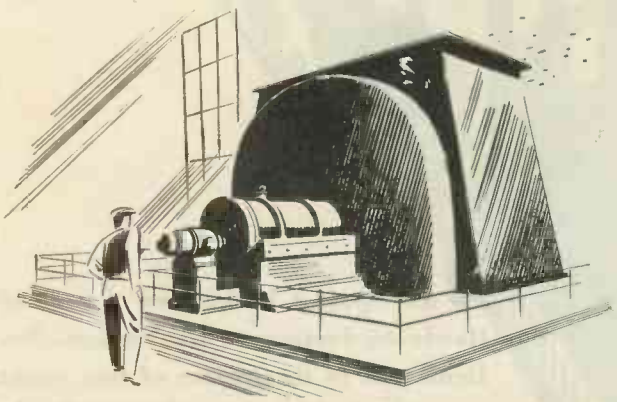
RCA Victor Division • RADIO CORPORATION OF AMERICA • Camden, N. J.

Electronics

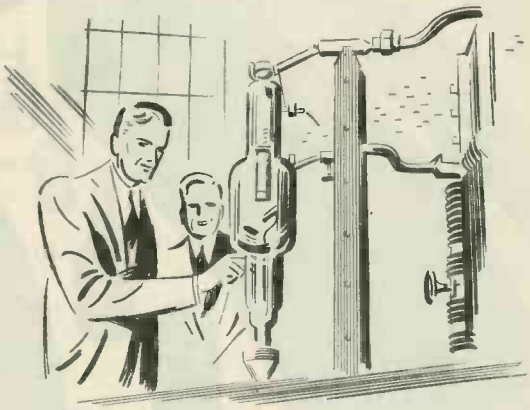
Power Line Carrier—an electronic application widely used by power companies, has greatly increased the reliability and capacity of power transmission lines, while saving critical materials. High-frequency waves, similar to radio waves, are transmitted *along the power line* instead of radiating into space. These waves, or carrier currents, may be used for reliable voice communication between remote points on a power system—or for instantaneous and automatic operation of protective devices at distant points in case of a fault on the line. They also serve as channels for transmitting metering information from one point to another automatically.

. . at Work

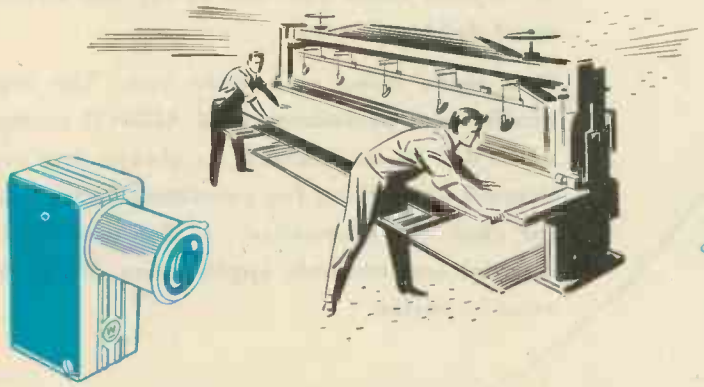
To industrial men, electronics has become a versatile working tool—speeding production, improving product quality, increasing efficiency—on a thousand wartime production fronts. Here are some of the practical ways Westinghouse engineers are putting electronics to work.



The World's Largest Induction Motor drives two 54-ton propellers at the Army's Wright Field wind tunnel. Its speed must be held constant at a preset value while test readings are being taken. Electronic regulators perform the job—holding speed "on the nose".



Millionth-of-a-Second X-Rays now enable engineers to detect flaws in inch-thick steel armor plate—photograph bullets in their flight through a gun barrel. By means of the ultra high-speed x-ray tube, weapons are constantly being made stronger, more efficient.



Protecting Workers Against Injury—On hazardous machines, such as punch presses and shears, a beam of light is projected across the machine to a phototube. As long as the operator's hand is in the danger area, the machine is prevented from operating.

In the Molding of Plastics, electronic high-frequency dielectric heating is finding wide application. By providing rapid and readily controlled rates of heating, it makes possible faster rates of processing, more uniform and better products.

J-91034

For further information on Westinghouse Electronic devices, write for Booklet B-3264. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

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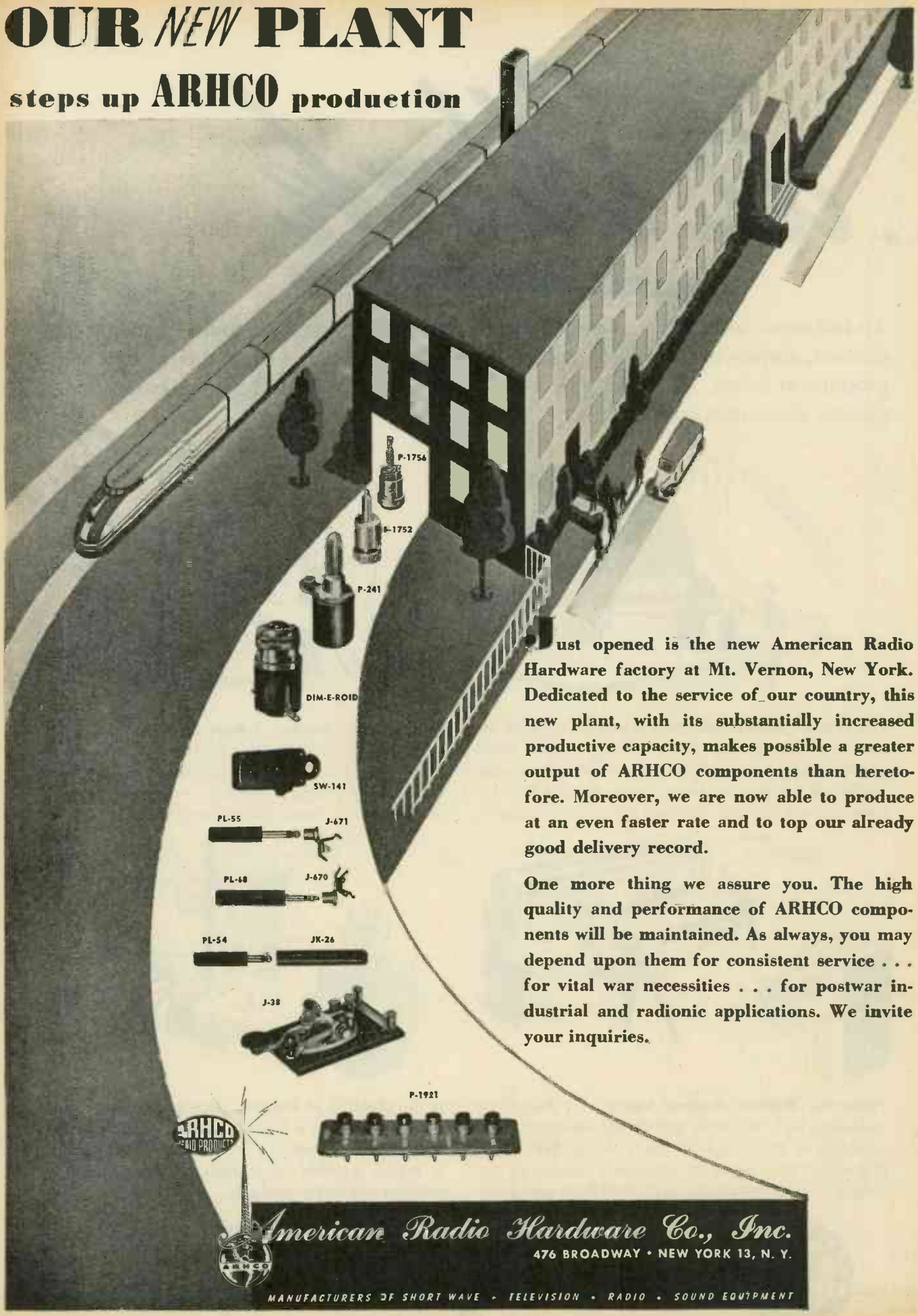
steps up ARHCO production



Just opened is the new American Radio Hardware factory at Mt. Vernon, New York. Dedicated to the service of our country, this new plant, with its substantially increased productive capacity, makes possible a greater output of ARHCO components than heretofore. Moreover, we are now able to produce at an even faster rate and to top our already good delivery record.

One more thing we assure you. The high quality and performance of ARHCO components will be maintained. As always, you may depend upon them for consistent service . . . for vital war necessities . . . for postwar industrial and radionic applications. We invite your inquiries.

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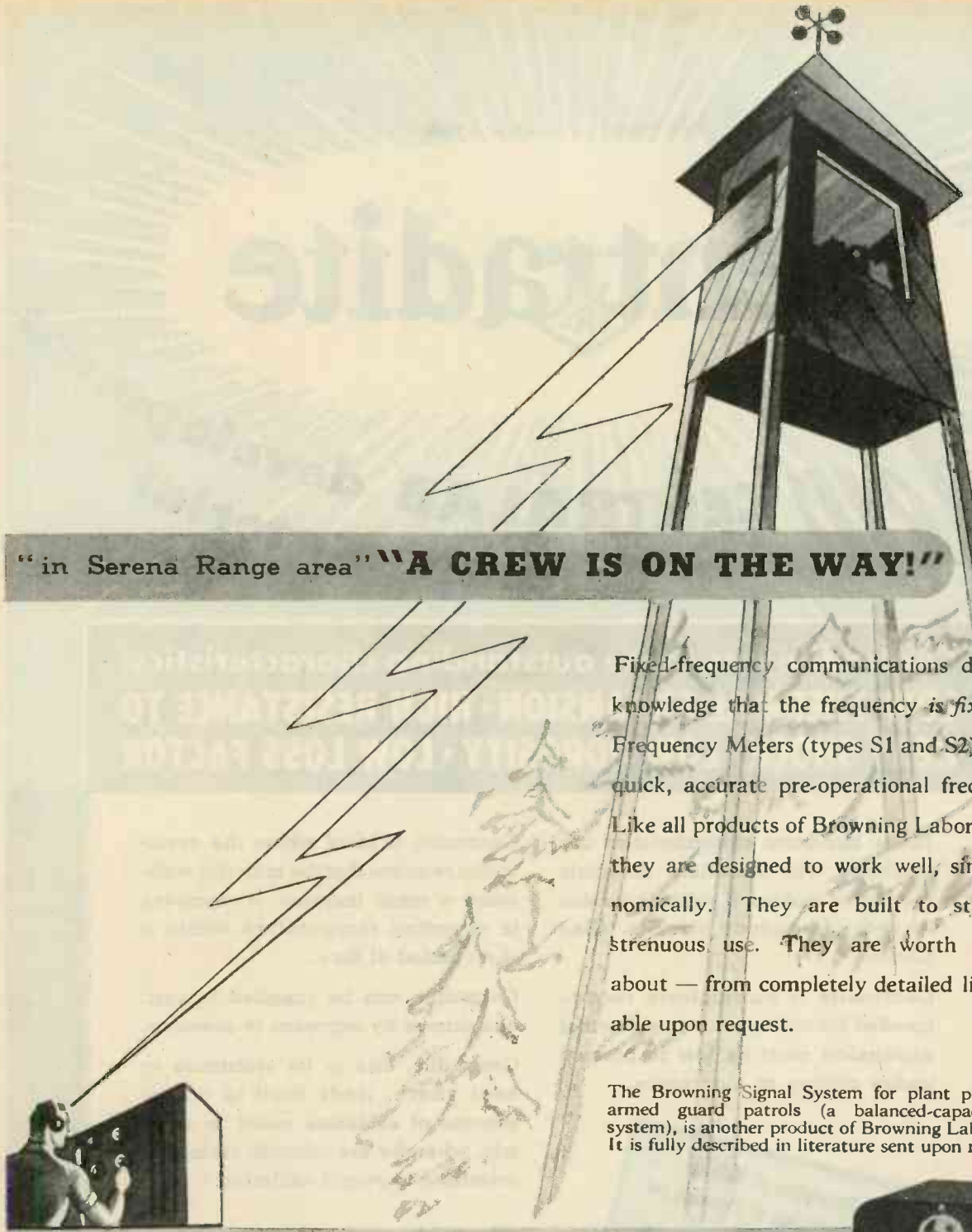

"in Serena Range area" **"A CREW IS ON THE WAY!"**

Fixed-frequency communications depend on sure knowledge that the frequency *is fixed*. Browning Frequency Meters (types S1 and S2) make possible quick, accurate pre-operational frequency checks. Like all products of Browning Laboratory research, they are designed to work well, simply, and economically. They are built to stand up under strenuous use. They are worth learning more about — from completely detailed literature available upon request.

The Browning Signal System for plant protection without armed guard patrols (a balanced-capacitance electronic system), is another product of Browning Laboratory research. It is fully described in literature sent upon request.

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A New CENTRALAB development in Ceramic material

Centradite has these outstanding characteristics:
LOW THERMAL EXPANSION • HIGH RESISTANCE TO HEAT SHOCK • LOW POROSITY • LOW LOSS FACTOR

These important characteristics are combined with excellent dielectric properties making it suitable for use in radio frequency circuits. (See Chart).

Centradite is particularly recommended for coil forms where thermal expansion must be low to prevent undue change in inductance.

Centradite is ideal where the application requires that the material withstand a rapid increase or decrease in operating temperature within a short period of time.

Centradite can be supplied in various shapes by extrusion or pressing.

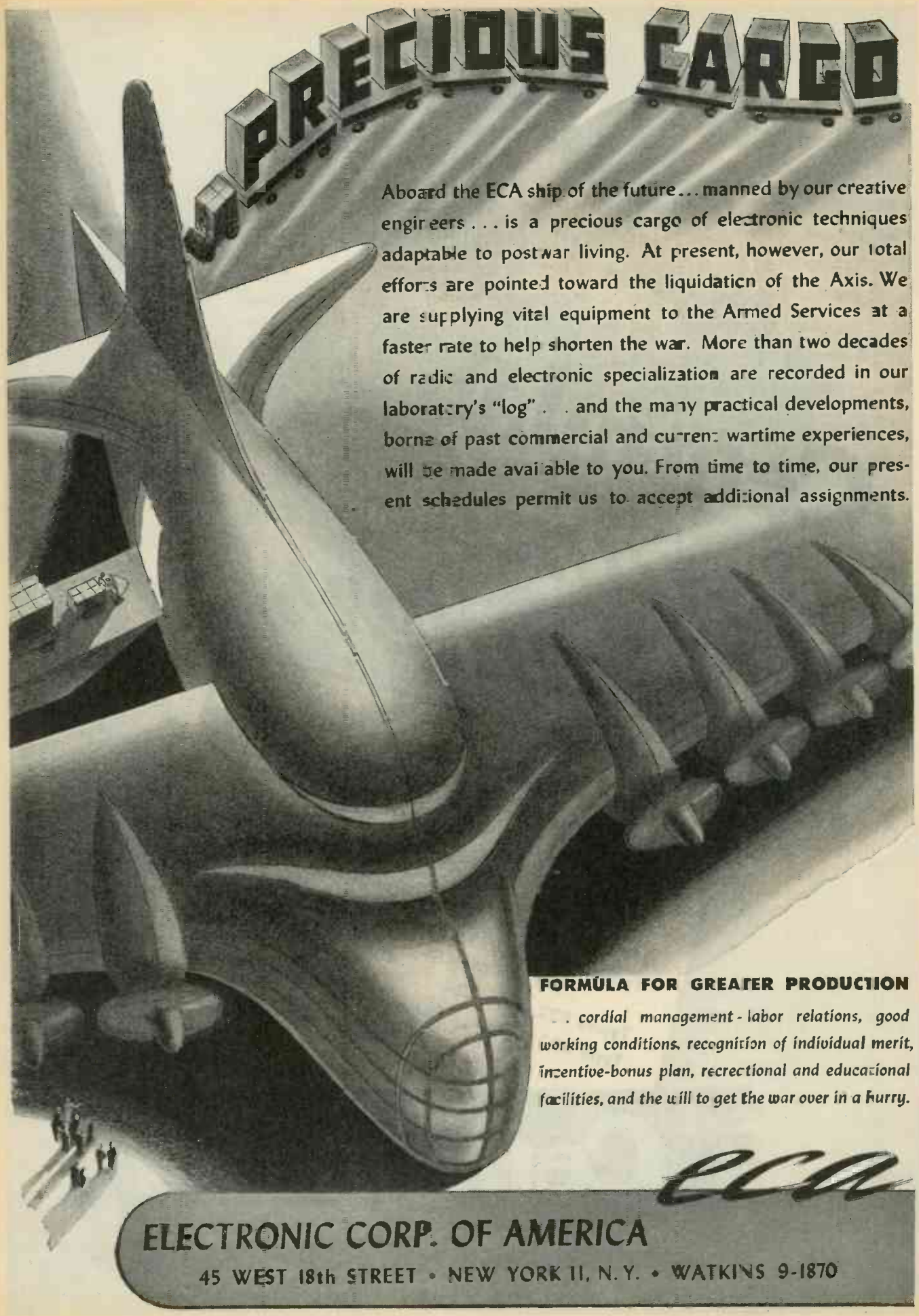
Centradite, due to its resistance to heat shock, lends itself to a new process of soldering metal to ceramic, whereby the ceramic surface is metalized to permit soldering.

We invite inquiries regarding the further uses which may fit your applications.

Description of Material	
Thermal coefficient of expansion per degree Centigrade	Body No. 400
Modulus of rupture in lbs. per sq. in.	20-100 C° 1.9×10^{-6}
Dielectric constant	20-600 C° 3.1×10^{-6}
Dielectric loss factor	13,000 lbs.
Grade per American Stand. C 75.1-1943	5.4
Porosity or moisture absorption	3.00 or less
Color of material	Class "L3" or better
	Zero to .007%
	White

Centralab

Division of GLOBE-UNION INC., Milwaukee



Don't lie awake nights . . .

. . . worrying about the countless intricacies involved in the design of new electronic devices. Don't worry, that is, unless you also are planning to use the best electronic tubes. For, just as a bridge must be strong enough to meet all the demands of the traffic it is intended to carry—so electronic tubes must be carefully chosen to perform perfectly. Raytheons are engineered to meet the most rigic requirements.

RAYTHEON TUBES, long known and respected by manufacturer and radio servicemen alike, are being specified more and more by advanced electronic engineers and designers whose vital projects demand the finest in tubes.

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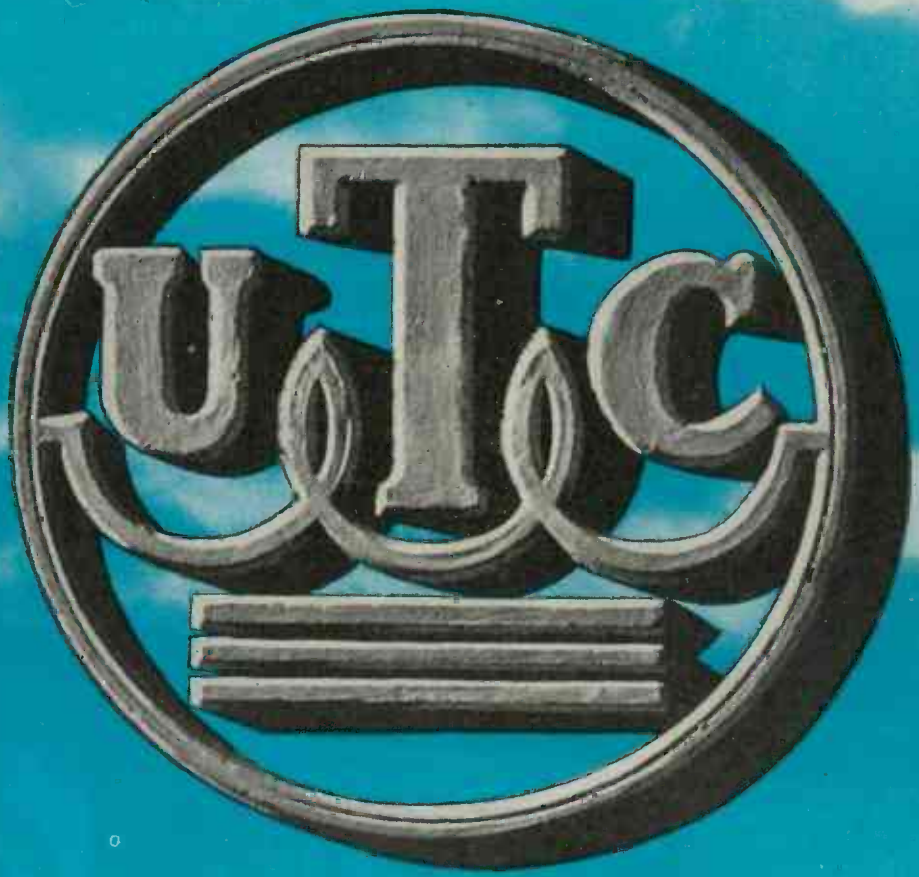

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ELECTRONIC INDUSTRIES

O. H. CALDWELL, EDITOR ★ M. CLEMENTS, PUBLISHER ★ 480 LEXINGTON AVE., NEW YORK (17), N. Y.

Multiple "Specs" Are a War Hazard

Lack of standardization of various critical components is responsible for bottlenecks that are seriously slowing production of electronic equipment for the armed forces. Radio concerns which hold war contracts know this. And to the responsible armed-forces heads charged with procurement, the situation is particularly painful, though part of the trouble admittedly can be dropped on their own doorsteps.

The story is a much-mixed one, but in the end it boils down to a few factors that have long been common knowledge but about which there has been little publicity and less action of a kind that would ease a situation already uncomfortable and growing gradually worse.

Leaving out of consideration for the moment the limited number of cases involving special equipment for special purposes, this glaring fact remains: The Army, the Navy, the Marines, the Coast Guard and the Air Force all use communications equipment that is basically the same insofar as concerns a great many components. Yet in each case these separate branches of the armed forces stand upon the prerogative of writing their own specifications for individual component parts. The unlovely result is that there exist as many as five different sets of specs for a single part, where one would do as well—provided there was a standard upon which to draw.

Same components, different names

Net result of the whole thing is that where contractor A is tearing his hair over a production line that has stopped for the want of some common component, contractor B has his stock shelves loaded down with the identical required part—but under a different designation. Hence it is not available. For, as most everyone knows, it would be something just short of heresy to suggest putting a "navy" capacitor into an "army" unit, or vice versa, no matter how identically the parts might otherwise match up.

Double-barreled problem

The problem is two-fold. First, lack of standardization. Second, lack of any common designation indicating interchangeability. Neither problem is incapable of solution. But until something is done about it, shortages will stop production lines and confusion will continue.

At the present time, according to incomplete surveys made by WPB, there is an estimated stock of $25,000,000 worth of usable components gathering dust on the shelves of contractors. In some cases these units represent contracts that have been cancelled or revised; in others they represent over-stocks for which the contractor will have no use perhaps for a year. In both cases they represent vitally needed parts for which some contractor is suffering and suffering badly. And manufacturers of parts are up to their ears with back-logs that in most cases literally would bury their plants.

More than anything else, these stocks of dormant parts represent the crying need that exists for the kind of cooperative action on the part of component manufacturers that will result in practical standardization.

"Re-ship, re-mark and ship-again"

By way of applying a remedy as immediate as appears possible under existing conditions, WPB is embarking on a plan to inventory all usable components not actually required by a contractor, or at all likely to be required for perhaps a 90-day period. Where necessary to alleviate shortages and keep production lines moving, parts will be shipped back to their manufacturers, re-marked and shipped to other manufacturers whose production lines have faltered or stopped.

It is planned in this way to ameliorate a condition which if continued will make it impossible for the armed forces to get the one-third more in 1944 that military authorities point out is imperative for victory. It is believed though that if this inventory—re-ship—re-mark-and-ship-again program can be successfully carried out, the four-billion-dollar radio goal of the armed forces can be achieved by the industry in 1944.

Looking Five Years Ahead

An interesting picture of things to come in broadcasting, was outlined at a meeting in New York last month, presided over by Dr. W. R. G. Baker, at which some of his business associates spoke.

Five years after the end of the war, the speakers predicted as in operation 100 television stations, 500 FM stations, 750 AM broadcasting stations, and 50 international stations. The coming of FM and its use for regional and local services, they suggested, would help to clean up the standard broadcast spectrum, making possible the use of more clear channels at higher powers. Regular broadcast transmitters of 500 kw were frankly mentioned, despite present FCC ban on such high powers. It is refreshing to find responsible engineers facing the full possibilities of the art, which uninformed regulation cannot hold back much longer.

COMPLETE INDEX TO ELECTRONIC INDUSTRIES FOR 14 MONTHS ON PAGES 238 TO 240

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heads unappointed. For complete list of Panels see page 122.

PUBLIC UTILITY USES

Some of the applications of vacuum tube circuits that have been developed to help in maintaining service

● Not surprisingly, the public utilities companies are among the most thoroughly electronized fields of industrial activity. Of these companies, the Consolidated Edison system, serving Greater New York and suburbs is an example. Most of the tube-applications used here are fairly typical throughout the ultilities industry. A few of them are special installations.

One interesting example is an equipment designed to detect vibration in a large generator. As is the case with most heavy-duty alternating current generators, this machine carries the armature winding on the stationary frame and the field winding on the rotor, in order to avoid the necessity of taking off the heavy current through brushes and slip-rings.

With the field-winding ground located about 30 per cent of the way from the negative slip-ring excessive vibration might develop, should a second winding ground appear in the generator field rotor.

The protective equipment consists of a vibration pickup mounted on the outboard generator bearing, an amplifier and relay, and a wall-mounted vibration recorder. The output of the pickup is proportional to the amount of the vibration in mils, at normal generator speed. The impulses are fed to a voltage amplifier, a phase inverter, and a push-pull triode output stage. The power amplifier output operates the recorder through a bridge-type copper oxide rectifier. By the use of selective relays, the equipment sounds an alarm if a bearing vibrates six mils or more. The relays will trip the generator from the bus and open its field circuit if the bearing vibration reaches 12 mils or more. (Circuit shown at bottom, page 67.)

Turbine vibration

A slightly different type of vibration amplifier and recorder system is used to measure the amplitude of transverse shaft vibration at known points near bearings of turbines. The pickup involves a shoe riding on the shaft. The shoe drives a moving coil in the field of a heavy magnet vibrationally insulated by springs. The output voltage of the coil is proportional to the product of the amplitude and the frequency of vibration. This voltage is sent to an integrator and amplifier, which drives a recorder calibrated in mils. A synchronous motor timer operates mercury switches by cams driven through a train of gears to enable automatic switching among several pickups.

The integrator makes the amplitude record independent of frequency (revolutions per minute of shaft) and proportional to actual amplitude of vibration at normal speeds. The amplifier itself uses inverse feedback for maximum stability against supply-voltage variation, and certain other circuit-constant changes.

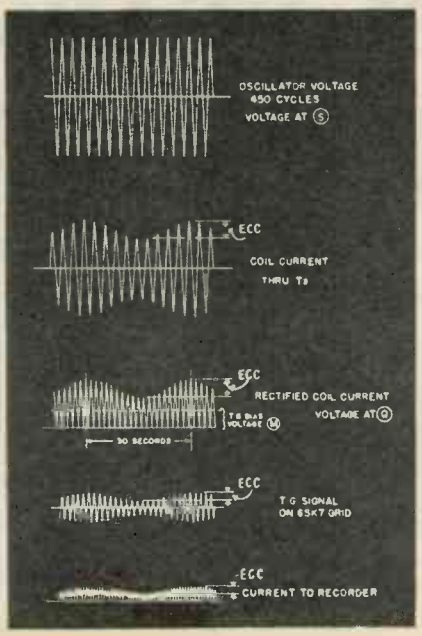
A third instrument rather typical of this class is the turbine-shaft unbalance recording equipment. Steam-turbine shafts may become unbalanced through uneven cooling of the blades around the periphery. It is important to detect such eccentricities before vibration aggravates the condition, allowing excessive leakage past packing-glands, or perhaps causing serious damage to the equipment.

A detector coil mounted opposite the front end of the turbine shaft is supplied with 450-cycle alternating current from a vacuum tube oscillator and amplifier. As the shaft rotates, any unbalance varies the air gap between the shaft and the iron core detector coil, changing the current through it in linear fashion. Referring to the diagram, the equipment uses a 6F7 oscillator and one 6J5 and one 2A3 as amplifiers. The voltage output of the detector coil is held constant by feedback through the biased 6H6 which gives a control voltage for the oscillator. The rectified output of the 25Z5 is proportional to the modulated 450-cycle detector coil carrier. A filter removes the carrier and passes the modulation.

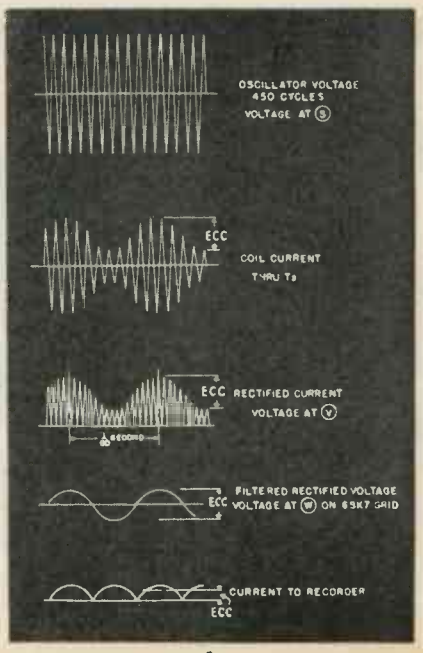
This, amplified by a 6SK7 and a 6F6, is then rectified by another 25Z5 to drive the recorder. Inverse feedback and electronic voltage control assist in holding performance constant.

In idling a heavy turbine, during stand-by periods, a "turning gear" and electric motor drive rotate the shaft at a few rpm. Such a modulation frequency would be too low for

Idling speed voltage and current wave shapes in shaft unbalance detector circuit on page at right



Running speed voltage and current relations for shaft unbalance detector at right



# of ELECTRONIC DEVICES

the amplifier as described. In order to secure a reading of shaft eccentricity at these low speeds, an automatic switch transposes the positions of the switch S_1 in the diagram. Part of the detector coil output is thus applied through one section of the 6H6. After amplification, this signal gives a recorder deflection corresponding to and changing with the air-gap. Total width of the band inked on the recorder chart is read as eccentricity.

Standard frequency by radio

Because of the widespread use of synchronous electric clocks and for other reasons, the frequency of 60-cycles per second must be held to within narrow limits. Moreover, the cumulative error, if any, over a period of time, must be corrected periodically.

A number of methods may be used to accomplish accurate frequency control. The first requisite is a 60-cycle standard frequency, checked against an accurate time report.

In New York City, the Bell Telephone Laboratories have made available a 60-cycle service over telephone wires, accurate to one part in a million. This voltage is derived from a carefully controlled crystal oscillator, checked regularly against Arlington time-signals. A cycle adding and subtracting device checks differences between the standard frequency and the signals.

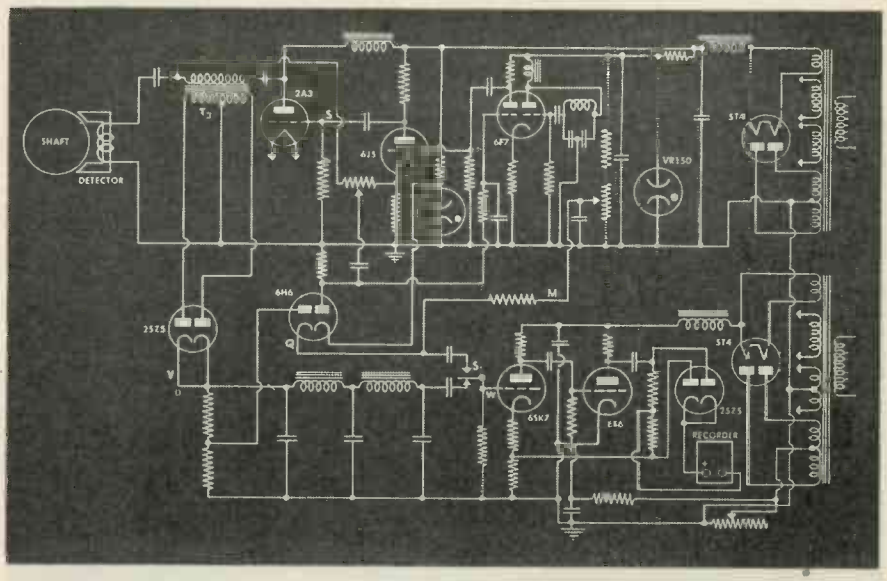
At the power-generating stations, this 60-cycle voltage is amplified and connected to one side of a synchroscope. A voltage from the power system is impressed on the other side. The synchroscope, a device to compare two similar ac frequencies, indicates by rotation in either direction whether the system frequency is high or low compared with the standard frequency. In one method of control, an operator watches the synchroscope and causes adjustments to be made in the amount of steam admitted to the turbine driving the ac generator. In another method a revolution counter on the synchroscope is checked periodically, and the turbines slowed or speeded to correct for accumulated cycles of error in system frequency. By still another method, the steam adjustment is made automatic.

Reception of the frequency standard by radio has been the subject of considerable experimental work. In the method illustrated, WWV's standard frequency signal is amplified and applied through a step-up transformer to a neon tube bent into a circle. A disk with a single radial slot or opening covers the tube, and is driven by a synchronous motor energized by the power system frequency. On viewing the rotating disk, a series of stationary light spots appear, evenly spaced in a circle providing the standard frequency (in cycles per second), is exactly divisible by the motor's synchronous speed in revolutions per second. The number of spots depends on the relation between the motor's speed and the frequency of the power system. If the light spots appear stationary, the standard frequency and the system frequency are in perfect agreement, while rotation indicates that the system frequency is high or low, depending upon the direction of rotation.

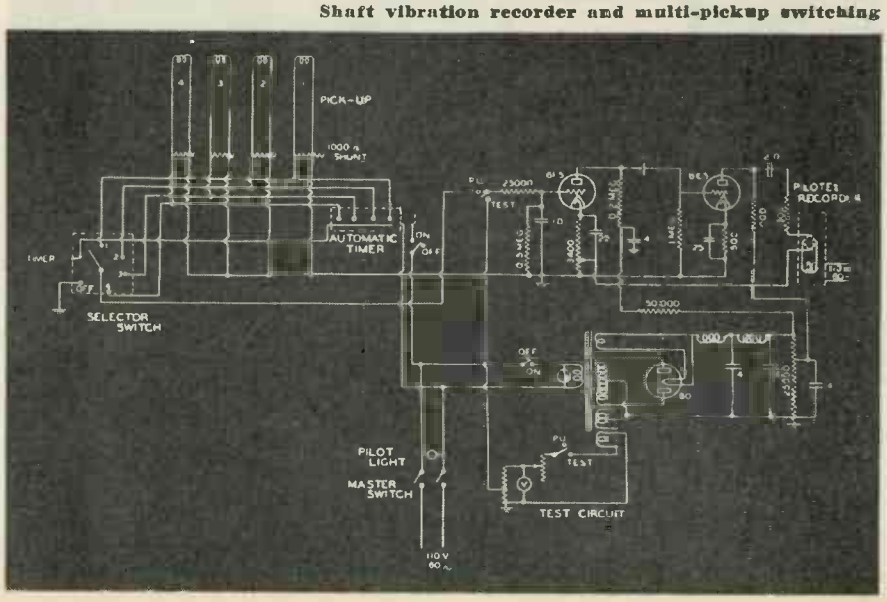
Load control

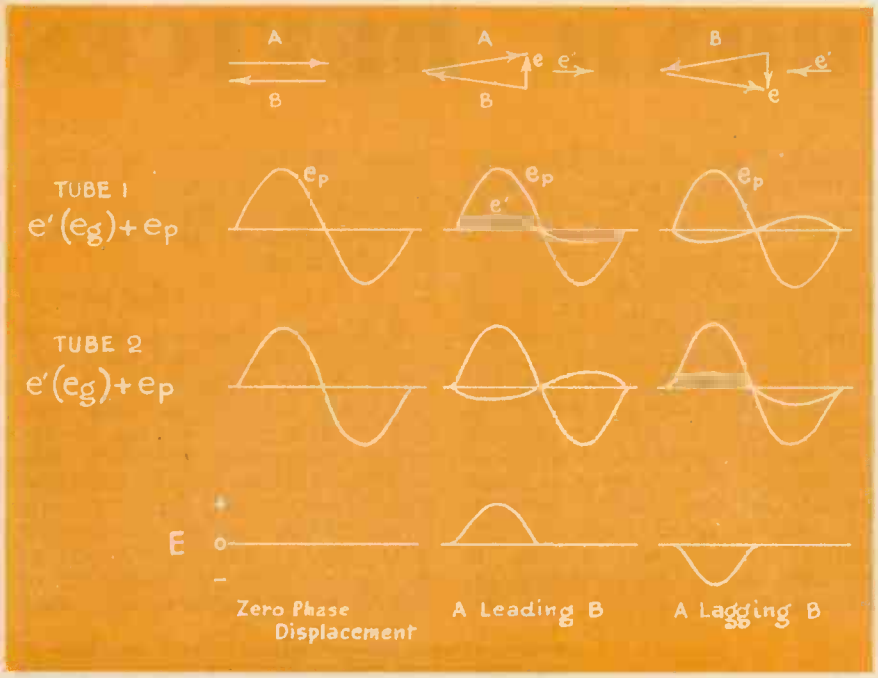
It has been said that the power companies operate on a band one-tenth of one cycle wide. In any event, the need for accurate control of generator loading is apparent when one considers that many generators may be contributing to the power supply of any given motor, heater, or electric lamp. Many generating plants of the same system, or frequently of two or more separate systems, may

Shaft unbalance detector circuit records amplitude of modulation of 450-cycle carrier with reluctance pickup



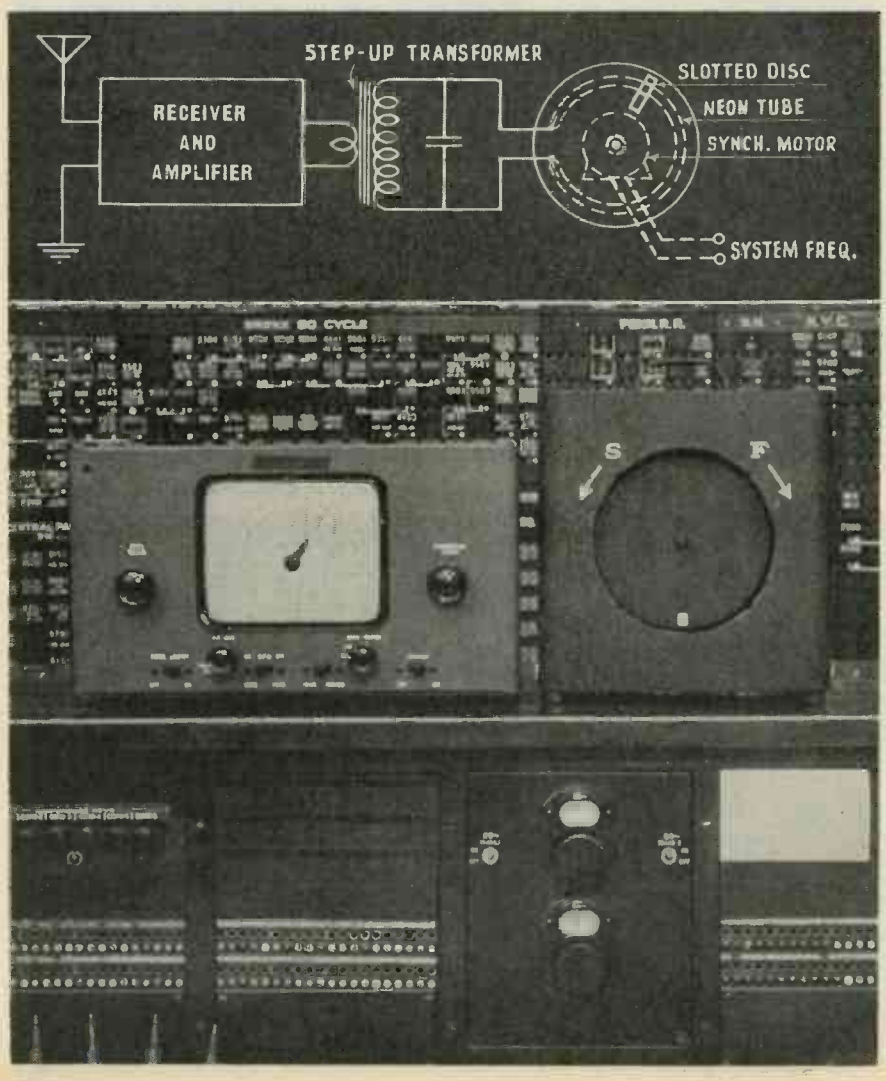
Shaft vibration recorder and multi-pickup switching





Curves showing action of phase displacement circuit under different conditions

Equipment used for comparison of system frequency with radio-received standard



be tied together in a network of local and long distance transmission lines. When the outputs of two or more ac generators are connected in parallel, it is apparent that one of them may "take it easy" as regards supplying current.

Because of interconnections between systems, the exact instantaneous angular position of a rotating generator in one city, in relation to that of another generator many miles away, may assume considerable importance. Furthermore, even within the confines of one system, it is economically desirable to distribute the load evenly among several generating plants, to avoid overloading individual generators or loss of energy by overheating of tie-lines and feeders.

In order to minimize load swings the System Operator now estimates the load in advance, but assigns load to each station in larger blocks and at less frequent intervals. The Station Operator increases load only with low or dropping frequency and decreases load only with high or rising frequency. Thus, errors in load anticipation which could cause load swings are automatically eliminated.

Land-wire telemetering

Many methods of metering current and voltage at a distant point have been developed. One popular type makes use of supervisory or other land-wires, and a rectifier transmitting dc to a distant milliammeter calibrated in terms of the voltage or current unit which it is desired to measure.

Several transformers are required. The main potential transformer is connected across two legs of a three-phase line to step the voltage down to a safe value. A small transformer with center-tapped secondary feeds this voltage to a full-wave rectifier whose output is impressed on the supervisory wires.

A current transformer, in series with one leg of the three-phase system, supplies voltage to the rectifier when line-current is to be measured. Automatic switching arrangements enable continuous indications to be made in rotation from several circuits.

High potential testing

Many types of modified high-voltage dc power supplies are in extensive use to test insulation breakdown, insulation resistance, or leakage. Such a unit provides adjustable voltage up to 10,000 and a current capacity to 10 milliamperes and has been found useful in testing motors, dielectrics, transformers, circuit breakers, buses of dis-

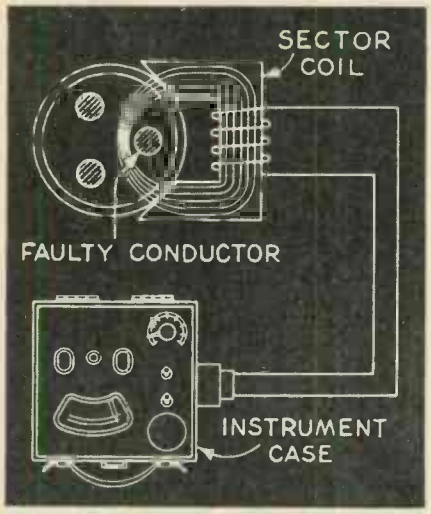
tribution substations, tools, bushings, etc.

The accurate location of faults, or unwanted low resistance paths, on power cable systems is accomplished by the use of high voltage to break down the faults and rather heavy current to reduce or carbonize the low resistance fault for easy detection.

Complete equipment for the purpose consists of the following principal parts:

1. Main rectifier unit
2. Control panel
3. Motor-driven interrupter
4. Current-limiting reactor
5. Fault-locating device

The rectifier includes the main plate transformer, filament and grid transformers, tubes, tube sockets, supports, line resistors, and discharge switch. Provision is made for the series-parallel connection of the main transformer when a voltage change is required.



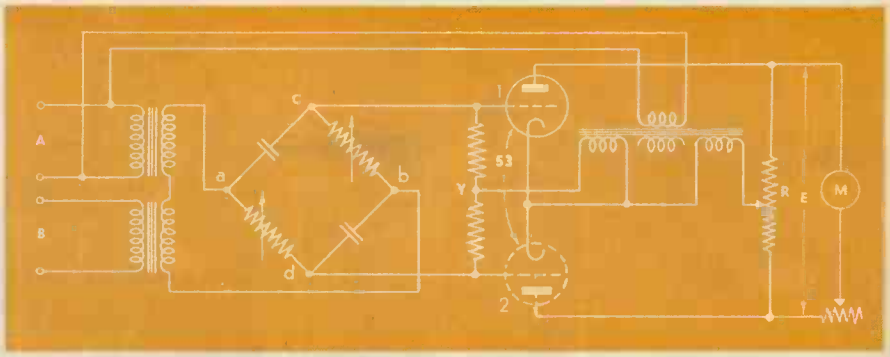
Inductively operated cable fault detector is supplied energy by pulse modulated dc supply at right

The motor-driven interrupter runs at a constant speed, operating as strictly "on-and-off" control for the tube grid circuit, and gives an interrupted wave that can be easily recognized and which has an average operating cycle of ½ second on and 1½ seconds off. These values have been found to be well within the usual tone range of a head set, and they also give satisfactory visual indication on the galvanometer.

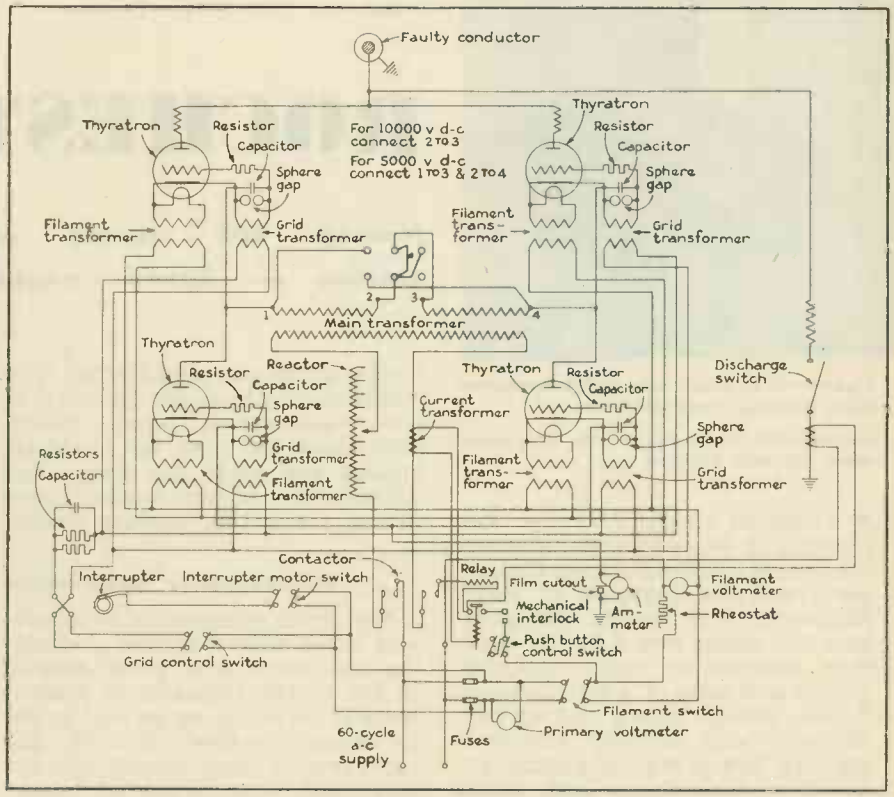
The interrupter is connected in series with the grid supply of the tube and is so arranged that positive and negative potentials are supplied alternately to the grid. This permits control of current through the tube for whatever duty cycle is required.

The fault-locating device consists of a single instrument case in

(*Continued on page 224*)

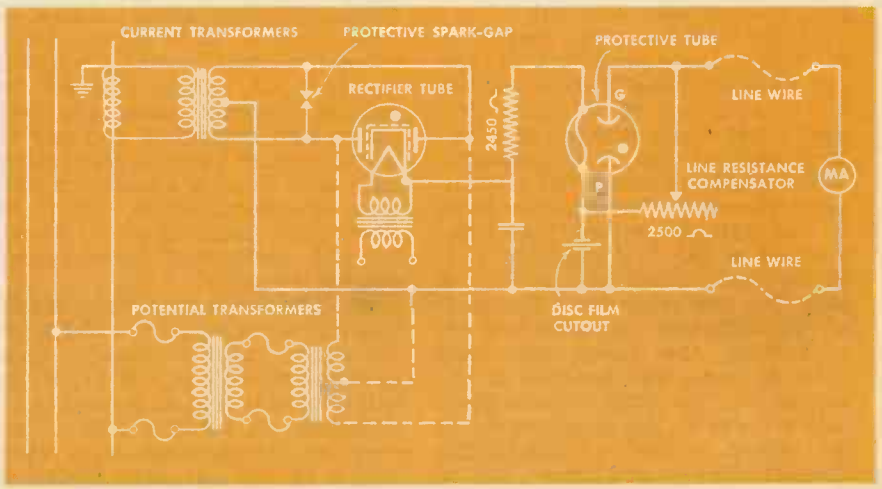


Balanced detector indicates phase difference between same frequency voltages A and B. For A and B in phase, E is zero. See vector diagram, opposite page



High voltage rectifier furnishes test potential for cables. Motor driven interrupter in grid circuit gives pulse wave for ease in tracing by inductive pickup

Telemetering rectifier circuit converts output of current or potential transformer to dc for remote operation of indication milliameter



R. Russell, Jr., Westinghouse

K. C. D. Hickman, Distillation Products

J. E. Maynard, General Electric

L. C. F. Horle, Consulting Engineer

Upper—O. L. Angevine, Secy., Rochester Fall Meeting Committee

Lower—Dr. W. R. G. Baker, vice-president, General Electric

ROCHESTER IRE

Nearly 600 attend annual two-day technical session — Seven engineering papers reviewed

• Fifteenth annual Rochester Fall Meeting of the Radio Manufacturers Association Engineering Department and the Institute of Radio Engineers, drew nearly 600 members and guests Nov. 8 and 9, where they listened to many technical papers and some of a less technical nature, though closely tied up particularly with military electronic matters, saw a motion picture, renewed acquaintances and talked shop during most of the two days of the gathering. And, attesting to the popularity of the function, long before the dinner that wound up the meeting, every seat in the banquet all had been sold out.

At the first technical session, F. S. Barton, vice-president of IRE and Chief of Radio Division, British Air Commission, Washington, presided; and the gathering immediately plunged into its deliberations.

The problems associated with the development of demountable tubes in the high power field were summarized in the first paper by I. E. Mouromtseff, Westinghouse Elec. & Mfg. Co., and progress in the matter of replacing filaments and re-exhausting the tubes was cited covering some two decades of development. The main impetus given this art was in the development of an easier means of exhausting tubes to the required degree, the oil condensation pumping system. The substitution of oil for mercury in the condensation pump system eliminated the need for liquid-air cooling and made the design and maintenance of continuously connected evacuating systems simple.

Demountable advantages

Numerous examples of demountable tubes were described, indicating that those with power ratings of 100 to 250 kilowatts at present seem to be in the range best suited for economical production. The advantage of a lower overall tube replacement cost, which of course appeals to the user, must be balanced by the provision of spare units which can be quickly put in service. Otherwise an operating delay is inevitable when making a filament replacement, because the whole unit is out of service for an interval of time needed for cooling the tube off, taking it apart, replacing filaments, reassembly, evacuating and seasoning, and any readjustment of circuits, all of which may take from a number of minutes to several hours. Thus the whole story comes down to a problem of evaluating inconvenience against economy.

At the present time, demountable tube units ranging from 350 to 450 kw output, with a probable upper economical limit of 500 to 600 kw, will doubtless find an appeal in the industrial hf heating field. However, an intermediate type, which comes to the customer sealed off and ready for use, but having the provision that it may be returned to be opened up and reassembled by the manufacturer, who has incorporated design features that permit this to be done, may become the best solution to the tube replacement problem in continuous service industrial installations.

Low voltage tubes

The second paper was on the operation of electron tubes on 28-volt circuits, and was given by Walter R. Jones, Sylvania Electric Products Inc. This paper featured the 28-D-7 double pentode of the power type (described in "Electronic Industries" for July, 1943). At certain times the output of a 28-volt storage battery might drop to as low as 22 volts, under which condition it is necessary to insure that no equipment operating therefrom fails to function. A receiver successfully operating at this low voltage (on both plate and heater) uses the following tube lineup—Sylvania type 14-J-7 as converter, 14-H-7 in the if stages, or a 14-R-7 is used when a diode-pentode is needed.

The output 28-D-7 power tube can be driven by a 14-N-7 or another 28-D-7, all of which give a satisfactory gain with a 28-volt plate supply and still deliver fair output on as low as 22 volts. Twenty-eight volt operation is proving useful in aircraft applications, because a marked reduction in the motor generator equipment can be

Walter R. Jones, Sylvania Electric | Wm. H. Parker, Stromberg-Carlson | F. S. Barton, British Air Commission | George H. Floyd, General Electric | I. E. Mouromtseff Westinghouse

-RMA MEETING

realized, in portable receivers, and amplifiers that are storage-battery powered farm receivers on 32-volt lighting circuits, railway train service and similar uses.

A Kodachrome film, "Crystals Go to War," was shown, depicting production procedures in crystal manufacturing in all its stages, produced by the Reeves Sound Laboratories of New York City. This film was prepared with the authorization and supervision of the Signal Corps.

IF transformers for FM

The development of if transformers for FM receivers was discussed in a paper by William H. Parker, Jr., of Stromberg-Carlson. The trend during the past few years has been to higher intermediate frequencies from 3.3 mc to 4.3 mc and in some cases as high as 8 and 16 mc. The best frequency is a compromise between gain, freedom from regeneration and required band-pass characteristics. Since it is necessary to provide upwards of one volt signal strength to the limiter, it is required in most designs to provide more amplification in FM receivers than in AM models. For a 5-microvolt sensitivity, the necessary minimum gain of 200,000 can be readily obtained with two if stages if they have a gain of about 40 each. With the use of the more recent types of high G_m tubes, such as the 6SG7, excellent stability was reported, even when higher intermediate frequencies, such as 8 to 16 mc are used. The latter frequency may prove of value if the FM band is ever altered to provide more channels at points higher in the range.

Types of evacuated capacitors described by Geo. H. Floyd

Vacuum capacitors

George H. Floyd of the General Electric Co. described the several commercial types of evacuated fixed capacitors, which are capable of maintaining definite capacitances and voltage breakdown values under all conditions of humidity, temperature, vibration, and barometric pressures encountered in commercial and military operations in radio transmitting equipment.

These capacitors, developed for the extremely high voltages encountered in transmitter design, are self-healing in most applications where a sustained arc cannot be set up after a break-over. Made from a number of concentric cylinders properly proportioned, they are capable of handling thousands of kv with negligible losses up to 50 megacycles or over. They are equally efficient at high altitudes where corona occurs in ordinary types.

At an evening session certain historical details referring to progress in Army communications were related by Major J. I. Heinz, U. S. Army Signal Corps.

The technical session on the second day was started by a report by Dr. W. R. G. Baker, Chairman of the Radio Technical Planning Board, which has been organized to make extensive surveys and recommendations as to frequency utilization, allocations, and system standards in all phases of radio activities. The sponsors are a group of non-profit associations interested in cooperating in this movement as outlined in other reports in "Electronic Industries" (Nov. 1943, Page 82, and Page 232 of this issue). He reported on the scope and aims of the Board as presently laid out, and gave a list of the technical panels being organized and their individual chairman.

Ceramic capacitors

R. B. Gray of the Erie Resistor Corp. reported on the many interesting characteristics possessed by certain ceramic materials having dielectric constants of 1000 or more. The possibility of using materials having dielectric constant values in excess of 70,000 may open up new fields of applications, but it was pointed out that other unusual characteristics also present, curtail the advantages in many uses. The large temperature vs. dielectric constant factor which is found, has been utilized to advantage when it is a large negative value and is substantially constant over a fair range of temperatures.

The latter characteristic, however, is difficult to attain with many compounds, especially those having high dielectric constants. In fact, with some materials, at the higher end of the temperature range found in regular operation, the capacitance of a condenser may jump several hundred per cent. In

(*Continued on page* 166)

(*Pictures on two following pages.*)

ENGINEERS at

With the E. I. cameraman

1—Henry L. Tholstrup (International Business Machines Corp.) and Victor J. Andrew (Andrew Co.)

2—F. Cheyney Beekley and Donald Mix (ARRL)

3—Frank H. R. Paunsette (Research Enterprises, Ltd.) and J. E. Brown (Zenith Radio Corp.)

4—R. O. Lund (Raytheon Mfg. Co.) and William T. Bishop (Aircraft Accessories Corp.)

5—Harold P. Westman (American Standards Assn.) and Dr. Ray H. Manson (Stromberg-Carlson Telephone Mfg. Co.)

6—Arthur H. Lynch (The National Co.) and Harold C. Beebe (International Resistance)

7—John F. Cannon, Christopher L. Snyder (General Ceramics Co.) and Paul M. Komm (Automatic Winding Co.)

8—K. W. Jarvis (Sheridan Electro Corp.)

9—C. P. Miner (General Electric) and Leroy H. Craig (Squier Labs, Ft. Monmouth)

10—Earl Detrick (General Instrument Corp.) and S. H. Stupakoff (Stupakoff Ceramic & Mfg. Co.)

11—George Lewis and Edward D. Phinney (International Telephone and Telegraph Corp.)

12—Sam Norris (Amperex Electronic Products) and Alexander Senarke (Amperex Electronic Products)

13—E. M. Meyer and J. F. Hitchcock

14—Clyde K. Huxtable (Belmont Radio Corp.) and R. F. Barr (Belmont Radio Corp.)

15—Robert S. Burnap (RCA Mfg. Co.), W. J. Walker (General Electric) and A. I. Crawford (Bell Telephone Laboratories)

16—R. B. Gray (Erie Resistor Corp.)

ROCHESTER

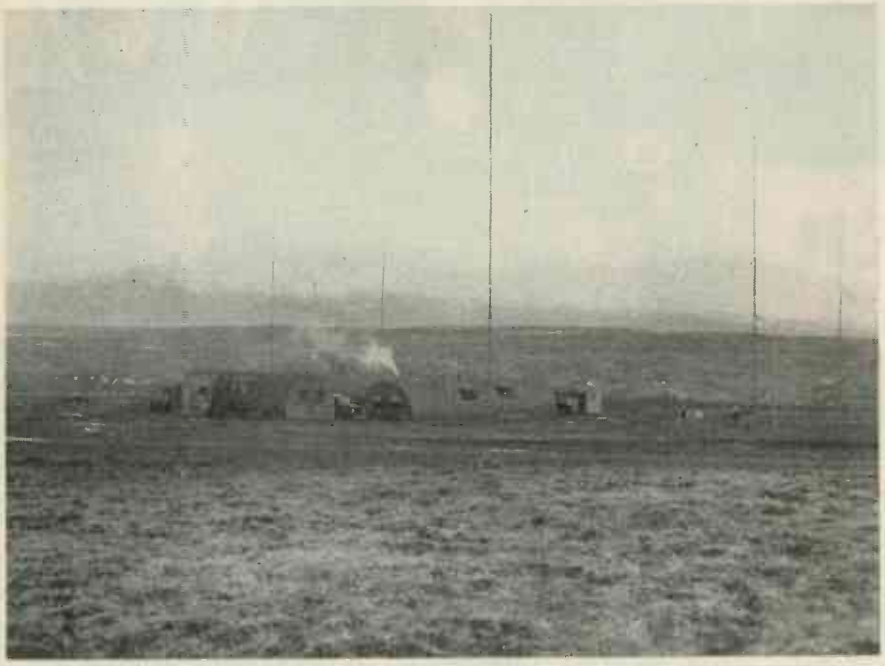
at the IRE-RMA meeting

17—F. W. Shor (Hallicrafters) Robert E. Samuelson (Hallicrafters) and J. F. Bartsch
18—Stuart W. Seeley (RCA) Gerrard Mountjoy (RCA) and Earl I. Anderson (RCA)
19—Earl L. Kent (C. G. Conn Ltd.) and Harner Selvidge (Kansas State College)
20—Charles N. Kimball, Jr. (Aircraft Accessories Corp.) Dudley E. Foster (Majestic Radio and Television Corp.) and F. A. Rudolph (Aircraft Accessories Corp.)
21—Henry W. Parker (Radio Tubes Ltd.) and Ralph R. Batcher (Electronic Industries)
22—George Lewis (International Telephone and Telegraph Corp.), Bond Geddes (RMA) and Frederick Williams (Philco)
23—Lewis M. Clement (Crosley Corp.) Louis G. Pacent (Pacent Engineering Corp.) and Roger Wise (Sylvania Electric Products Inc.)
24—F. B. Tatio and J. Callanan
25—Monte Cohen (F. W. Sickles Co.) G. E. Richter (American Lava Corp.) and J. F. Morse (American Lava Corp.)
26—Harvey J. Klumb (Rochester Gas and Electric Corp.)
27—Robert M. Bowie (Sylvania Electric Products Inc.), Chalon W. Carnahan (Zenith Radio)
28—William F. Diehl (Airplane and Marine Direction Finder Corp.) and Jerry B. Minter (Measurements Corp.)
29—Bond Geddes (RMA) and David Smith (Philco)
30—Russel M. Planck (Radio Mfg. Engineers Inc.) and Earl I. Anderson (RCA)
31—Ralph A. Hackbusch (Research Enterprises Ltd.) and Virgil M. Graham (Sylvania)

SIGNAL CORPS' LONG

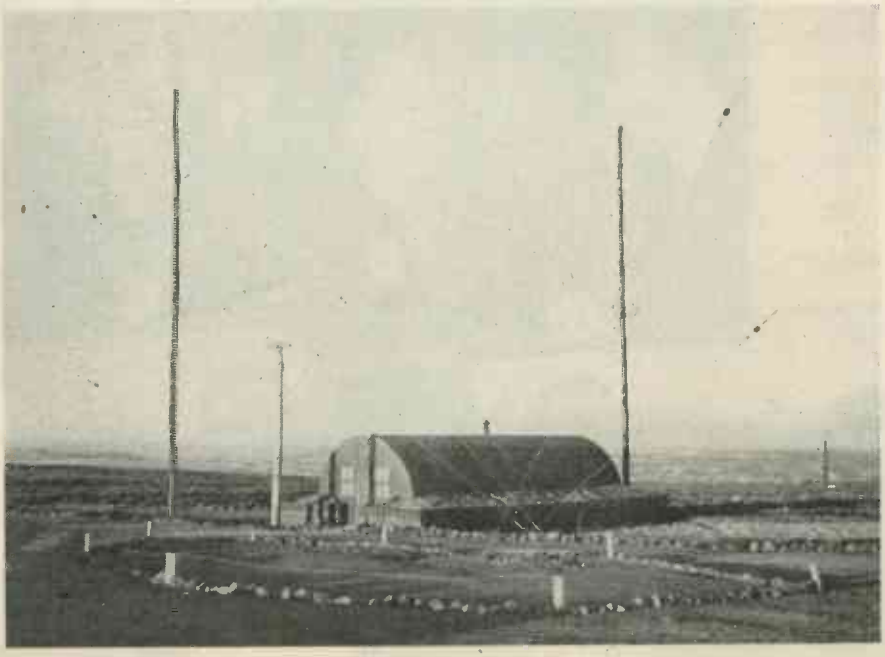
by ROLAND C. DAVIES
Electronic Industries, Washington Bureau

Completion of six Arctic area stations within 28 days provides uninterrupted 24-hour communication



Typical of the newly finished stations in the Signal Corps' long wave network, this one, housed in Nissen huts, is located somewhere in Iceland

Far flung outpost of communications, this high frequency station of the U. S. Army is in the Arctic region. Nine doublets are suspended from four 60-ft. poles



● Demonstrating the remarkable efficiency of the Army, a half-dozen long wave radio communications stations recently have been constructed within the extremely short span of 28 days by the Signal Corps in the North Atlantic and Arctic Circle areas to establish 24-hour radio service both for the Army Air Transport Command and for administrative and command communications.

The new long wave network will link the United States with Newfoundland, Labrador, Greenland, Iceland and Great Britain and will insure radiotelegraph and radioteletype communications completely uninterrupted by the effects of the magnetic storms so prevalent in that region. The interferences occur especially during the winter and are now intensified by the present upgrade of the new sunspot cycle. The United States terminus of the network is located in Northern Maine.

The new long wave network was deemed imperative both in rendering completely stable radiotelegraph communications for the Army Air Forces and in establishing uninterrupted radiotelegraph links between the American Army's command and Great Britain and the posts in the Arctic Circle. And, when peace comes, this communications pioneering by the Signal Corps will certainly be most valuable for aircraft traversing the Great Circle route and for communications links between the United States and these Arctic places and Northern Europe.

Men and materials airborne

The construction within 28 days was a most dramatic episode with technical experts on all phases of radio station construction being gathered from virtually the four corners of the globe and flown to the northern points. The equipment likewise was transported largely by plane. All red-tape was cut and every operation was expedited at a breathlessly speedy pace.

As a contrast with such a project in peacetime it is believed that just to engineer the establishment of

WAVE RADIO SYSTEM

these six stations in their remote locations and the pioneering type of the installations, particularly in Greenland, Iceland and Labrador, would have taken about a year. The Signal Corps, however, had a job to do in a rush before winter set in. Therefore, every means possible was taken to complete the construction with airplanes winging their way over the Arctic and North Atlantic waters to carry apparatus and personnel whenever needed and the Signal Corps received the utmost cooperation of the U. S. Army Air Forces and the Royal Air Force.

The necessity for the new long wave network was determined by the Army last September 1. It was approved most expeditiously by Major General H. C. Ingles, Chief Signal Officer, and the wheels were set in motion at once by Brigadier General Frank E. Stoner, Chief of the Army Communications Service of the Signal Corps, and Brigadier General H. M. McClelland, Army Air Forces Communications officer, under whose direction the project was accomplished. Lt. Col. H. H. Wagner of the Signal Corps was in charge of the actual construction of the stations in the North Atlantic area.

Anchoring antennas in rock was only one of the many problems involved in construction of the Signal Corps' six new long wave transmitters in the Arctic

Manufacturers who cooperated

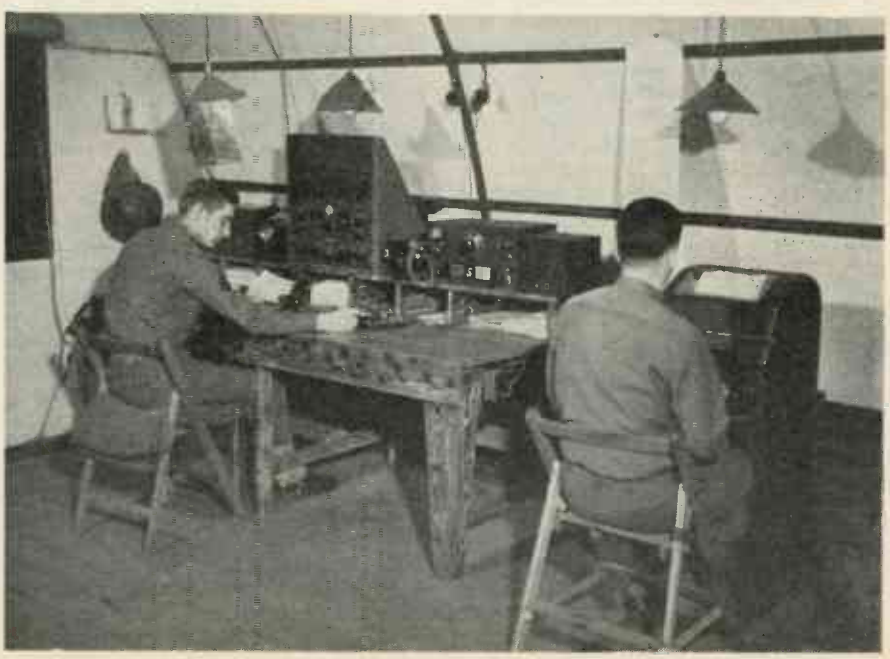
For the next two weeks the engineering planning was mapped out round-the-clock with literally hundreds of blueprints and specifications being drawn up. Then several score of technical and installation specialists, both Army and civilian, were gathered from the four corners of the earth, coming from Africa, South America, Alaska and both coasts of the United States, to supplement the Signal Corps and Army Air Forces communications technicians already in the North Atlantic region. The men of the technical engineering personnel assembled for the project were all specialists in building Signal Corps radio stations. They were brought into the six points by plane and the departures of many of them were so hasty that they left laundry and personal belongings scattered at their previous bases.

The equipment and components for the stations were assembled from a number of manufacturers. To secure some special apparatus for this network, the Signal Corps had its laboratories at the Signal Depot at Philadelphia design and build certain types of equipment. The transmitting equipment was purchased from General Electric, Press Wireless and Wilcox Electric Co. The receiving apparatus was manufactured by Federal Telephone & Radio Corp. and the Hammarlund Mfg. Co. The radio teletype equipment was built by Western Electric and the Teletype Corp., while Western Electric also supplied special radio terminal apparatus.

Most of the equipment was flown in lots to the new stations, but some of the heavier apparatus had to go by sea routes. To be sure that there was no slip-up in deliveries or damage to the airborne

(*Continued on page* 228)

The Army's new long wave receiving stations in Arctic Circle areas look like this. Transmitters are located elsewhere and remote controlled through keying lines



ARMY RADIO Objectives

Why the Signal Corps was reorganized. Steps being taken to insure smooth flow of communications materiel to overseas theaters

• To handle the many and varied problems of the Signal Corps, including the responsibility of furnishing the American Army and the Allied forces under lend-lease with the most modern communications equipment now known, the operation of the Army's fixed communication network, the training of specialized Signal troops and units and the Army photographic work, Major General H. C. Ingles, when he became Chief Signal Officer last July 1, after careful consideration, instituted several changes in the Office of the Chief Signal Officer. These were designed to provide for greater flexibility in its operations and to group like functions under centralized control.

The reorganization comprised the formation of five Services and four Divisions. The new Services were: Engineering and Technical Service; Procurement and Distribution Service; Personnel and Training Service; and the former Signal Operating Service was re-designated as the Army Communications Service. The Army Pictorial Service which was formerly under the staff supervision of the Headquarters, Army Service Forces, was returned to the jurisdiction of the Chief Signal Officer. The Divisions were: the Plans and Operations Division, a consolidation of the former Office of Planning Director and the Communication Coordination Division, the Legal Division, and the Fiscal Division which were re-designated as Staff Divisions. An Office Service Division completed the reorganization. Each Service is made up of a number of branches in order to decentralize the functions.

Field agencies

The Field agencies, procurement districts and depots, under the staff supervision of the Procurement and Distribution Service, were decentralized to give them full responsibility for purchase and production. The field agencies included in the new set-up are: Dayton Signal Corps Procurement District and Depot where ground has just been broken for a new Depot to house airborne radio equipment; Monmouth Signal Corps Procurement District and Depot; Philadelphia Procurement District; and Boston Signal Depots, and the New Cumberland and Atlanta Signal Sections of the Army Services Forces Depots (constituting the Eastern depot group); Chicago and San Francisco Signal Corps Procurement Offices, the Chicago, Los Angeles, Sacramento, and Seattle Signal Depots and the Utah and San Antonio Signal Sections of the ASF Depots (constituting the Western procurement and depot group); Lexington Signal Depot, and Holabird Signal Depot. In addition, other field agencies are the Signal Corps Inspection Agency, which includes inspection zone offices located in Newark, Philadelphia, Dayton, Chicago, and San Francisco; the Storage & Issue Agency, Philadelphia; the Price Adjustment field offices (Philadelphia and Chicago); and the Stock Numbering Agency and Supply Survey Agency, both in Philadelphia.

As changing conditions on the battle front dictate, other adjustments will be made in the administrative organization so that the duties and functions of the Office of the Chief Signal Officer will continue to be handled efficiently and expeditiously.

70,000 prime contracts

By obtaining the delivery of the largest amount of signal communication equipment in the history of the nation, the Signal Corps procurement organization successfully accomplished its objectives during the 1943 fiscal year. More than 70,000 prime contracts were placed, involving an expenditure of approximately $3,500,000,000. The greatest expansion in procurement took place in the field of aircraft radio and the procurement of all types of communications, meteorological and photographic equipment doubled. Many difficult problems were encountered in the procurement and production of Signal Corps equipment which covered more than 70,000 separate items.

For the fiscal year 1944 the Signal Corps is planning to procure more than $5,000,000,000 worth of signal equipment. (Since the beginning of the 1944 fiscal year each month has recorded a steady increase over the comparable period a year ago. In September the gain over August was estimated at 13 or 14 per cent and a similar increase is felt to be under way in October.)

The goals set for the production of Signal Corps equipment are necessarily high because of the vastly increased demands for vital communication supplies needed by our fighting forces now operating in every quarter of the globe. To accomplish these objectives, conferences are held in the office of the Chief Signal Officer with various manufacturers and communications industry executives. These conferences aid in speeding up production; help to link more clearly the interests of industry with that of the government in procuring equipment; and insure production on time and in the right quantities.

Communication needs

The advances made in radio and electronics necessitated the placing of contracts for many complicated items never before constructed, which involved the application of the greatest skill and talent in overcoming production problems. Unlimited quantities of special plant machinery and machine tools had to be provided. The shortage of critical materials required the development and use of great quantities of substitute materials. The inadequacy of industrial facilities made it necessary to sponsor many plant expansions. The manpower shortage presented the difficulty of securing sufficient engineering and other technical talent. Throughout the year the Signal Corps effected close liaison between different groups of industry so that technical and production experience would be available and utilized by others, especially the smaller concerns.

As American troops proceeded overseas in increasing numbers and engaged the enemy on many different fronts, it became necessary to calculate with extreme care the communications requirements of each theater of operations. For example, the Signal Corps prepared complete communications plans for the North African and Sicilian

(*Continued on Page* 208)

CHIEF SIGNAL OFFICER

COMMANDING GENERAL ARMY SERVICE FORCES

Maj. Gen. H. C. Ingles

BOARDS & COMMITTEES

CONTROL DIVISION

Lt. Col. D. L. Stevens

STAFF DIVISIONS

PLANS & OPERATIONS

Brig. Gen. F. C. Meade

FISCAL DIVISION

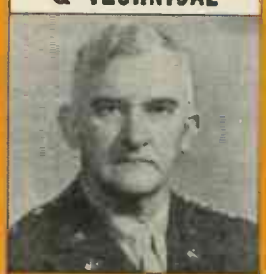
Col. J. T. Watson, Jr.

LEGAL DIVISION

Col. B. E. Snow

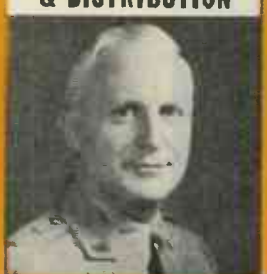
OPERATING SERVICES

ENGINEERING & TECHNICAL



Maj. Gen. R. B. Colton

PROCUREMENT & DISTRIBUTION



Maj. Gen. W. H. Harrison

OFFICE SERVICE DIVISION

Col. D. E. Washburn

ARMY COMMUNICATIONS

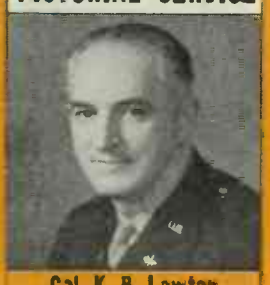
Brig. Gen. F. E. Storer

REQUIREMENTS DIVISION Director: Col. G. H. Palmer	PROCUREMENT DIVISION Director: Col. W. M. Mack	DISTRIBUTION DIVISION Director: Col. G. I. Back
COMPUTATIONS BRANCH Chief: Maj. E. J. Pouzar	PURCHASES BRANCH Chief: Lt. Co. P. F. Hannah	STOCK CONTROL BRANCH Chief: Lt. Col. J. H. Russell
PROGRAM CONTROL Chief: Lt. Col. A. E. Brundage	PRODUCTION BRANCH Chief: Col. Ralph L. Hart	STORAGE BRANCH Chief: Maj. J. J. Healy
EQUIPMENT BRANCH Chief: Maj. L. L. Peterson	INTERNATIONAL AID BRANCH Chief: Lt. Co. G. E. Kahler	SHOPS BRANCH
REQUIREMENTS SERVICE BRANCH Chief: Capt. W. A. Reardon		REDISTRIBUTION & SALVAGE BRANCH Chief: Col. B. A. Falk

PERSONNEL & TRAINING SERVICE

Brig. Gen. J. V. Matejka

ARMY PICTORIAL SERVICE



Col. K. B. Lawton

Organization chart of the United States Army Signal Corps as recently revised by Chief Signal Officer Major General H. C. Ingles, showing responsible heads of all Staff Divisions and Operating Services

Operator placing small gear in fixture preparatory to inductive heating for surface hardening with G-E 15 kw electronic heater

General view showing internal arrangement of the 15 kw heating equipment with the operator inserting one of the rectifier tubes

• The term "electronic heating" covers the application of high-frequency vacuum tube oscillators to two broad fields—the induction heating of metals, and the dielectric heating of non-metallic materials such as plywood, plastics, and foods. Although the equipments for both applications are somewhat similar, the methods of heat generation and its effects on the material are widely different.

In induction heating, the part is placed in, or adjacent to, a water-cooled inductor coil which carries a high-frequency alternating current. The magnetic field thus produced induces a current in the surface of the part by a process similar to that which occurs in a transformer, and causes it to heat by resistance losses. This heat is generated entirely in a surface layer, the depth of which is determined by the frequency used.

Dielectric heating on the other hand is essentially a voltage phenomenon. The charge is placed between two plates which form a capacitor, and a high-frequency voltage is applied. Thus, when materials are used which are relatively very poor dielectrics, considerable power in the form of heat can be generated within them. This phenomenon involves both a certain amount of conduction losses and heat generated by molecular friction caused by the alternating electric field existing throughout the material, so the heat is distributed uniformly through the mass.

Induction heating theory

When an alternating current flows in any conductor, an alternating magnetic field is set up in the surrounding area. Likewise, when any conducting material is placed in an alternating magnetic field, a current flow is set up in that material. This current, called an eddy current, is such that the counter magnetic field generated by it will tend to cancel the existing field.

Since the external magnetic flux must penetrate the surface before reaching the interior of this conducting material, the greater part of the current flow will be near the surface. As the frequency is increased, the current flowing on the surface becomes more effective in generating the total counter magnetic field required, and less current will flow in the layers below the surface. This "skin effect" results in concentration of current flow on the surface or skin of the body.

In induction heating, the inductor coil (or heater coil) can be thought of as the primary of a

Electronic Heating Principles

by J. P. JORDAN

Electronic Heating Section; General Electric Co.
Industrial Heating and Welding Engineering Division

Fundamentals that govern theory and practical application of tube heating equipment to various industrial uses

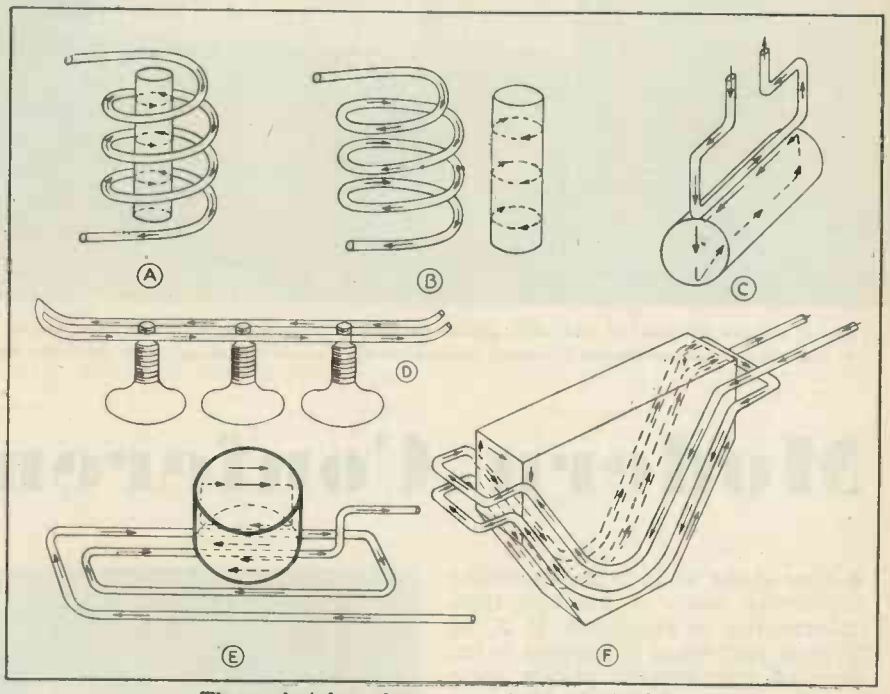
transformer with the material load or charge as a single-turn secondary. Thus the load appears as a resistance in the inductor coil. However, although this is true in all cases, in complicated applications it is often easier to think of the coil as setting up a magnetic field of a certain shape, which in turn causes currents to flow in the desired areas in the charge.

Note that these currents must flow in closed loops in the same plane as the coil currents. Thus if a coil is placed around a bar, the current will flow in a closed loop around the surface of the bar in the same plane as in the coil. But, if the same bar is placed close to the outside of the coil, the current will still flow in the bar as before, although with a considerably smaller magnitude since the magnetic flux density outside a coil is less than within it.

The sketches indicate the current flow in both the part and the coil to show the above concept in actual heating problems. In magnetic materials hysteresis loss will create some heat, but it is generally so small in comparison to the eddy current losses that it can be disregarded.

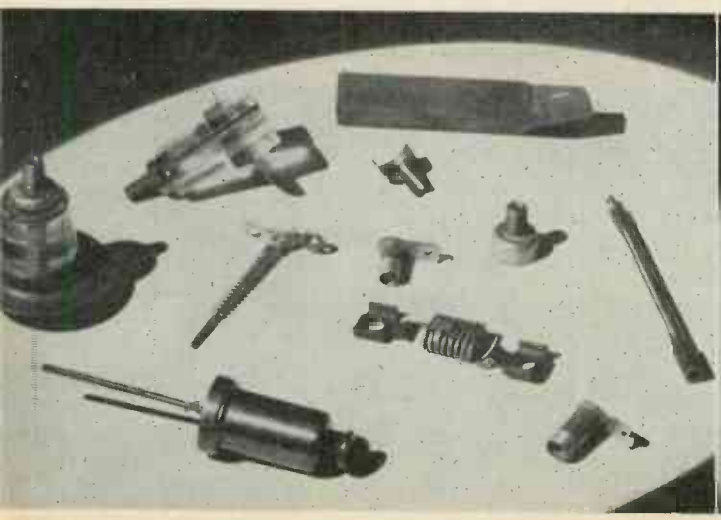
The rigorous equations for eddy current losses are quite complex and of little general use. However, some approximate formulas will serve to show the relationship of the various parameters, although, since many of the factors are difficult to measure with any degree of accuracy, they cannot be applied to practical problems in most cases. Equation I gives the amount of power dissipated as heat in the surface of a part in terms of the magnetic flux density, the frequency, and the electrical characteristics of the metal being heated. Since the magnetic flux density (H_i) is proportional to the ampere turns in the coil, the factor H_i^2 could be re-

(*Continued on page* 176)

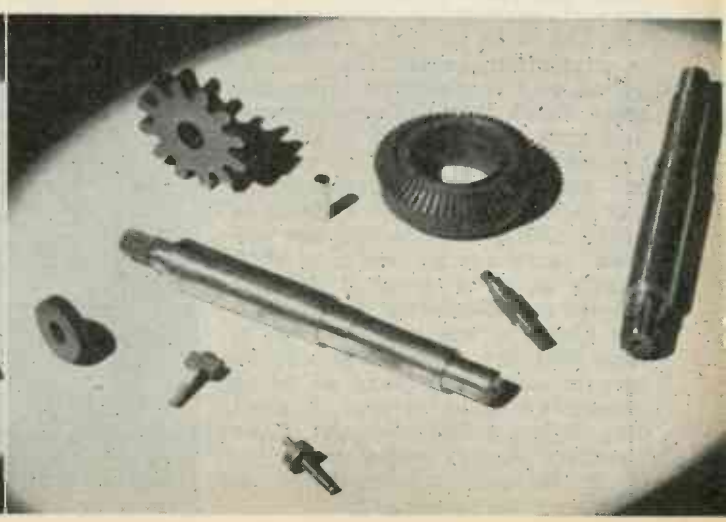


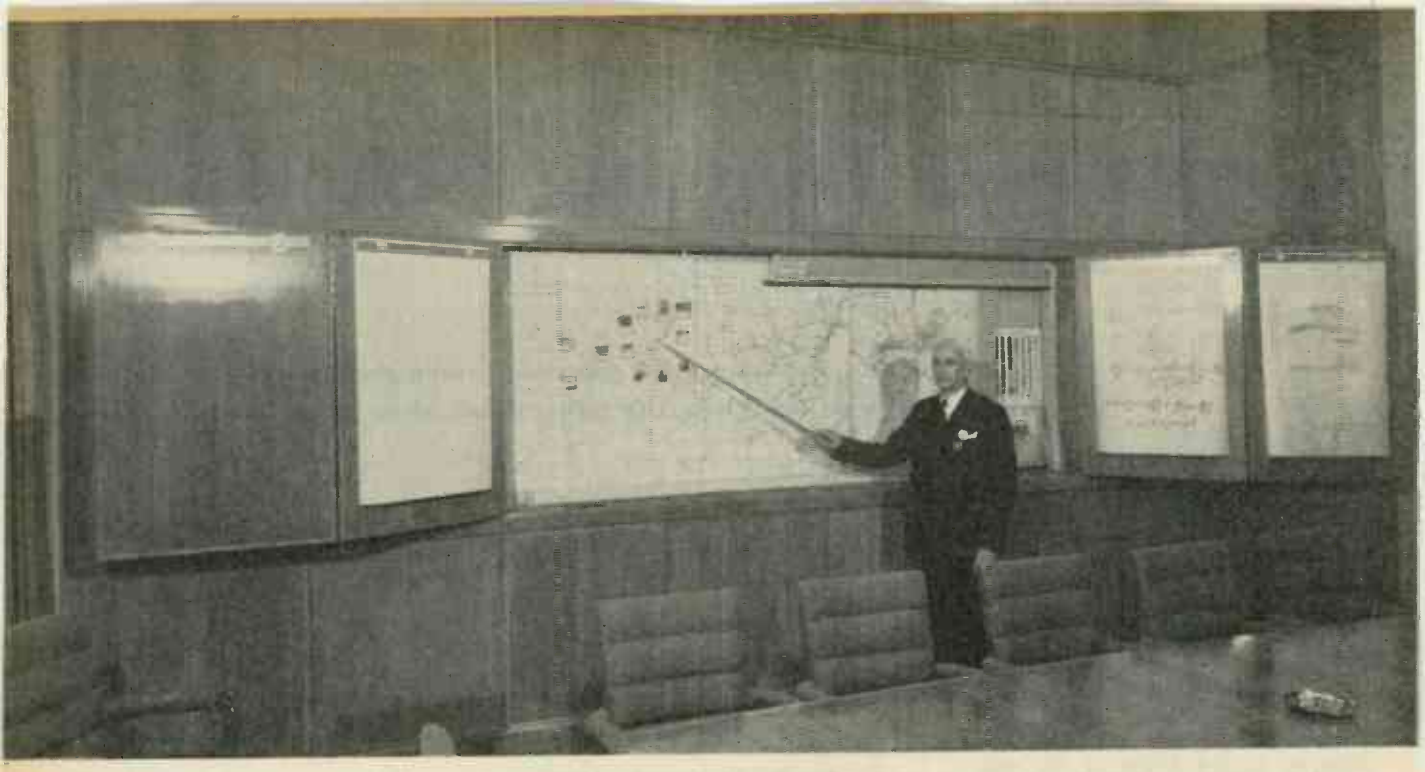
These sketches show current flow and illustrate the principle that coil and part become in effect the windings of a transformer

Typical group of parts now being inductively brazed with G-E 5 kw electronic heater shown below



Some of the parts that have been selectively hardened with electronic heater. Etched areas show hardened surfaces





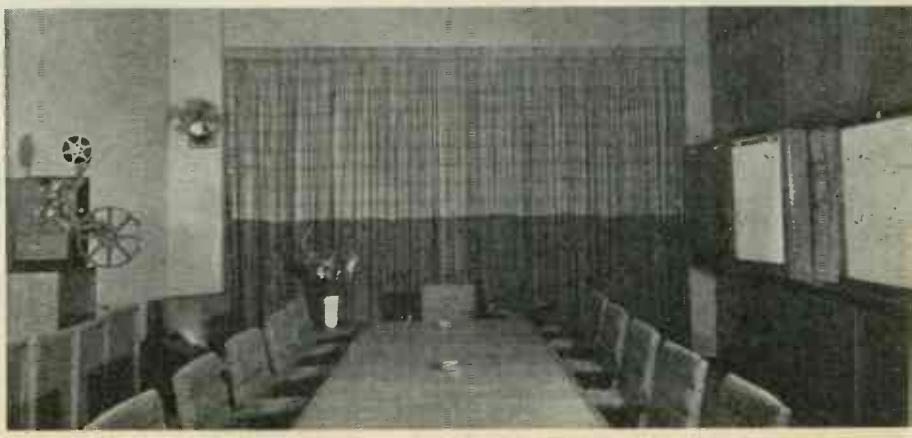
Center panels in one of the side walls of RCA's Princeton Laboratories swing on hinges and may be opened to reveal an ingenious compartment holding spring roller mounted maps and various displays and charts which slide in grooves

Modern Conference Room

● One of the walls in the executive conference room of the new RCA Laboratories in Princeton, N. J., 20 ft. long, isn't what it appears to be. Four of the central panels in a broad expanse of bleached walnut are mounted on piano hinges and may be folded back disclosing a space 10 ft. long, 4½ ft. high and 8½ in. deep in which various charts, maps and a movie screen are concealed. Charts slide left and right in grooves; in another set of grooves a blackboard may be slid out for use. Covering the back of the space is a cloth-covered pin-up board for affixing drawings, pictures or other exhibits. At the top, track-type racks hold maps of various sorts mounted on spring rollers.

In the event that the blackboard or projection screen are not required, and it is desired to use the space which they normally occupy, they may be lifted out of the enclosure entirely. Then the grooves are available for the insertion of 3/16 in. composition board panels to which charts or drawings are affixed. As many as twelve of such boards may be inserted in the grooves and displayed. Attached to the backs of the panels so as to come into view when the panels are opened, are large pads of white paper, 24 x 48 in. so that speakers may illustrate their remarks. This ingenious display was designed by O. S. Shairer, vice-president in charge of the laboratories.

When closed, as demonstrated by vice-president O. S. Shairer who designed the ingenious display, panels completely conceal the display compartment



In addition to displays the compartment also holds a motion picture screen

RADIO SYSTEM Standards

by RALPH R. BATCHER
Consulting Editor

Continued progress in new fields involves consideration of many complex problems in frequency allocations undertaken by RTPB

● The task facing the Radio Technical Planning Board in its determination of the state of technical advances, so that there may be an equitable division of the available frequency channels, involves problems of greater magnitude than those tackled by any previous radio conference. To all radio groups the satisfactory assignment of frequencies is necessary for continued progress in many new fields of activity which deal with further contributions to the science of peaceful living. In many cases it means their very existence.

There are at least seven groups to be considered. Listed alphabetically, these are: (1) Amateurs, (2) Broadcasting AM and FM, (3) Commercial communications between fixed and mobile points, (4) Industrial control and communications, navigational (and avigational) aids, (5) Local point-to-point relay services, (6) Military services, (7) Television and Facsimile.

The problems are threefold: First—no one knows how many frequency bands there are to distribute. One end of the total range is known—but where is the other? The answer to this and also to how narrow each band can be, depends upon many unannounced technical advances that have been made here and there and in different ways, as contributions to the war effort. Many of these have important although unappraised bearing on the most effective utilization of these frequencies to postwar applications.

Service requirements

The second problem relates to the service requirements in every application. Do the present assignments serve the public? (For in the final analysis all services must be related to some public use, in the American way of life). If an extension is needed to the frequency assignment for a particular service, or its removal to another part of the spectrum, the interference encountered, service range, multiple-path reflections, cost of equipment changes (both transmission and reception) are but a few of the questions which must be answered. The third part of the study concerns the appraisal of new services and the extension of existing services into new fields. As a single example of the problem, the former radio control and communication service in commercial aviation is well able to handle much of the needs of the commercial airlines, with possibly some revision in the technic and procedure. But what about services for privately owned planes, ownership of which has been cited so frequently as the final objective of present-day savings? This is but one of dozens of services asking for frequency assignments.

SEVEN ESSENTIAL GROUPS

1—*Amateurs*

2—*Broadcasting*
AM and FM

3—*Commercial*
Communications between fixed and mobile points

4—*Industrial*
Control and communications. Navigational and avigational aids.

5—*Local Relay*
Point to point services

6—*Military Services*

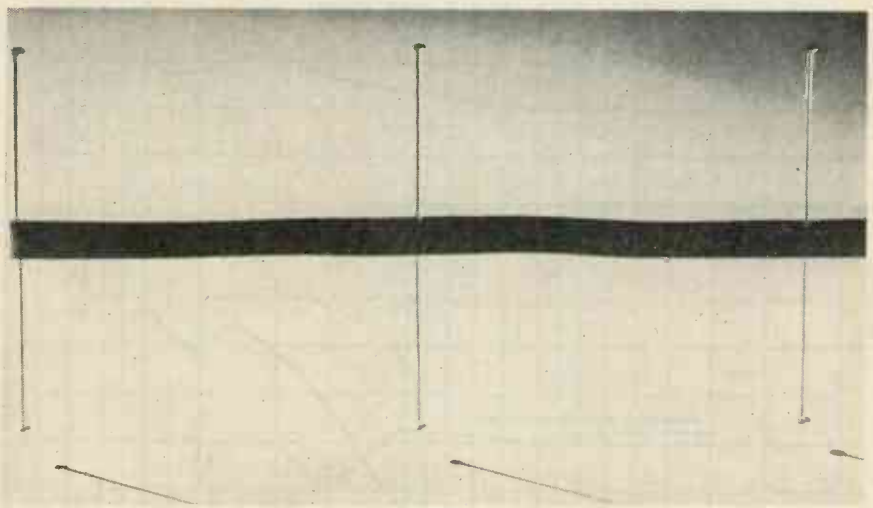
7—*Television and Facsimile*

At present there are as many answers to these problems, as there are those who have been asked the questions—since spur-of-the-moment replies are the rule. Public buying psychology will also loom as an important factor, and this will depend largely on the amount of spending money that is available to a buying public.

Which?—or both

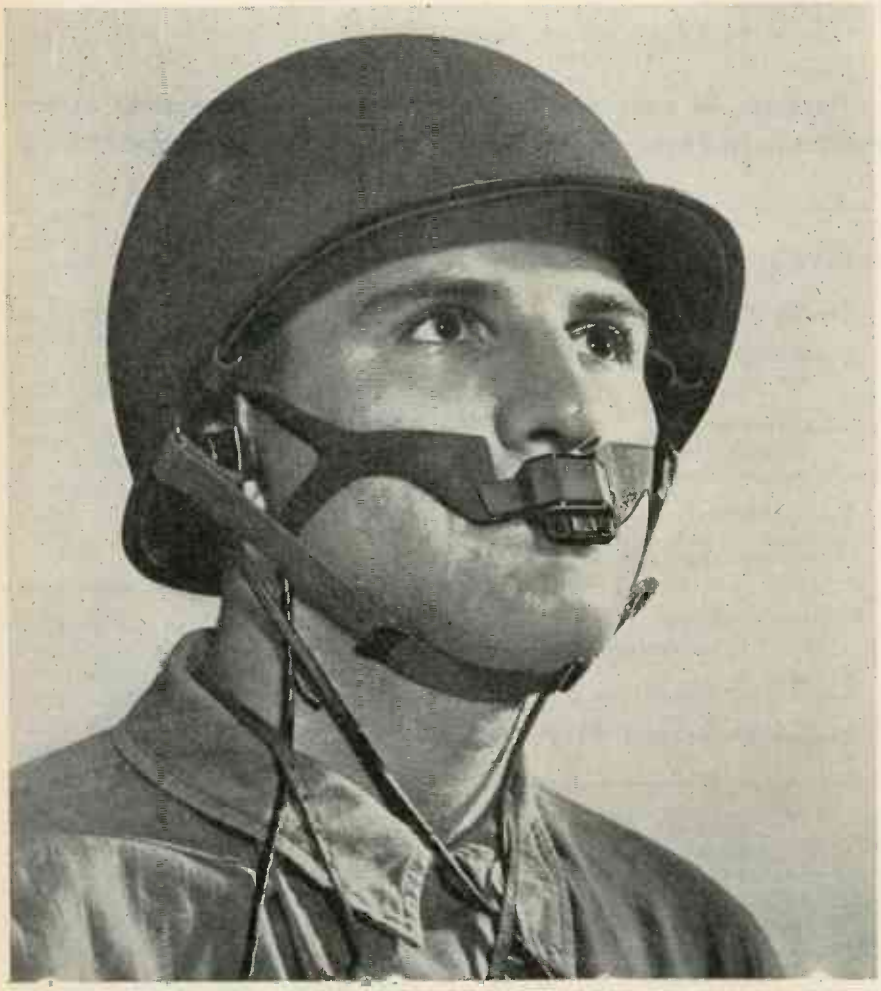
There are many who will discuss the merits of frequency-modulated broadcast service, and others who have decided views on television. But in the end, will the public want one "and/or" the other? In other words, to what extent will FM sound round out the possibly limited hours of service from a television station, using its present FM (or a modified system) sound channel. Or will full 24-hour FM service in other channels and using other receivers be required? These ideas are among those now going around radio circles, and are not necessarily the views of "Electronic Industries." Similar questions are to be found in almost every activity using radio channels.

(*Continued on Page* 218)



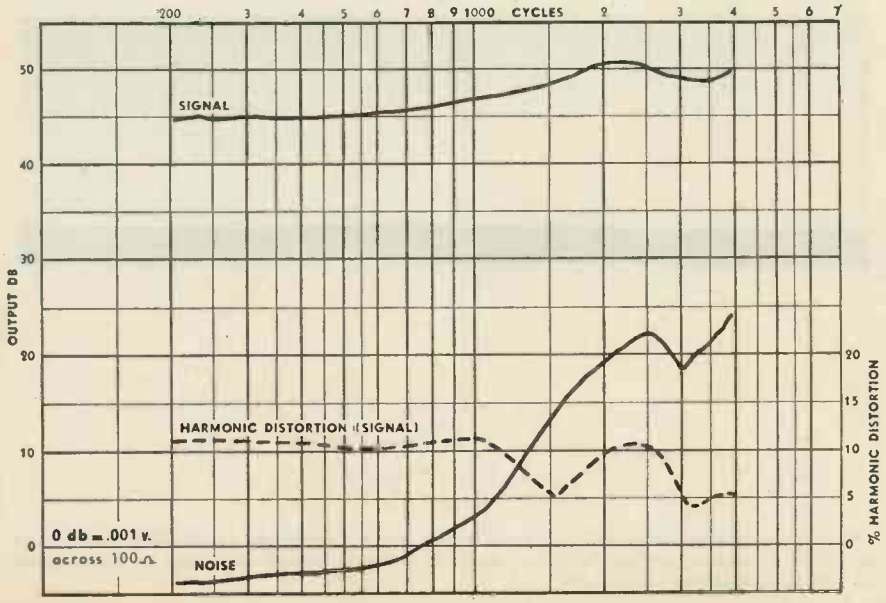
This three-element broadside antenna array, with a series of top-loaded, half-wave sections at about 300 mc, shows actual lengths involved although common pins do not have highest efficiency!

NOISE ATTENUATING LIP



Soldier equipped with lip mike and hearing-aid type earphones

Record of typical test. Sound pressure of noise and signal equal at microphone (about 114 db). Noise source six inches or more distant. Noise out of mike at least 25 db down at all speech frequencies. Current through microphone and 100-ohm load is 52 milliamperes



● Inside airplane cabins, tanks and in many other locations, background noise may average considerably higher than normal speech measured at the lips. The problem of perfecting a microphone which would respond to speech while attenuating background noise has been attacked in various ways. The principal method of attack has been to take advantage of a highly directional characteristic. Few microphones operating on this principle have been adequate under the severe conditions encountered by the Armed Forces. The well-known throat microphone incorporates careful acoustic shielding against ambient noise and gives a satisfactory signal-to-noise ratio in the output, but because of the almost complete absence of speech sibilants in the output, provides poor intelligibility.

Noise cancellation

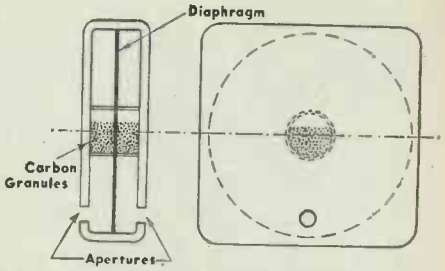
The new type T-45 lip microphone materially increases the signal-to-noise ratio by a new application of an old acoustic principle. Background noise cancellation is achieved by introducing ambient noise into two apertures on opposite sides of the diaphragm in nearly equal phase relation. Sound pressure striking both sides of the diaphragm at approximately the same time cancels out and thus results in almost no motion of the diaphragm. In use, speech is applied at close range directly into only one aperture.

The lip microphone was conceived by F. Cheyney Beekley, of the American Radio Relay League. Experimentation and development finally resulting in the approved type T-45 was the work of Louis Burroughs, Chief Engineer, and A. R. Kahn, Electro-Voice Mfg. Co., South Bend, Ind., in collaboration with H. C. Hornickel, Engineer, Ft. Monmouth Signal Lab. The mike is now standard equipment for the Signal Corps ground forces, and is intended to replace the throat microphone. A hand-held model of the differential microphone has been used successfully in combat by the Canadian ground forces for over a year.

Referring to the cross-sectional diagram, the thickness of the microphone is small compared to the average wavelength of the ambient

MICROPHONE

Differential microphone gives highest signal-to-noise ratio by acoustic cancellation of background sound waves



Simplified cross-section of lip mike, approximately actual size. One "button," for mechanical loading only, is not in circuit

noise it is desired to suppress. The noise cancellation is a function of T (distance from one side of diaphragm around mike to other side) for sound wavelengths which are considerably greater than this distance. The average noise encountered inside military equipment may be well above 115 db with a large portion in the 70 cycle vicinity together with all other frequencies up to about 3,000 cycles. Loud speech measured ⅛ in. from the lips approximates 114 db above the threshold of hearing.

Eliminates background

A standard microphone held close to the lips may give noise attenuation down 5 db measured at the ear phones. The lip microphone averages 20 db noise attenuation, which means almost complete elimination of background noise. At this level of sound pressure the microphone produces less than 10 per cent of total harmonic distortion at 1,000 cycles.

The frequency response, relatively flat from 200 to 4,000 cycles, is adequate for all speech transmission purposes. The microphone complete with harness, cord, and plug weighs about 1¾ oz., is 1¼ in. square and ⅜ in. thick. The molded Bakelite case reduces the use of strategic materials and facilitates mass production.

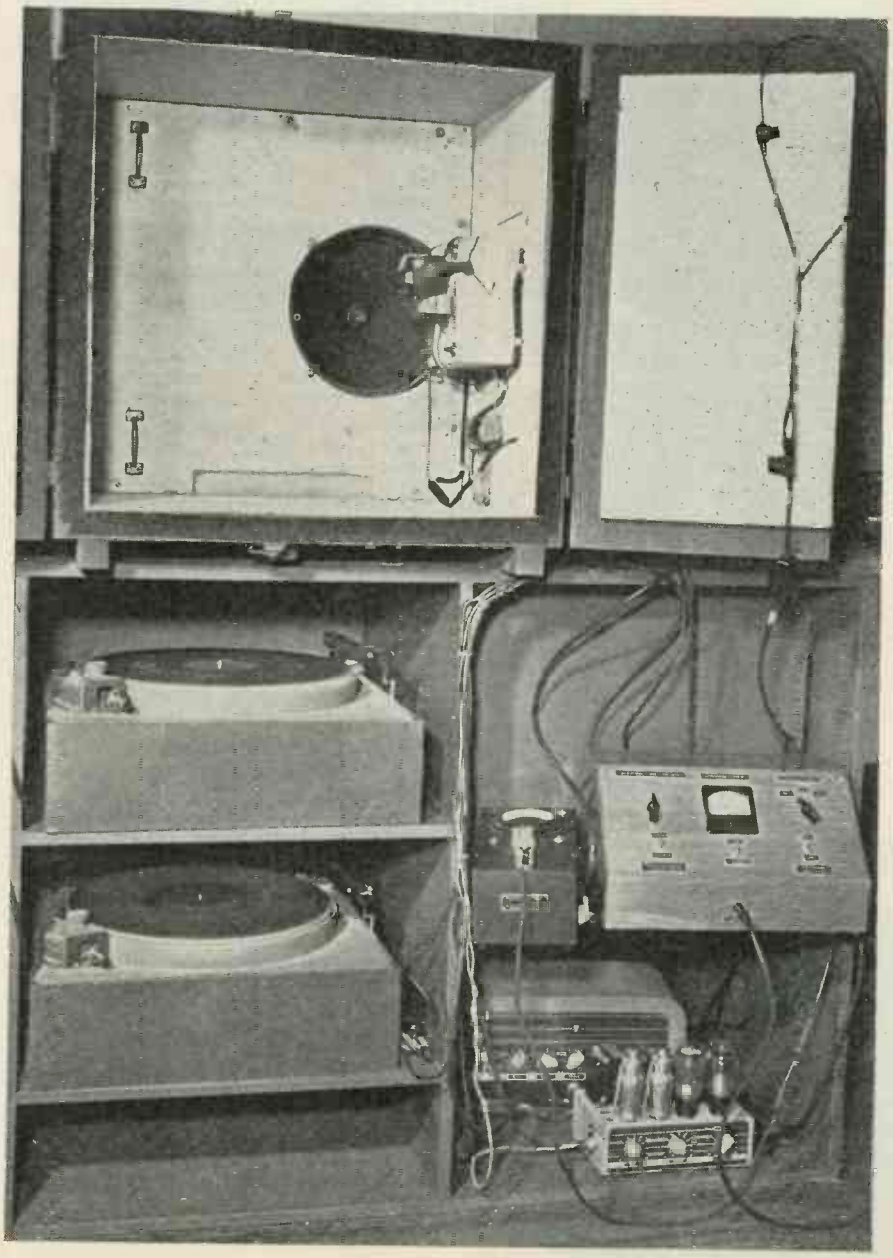
The lip mike was originally designed to be worn like a pair of goggles, but wide variation in the position of ears dictated the adoption of the present method using a mounting plate which rests on the upper lip with bands to the ears. This construction permits the microphone to be worn under gas masks or dust respirators. Feather edges on the supporting straps preclude the possibility of disturbing the seal of the gas mask against the face.

Rugged construction

The T-45 meets all requirements for rugged construction since it has successfully withstood over 20,000 falls from a specified height. It is designed for operation under conditions of ambient temperature range from minus 40 to 185 deg. F. Use of a specially developed synthetic rubber membrane four ten-thousandths of an inch thick over the apertures protects the diaphragm and buttons from breath and other moisture. The microphone withstands total immersion for ten minutes.

Uses for the microphone other than in combat already include its adaption to airplane engine test cells, police dispatching and communication, factory communications and public address and in divers' helmets where reverberation formerly was a major problem.

Microphone test-chamber at Fort Monmouth, N. J. One turntable supplies simulated tank-noise through speaker in celotex-lined cabinet. Another produces speech or frequency signal ¼-in. from mike. Both signals measure about 114 db at microphone. Noise and signal output are compared on Ballantine meter



Induction

Limited-range indus by AM and FM car

▼ **Fig. 8. Dual-turntable unit with microphone mixing facilities used at central station**

◀ **Fig. 7. RF line termination unit employed on rf transmission line to prevent excessive radiation of wave energy**

◀ **Fig. 6. RF attenuator and line coupling unit which controls the amount of rf power impressed on power lines in definite predetermined stages**

● Extensive technical developments in the field of carrier-current telephony and limited-range induction radio systems during the war period have demonstrated the value of these forms of communications in point-to-point and restricted-range mobile services. Non-military adaptations of these methods present new communications technics with which to effect the following functions: (1) to achieve centralized managerial control and coordination of operations in various sections of large industrial areas such as factories, steel mills, and shipyards, or in large construction jobs where high noise levels reduce the effectiveness of conventional public address loudspeakers, (2) to quickly reach key personnel in various parts of large industrial areas where loudspeakers cannot or should not be employed, (3) to enable centralized managerial control of movement of motor trucks and locomotives within a plant area, (4) to permit utilization of existing electric power or telephone circuits extending throughout large industrial areas, in providing communications channels suitable for use in duplex transmission of voice signals and graphic record material such as drawings and printed forms, by associated facsimile or teleprinter apparatus, (5) to disseminate morale-building musical programs and announcements throughout plant areas via existing electric power circuits and conventional broadcast receivers, installed at localized work points, or special receivers with associated public address loudspeakers when high level acoustic coverage of large work areas is required. These services may be provided with a minimum of equipment and without the requirement of large quantities of wire, by means of carrier-current signals impressed on existing power lines or other roadside conductors extending between a central control station and all active sectors.

Shortages in critical materials such as wire, telephone and public-address equipment, or the nature of many mobile operations in which it is necessary to reach operators of motor vehicles and locomotives or supervisory personnel equipped with pocket-size receivers and earphones of hearing-aid type, moving between various parts of extended industrial areas, have precluded the use of direct-wire communications facilities for these services, while normal space radio transmitters cannot be employed for various reasons, such as lack of available frequencies.

Through application of newly developed induction radio equipment and rf distribution technics, a practical solution is presented to many wartime and postwar problems of this nature. The new technics also promise to open communications fields and services which before the war were non-existent and may therefore provide much-needed employment opportunities for many engineers and technicians, as well as others now engaged in military work.

Prior to the war period, the principal industrial uses of carrier-current communicating systems were (1) in providing point-to-point services in connection with telephone, telegraph, and electric power circuits maintained by public utility groups,[1] (2) in inter-office communications where distances were relatively short, and

RADIO

by W. S. HALSTEAD*

rial communications
ier - radiotelephony

(3) in connection with rail circuits for train communications.[2] The use of carrier-current technic at frequencies in the broadcast band had also been initiated in 1937 by several colleges in providing a localized broadcasting service, limited to the campus, by means of low-power transmitters which usually were coupled to electric power lines.[3] After this country entered the war, carrier-current systems of this general type were employed in defense communications work by OCD, and in Army cantonment areas by the Special Services Division, for program-distribution purposes.[4] The successful use of power lines in this manner provided a limited-range communications service of considerable practical value in that existing broadcast receivers could be employed in the vicinity of the carrier-current transmitter without injecting the frequency allocation problems which would be involved in connection with the operation of normal space-radio transmitters.

Distribution problems

The use of carrier-current systems operating at broadcast frequencies in covering large areas, while desirable for some services because of the utilization of existing broadcast receivers, was complicated by three major factors: (1) the requirement for low signal level on power lines in order to prevent radiation of wave energy beyond the area served by the power lines, (2) rapid attenuation of signal energy by electric power circuits, particularly in underground cables and in line transformers, and (3) the susceptibility of low-level carrier systems to interference by transients and other electrical noise normally encountered on electric-power distribution networks.

Concurrently with the prewar development of carrier-current signaling technics, members of the Halstead engineering group, in conducting an experimental program in the traffic control and communications field, developed improved methods for effecting restricted-range, directional communications with vehicles proceeding in specific traffic lanes, such as highways and railway tracks, by means of the laterally-extending induction field generated by rf carrier signals impressed on parallel-wire transmission lines or electric power lines installed along highway or railway traffic lanes.[5] This induction signaling method was first utilized on a public service basis in connection with standard automobile broadcast receivers in the summer of 1940 in providing an experimental highway radio service for motorists on the George Washington Bridge, New York City, during the last season of the World's Fair,[6,7,8] and has since been applied by the Armed Forces in various restricted-range communications services of a nature which cannot be described at this time.

Carrier-current radio equipment and rf distribution technics recently developed by the Halstead Corp. have been successful in extending by a considerable amount the useful range of earlier systems operating on broadcast frequencies. The new systems, which incorporate automatic frequency conversion or repeater transmitters and receivers, overcome the principal difficulties involved in transmitting rf carrier signals over existing power line circuits without objectionable space radiation, and provide good signal coverage over wide areas regardless of the signal attenuating characteristics of different sections of wire networks employed in electric power distribution. As broadcast frequencies may be used in these systems, conventional broadcast receivers may be utilized, thereby simplifying current procurement problems and expanding the wartime usefulness of existing equipment.

An application of a typical system of this type in providing induction-radio coverage of principal buildings, streets, or railway tracks in a representative industrial area of large size, is illustrated in the block diagram of Fig. 1. Carrier signals from a central control room, where microphone and transcription units are installed, are impressed on 23,000-volt feeders at a primary distribution frequency in the 50 kc-150 kc band by means of a 10-15 watt transmitter and associated transmission line or induction cable, 500-1000 ft. in length. The line normally is installed

Fig. 3. Portable zone transmitter and receiver. Induction cables, attenuators, and termination units are carried in compartment at right

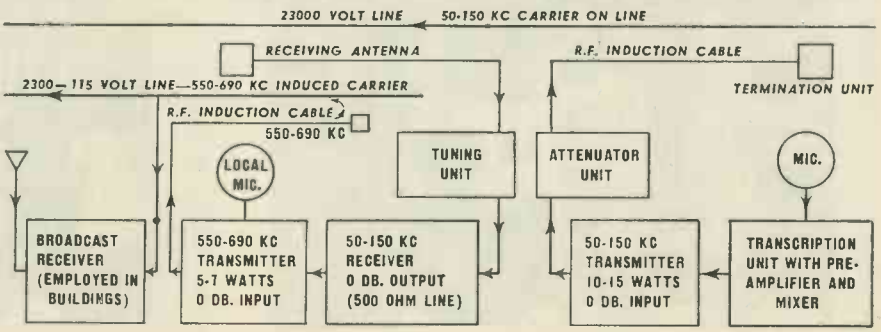


Fig. 2. Block diagram of central station and zone redistribution or repeater equipment

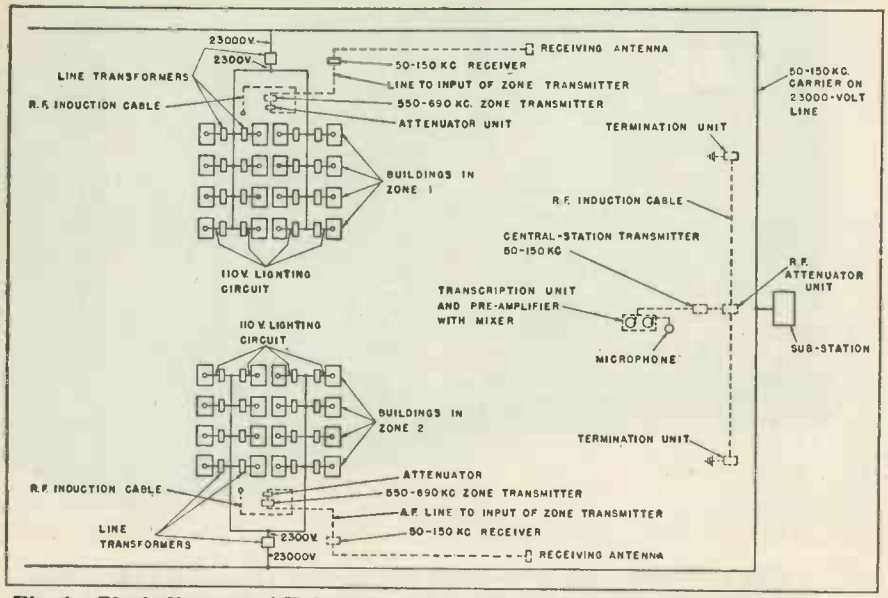


Fig. 1. Block diagram of Halstead carrier-current system showing units employed in distributing carrier signals over large areas by central station and converter transmitters

in proximity to overhead feeders in order to induce sufficient rf signal energy on the power line to override normal line noise at the most remote zone within the area to be covered. Primary distribution signals may also be impressed on 23,000-volt feeders by capacitive coupling, through a suitable condenser, with a 115-volt secondary circuit in the vicinity of the substation, or by coupling direct to the 23,000-volt feeders through suitable link-coupled or tuned L/C matching sections. The last method, although most efficient, possesses a disadvantage in that special high-voltage line coupling condensers, now difficult to procure, are required, while installation requires the services of men skilled in handling high tension circuits. The low frequency primary signals, once impressed on the power line, are distributed with relatively low attenuation throughout the area served by the power network.

At each zone, or each group of buildings served by secondary feeders of the power system, a small converter or zone transmitter and receiver unit is utilized in receiving the primary signal in the 50 kc-150 kc band and in redistributing the signal, over 2300-volt and 115-volt circuits, throughout the zone on a locally-unused frequency in the standard broadcast band. Coupling between the 23,000-volt feeders and the zone receiver may be effected by means of a simple transmission line or antenna extended parallel to the 23,000-volt line, as is illustrated schematically in Figs. 1 and 2, or by means of capacitive coupling between the receiver input circuit and a 115-volt secondary line at a point in the vicinity of the pole transformer. Secondary signals on a frequency in the broadcast band may be impressed on the 2300-volt and 115-volt circuits by means of an rf transmission line, 500-1000 ft. in length, installed in proximity to 2300-volt and/or 115-volt circuits extending throughout the zone.

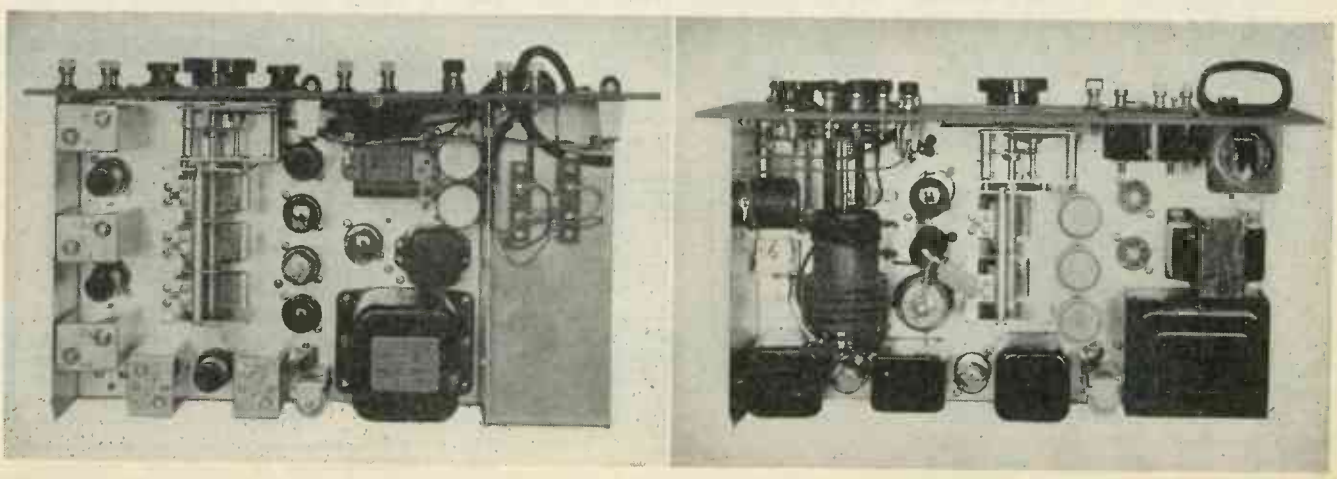
Control of zone units

Zone transmitter and receiver units such as those in Figs. 3 and 4 may be installed in any section of an area or in any building where signals need reinforcement in order to override local noise conditions, or where it is desirable to provide means for selectively transmitting intelligence within a given zone. In this manner, a small zone transmitter and receiver may be employed in redistributing carrier signals from the central station, or it may be controlled locally to provide selective coverage of a particular sector.

The amount of power impressed on 23,000-volt, 2300-volt, or 115-volt circuits by the central-station or zone transmitters is controlled in definite stages by means of an rf attenuator and line coupling unit of the type shown in Fig. 6. In this manner, the carrier signal level on secondary feeders in different zones may be adjusted in accordance with the signal level requirements for satisfactory reception in various sections of each zone. The same unit may, if desired, be employed in providing a convenient form of capacitive coupling between the zone transmitter and 115-volt secondary circuits in buildings when it is desirable to effect selective coverage of smaller areas.

Line termination units, such as illustrated in Fig. 7, are installed at the end of parallel-wire transmission lines to provide maximum transfer of signal energy from transmitter to power line without excessive radiation of wave energy. These units are employed also when ground-laid cables are utilized in developing localized rf induction fields extending along lanes

Fig. 4. Top view, receiver (left), and carrier-current transmitter (right)



of traffic on which power lines do not exist, or in event it is not desired to impress substantial amounts of carrier energy on overhead power circuits.

In installations of the system described in this article, dual-turntable units of the type shown in Fig. 8 have been supplied. These units, manufactured by the Halstead Corp. provide in compact form complete public-address facilities for simultaneously handling two transcription disks and two microphones, including all amplifiers and mixers.

Transmitters in adjoining zones or in adjoining sections of the same zone are operated on different frequencies spaced at least 20 kc apart. As carrier signals at frequencies in the broadcast band are attenuated rapidly by power line circuits, desired signals from a nearby transmitter will completely override unwanted signals from a remote transmitter operating on the same frequency, with no heterodyne effect being noticed. In this manner, an extensive system, covering many square miles of territory, may be operated without

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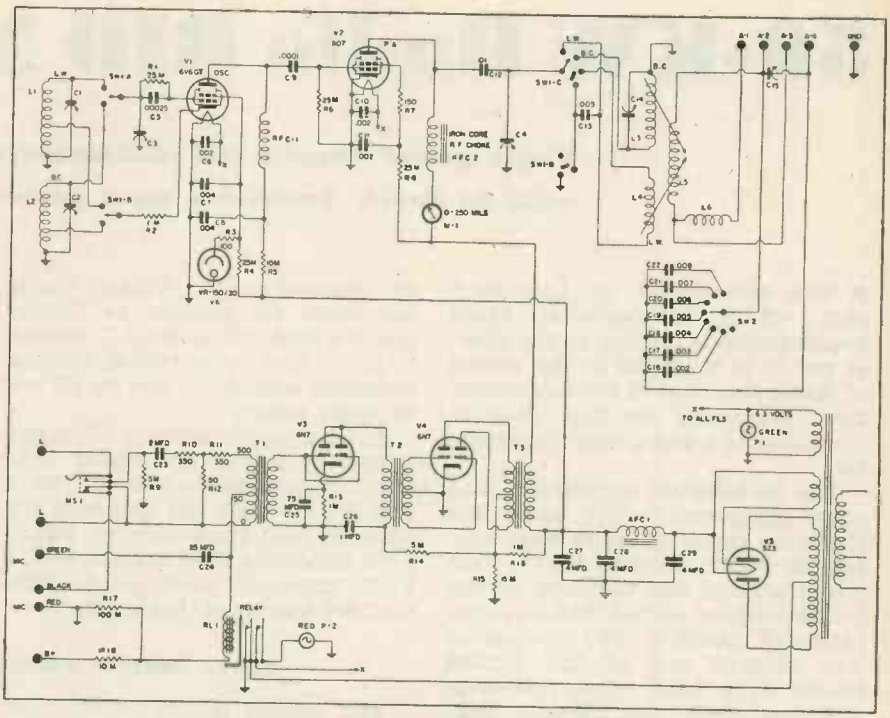


Fig. 9. Circuit diagram of carrier-current transmitter employed in signal redistribution and repeater service

Fig. 10. Circuit diagram. A carrier-operated relay controls the operation of associated signal converter or repeater transmitter

50-KW Radio RIO NACIONAL

Single power supply and modulator switched to either of two rf units in South America's most powerful short wave transmitter

• New evidence of the important part which international radio broadcasting is playing in the global war is to be found in the record of Radio Nacional of Rio de Janeiro, now concluding its first year of operation as a short wave transmitter.

The 50-kilowatt transmitter and other equipment, which make this the most powerful short wave station in South America today, were manufactured and installed by the Victor Division of the Radio Corporation of America. The equipment was shipped out of the United States at a time when coastwise shipping along the Atlantic Seaboard was menaced by Axis submarines, and the project was completed under hazards which added to the drama. The installation was made by the International Department of RCA Victor through its subsidiary company, RCA Victor Radio, S. A., of Rio de Janeiro, with John F. Dawson, RCA engineer, as installation supervisor.

The streamlined studios of Radio Nacional are on the 21st and 22nd floors of the building which houses the newspaper "A Noite," leading Brazilian daily. The station's eight antennas, five of which are directional, are situated a few kilometers outside of Rio. Two of the directional antennas (16 and 25 meters) are beamed to the United States, two more are beamed to Europe, and the fifth (25 meters) is beamed to Asia. The three non-directional antennas operate on the 16, 25, and 31 meter bands.

Short wave broadcasts are transmitted by the station under three identification calls—PRL-7, PRL-8, and PRL-9—with the following frequencies and wave-lengths: PRL-7, 9,520 kilocycles, 30.86 meters; PRL-8, 11,720 kilocycles, 25.60 meters; PRL-9, 17,850 kilocycles, 16.91 meters.

Three control booths

The station is completely RCA-equipped, including speech input equipment, racks, turntable, and recording equipment. Three control booths serve the total of seven studios. Fifteen 44-BX velocity microphones are used in the main studio along with six of other types with deluxe boom and program stands.

The 50-kilowatt transmitter is one of the 50-HF Type which was also installed at Leopoldville in the Belgian Congo; at Brazzaville in French Equatorial Africa, and elsewhere.

Rectifier, audio, and control circuits of the 50-HF are much like those developed for the RCA 50-E broadcast transmitter. The rf circuits, however, are naturally quite different, since the requirements of international broadcasting present problems that are not ordinarily encountered in domestic medium-frequency transmitters.

Provided in the 50-HF, for example, are the means for quickly setting up or changing frequencies to any spot in the range from 6 to 22 megacycles. This is done by including two radio frequency channels, each complete from crystal to output amplifier stage and each contained in a separate compartment with separate interlocking systems, so that one may be entered for work while the other is on the air.

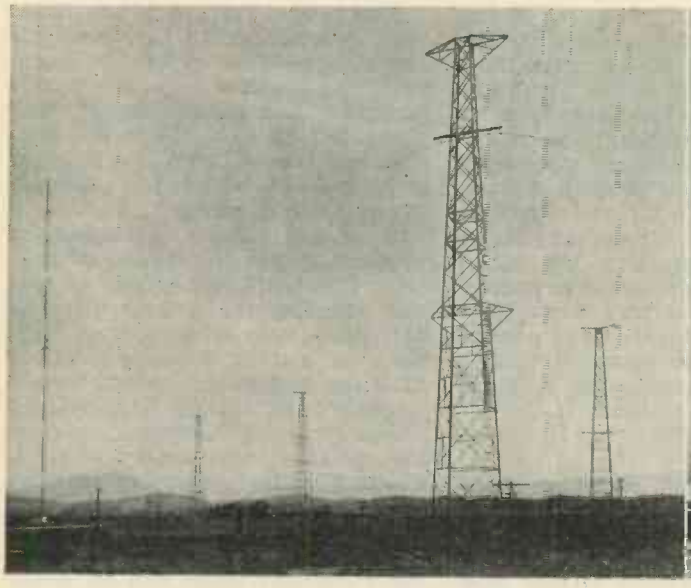
A single power supply and a single modulator unit are so arranged that they may be switched to either radio frequency unit, the changeover requiring no more than five seconds. The modulator and power supply units are arranged in the center with the two radio frequency channels at either side.

The farthest doors on each side give access to the fronts of the exciter units, while the innermost doors on each side lead to the two rf compartments, and the center door opens into a control compartment.

All control relays, contactors, and distribution switches are cen-

50-kw shortwave transmitter recently put on the air by Radio Nacional of Rio de Janeiro, Brazil

Inside view of main control room distributing programs to both long and short wave transmitters



The eight antennas, five directional and three non-directional, are supported on six 105-ft. towers

The modern transmitter building is about 12 kilometers from the center of Rio de Janeiro

Inside the control compartment of Radio Nacional, located behind the center panel of the control room shown on opposite page

tralized on panels in the control compartment, the door to which is not interlocked, so that it may be entered during operation for the purpose of checking on the operation of the control circuits.

Dc power from the 1.5 kv, 5 kv, and 10 kv rectifiers may be switched to either of the radio frequency units. An important feature of the rectifier circuit is the inclusion of a spare tube, the filament of which is kept heated during operation, with switching arrangements which make it possible to cut the spare into the circuit for immediate use in place of any one of the six regular tubes if one should fail. A bias rectifier on the modulator is the only additional dc power supply required for operation of the complete transmitter.

Low distortion operation

High-level class "B" modulation of the 50-kilowatt carrier is provided. A "cathode-follower" driver, along with highly stabilized feedback circuits, provides low-distortion operation. The modulator unit proper uses two RCA-880 tubes, the same type as used in the power amplifier.

There are four crystal positions in each rf channel. The crystal oscillator is followed by a doubler, three intermediate stages, and a driver stage using two 827-R air-cooled tubes. Low-power intermediate stages are tuned and reset by means of tap switches and variable capacitors. Excitation ratios are controlled by capacity dividing circuits. Adjustment is simplified by

the lack of transmission lines for inter-stage coupling.

The power amplifier proper is made up in two units for easy installation. The front section contains the two 880 power amplifier tubes with associated water insulating coils, variable tank capacitor, variable neutralizing capacitor, filament transformers, and seal air blower.

Cooling water is supplied directly to the tube jackets through short ceramic pipes of small cross-section, thus reducing radio frequency power loss in the water to a negligible amount. A motor-driven variable tank capacitor is used for tuning over a small frequency range. It consists of a single hinged plate at ground rf potential operating in conjunction with two differentially variable plates which are attached directly to the tube jackets.

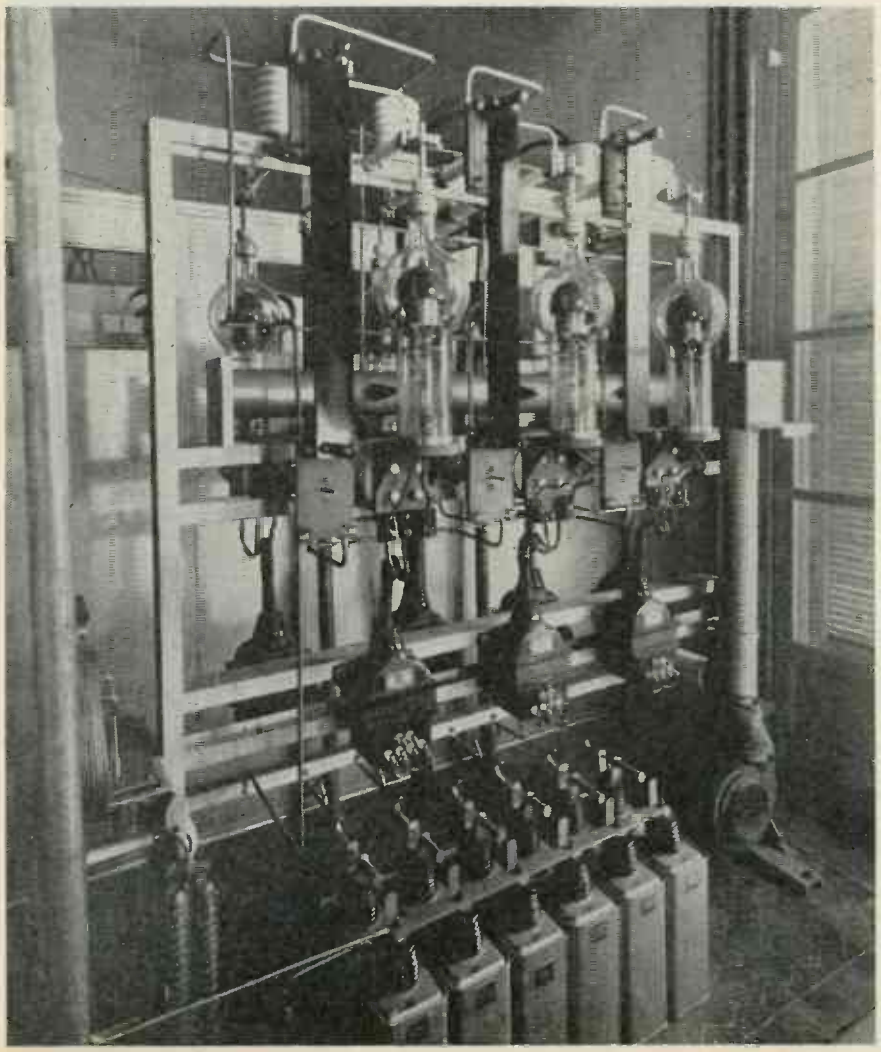
The differential variation is utilized for balancing the plate currents of the two tubes in push-pull. Spurious frequency circuits are minimized by the lack of any inductance between the plates of the tubes and the capacitor plates. The same holds true for the fixed neutralizing capacitor plates which are attached directly to the tube jacket.

The rear section of the power amplifier unit contains the tank coils and output circuits. A rectangular coil made up of 1-in. copper pipe covers the frequency range from 6 to 14 megacycles. Two turns are required for the lower frequency range. The lower turn is variable by means of a motor-driven control so that the tank capacitor tuning range can be augmented by variable inductance as well.

"Hairpin" inductor used

Above 14 megacycles the 1-in. copper pipe is replaced by a hairpin-type inductor of 2-in. copper pipe which serves to cover the range from 14 to 22 megacycles. A shorting bar on the hairpin is set at the proper point for the frequency desired.

High voltage rectifier of Radio Nacional showing filter condensers and the six RCA 857-B tubes supplying the 50 kw short wave transmitter



The output tuning circuit uses inductors similar to the tank circuit and a motor-driven balanced variable capacitor to form a parallel tuned tank coupled to the plate tank. Output to a 300 to 600 ohm balanced transmission line is taken directly from the two hot plates of the variable capacitor.

A motor-driven arrangement provides means for raising or lowering the complete assembly of output coupling coils and variable capacitors, thus allowing for a variation of output coupling without affecting either the output circuit or plate tank tuning. This feature allows for quick compensation during operation when sudden weather changes cause variations in the transmission line impedance. All five motor tuning control keys are located on the front panel where the controlled effect can be noted on panel instruments.

A portable dummy antenna is included in the equipment and is particularly useful during initial adjustment on a new operating frequency. Capable of dissipating the full 75-kilowatt output from the transmitter (50 kw modulated 100 per cent), it can be set up for any resistance between 300 and 600 ohms at any frequency between 6 and 22 megacycles.

Already established both as a cultural link among the Americas and as a potent counter-force opposing Axis radio coverage of the Latin American nations, Radio Nacional has, by its achievements, marked up another triumph for wartime radio engineering.

Dedicated to freedom

Operated under the direction of the Brazilian Government and dedicated "to the service of civilization, to the purpose of good neighbor relations, to the sacred cause of freedom," this new and powerful voice of Brazil has been heard around the world in broadcasts transmitted in three languages.

Letters received by the station from listeners in Europe, Asia, Africa, Australia, and the Americas have testified to its transmitting power, clarity of reception of its broadcasts, and the appeal of its programs.

These programs include news, sports, music, dramatic performances, army and navy bulletins, and special broadcasts. RCA sponsors a daily 15-minute broadcast of Associated Press news over the station. Programs are designed to provide news, information, and entertainment to the Portuguese and Spanish speaking nations throughout the world, and to give the people of other nations an understanding of the culture of Brazil.

THE TELEVISION MARKET

by THOMAS P. JOYCE*
RCA, Camden, N. J.

Probable receiver price levels, transmitter installations and growth of potential audiences projected into future

● To make television a nationwide broadcasting service will involve the investment of millions of dollars in studios and transmitters to be located in the key cities of the United States; and more millions of dollars for the building of network facilities and the production of suitable television advertising programs. Television cannot succeed without these services — but the answers to these problems would develop rapidly if the biggest problem of all were solved—namely, an acceptable low-cost television receiver. This is the number one problem of the postwar television industry.

Why do I say this?

Because:

1. Existing radio station owners are smart enough to know that if acceptable television receivers can be produced for the mass market, television audiences will build at a rapid rate. This means that the operators of a television station will not have to wait an indeterminate number of years before they have television audiences large enough to produce substantial advertising revenue with which to pay operating costs and show some profit.

2. The application for television licenses by 100 or more prospective operators across the United States, which I believe the advent of an acceptable low cost television receiver would bring forth, would have a salutary effect on the price of television transmitters and studio equipment. It would mean that manufacturers—instead of building one, two or three transmitters at a time—would build, possibly, 20 to 25 at one time. The lower prices made possible by this semi-quantity production as compared with the cost of tailor-made equipment would encourage still more enterprising business men to go into the television broadcasting business. Lest you think that this estimate of 100 or more television transmitters is over-optimistic, may I call your attention to the fact that the number of television broadcasting stations in existence, plus the applications on file with the Commission for experimental and commercial television broadcasting permits, total about 50.

*From address at Advertising Club, New York City, Nov. 10.

Television networks

3. The business interests erecting television transmitters in the key cities of the United States, would create a tremendous pressure for the development of network facilities. Again, some enterprising organization will see that the combination of the rapid development of television facilities in a number of key cities of the United States, and a mass market price for the television receivers, would in the course of two or three years create an economic foundation for the profitable operation of network facilities, thus firmly establishing chain network television. These network facilities will also be available for frequency modulation programs and facsimile.

4. The big national advertisers would recognize that the existence of low price television receivers would assure the rapid development of a vast home television audience. Future television advertisers will want to get in on the ground floor with television programs. The programs put on by these sponsors will be good programs—even though in the first two or three years the cost of television advertising per unit of circulation may be greater than advertising in already established advertising media. These marketing leaders know that television will be not only the greatest advertising force in the world—but the greatest sales force as well. For the first time, it will be possible for the manufacturer or distributor of merchandise actually to demonstrate his product or products in millions of homes simultaneously and at extremely low cost. That is more than effective advertising. That is effective selling.

Is there any foundation for believing that this is the way that television is going to develop in the postwar period? I believe that there is.

How much will they pay?

Recently, we made a survey in 11 cities of a cross-section of the public by age, income and sex. Among the questions we asked were:

"Would you or your family consider buying a radio and television receiver if the price were $400?". . . 10.3 percent answered "Yes."

To those who said "No," we asked:

"Well, would you buy if the price were $300?" The cumulative percentage became 19.9 percent.

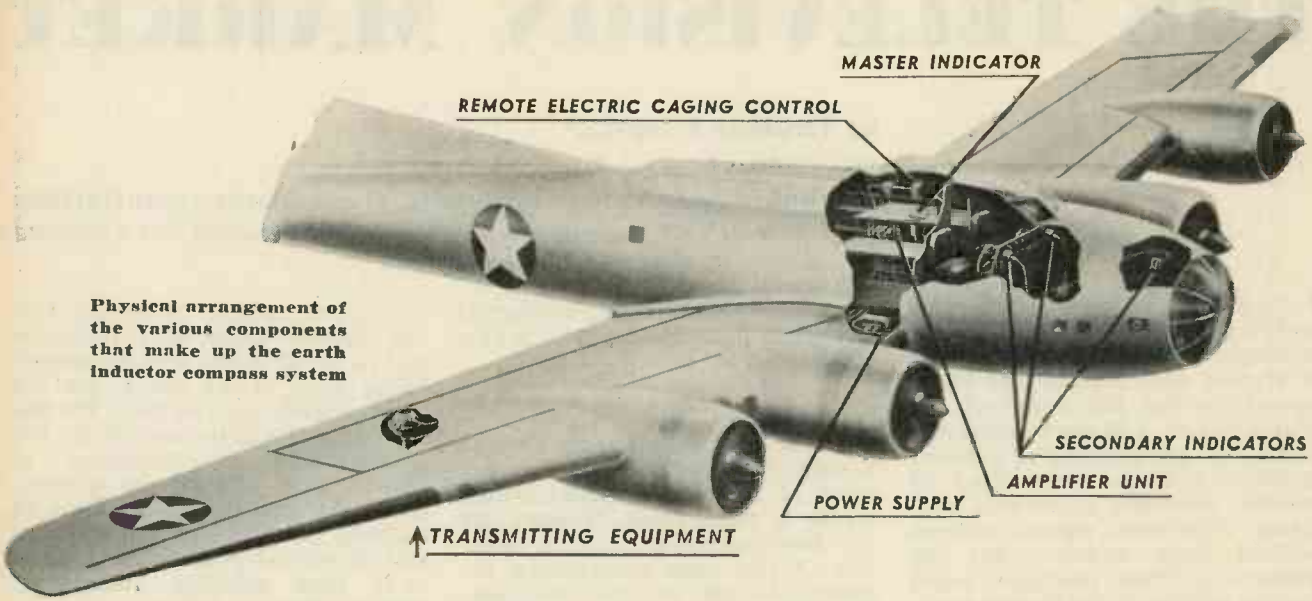
To those who still said "No," we asked:

"Well, would you buy if the price

(*Continued on Page* 216)

THE TELEVISION MARKET OF THE FUTURE

Period	Annual Receiver Sales	Population of Area Served	Wired Homes in Area Served	Percentage of National Buying Power
PRESENT	.....	25,907,600	7,410,922	28.46
AFTER 3-4 YEARS	.....	70,000,000	9,379,039	36.62
AFTER 5 YEARS	2,500,000	72,159,000	17,252,000	61.50
AFTER 10 YEARS	3,500,000	100,000,000	23,700,000	82.00



Physical arrangement of the various components that make up the earth inductor compass system

Gyro FLUX GATE COMPASS

Stabilized earth inductor element gives greater accuracy and eliminates magnetic disturbances

● Ever since the invention of the mariner's compass, generally credited to the Chinese, attempts have been made to improve and perfect this instrument upon which navigation on the seas, and under them, and latterly in the skies, depends. It appears now that the greatest step forward is embodied in the Pioneer Gyro Flux Gate compass system, which is a development of the Eclipse-Pioneer Division of the Bendix Aviation Corporation at Teterboro, N. J., and is in production at the Bendix Philadelphia Division.

Not only does this new system unerringly provide a highly-accurate indication of direction, but it does so within relatively close proximity of the earth's magnetic poles, as compared with ordinary magnetic compasses. It thus represents a considerable improvement over any previously available equipment and is at present widely used by our armed forces both in the air and on the high seas.

The Gyro Flux Gate system includes an earth inductor compass element stabilized beneath a gyroscope. By building the gyro and earth inductor element into a transmitting unit, and providing indicators which are mounted at a distance, a location free from magnetic disturbances can be obtained for the transmitting element of the compass. As a result, deviation is greatly reduced and disturbances set up by armor and other ferrous masses, as well as effects produced by the movement of equipment, are minimized.

The system consists of a transmitting unit, either a remote manual or electrical caging unit, an amplifier, a master indicator, and a repeater indicator. The caging unit is used solely to provide speedy erection of the gyro. This is done by going through a cage-uncage cycle, always leaving the gyro in the uncaged state. In contrast to most other gyro instruments, the Flux Gate Gyro is never to be caged except momentarily during the erection cycle.

Ac power is provided by an inverter, operated from the ship's dc power supply.

Unaffected by maneuvers

The system provides an accurate indication of the magnetic heading of aircraft under all possible flight conditions up to a limited angle. The operation of the magnetic azimuth sensitive element called a Flux Gate is entirely electrical, and because it is maintained in the horizontal plane by stabilizing it with an electrically-driven horizon gyro, the indications of this compass system are not appreciably affected by any normal flight maneuver, within the angular limitation prescribed, and will show no significant effect from acceleration or turning.

The system has been made remote indicating, which permits mounting the magnetic sensitive element in a position where the local magnetic deviations are at a constant minimum, and at a point remote from current-carrying conductors or other electro-magnetic disturbances.

Remote transmitter

Besides reducing the uncompensated deviation present in compass readings, the location of the transmitter, remote from magnetic disturbance, results in improved compass performance, due to the increased effective strength of the horizontal component of the earth's magnetic field, which is the activating force for the magnetic driving element.

Extreme accuracy of indication without the necessity for compass correction cards is provided. This improvement is derived from the use of an adjustable cam-type compensator incorporated in the master indicator. In addition, the master indicator is equipped with a dial reading adjustment, whereby the navigator or other operator may introduce into the system, correction for the value of magnetic variation, thereby obtaining a compass reading which is fully corrected and requires no interpola-

tion. In other words, true heading may be read directly from the dial. Adjustments for both deviation and variation are automatically transmitted to the secondary repeaters so that all indicators throughout the entire ship simultaneously give duplicate readings.

As with any magnetic compass, the primary purpose of this instrument is to give an indication of the direction of the horizontal component of the earth's magnetic field where it can be readily viewed by those interested. In a plane this means that the magnetic element must remain horizontal at all times, and that at least one remote indicator be provided since a magnetic element cannot be mounted in a position accessible to personnel without being affected by magnetic field distortion from neighboring objects.

The Flux Gate picks up the directive force of the earth's magnetic field. It contains three equal arms forming a triangle, each arm having a core of high-permeability alloy, and each provided with an exciting winding and a pickup winding.

When the exciting winding is energized, the flux intensity of the earth's field causes an induced current to pass through a cycle from maximum to minimum during each half cycle of the exciting current, which is derived from an oscillator circuit mounted in the amplifier cabinet. An alternating current in the pickup coils results, the frequency of which is twice that of the exciting current and the amplitude of which is exactly proportional to the amount of the earth's flux passing through that particular arm.

Three signal voltages, thus obtained (which, in general, are of three different magnitudes) are connected to the stator terminals of a coupling Autosyn contained in the master indicator.

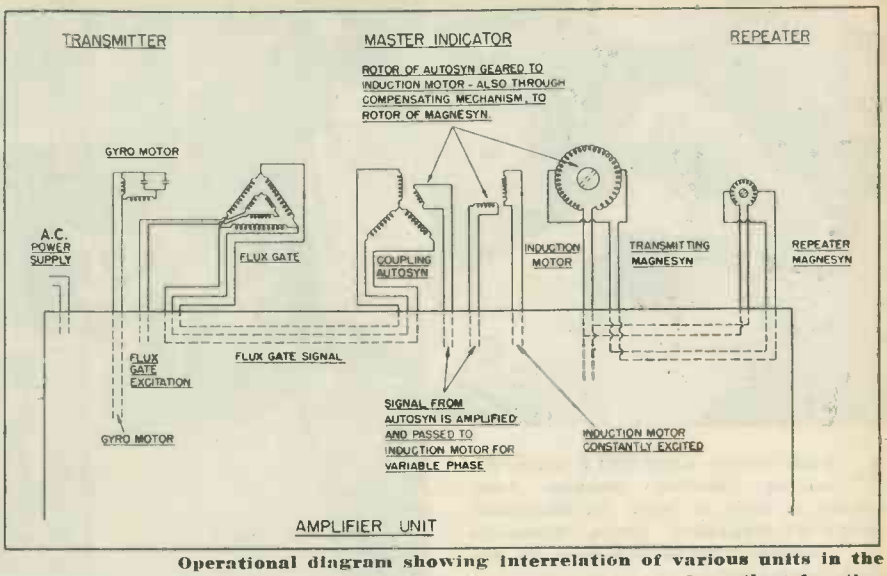
Stabilizing gyro

The Flux Gate element of the transmitter is stabilized in the horizontal plane by attaching it to an electrically-driven horizon gyro. The gyro motor is a four-pole split-phase type of unit, which operates from an ac input source.

The gyro motor is self-starting, without brush connections. The gyro head contains a rolling ball type of erection system which tends to maintain the gyro axis in a vertical plane by setting up a restoring force which is a function of the amount of displacement of the gyro axis from the vertical.

The characteristics of the alloy of which the Flux Gate core is

(*Continued on page* 172)

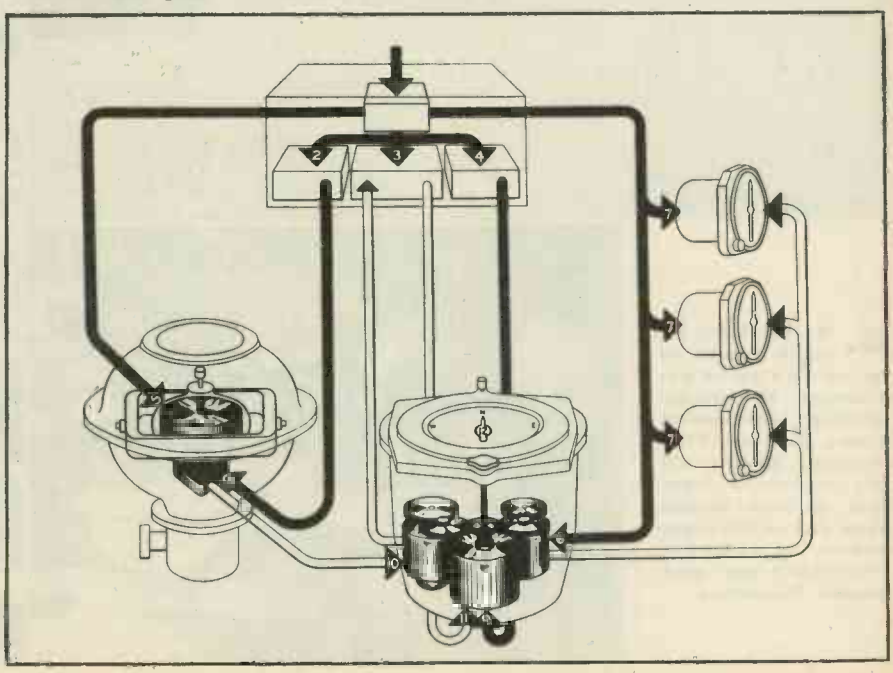


Operational diagram showing interrelation of various units in the gyro flux gate compass system and indicating how they function

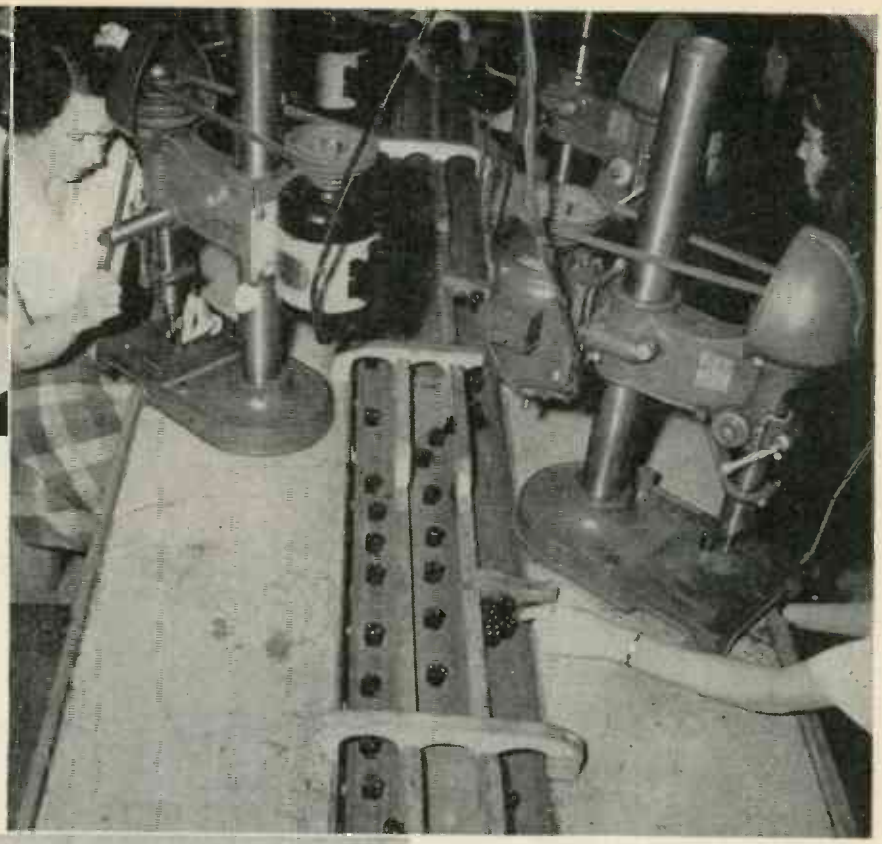
Master indicator which controls several repeater indicators

Amplifier and oscillator unit which supplies operation power

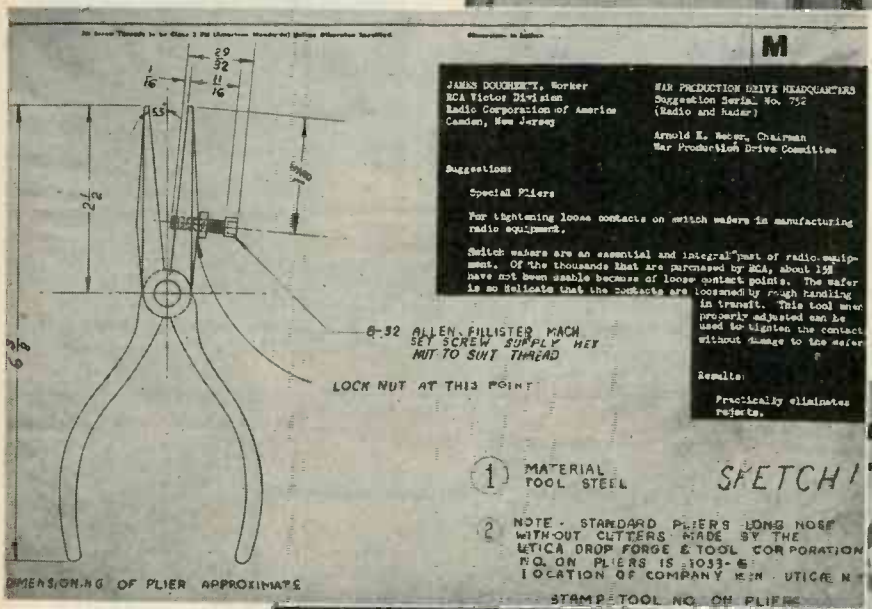
Operation of system when aircraft is heading straight on course: Power from aircraft central supply enters the Voltage Adjuster (1) and goes to following points—Cycle Oscillator A (2); Amplifier (3); Cycle Oscillator B (4); the Gyro (5); the Transmitter Magnesyn (6) and the Magnesyn Repeaters (7). Oscillator A (2) furnishes excitation power for the Flux Gate (8). Oscillator B (4) provides current for the fixed phase of the Induction Motor (9).



1. PRECISION ASSEMBLY often demands absolute freedom from specks of dust or lint. In Mansfield, Ohio, Westinghouse plant, operators use vacuum-cleaning pipe-line on optical apparatus



2. TIGHTENING loose contacts in rotary switch wafers is easy with this modified long-nose pliers. Use of the gadget eliminates rejects (formerly 15 per cent) by tightening contacts without damaging wafers

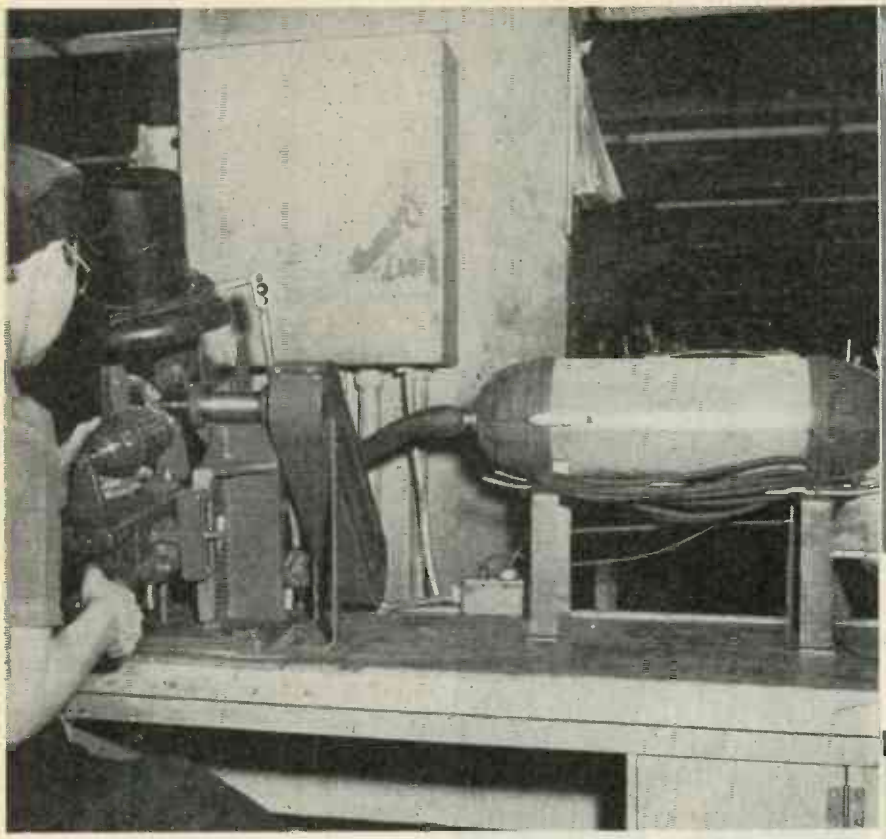


3. BLINDNESS again proves to be an advantage. Clarence McPherson, Aircraft Accessories Corp., Kansas City, Kansas, ground 50 per cent more crystals in one month than any of the other expert workers. Ninety-five per cent passed inspection

4. PROCESS BELT conveyor automatically moves articles from one track to another. Northam Warren Corp., Stamford, Conn.

Factory

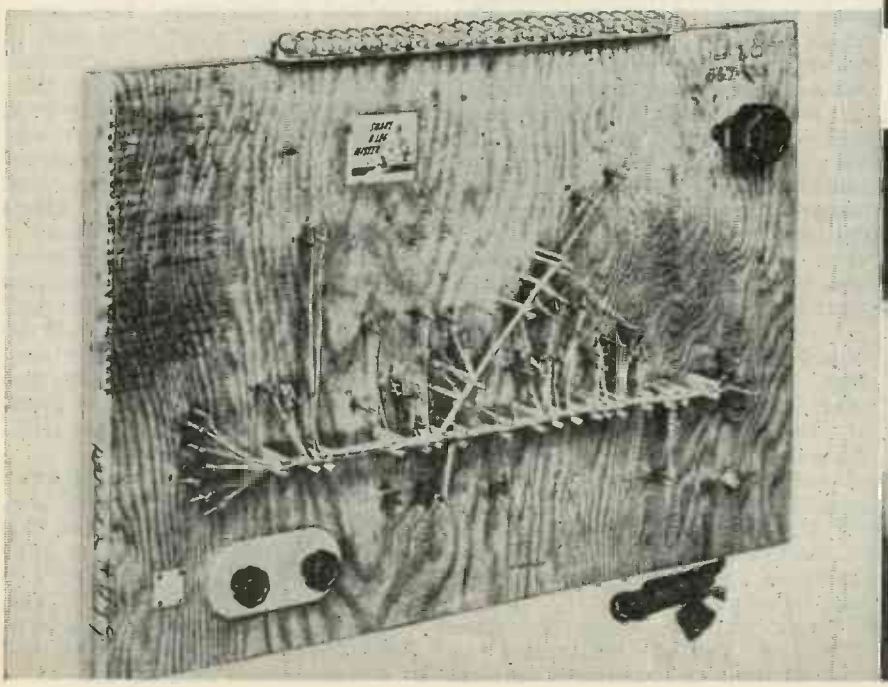
5. TOOL LIFE is extended up to 20 times by hard, thin chromium plate, at Westinghouse East Springfield, Mass., plant

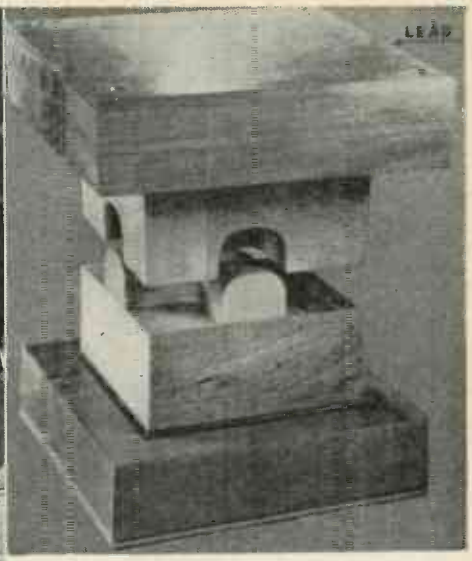


6. CONVERSION of household vacuum cleaner to wartime use, sucking away mica dust from undercutting commutators, at G-E Fort Wayne, Indiana, works

SHORT CUTS

7. SAVING WIRE, speeding assembly, Philco's cableboard features precutting, skinning, and tinning wires, stringing on "stand-off" studs, inserting ends in slotted terminal pins, and lacing. Rotary switch checks circuits through lamps and pairs of terminal pins.

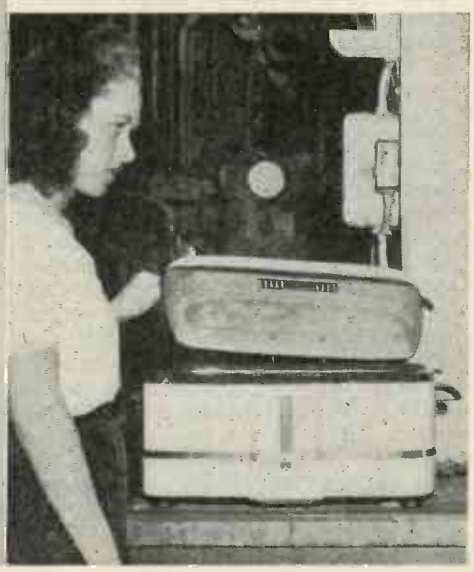




8. PLYWOOD, an improvement on lead for seat or cushion on dies, at Yellow Truck & Coach Mfg. Co., Pontiac, Mich.

9. ELECTRIC OVEN to bake motor parts. (See 10)

10. ELECTRIC ROASTER anneals plated lock washers, screws, etc. Both G-E ideas.



ENGINEERING EXECUTIVE

by E. FINLEY CARTER,
Director of Industrial Relations and Member, Board of Directors, Sylvania Electric Products Inc.

● In observing the almost miraculous achievements of some of the new creations in the field of electronics, developed under the impact of war needs and the psychology of self-preservation, the individual with an industrial relations point of view cannot but observe an interesting by-product of this developmental process. The significant fact is that accompanying these achievements are new social developments within the radio engineering and electronics professions which will in the end, perhaps, play a more decisive role even than the technical and material developments themselves. For the creators are growing with their creations.

Human engineering

Specifically, we can observe a broadening of the radio engineer's horizon. At Sylvania, we have been forced to take engineers out of our laboratories and place them in charge of production plants or even use them in the field of our relations with the customers. This has been an experience in human engineering not limited by the doors of any one concern, but is found throughout the radio industry. Under the new conditions, the radio engineer has found that he can no longer figuratively "bury himself in his laboratory" and thereby maintain mastery of his creations. While in the past the radio engineer might have been content with the exclusive functions of the observation of phenomena, arriving at conclusions from these observations and out of them creating new devices, he must recognize that his responsibility and range of interest now must embrace the complete cycle through which his creation passes. He must broaden his outlook to include the additional steps of presentation, coordination, production, distribution and application in their broad aspects. He must learn to appraise the social aspects of new developments. To do so, his familiarity with equations must be expanded to include the human equation.

There are many reasons why,

E. FINLEY CARTER

because of their aptitudes and training, certain individual engineers or physicists may better direct their major efforts to certain specific stages of this cycle. Nevertheless, the radio engineering profession, as well as individuals in it, should recognize the importance of each link in the chain and develop a good working knowledge of the whole process so that they may better perform their individual parts. It should be emphasized that the radio engineer's broader horizon embodies the presentation of his conclusions to management, the coordination of the efforts of others involved in developing those conclusions, the production of the devices created, their distribution, and their final application to the service of mankind.

There is no need to dwell upon observation, conclusion, and creation. Sufficient emphasis has already been placed upon those phases of the development cycle in the normal course of an engineering education. Just enough should be said, however, to provoke constructive thinking about the other stages in the evolutionary process leading up to the creation of a new device and its application.

Many brilliant engineers have definitely limited themselves as well as their contributions because of their inability or unwillingness to present a new idea in a sufficiently convincing fashion to get it accepted by management. Because of the failure of these ideas to be accepted, there has been a tendency on the part of some to develop a disillusioned attitude or condemn management when, as a matter of fact, had the engineer's power of observation been directed toward a study and understanding of the manager's reactions and a good presentation in the light of these observations, not only could management have been sold, but the engineer could have won outstanding recognition as well.

Accept suggestions

There are engineers who, strangely, adopt the attitude that they have made a contribution only if they have supplied all the ideas that go into a new device from their own conclusions. To accept the thoughts of others, they think would rob them of their own due credit, and compromise is reprehensible. They may be long on their yearning for recognition but short on cooperation and coordination. Here again the engineering mind often fails to employ its powers of observation upon human reactions and thus discover a basic fact. A really good engineer is glad to accept the suggestions of others and incorporate them in his thinking, at the same time freely giving credit where credit is due. Such an attitude is essential in a manager or director and is the key to the development of one of today's most valuable personnel units—an executive with an engineering background. The need for such men is not temporary but is becoming more intense as products continue to become more technical and complex.

Many engineers have shied away from production, frightened perhaps by the thought that it is "too routine." Yet production is anything but that for men with a quest for the better way. True, there are many repetitive operations but they can always be im-

(*Continued on Page* 212)

CALIBRATING SPRINGS

Descriptive analysis of the functions of electro-mechanical equipments for automatically checking and sorting components

● The schematic diagram of the electronic control described in Part I* may be broken down into distinct segments, each having a definite function. It may therefore prove helpful to describe each section, to simplify the use of parts

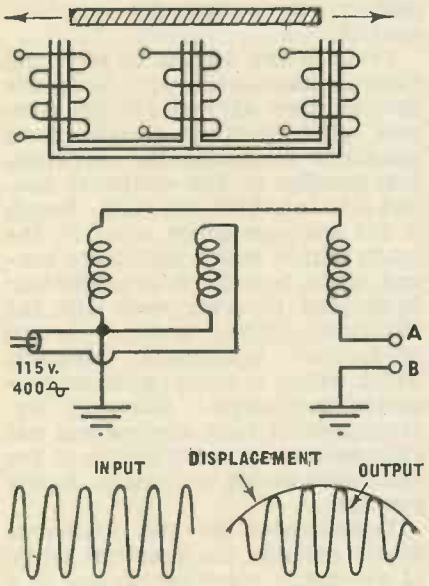


Fig. 1

of this system in set-ups for other applications which may be in mind.

The electromagnetic "E" pickoff shown pictorially and schematically is fed with single phase, 115-volt, 400-cycle energy. The output signal is a 400-cycle carrier with amplitude proportional to the displacement of the armature and carrier phase dependent upon the direction of displacement of the armature from center position. (Fig. 1.)

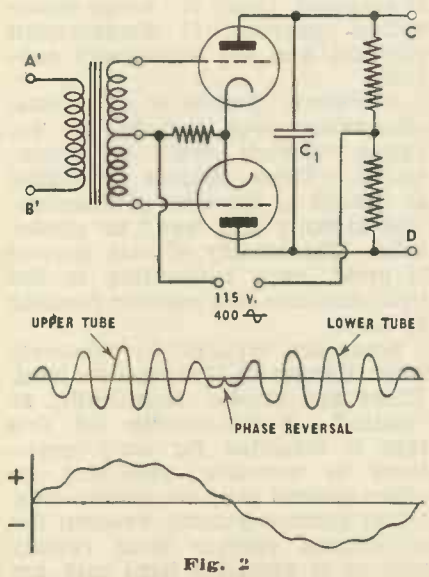


Fig. 2

Fig. 2 shows the pre-amplifier. Depending upon the phase relationship of the carrier voltage to the supply voltage, either the upper tube or the lower draws plate current during each positive plate-voltage swing. The resulting plate current pulses are integrated by C-1 so the output is a dc voltage, (with slight 400-cycle ripple) varying as the modulation envelope of the signal voltage. This particular amplifier is good up to about 15 cycles modulation frequency.

In the power amplifier stage shown in Fig. 3 one tube is cut off, while the other is drawing current proportional to this signal voltage, depending upon the polarity of the dc voltage between C^1 and D^1. The input and output signals of this stage are shown at right. The output is a 400-cycle signal with one lobe semi-sinusoidal and the other lobe flat-topped.

Condenser C-2 in Fig. 3 has two actions: (1) It tunes the reflected plate load impedance and thereby improves the wave shape (rounds out the flat-topped lobes), and (2) it shifts the phase of the 400-cycle output voltage with respect to the supply voltage.

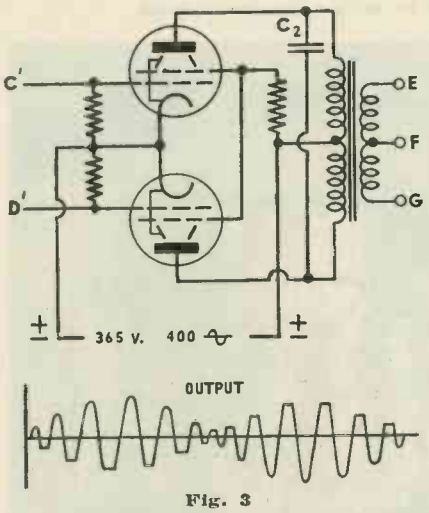


Fig. 3

The three-phase motor and associated hybrid 3-phase system are displayed in Fig. 4. The R-Y phase voltage (feeding the output tubes through the power transformer) is rotated by C-3 until it is approximately 90 deg. to phase voltage

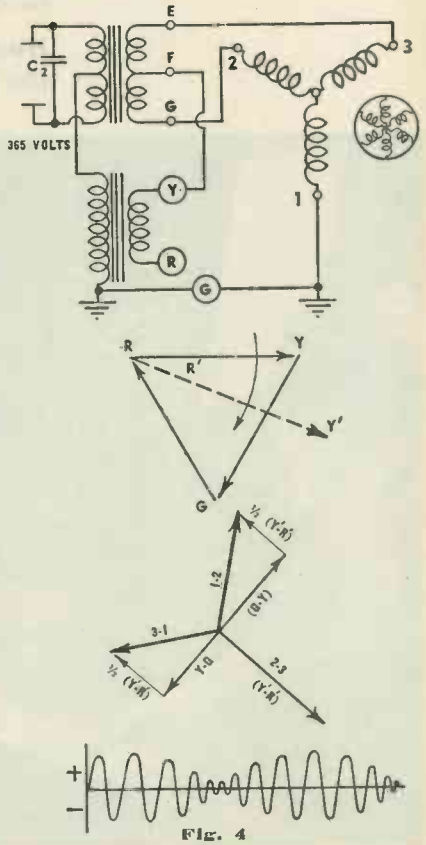


Fig. 4

Y-G. Since the output winding of the output transformer is center tapped, plus and minus halves of this shifted R-Y phase are added to the Y-G phase voltage in such a way as to produce two phase

(*Continued on page* 170)

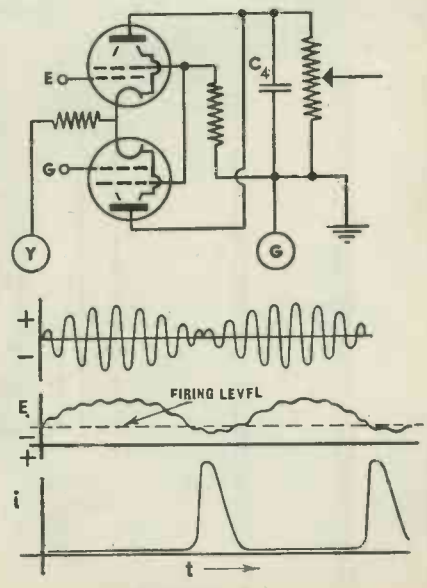


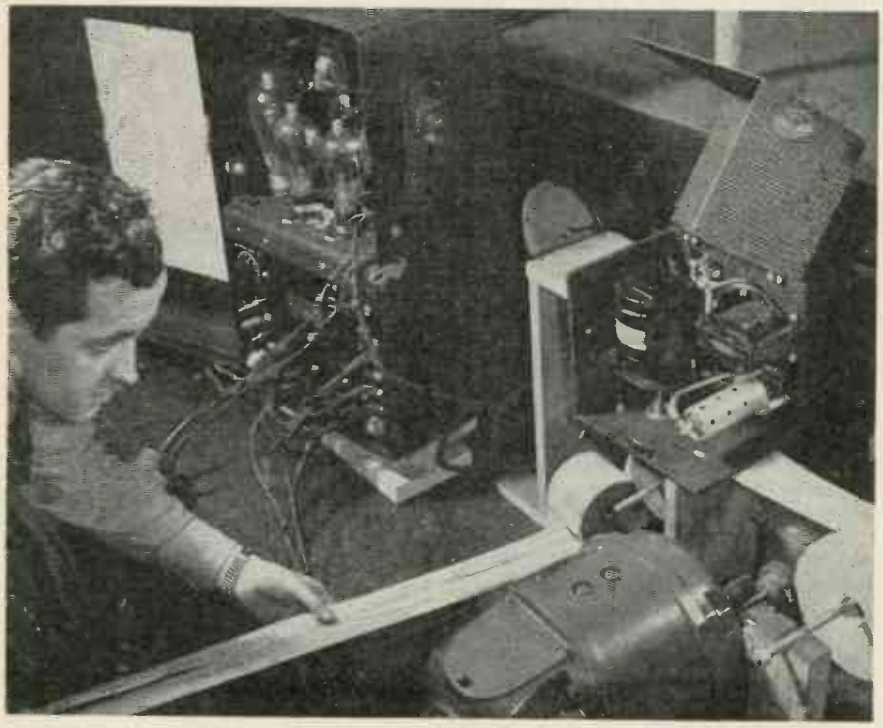
Fig. 5

*Electronic Industries for November

INDUSTRIAL CONTROLS

by S. J. MURCEK
Electronics Section
Control Engineering Dept., Westinghouse
Electric & Mfg. Co., East Pittsburgh, Pa.

How electronic applications are being used to extend the field of automatic operations in manufacturing



Dynamic type of control applied to paper rewinding machine to maintain paper edge in a fixed position, resulting in a roll with uniform edges

"XT" electronic synchronizer which is used to automatically connect a large turbo-generator to a "live" line in proper synchronization

• Fundamentally, the electronic device is an outgrowth of an age-old and well-known development: namely, the automatic machine control.

Prior to the advent of electrical control, mechanical and hydraulic devices were utilized for the purpose of converting certain basic machines to automatic operation. Introduction of the electrical control into this field extended, though it did not necessarily simplify, the limits within which automatic control might be applied to production equipment. However, even with the electrical control system, certain production equipment problems which defied practical solution presented themselves. Naturally, development of such devices was not abandoned and the evolution of the electronic device or control finally resulted.

Development of the electronic device extends the practical limits of automatic machine control to a fantastic degree. This new-old device can see, hear, feel, or even think, and can convert these impressions into the physical reactions necessary to exert appropriate automatic control over various items of production equipment. Technically, electronic devices may be classified with respect to the means from which the device in question is actuated, thus: (1) visual observation controls, (2) displacement controls, and (3) supervisory controls.

Electronic devices of the visual observation type include the so-called "electric eye," or Phototroller. These operate by reason of change in the level of illumination striking the "eye," or phototube. The variety of such devices is great, each responding to the light stimulus in a manner peculiar to itself.

Some are actuated by relatively slow changes in illumination level. These are known, technically, as "static." A Phototroller of this type is intended for such operations as counting, switching, or other general purpose applications. Other control systems, wherein the phototubes operate from rapidly varying or pulsating light only, are of the "dynamic" type. A rewind

regulator, for instance, falls in the dynamic classification. Its function is to apply control to a paper rewinding machine so that the paper edge remains in a fixed position during the rewinding process. This results in a completed roll with uniform edges. The regulator actually "sees" the paper edge, and may be conveniently arranged to maintain the longitudinal position of a relatively narrow or thin line. Both the static and dynamic systems can be arranged to operate from reflected light, as well as from infra-red or "invisible" rays.

Displacement controls

This problem illustrates an example of a displacement control of the electronic type arranged for actuation by various physical movements, such as shaft rotation, physical movement of the product, or production equipment component, such as a planer bed, and, in some instances, vibration of a real body. Here the physical displacement, converted to an electrical voltage or current by means of a suitable device, causes the electronic device proper to react in the desired manner. An example is an electronic speed regulator that is actuated by the voltage developed from a small tachometer generator affixed to the shaft of the motor under control by the regulator. It should be observed here that the extra load placed on a machine by the tachometer generator is so small as to be negligible, often being less than the bearing friction in the machine.

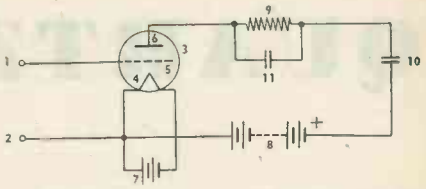
The electronic loop regulator controls the length of sheet steel strip, hanging in a loop form, between the mill coil winder and the last processing rolls. Another supervisory electronic device is the photo-electronic classifier, which automatically sorts the product under observation by color, size, or physical shape. These represent two radically differing types of supervisory electronic devices, one primarily independent of the condition of the controlled product, the other operating with respect to product characteristics. Included among supervisory controls are electronic welding timers, especially those of the synchronous type. In another field is the "XT" electronic synchronizer, which automatically connects a turbo-generator to a "live" transmission line.

Most types of electronic devices are based on the operation characteristics of a type of "radio" tube. The theory of this important element included in electronic devices is simple, and readily understood. In the fundamental illustrated circuit, if a voltage is applied to terminals (1) and (2), so that the grid is negative with respect to the filament, by the inverse of the well-known law of attraction between electrically charged bodies, the electron stream emitted by the filament is opposed by the negative charge on the grid, and the tube plate current is materially reduced. If the negative charge on the grid is high enough, the plate current flow through the tube will be completely stopped. Conversely, if the control grid of the tube (3) is made positive with respect to the filament, the electron stream is accelerated, and the current flow through the tube, as indicated by the milliameter, becomes greater.

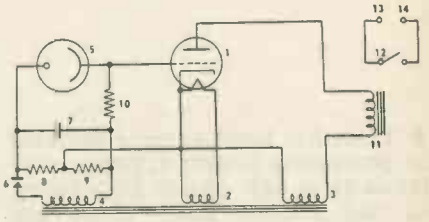
In either of the preceding instances, the control voltage on the grid is very small with respect to the relatively large plate supply voltage. Again, the grid draws a current only when it is positive with respect to the filament, and this current is a small fraction of the plate current value. Herein lies the value of this remarkable electronic device. The microscopically small value of energy required to control the relatively large plate circuit power of the tube provides a leverage, or electrical advantage, greater than that obtainable in any other manner.

A simple, photo-responsive electronic control is shown in sche-

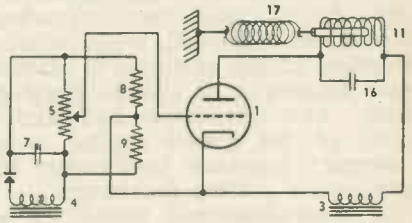
(*Continued on page* 188)



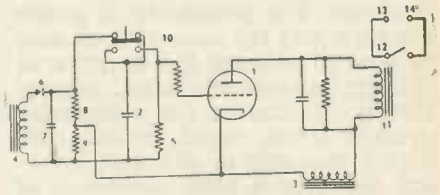
Schematic of basic electronic circuit



Schematic of photo-response control

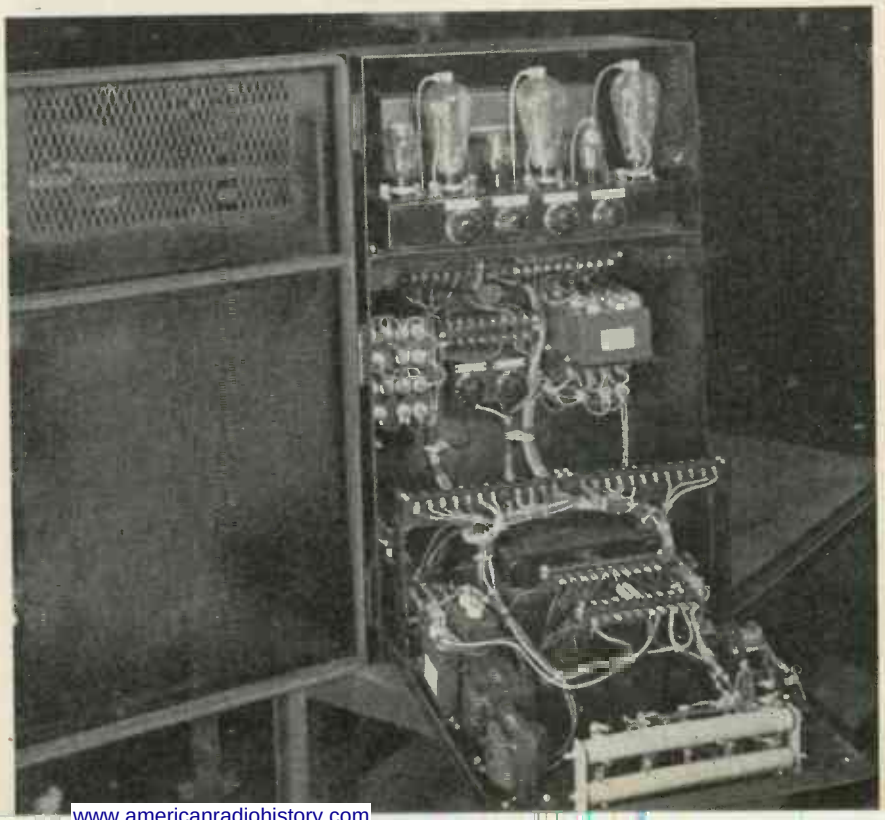


Schematic of displacement control



Schematic of timing control

Electronic loop regulator controls length of sheet steel strip hanging in loop form between the mill coil winder and the last processing roll



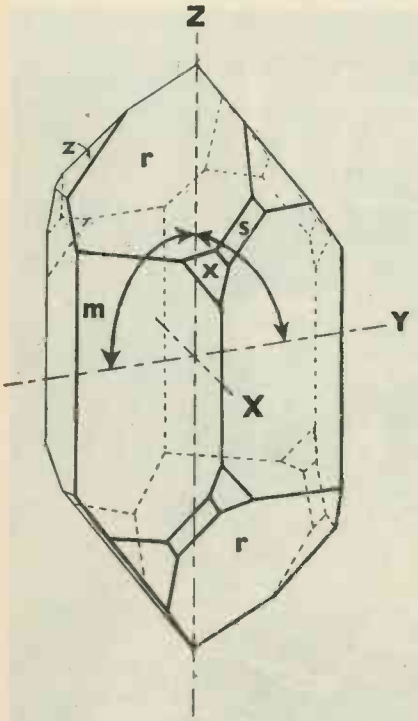
QUARTZ ORIENTATION

by RAY SETTY
Aircraft Accessories Corp.
Kansas City, Kansas

Production methods of locating X, Y, and Z axes with conoscope and X-ray measurements

● There are three general methods of processing quartz crystal oscillators from raw quartz in industry at the present time. These are known as the direct wafering, the X-section, and the Z-section methods. All of these manufacturing procedures require an accurate orientation of the raw quartz crystal with respect to its crystallographic axes. This orientation and alignment of the quartz crystal is a necessary operation preliminary to any of the cutting procedures.

A diagrammatical sketch of a perfect quartz crystal indicating its crystallographic axes and its faces, is shown. The properties of quartz are such that the natural faces may be used to indicate the direction of the crystallographic axes, thereby greatly facilitating the orientation process. Thus, faced crystals are highly desirable to all manufacturers. However, a high percentage of the quartz consumed in the manufacture of the quartz crystal oscillators is obtained from unfaced material. The procedure and equipment developed by this company present a method which is both versatile and accurate for the first alignment and mounting of both faced and unfaced crystals of all weights except the faced crystals of the medium weight class which are conventionally mounted on either a prism or apex face.



Right hand quartz crystal with identifying faces and axes

Direct wafering

As a first step in raw material inspection, the quartz crystals are submerged in hydrofluoric acid, or other etching solution, long enough to produce a fairly deep etch pattern. As an optional procedure the operator may sand-blast the crystals before etching. The examination of etch marks is made under a 150 watt Mazda projector. The electrical twin lines are traced with India ink, and useless areas are marked, leaving usable areas clear.

The next inspection is made in the oil bath, using polarized and arc lights. The distribution of optical twinning and other defects are indicated. On the unfaced crystals the approximate Z-direction is indicated by applying a dot of rapid dry lacquer.

Z-axis orientation

Next the crystal must be fastened securely to the quartz holder. The pronged head of the quartz holder is set momentarily in a ¼ to ½ in. deep solution of hot Lakeside cement, then placed immediately upon a previously heated quartz crystal. Increased holding power can be obtained by painting cement over the gaps between the tips of the metal prongs and the quartz. The holder, with its quartz, is inverted and placed in a cooling rack. The steps of this routine are demonstrated.

The quartz holder is next placed in the conoscope supported by the attachment as shown. The crystal is rotated until a position is found in which a series of concentric interference bands appears. In this position the line of sight through the crystal coincides with the optical or Z-axis, and a firm tightening of the clamps fixes this Z-direction perpendicular to the arm of the quartz holder. Before removing the quartz from the conoscope, the hand of the quartz may be recorded on the holder with a wax pencil.

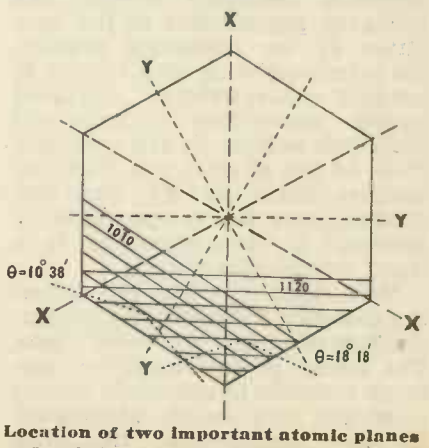
X-axis orientation

To facilitate the X-raying procedure a small surface of not more than a half-inch square is ground onto the quartz. In grinding, the arm of the holder is held vertical.

Next the holder is fitted onto the X-ray attachment. This places the Z-axis in a vertical position. Because of the atomic structure of quartz there are symmetrically arranged three X-axes and three Y-axes in a plane perpendicular to this Z-direction. The XZ and YZ-planes are shown schematically.

It will also be noted from this drawing that there exists an atomic plane, either XZ or YZ, for every 30 deg. of rotation about the Z-axis. Thus it is obvious that regardless of the relationship between the quartz and its holder, the angle between the reference arm and the nearest X or Y-axis will never be greater than 15 deg.

The X-ray operator may use either of these planes to determine the angle between the X-axis in the quartz and reference arm of the quartz holder. The angle, θ, at which each of the atomic planes will reflect X-rays is indicated in the figure. The ionization chamber is set at the angle of 2 θ, for example 36° 36′ to receive reflections from the $11\bar{2}0$ atomic planes. By moving the goniometer arm of the X-ray



Location of two important atomic planes and their X-ray reflection angles

machine the quartz is rotated until the meter of the ionization chamber is at maximum deflection, which indicates that the incident X-ray beam is at an angle of 18° 18′ to the $11\bar{2}0$ atomic planes. The amount of rotation necessary to obtain this condition is written on the quartz holder for reference in mounting.

No reading indicates that the incident X-ray beam enters the quartz at an angle greater than ± 18° 18′ with respect to the $11\bar{2}0$-plane, and X-ray deflection will be obtained from the $10\bar{1}0$-atomic planes. It is necessary to substitute the value of this X-ray reading in a simple relation to determine the angle between the X-axis of the quartz and the reference arm.

Mounting procedure

The general procedure is easily understood from the photograph. As stated above, the value recorded on the reference arm is the angle between the X-axis and the reference arm of the quartz holder. Therefore, in mounting the quartz, the holder arm must be rotated from the vertical, (90 deg. to the top of mounting table) the amount indicated to orient the X-axis to a vertical position.

By holding the quartz over a polarity indicator with X-axis approximately vertical, the operator may determine the polarity. Now, by use of a Starrett protractor the quartz holder arm is oriented accurately on the mounting table by using its top horizontal bar as a reference. A corrugated cardboard strip, in the form of a hoop, is placed around the crystal. A ¼ in. layer of sealing wax is poured into the cardboard. The sealing wax is then topped with Sauereisem cement to prevent cold flow.

Section orientation

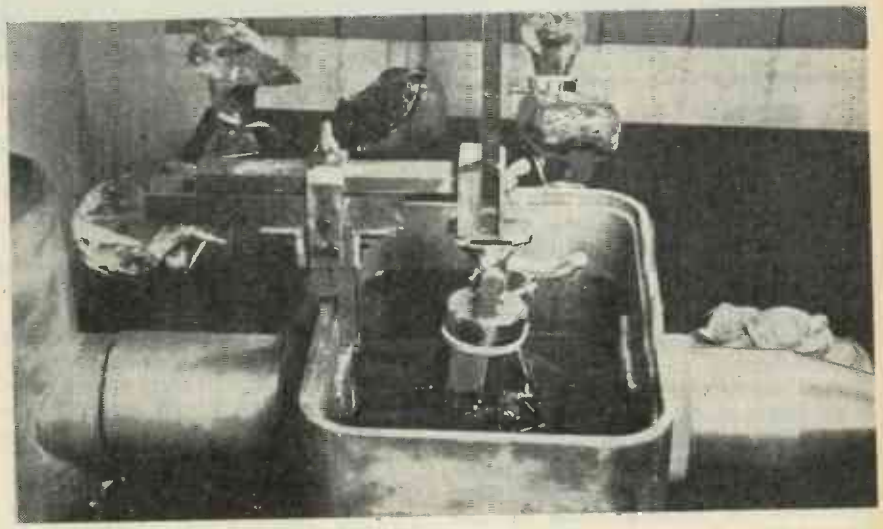
The orientation and mounting operations and equipment employed to obtain X-sections are identical and are followed in detail to those described under "direct wafering," except for two necessary major changes.

The etching procedure is omitted at that stage of manufacture, and is deferred until the quartz has been cut into X-sections. The advantage is that pinhole examination can be used in addition to general inspection as to quality of quartz. Thus omit steps asking for hand and polarity.

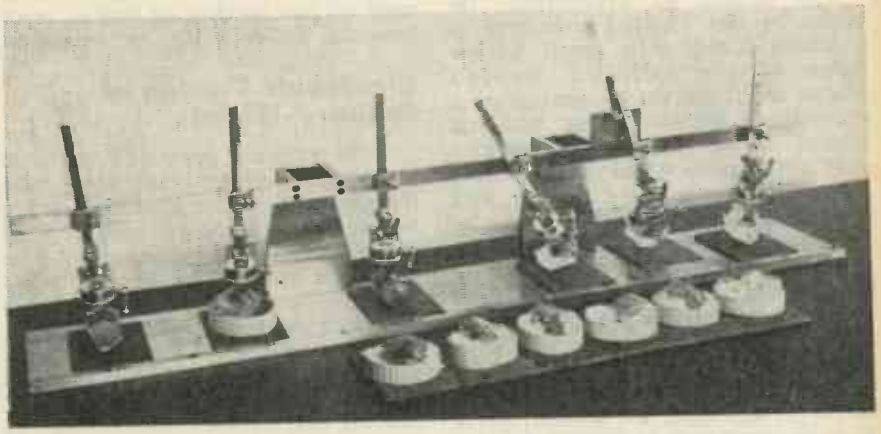
The second change is in orientation. The objective was to orient the quartz so that the X-axis would be vertical when mounted. In this

(*Continued on page* 176)

Heated crystal is cemented to three-prong holder with adjustable positioning head

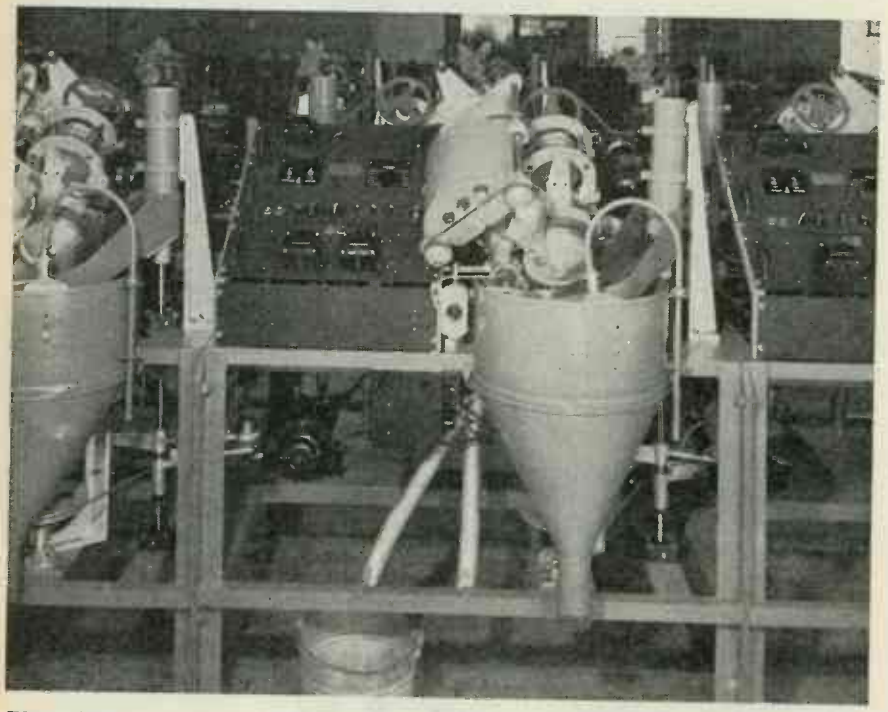


Crystal in holder is rotated in light beam of conoscope until Z-axis is positioned perpendicular to holder



Crystals in holder are molded into wax for sawing after X-ray determination of X-axis

Electronic Tubes on the Job



Photoelectric sorting machine inspects sixty beans a second—one bean per cycle!

Food Product Sorting

In the plant of the C. H. Runciman Co., Grand Rapids, Mich., an installation of thirty-two photoelectric bean-sorting machines processes 80,000 pounds of Michigan navy beans in twenty-four hours. This means about 166,000,000 beans have to be viewed from both sides by photocell units and either passed or rejected, at the rate of sixty per second per machine.

Another Runciman Company plant at Lowell, Mich., processes 185,000 pounds of beans each day. Photoelectric sorting units in the United States automatically process over a billion pounds of food products each year.

The means of presenting the beans to the viewing members is a wheel fitted with small hollow tubes on the periphery through which air is drawn by means of a centrifugal blower. One bean is picked up on each of the ferrules and held there while it is passed through the viewing chamber and viewed from both sides. If the bean is of proper color to meet U.S. grading standards, it is passed by the viewing mechanism and falls on a moving conveyor belt which takes it through a proper sacking mechanism.

If, on the other hand, the bean is dirty, diseased, or broken, or if foreign material is picked up by the wheel, the photoelectric circuit operates a rapid solenoid which ejects the bean into a separate container. Beans are presented to the viewing chamber equally spaced in single file.

The equipment illustrated was designed and installed under lease by the Electric Sorting Machine Co., Grand Rapids, Mich. Equipments for processing beans, peas, peanuts, or similar items formerly were of the "dark-trip" type which examine the product in terms of per cent of light reflectivity.

Modern equipment is of the "bichromatic" type, which is capable of making separations according to color or a number of colors from either end of the spectrum. Such equipment is now standard and is used in the sorting of beans, peas, peanuts, coffee and other products.

Electronic Timing of Balance-Wheels

It is common practice to time a balance-wheel by regulating the length of the associated hairspring before it is assembled with the remainder of the movement for a watch or clock. The timing is essentially an adjustment to the desired resonant frequency.

The electronic apparatus described in U. S. Patent No. 2,330,416 to George W. Borg Corp. gives a reading and a record both indicating whether or not the balance-wheel resonates at the desired frequency. The wheel is driven by pulses at this frequency. Its oscillations generate a photoelectric current which is amplified, its amplitude—a maximum at resonance—indicated by a voltmeter, and its frequency deviation from the driving frequency recorded. The length of the hairspring is then regulated and the procedure repeated until deviation of the resonant frequency from the desired frequency is satisfactorily small. The voltmeter reading is less accurate than the record, but may suffice in some instances; in others fine adjustment will be made with the aid of the record.

Dynamic Balance

Designed and built by Pioneer Instrument Division of Bendix Aviation Corp., Bendix, N. J., these compact units are used in balancing electric gyroscope rotor-and-magnet assemblies. Rotors and magnets are marked individually at the point of unbalance by an electric spark. Excess metal causing vibration is removed from the rotor by use of an inbuilt drill, and from the magnet by a separate grinding operation.

The detection and marking of points of maximum unbalance is accomplished while the rotor-and-magnet assembly is revolving at approximately 10,500 rpm on its own bearing support cones in the balancing frame of the machine. The vibration due to an unbalance at one point on the circumference

Dynamic balancing unit marks location of unbalance by spark-discharge to rotor under test. Amount of unbalance is read on milliammeter at left

and occurring once per revolution, is transmitted through a vertical vibration bar on the balancing frame to two microphone pickup feeler bars. Since most of this vibration is transmitted to the feeler bar (either top or bottom, whichever is nearer the horizontal plane of unbalance), it is possible, by means of an electric switch, to connect an amplifying circuit to the microphone attached to the feeler bar nearest the plane of maximum unbalance.

Measuring unbalance

With the vibration thus detected and located, its amplitude is transmitted through the microphone to the amplifying circuit. The pulsation of unbalance (as felt by the microphone feeler bar) occurs in a regular sine wave pattern. One peak of this sine wave represents the time at which the point of unbalance is adjacent to the microphone feeler bar. The amplifier output is a wave having but one peak occurring 90 deg. later than when the point of unbalance was adjacent to the microphone feeler bar. This impulse fires a thyratron tube energizing a spark coil and spark electrode 90 deg. after the point of unbalance has passed the microphone feeler bar. An impressed 60-cycle voltage allows a condenser in the thyratron circuit to charge and supply the added power required to produce a satisfactory marking spark.

Compensation for the 90 deg. lag of the spark is provided in the design of the balancer by locating the spark electrode 90 deg. in the direction of rotation from the microphone feeler bars.

The spark electrode used to mark the rotor is adjustable, in a vertical plane, so that the operator may set it opposite the top or bottom of the rotor side, depending upon the horizontal plane in which the maximum unbalance occurs. The spark electrode is brought in close to the rotor and the circuit, is closed by means of a toggle switch. This causes a spark to leap across the gap to the rotor and etch it lightly at the point of unbalance.

When the part being balanced is up to speed (10,500 rpm) the operator may vary a potentiometer and compare the circuit current with the known current for a measured amplitude of vibration, thus obtaining a relative indication of the amount of unbalance. This indication is determined by a figure on the potentiometer dial, which may in turn be converted into inches of drilling depth by reference to a calibration chart.

An oscillator fires a stroboscopic lamp at a previously calibrated frequency to indicate when the rotor has attained balancing speed.

Propeller Governor Tester

The Nash-Kelvinator Corp., Detroit, Mich. has developed an electronically-controlled precision testing apparatus that checks the accuracy of delicately balanced hydromatic airplane Hamilton Standard propeller governors which the company is manufacturing for the Army Air Forces.

The governor, which automatically adjusts the pitch of the propeller blades so as to make the most efficient use of the engine's power at a given speed, must be accurate to within 5 rpm, or two-tenths of one per cent at maximum speed. This was about four times as fine a tolerance as the efficiency of the best tachometer which could be obtained.

Functions hydraulically

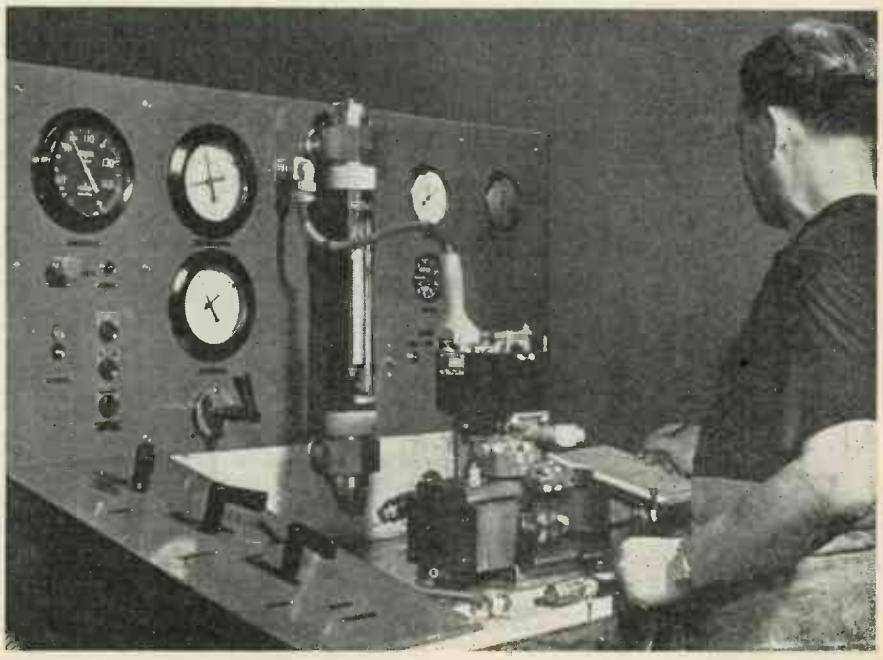
The propeller governor to be tested is mounted on the stand and hooked up to an electronically controlled dc motor operated from the ac power line. The governor is then attached to a pressure oil system which serves as a "dummy propeller." Since the governor itself functions hydraulically, it regulates the pressure in the testing device, and thereby controls the speed of the motor. This same motor also drives an alternating current generator. Measuring the frequency of the ac output gives the rpm of the governor.

Victory Time Signal

An unusual form of time signal has been in use at Radio Station WTIC for the past several months. Instead of the conventional beep, WTIC uses three dots and a dash, the Morse letter "V"—symbol for Victory. Conceived by Irwin Cowper, Assistant Sales Manager and designed by Herman Taylor, Chief Engineer of WTIC, the "V" signal is keyed by means of a special toothed, motor-driven cam, the conclusion of the dash always occurring within a fraction of a second of the hour. The impulse, which starts the motor shortly before the hour, is sent to WTIC from a Western Union master clock, normally used for the hourly correction of the studio clocks. Utilizing a fractional horsepower motor coupled to a cam mechanism and using micro-switches for keying and timing, the equipment in use since July 4, has provided uninterrupted reliable service.

The unusual feature of this time signal is the fact that the three dots are sent in the musical key of "G", while the dash is sent in the key of "E" flat, following the motif of Beethoven's Fifth Symphony which has been much publicized since the start of the war for its opening theme of "V" for Victory. A modified General Radio audio oscillator is used to supply both tones, the change in pitch being accomplished by a variation in the oscillator grid circuit.

Testing and timing aircraft propeller governors at Nash-Kelvinator. Stand is equipped with G-E motor control, which holds preset speed between 900 and 3,000 rpm. Thymotrol's current-limit circuit spots tight governors by dropping speed



SURVEY of WIDE READING

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

On Intermittently Ceasing Self-Excitation

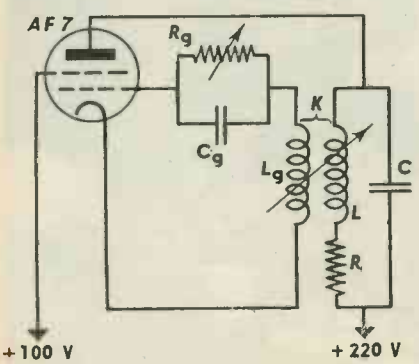
H. Barkhausen and K. Bose (Hochfrequenztechnik und Elektroakustik, Berlin, August, 1942)

If the product of amplification factor and feedback ratio is equal to unity, the amplitude of the oscillation generated by the circuit shown is supposed to be constant. However, to obtain stability, it is necessary to compensate for the amplitude dependency of the average mutual conductance; that may be done by insertion of the R_gC_g circuit which provides a suitable bias effecting amplitude control. It is known that if C_g exceeds a certain critical value, intermittent self-excitation starts, i.e., the oscillations stop suddenly, set in again, stop, etc. In this paper, the equations describing the operation of the circuit are derived and conditions for stability and for occurrence of intermittent self-excitation are discussed.

It is established that the oscillation is unstable if

$$\mathrm{Re}_g \frac{\partial \mu}{\partial e_g} > - \frac{\frac{\partial J_g}{\partial E_g} - \frac{1}{R_g}}{2 L \mu}$$

where e_g is the ac grid voltage, E_g the dc grid voltage, J_g the dc grid current, and μ the mutual conductance of the tube. This is equivalent to the statement that the oscillations become unstable if a change in oscillation amplitude of the plate circuit, disregarding the regulating effect of the R_gC_g combination, declines more rapidly than the grid condenser discharge takes place, so that the compensating action is too slow. Experiments confirmed the expected influence of circuit and tube constants on the occurrence of intermittent self-excitation. Also the dependency of the average mutual conductance on ac and dc grid voltages, assuming a straight characteristic, was found to be in good agreement with the computed curves.



Feedback circuit

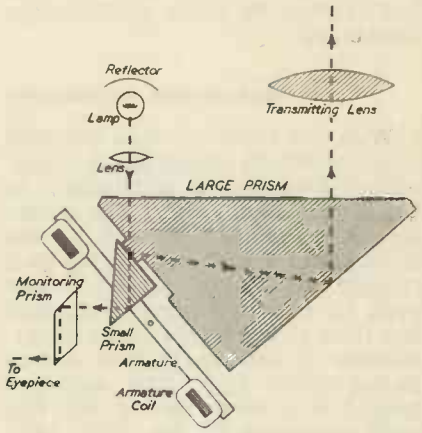
It is further explained that the damping effect of the ac grid current, not considered in the previous derivations, will cause an increase in the stability of the system. Consequently, stability may be obtained, even for an infinite value of C_g, by reducing R_g sufficiently. Alternatively, the C_gR_g combination may be replaced by a suitable biasing battery.

German "Speech-on-Light" Apparatus

D. G. Hull (Electronic Engineering, London, October, 1943)

A light-modulated signalling apparatus for voice communication which is being used by the German Army is described. The sender-receiver head contains a lamp, the modulator, color filters, the transmitting lens and the receiving lens, the photocell and its amplifier, and a built-in telescope. The L. F. amplifiers, one for sending and one for receiving, and the necessary batteries are contained in a separate box. Details of the different circuit elements are given.

The light beam from the modulator lamp strikes the hypothenuse side of a right-angle prism, and is then reversed in direction by two internal reflections of the prism. The other angles of the prism are not quite 45 deg., so that at the point of the first reflection the mean angle of incidence is approximately the critical angle of glass and air media. As the armature moves, the pressure of the small moving prism against the large prism changes in accordance with the voice currents, and as the intensity of the reflected light beam varies with the pressure, modulation is effected.



Light modulator

The telescope is intended for aligning the station to the distant terminal; it also serves as a monitoring device. For this purpose, the light lost at the first reflection of the large prism and entering the small moving prism is passed on to the eyepiece of the telescope. The image of a small grid mesh etched on the contact surface of the small prism becomes brighter and duller while modulation takes place.

The apparatus may be operated on white, red, or infra-red light. Sender and receiver must be set up in view of one another; five miles being the average effective range. Provision is also made for morse transmission; greater distances may then be obtained. Duplex communication is not possible unless a telephone line and associated bridge circuit are used for transmission.

Reflection and Transmission in Wave Guides

L. Pincherle (Philosophical Magazine, London, August, 1943)

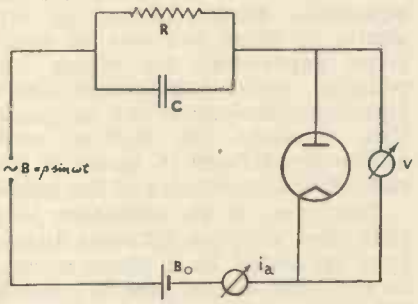
The reflection and transmission properties of electromagnetic waves in hollow tubes of rectangular cross-section and with infinitely conducting walls are studied. In general such a wave can be considered as the resultant of four transverse plane waves, traveling across the tube with the velocity of waves in an unrestricted medium and reflected at the walls of the tube, thus constituting a number of criss-cross paths.

Expressions for the reflected and transmitted intensities are considered at a surface of separation between air and an absorbing dielectric and for a sheet of this dieletric. It is then established that the same expressions are obtained by applying the ordinary Fresnel formulas to the criss-cross component waves.

On Multi-Signal Transmission

H. Raabe (Bulletin des Schweizer Elektrotechnischen Vereins, Basle, April 7, 1943)

To transmit several signals over the same line, the signals are alternately applied to the line for short periods of time so that actually only parts of each signal are transmitted. The resulting distortion is considered as a function of the interrupting frequency as compared with the frequencies of the signals to be transmitted.



Basic diode circuit

The Diode as Rectifier and Detector

J. Aharoni (Philosophical Magazine, London, August, 1943)

The mathematical theory of the diode circuit shown, operating as rectifier or detector, is developed for a non-linear part of the tube characteristic; in the region considered, the plate current is assumed to be of the form $aV + bV^2$.

If condenser C is disconnected, the static tube characteristic can be used to plot a solution of the problem illustrating the rectifying effect of the diode circuit. The corresponding equations are also derived and discussed.

A differential equation for the voltage V, with the condenser C inserted as shown, is set up and solved by the perturbation method assuming b to be small. An expression for the rectified voltage is found; it is proportional to the square of the input voltage. The percentage ripples for the fundamental frequency and for the first harmonic are computed.

Regarding detection, the amplitude of the resulting audio voltage is proportional to the amplitude of the carrier and to the amplitude of the input audio voltage; higher frequencies are reproduced with a slightly smaller amplitude. Though the rectified dc voltage for weak signals will be proportional to the square of the rf input voltage amplitude, the detected voltage, or dc output voltage variations, will be proportional to the audio input voltage itself. However, the formulas indicate that the more fidelity expected from a detector circuit, the less efficient it will be.

On Secondary Electron Emission

I. Gimpel and Sir Owen Richardson (Proceedings of the Royal Society, London, Series A, September 6, 1943)

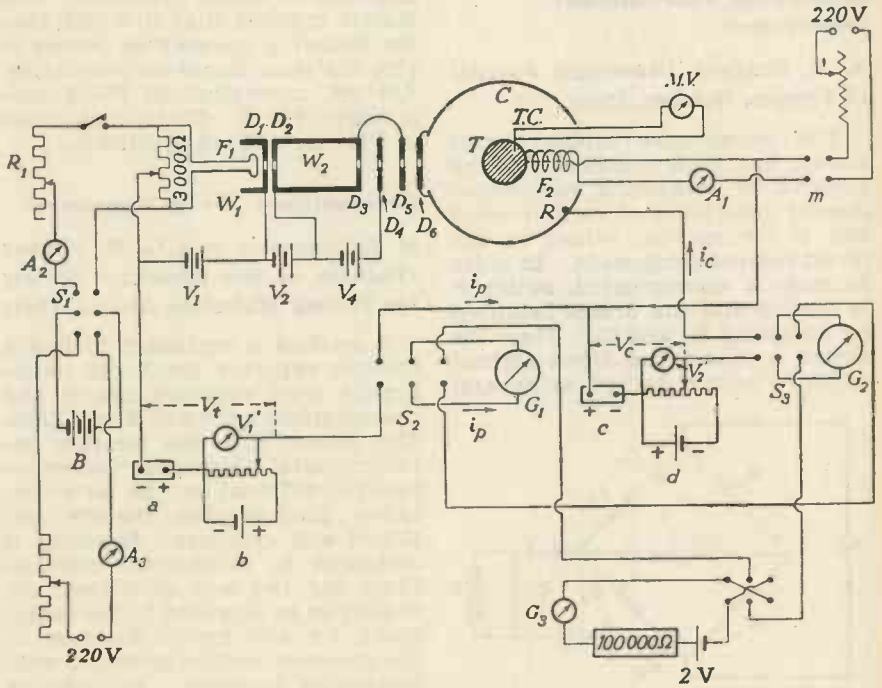
The paper describes a method and apparatus for measuring and analyzing the secondary electron emission from metals with primary electrons of about 1 eV and less. In this region it is difficult to obtain a narrow electron beam because the cross-section of such a beam increases as it proceeds due to the mutual repulsion of the electrons. Therefore, an electrostatic electron lens is used to focus the electron beam, emitted by cathode F_1, which strikes target T mounted in the center of a spherical collector C.

The secondary emission coefficient is obtained from the readings of galvanometers G_1 and G_2, having sensitivities of 5.4×10^{-10} and 3.3×10^{-10} amp./mm, which measure respectively the primary electron current i_p (as the sum of the current i_T to the target T and the current i_0 to the collector C) and the secondary electron current i_c; the secondary emission coefficient is then the ratio i_c/i_p. When readings are taken the current to the target heating circuit F_2 is switched off. The potential of the target with respect to the cathode V_T and that of the collector with respect to the target V_0 can be changed in steps of 1.5 V. Apparatus and experimental procedure are described in detail.

The operation of the apparatus is studied and corresponding formulas for the evaluation of the results are derived. Particularly, the energy distribution for primary and secondary electrons as functions of the different voltages and currents are derived. The contact potentials between cathode and target and between cathode and collector enter into the computations and had to be determined.

The secondary emission coefficient i_c/i_p was found to be constant and approximately equal to 0.24 over a range of primary electrons from 0.35 (the lowest energy practicable with a tungsten thermionic source) to 1.0 eV, or even a good deal higher and possibly up to 10 eV.

Further, the investigation showed the secondary electron distribution to be identical with the primary electron distribution, indicating that the secondary beam consists entirely of elastically reflected electrons as distinguished from inelastically reflected electrons giving off energy during the process of reflection. Under these circumstances,



Measuring secondary electron emission coefficients

the coefficient of reflection and the coefficient of secondary emission have the same value. Theoretical aspects as to the coefficient of reflection to be expected are included. The work function of the target consisting of thermally etched copper was computed and is given as 4.98 V.

Tube Oscillator Theorem

E. Williams (Wireless Engineer, London, October, 1943)

A single procedure, applicable to all orthodox negative-grid oscillator circuits, to deduce the frequency of oscillation and the maintenance condition is presented in the form of the following theorem:

$$Z + r_a/(1 + \mu N) = O,$$

where r_a = tube impedance (plate incremental resistance), μ = amplification factor, N = complex ratio V_g/V_a, and Z = impedance of the whole external circuit connected between plate and cathode. The theorem is proved by considering an equivalent circuit; linear tube characteristics are assumed.

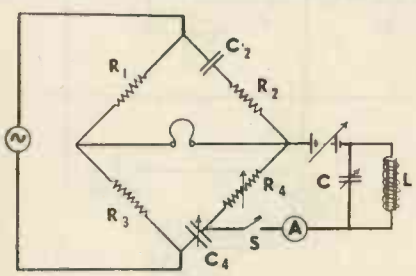
By substituting for Z and N in the above equation and by separating real and imaginary parts, oscillation frequency and maintenance condition for the tuned-plate oscillator and for the Colpitts oscillator, respectively, are derived. Oscillators which consist of a closed circuit with the tube's plate, cathode and grid tapped on to this circuit are also treated in general—the Colpitts oscillator being a particular example.

Measuring Incremental Inductance

A. E. Benfield (American Journal of Physics, October, 1943)

The capacitance bridge circuit shown has been designed for the purpose of measuring the incremental inductance of an iron-cored coil L for varying values of the direct current component. In order to make a measurement, switch S is opened and the bridge balanced by adjusting R_4 and C_4. Then the switch is closed, the direct current adjusted to the desired value, and condenser C varied until the tuned circuit LC exhibits parallel resonance. In practice, the conductance of the tuned circuit may still be appreciable, so that a slight increase in R_4 will be necessary to bring the sound in the earphones to a sharp minimum. If the Q ratio of the coil is moderately large, the incremental inductance of the coil is equal to $1/Cw^2$.

When measuring a coil having a dc resistance of 680 ohms and an incremental inductance varying between 4 to 20 henries, it was found that 2000 ohms was a suitable value for each of the resistances R_1, R_2, R_3, and R_4. The capacitances C_1 and C_4 were each about 1μf and the frequency 1200 cycles.



Measuring incremental inductances

FM for Power-Line Communication

E. W. Kenefake (Electrical Engineering, October, 1943)

Following an outline of the difference between AM and FM, an explanation is given for the reduction in random noise and for the elimination of noise caused by the corona present in power lines if FM is used.

Investigations were carried out with a frequency-modulated system for power-line communication, employing frequencies below 200 kc and a deviation ratio of one to one. Noise measurements show considerably more noise reduction for FM as compared with AM than predicted by the theory. This is ascribed to the particular type of noise used which is the one to be expected in actual operation. The results indicate that it would take the following transmitter powers to give the same signal-to-noise ratio: AM 100, unemphasized FM 8, emphasized FM 2. Other advantages of FM over AM are pointed out.

Determining X-ray Exposures

H. E. Seemann and G. M. Corney (Bulletin of the American Society for Testing Materials, August, 1943)

A method is explained to find a suitable exposure for X-ray radiographs from exposure charts and characteristic curves of X-ray films. The former give the relation between metal thickness and exposure for different kv, the latter between photographic density obtained and exposure. Exposure is measured in milliampere-minutes. From the two sets of curves, the density to be expected in the radiograph for any metal thickness in the specimen may be predicted with reasonable accuracy. An example is studied.

On Impedance of Wave Guides

H. T. Flint and L. Pincherle (Proceeding of the Physical Society, London, July, 1943)

It is the purpose of the paper to bring out the close analogy in the mathematical theory of hollow wave guides and parallel wires, and to explain the application of the impedance concept in the case of wave guides. Knowledge of the relation between current and potential in the case of parallel wires and of the reflection properties of impedances placed across them can then be used in the solution of wave guide problems.

Disregarding the distribution of the field components across the tube, the partial differential equations relating the scalar potential and the vector potential of the electromagnetic field for the transverse magnetic wave are seen to be identical with the conventional line equations. By identifying the constants in these two sets of equations, expressions for vector impedance, vector admittance, characteristic impedance and propagation constant for hollow wave guides are defined in terms of the electric characteristics of the guide.

The case of an infinitely long tube filled with two different dielectrics separated by a plane normal to the sides of the tube is treated. The analogous line consists of semi-infinite parallel wires terminated by an impedance equal to the characteristic impedance of the second half of the tube. Coefficients of reflection and transmission for this circuit in terms of the tube constants are readily found from line theory. A dielectric slab of glass or wax placed within a tube is shown to act as if it were a line terminated by the characteristic impedance of the tube. Similar analogies also exist for transverse electric waves, and several problems are considered in connection with this type of wave.

Experimental methods are suggested for determining impedances of hollow guides by analogy with methods which have been applied in the case of conducting guides. Dielectric constant and absorption can be measured for a material introduced into the guide by comparison with a known material.

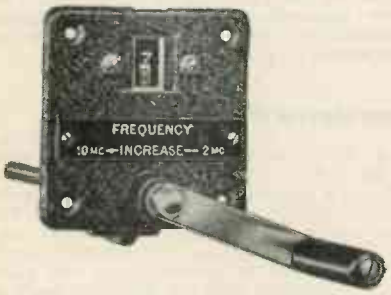
On Ideal Filters

D. A. Bell (Wireless Engineer, London, July, 1943)

The use of Heaviside's unit function to determine the transient response of an electric wave filter and the defects of this method are discussed.

WHAT'S NEW

Devices, products and materials the manufacturers offer

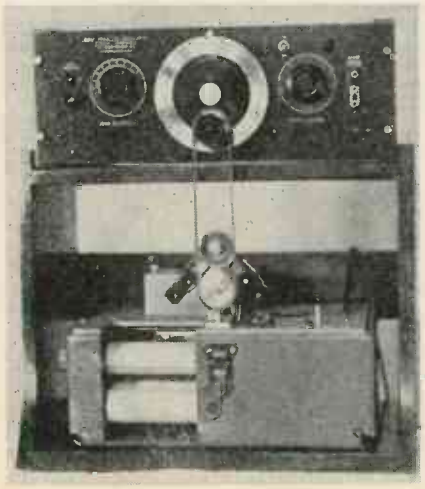


Rotary Counter Assembly

Originally designed for registering rotary coil turns, the B & W cyclometer type counter unit is adaptable to practically any application where a shaft must be turned a pre-determined number of times, or set at any pre-determined position. The exact number of turns, down to tenths of a turn, are recorded on the counter. Standard counters record 10 turns. Others, also available, record up to 100-1000 turns. Used with rotary coils, the counters provide a quick, easy means of setting the contacts at any desired inductance value. Assemblies have direct shaft drive (1:1). Shafts can be any length. A Veeder-Root counter is used. The gear drive is direct, with precision cut steel gears. Units are light in weight (8 oz.), are available with right or left hand rotation, and can be supplied with name plates to suit the application. Manufactured by Barker & Williamson, 235 Fairfield Ave., Upper Darby, Pa.

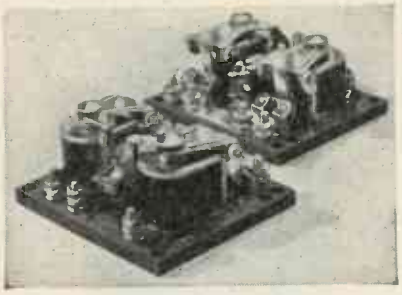
Frequency Response Recorder

The automatic frequency response recorder of the Sound Apparatus Co., 150 West Forty-sixth St., New York 19, N. Y., is used in combination with a General Radio audio beat frequency oscillator. Some of the main features include: a complete automatic frequency response run from 20 to 20,000 cycles covering a range of either 20, 40, or 60 db; recording forward and backward; it stops automatically at any pre-determined point of the frequency scale; the record (ink) is written on standard semi-log. paper; recorder and oscillator can be used at any time as separate units, since complicated connections are avoided. With this equipment an unskilled operator can perform a multitude of complicated measurements of electro-acoustical apparatus which otherwise would require engineering skill and a great amount of time.



Dynamic Braking Relay

Instantaneous dynamic-braking with split-series field motors is provided in new Struthers-Dunn relay types 68HX100 and 67HXX100. Positive action, less weight, and simpler mechanisms are thus provided for a wide range of aircraft and other applications. The new relays are of "Nutcracker-construction" in a



new, light-weight design having exceptionally strong contact pressure. There are no sliding contacts. Positive "memory" contacts select the proper field winding to give reverse torque for braking. All parts and contacts are readily accessible for inspection. The relays operate in all positions, and withstand salt-spray, vibration and altitude tests. Supplied by Struthers-Dunn, Inc., 1321 Arch St., Philadelphia, Pa.

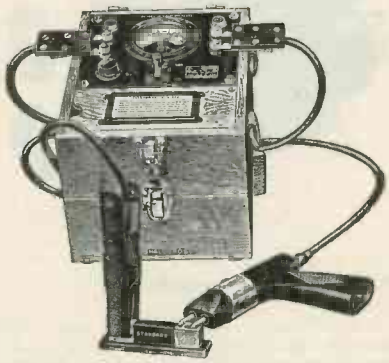
Miniature Motors

Two new miniature single-phase 400 cycle motors have been put in production by Eastern Air Devices, Inc., 585 Dean St., Brooklyn, N. Y. Model J31 is rated at 1/50 hp continuous duty at full load, over 7000 rpm, on 115 volts and .38 amps. input. The stall torque is 1.5 oz.-in., the required capacitance 1 mfd and the weight 15 oz. Model J31A, single phase low heat rise induction motor is rated at .01 hp, 7200 rpm at 115 volts and .28 amps. input. Stall torque is 0.4 oz.-in., the required capacitance is 1 mfd and the weight 15 oz.

Low-Resistance Test Sets

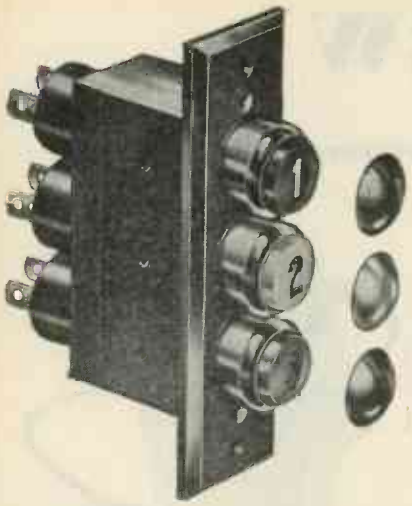
Two new low-resistance test sets, type 645 (Army range) and Type 653 (Navy range) have been designed by Shallcross Mfg. Co., Collingdale, Pa., to include all popular features of previous models with the added convenience of complete portability.

The test unit containing the meter, batteries, switches, control, etc., is supported by means of adjustable shoulder straps. Bond or contact resistance measurements as low as .0001 ohms can then be made, by attaching a fixed clamp to one side of the bonded surface, then touching the hardened points of the pistol grip exploring probe to the other side. Type 645 (Army range) is 0.005 and 0.5 ohms full scale. Type 653 (Navy range) is 0.003 and 0.3 ohms full scale.



High-Altitude Capacitors

Based on extensive tests and studies of terminal breakdown voltages in rarefied atmosphere, Aerovox Corp. of New Bedford, Mass., is now offering high-altitude oil capacitors to aircraft equipment builders. One of these capacitors is similar to the standard Aerovox Type '12 round-can barrier-cap units, except that one terminal is a short screw post. The other is a tall insulator post with corona shield at top. The cover assembly is a one-piece ceramic cap, with the can top spun over a rubber gasket and the cap for a perfect hermetic seal. The arrangement of terminals, corona shield and ceramic cap minimizes surface leakage, corona losses and probability of voltage breakdowns even at extreme altitudes. Hyvol vegetable oil is the impregnant and fill and has the characteristic of maintaining effective capacitance even at sub-zero temperatures.



Pilot Light Assembly

A new Dialco "Trio-Light" pilot light assembly is being manufactured by the Dial Light Co. of America, Inc., 90 West St., New York. The unit is designed to aid in the control of multiple coordinated circuits, and is obtainable in any size bank, in multiples of 3 pilot lights to each "Trio-Light." Thus, if an installation has 12 circuits, a bank of 4 "Trio-Lights" will be required. Features of this item include the following: color-coded flat lenses with etched numbers, letters, or words. Half-round lenses may also be used. Choice of lens colors includes red, green, amber, blue, yellow, opal, white, and clear. Silver plated terminals are so secured as to insure perfect contact under severe stress. Lamp sockets of pilot lights accommodate bayonet base lamps which are easily removable from front of panel. The unit may be obtained grounded or ungrounded.

DC Timing Motor

Haydon Mfg. Co., Inc., Forestville, Conn., has developed a new type of dc motor for timing applications. This is a normally running 6 volt motor with resistance wire calibrated at the factory for 12 volts, 24 volts, and other voltage applications. It is available with all the various output shaft speeds which the company now has in its ac line of timing motors, these speeds secured through sealed-in lubricated gear trains. Speeds available will be from 900 rpm down to one revolution per month. Extremely consistent speed is obtained by the governor effect of an electrical eddy current drag built into the motor. There is no arcing at high altitude operation and brush life is unusually long. The motor can be purchased with special lubricant for operation at extremely low temperatures. This motor is new in design, reversible, weighs approximately 6 oz. and operates on a current input of approximately 100 ma., no load. The motor, including gear reduction, measures only 2-7/16 in. high x 2⅛ in. wide by 1⅜ in. deep.

Portable Industrial X-Ray

Searchray Model 150, second in a series of self-contained X-ray units for industry, has been developed by North American Philips Co. Inc., through its Industrial Electronics Division, 100 East 42nd St., New York. The equipment is designed for inspection of parts, assemblies and finished products of metal, hard rubber, plastic, bakelite, ceramics, dielectric materials, etc. It makes possible the taking of highest quality sharp radiographs quickly by plant personnel under controlled conditions, without the expense of a skilled X-ray technician or the cost of a lead-lined room. It is simple to operate because of fixed milliamperage over the entire kilovoltage range. An electrical interlock, which interrupts the circuit while the radiographic compartment is open, eliminates danger.

Searchray has a continuous kilovolt regulator which permits adjustment during viewing operation at any point from 0 to 150 kv. The apparatus can also be set for correct metal thickness on a direct reading scale when radiographs are to be taken. The continuous voltage regulator has four 11 in. linear scales, one each for KvP, aluminum, brass and steel. A cassette tunnel at the bottom of the radiographic compartment makes possible insertion and removal of X-ray film or paper without disturbing the position of the object. Long tube life on continuous or intermittent operation is assured by an electrical circuit so arranged that high tension can only be applied at a relatively low value. An automatic, electrically operated water valve controls the cooling of the tube. Overall height is 82 in., the radiographic compartment being 25¾ in. high, 35 in. long and 25 in. deep. Current characteristics are 220 volts, single phase, 60 cycles, ac. Weight is approximately 600 lb.

Radio Frequency Capacitometer

A new radio frequency capacitometer, designed for precision measurements of small capacitance and inductance, has been developed by the Specialty Division of the General Electric Co. Electronics Department. Application is in industrial, college, and other laboratories. The instrument weighs 55 lbs. and is a completely self-contained portable unit in a steel case with a hinged cover and handles at the sides. Indicating instruments, controls and fuse are conveniently mounted on the instrument panel. The front panel and base can be withdrawn as a unit for standard rack mounting. The new capacitometer measures directly at radio instead of audio frequency, measurements being performed with the aid of an oscilloscope instead of phones. The scale on the unit can be read from 0 to 1000 micromicrofarads when measuring capacitance, with inductance measured in the range of 0 to 1000 microhenries.

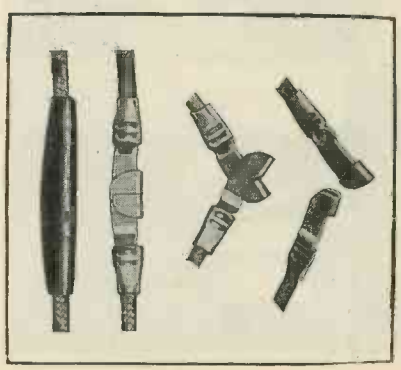
Regulated Power Supply

A rack mounting power supply with a dc output variable between 200 and 300 volts and regulation within 1 per cent for a current range between 0 and 140 ma, has been developed by Harvey Radio Laboratories, Inc., Cambridge, Mass. It is designed to operate from 115 volts ac. The output may be obtained from a two-prong plug (for convenience in connecting) or from binding posts. Two toggle switches are used in the power supply to control the filaments and plate voltage separately. Each switch also controls a 6.3 volt, 5 ampere filament supply which is brought out to external binding posts. The tube complement consists of one 5V4G full-wave rectifier, two parallel 6Y6G regulator tubes, one 6SJ7 control tube and one VR-105 constant voltage

tube. Other features include a dc voltmeter measuring output voltage; separate fuses in each transformer primary as well as the dc output circuit, a pilot light on each switch.

Solderless Terminal

Aircraft-Marine Products, Inc., Harrisburg, Pa., has a new (AMP) solderless splicing terminal with insulation support which affords a quick, positive splice for connecting wires until intentional quick disconnection is desired. Precision installation tools make all three crimps in one operation. Only two identical parts are required to make a connection. The tensile strength of the splice is greater than that of the wire itself, yet the assembly is easily and quickly uncoupled when desired. A four-point "knife-switch" wiping action assures minimum contact drop through the coupling. Insulation sleeving slips on easily and is held firmly in place.



Tube Test Equipment

The problem of designing the test equipment for high voltage and high power transmitting and rectification tubes according to either Army-Navy or commercial specifications is often assumed to be a minor one, but in many cases is as difficult as the main design problem of the tubes. A series of high power tube test set-ups has been devised by "S" Corrugated Quenched Gap Co., Garfield, N. J., to fill this need, with components flexible enough to handle problems associated with any particular types of tubes. A life test set-up and a tube characteristic measuring position for 872A rectifiers and related types are illustrated and indicate typical arrangements for tubes large enough to be tested individually. In accordance with military requirements, these tests are usually laid out for full loading of the tubes at high power factors, and do not incorporate power saving circuits using low power factor values.

400-Cycle Induction Motor

Most recent addition to Eastern Air Devices, Inc., 585 Dean Street, Brooklyn, N. Y., line of 400-cycle equipment is a small 115-volt, 400-cycle, high efficiency

induction motor. This motor may be used for general purpose applications requiring up to 1/50 hp continuous duty at 7200 rpm, in most fields where dc motors have heretofore been used. A similar unit may be wound to deliver up to .1 hp over a very short duty cycle, as in operation of motor driven valves. Size is 2-29/32 in. long x 1-15/16 in. diameter. Weight is 15 oz. The motor is obtainable either in three-phase or single phase capacitor.

De-Icer Rivets

Production of "rivnuts," a one-piece combination rivet and nut plate developed by the B. F. Goodrich Co., Akron, Ohio, to fasten its rubber de-icers to airplane wings, has now expanded to the point where these fasteners can be offered for general industrial use. The device is a threaded, tubular rivet which, by means of a special tool, can be "headed" while working entirely from the "other" side, thus making it possible for parts to be fastened onto otherwise unreachable inside surfaces or in tight places where a worker could not operate. It can be used as a straight rivet, permanently headed on both sides, and the interior threading permits insertion of a screw so that the parts can later be separated. Rivnuts are made of an exceptionally strong aluminum alloy.

Electric Tachometer

A self-energized tachometer that can be used either as a hand type or separable type has been developed by the Ideal Commutator Dresser Co., 5194 Park Ave., Sycamore, Ill. It consists of a small generator, coupled electrically to an electric meter. The generator itself consists of a small, permanent "Alnico" magnet rotor which is mounted on precision sealed ball bearings and capable of continuous operation at any speed within limit of the meter. The meter or indicating instrument is a rectifier type, including a D'Arsonval movement. It is capable of withstanding a momentary overload up to four times the maximum speed indication without damage. The meter is provided with two scales—"Hi" and "Lo". A switch provides for easy changing from "Hi" to "Lo" range. The generator and meter are made as separate elements and coupled together by a precision made bayonet lock. A 5-ft. cord complete with coupling plug is provided. Size of generator is 1⅝ in. dia. x 3¾ in. long (including ¾ in. shaft extension), weight 8 oz. Size of meter, 3 x 4¼ x 2½ in., weight 20 oz. The tachometer is available in two sizes for 0 to 2500 rpm and 0 to 5,000 rpm.

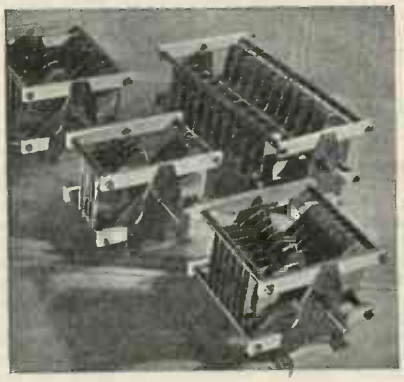
Tube Bottoming Machine

A new glass tube bottoming machine with improved features and wider range of work has been brought out by the glass machinery department of the Eisler Engineering Co., Newark 3, N. J. The glass tubing, cut to double required length, is placed in the mechanically agitated feeder and then forwarded piece by piece. The tubes carried automatically in forward direction, and at the same time kept continually in rotation about their own axes by rollers underneath, pass an arrangement of gas burners which preheat the place of the tubing where a flat or round bottom has to be formed. Additional small rollers are provided pressing slightly on top of the tubing to hold them in proper position during the operation of bottoming. After preheating, a special cut-off burner divides the glass tubing in two pieces. The flat bottom is then made by pressing the cut tubes gently against a preheated steel plate, called Bottomer. A special device combined with a properly shaped mold, inserted in place of the formerly used steel plate, is used when round bottoms are required.

After the bottom forming is accomplished a glazing process starts by employing a series of appropriate burners for smoothing the sharp edges at the open end of the tubes. Subsequently, a cooling off position is supplied before the finished double tubes are automatically discharged and delivered to a shelf.

Condensers for Heating

A broad line of heavy-duty variable air condensers fitted for electronic heating applications is being manufactured by Barker & Williamson, 235 Fairfield Ave., Upper Darby, Pa. Type CX variable condensers are of sturdy, unconven-



tional design. Features include perfect electrical design symmetry and built-in neutralization coupled with mechanical durability. Their construction also lends itself admirably to the built-in mounting of standard inductors in such a way that lead lengths and resulting lead inductance are reduced to an absolute minimum. They are available in almost any required capacity for electronic heating use up to 5 kw, 12,500 volts.

Manufacturers of products intimately related with the electronic field are invited to submit brief technical descriptions of new items placed on the market. Such descriptions may be accompanied by small electros, not exceeding 2 inches in width, or by sharp photographs on glossy paper.—Editor.

NEW PATENTS ISSUED

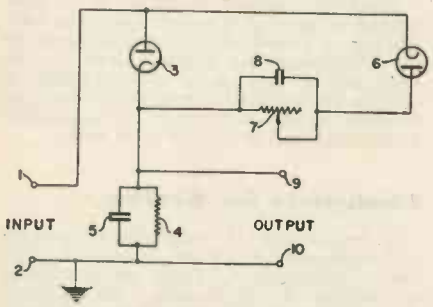
Summaries of inventions relating to electronic uses

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.

TELEVISION

Demodulator

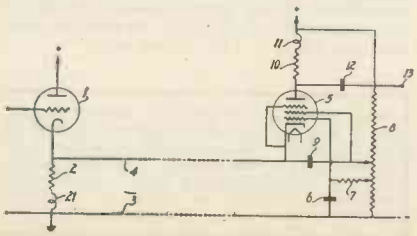
The detector is intended for television receivers and has a controllable output; the control has no effect on the frequency response characteristic of the circuit. According to the invention both half-waves of the signal are detected by the two circuits including tubes 3 and 6, respectively, the resulting demodulated



voltages being of opposite polarity. By adjusting potentiometer 7 the intensity of the resulting demodulated wave can be controlled. M. Cawein, Farnsworth Television and Radio Corp., (F) Sept. 29, 1941, (I) Sept. 21, 1943, No. 2,329,877.

Coupling Transmission Lines

Transmission line 3, 4 in a television signal amplifier is to be terminated in an impedance which offers a low resistance to alternating current and a high resistance to direct current. For this purpose the output end of the line is connected as a cathode load common to the control grid and plate circuit of tube 5, and the control grid is maintained at zero signal potential. The plate load impedance is small compared with the internal tube impedance. By this arrangement, the direct current resistance is equal to the direct current resistance of the tube and the alternating current resistance is equal to the reciprocal of the sum of the mutual conductance of the tube and the reciprocal of the plate impedance of the tube, the second term usually being negligibly small compared with the first one. The resistive impedance connected across the



output of the transmission line will appear in parallel with both the direct current and the alternating current resistance. Other arrangements, one also transmitting the direct current component of the television signal, are shown and described. C. W. Brown, Radio Patents Corp., (F) March 6, 1942, (I) Sept. 21, 1943, No. 2,330,109.

MEASURING DEVICES

Counting Device

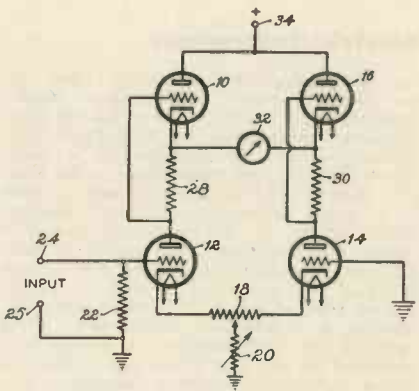
By combining several relays and gaseous discharge tubes in an electric circuit, events occurring at different places are counted separately whether occurring simultaneously or in succession. E. W. Hullegard, Telefonaktiebolaget L. M. Ericson, (F) Nov. 6, 1939, (I) Sept. 7, 1943, No. 2,329,048.

Measuring Time Intervals

The time elapsing between the disengagement of a relay armature with either one of its contacts and the engagement of the armature with the other of its contacts is to be measured. Two condensers, two vacuum tubes and a Wheatstone bridge are suitably connected to obtain the desired indication. The charges on the two condensers are compared, one being charged to a definite potential, the other acquiring additional charges during every transition of the relay contacts. W. R. Young, Bell Telephone Labs., (F) Jan. 6, 1940, (I) Sept. 14, 1943, No. 2,329,504.

Tube Voltmeter

The four resistances of a Wheatstone bridge are vacuum tubes; tubes 10, 12 and tubes 14, 16 are connected as two dc amplifiers, thereby increasing the sensitivity of the system. Application of a negative potential to control electrode of



tube 12 causes an increase in the impedance of tubes 12 and 16, and a corresponding decrease in the impedance of tubes 10 and 14. This causes an unbalanced condition of the bridge indicated by meter 32. The circuit is balanced for zero input potential by adjustment of the tap on resistor 18, and its sensitivity may be regulated by varying resistor 20. Other balancing or sensitivity regulating means may be provided. O. V. Mitchell and J. A. Hultquist, (F) Jan. 1, 1943, (I) Sept. 7, 1943, No. 2,329,073.

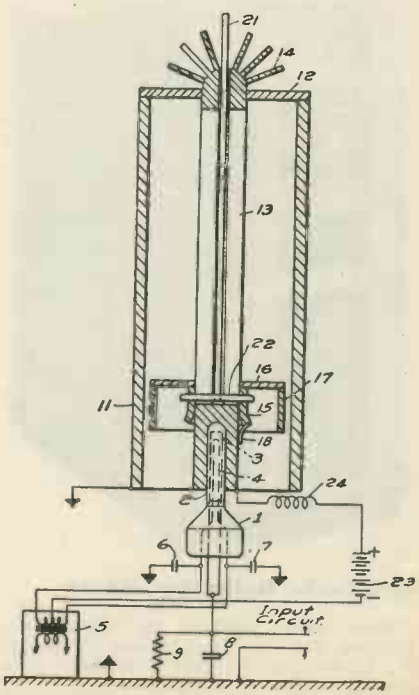
HF AND UHF

Modulation Indicator

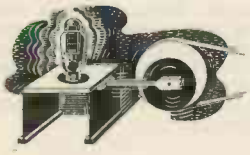
The modulation measuring device is designed for high frequencies where the capacity of cables or of long conductors is not negligible. The transmitter to be investigated is modulated by a saw-tooth voltage wave, and the resulting modulated carrier wave is demodulated to obtain the original saw-tooth. This is applied to one pair of deflecting plates of a cathode ray tube and the original undistorted saw-tooth wave is applied to the other pair. The resulting trace on the fluorescent screen will be a straight line if there is no distortion introduced by the transmitter. C. D. Kentner, RCA, (F) Jan. 31, 1942, (I) Sept. 14, 1943, No. 2,329,625.

UHF Resonator

The central core 13 of the concentric line 11, 13 used as resonator, is machined out to receive with a perfct fit anode 2 of tube 1; it conducts away the heat dissipated within the anode. The concentric line is tuned by displacing plunger 16, 17; two resonant frequencies are possible corresponding to the resonant space between the open end of the resonator and the disk 16, and between the disk 16 and the end of the resonator closed by conducting plate 12. Which one of these resonant frequencies predominates depends on the width of the air gap be-



"We vibrate, 'em, too, Miss Gadfly . . . . ."



Miss "Tiny" Gadfly, impelled and inspired by the vision of a svelte, girlish figure, oscillates in phase with the vibrations of "Little Gem." With like determination, but with a different scientific purpose, Hytron tubes are also vibrated vigorously.

A motor-driven eccentric arm mercilessly agitates the tube while a sensitive vacuum-tube voltmeter discloses the slightest variation in the a.c. component developed across the plate load resistor. An imperfect weld—a loose element—a potential short circuit—these, and other trouble-makers are instantly detected.

Tubes which pass this standard Hytron factory test are not likely to fail. When subjected to the ruthless throbbing of machines of war by fighting men too intent on a battle for survival to baby them, these tubes "get the message through."

BUY ANOTHER WAR BOND

OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

HYTRON CORPORATION ELECTRONIC AND RADIO TUBES

SALEM AND NEWBURYPORT, MASS.

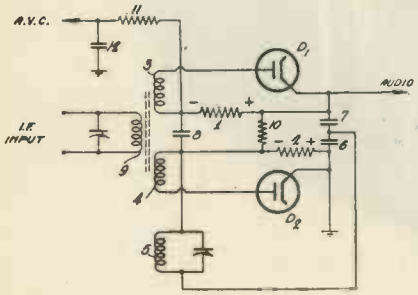
HYTRON RADIO TUBES

tween portion 17 of the plunger and outer conductor 11 of the concentric line. J. Hutcheson, Westinghouse Electric & Manufacturing Co., (F) Jan. 14, 1942, (I) Oct. 5, 1943, No. 2,331,193.

FM

Discriminator-AVC Circuit

The diode loads 1, 2 are connected differentially with respect to the audio output of the detector—condenser 8 having a negligible impedance at audio frequencies—but are connected in an additive manner with respect to the direct current output of the diodes thereby providing an avc voltage. Filter network 11, 12 removes the audio component. The magnitude of the derived avc voltage will be symmetrical about the center frequency of the detector. Another circuit works as AM detector for one intermediate frequency and as FM discriminator for another intermediate frequency, both having effective amplitude control. C. McCoy, Philco Radio and Television Corp., (F) Oct. 17, 1941, (I) Oct. 5, 1943, No. 2,330,902.



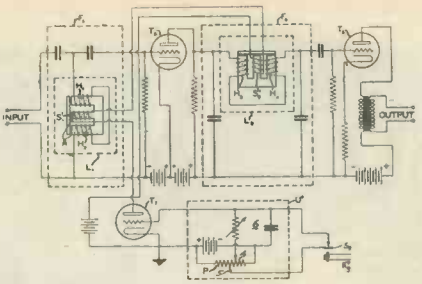
Frequency Modulator

The mean carrier frequency is supplied directly by a constant frequency oscillator which may be crystal-controlled, and the operation of the system depends upon the fact that two balanced modulators whose outputs are combined and whose inputs are excited with carrier frequency voltages ninety degrees out of phase can produce a complete phase rotation of the carrier frequency in their combined output when their grid circuits are supplied with controlling voltages of the proper character in addition to radio frequency excitation voltages. According to this statement two balanced modulators are provided and another modulator and phase-shifters supply the required input voltages. A relatively high degree of frequency modulated voltage is obtained directly from the crystal controlled oscillator. W. H. Wirkler, Collins Radio Co., (F) Dec. 13, 1940, (I) Aug. 24, 1943, No. 2,327,382.

MISCELLANEOUS

Variable Frequency-Response Receiver

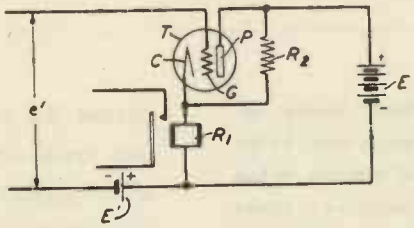
Intensity and dominant frequency of reflected waves recorded in seismographic exploration generally diminish with the travel time of the wave. It is therefore desired to vary the frequency vs. amplitude response of the recorder as a function of time, and to simultaneously and independently vary the net overall amplification. This may be accomplished by



the controlling network shown. Reactors H_1, H_2 and H_3, H_4 are inserted in the grid and plate circuits of the amplifier stage. Their inductances depend on the direct current through the windings S'_1 and S'_2 which in turn is regulated by the potential on grid of tube T_7. The variation with time of this potential will depend on the time constant of the RC circuit 6. It will be understood that any desired frequency response-time characteristic may be obtained by a suitable controlling circuit. H. Hoover, Jr., and M. Swan, Consolidating Engineering Corp., (F) Jan. 30, 1939, (I) Sept. 28, 1943, No. 2,330,216.

Thyratron-Controlled Relay

Variations in the plate supply voltage E of the controlling thyratron are compensated for so that the tube will fire at a desired input voltage e' independent of the voltage on its plate. For this purpose, the relay R_1 is placed in the cathode lead and resistance R_2 is connected between cathode and plate of the thyratron. It is shown that by choosing R_2



appropriately, the negative voltage developed across R_1 and applied to the grid may be made to compensate for any change in the plate voltage, thereby maintaining the required firing potential constant. S. B. Ingram, Bell Telephone Labs., (F) Aug. 26, 1941, (I) Sept. 21, 1943, No. 2,329,764.

Secondary Electrons as Relay or Trigger

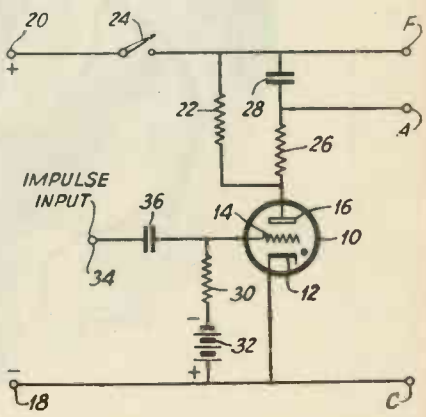
Particular embodiments of the tube described in the August 1942 issue of the Journal of Applied Physics and in U. S. patents Nos. 2,293,177 and 2,309,019 are claimed. External magnetic fields are used to trigger the tube on and off by controlling the electron flow to the secondary anode. A. M. Skellett, Bell Telephone Labs., (F) Sept. 1, 1942, (I) Sept. 21, 1943, No. 2,329,792.

Sensitivity Adjustment

The device is intended to control automatically the sensitivity of a receiver as a function of the disturbance level present. It is to be used in echo sounding instruments of airplanes. Time delay is introduced so that the signals are affected by the amplitude control only to a small degree. R. Wellenstein, Alien Property Custodian, (F) April 4, 1940, (I) Sept. 14, 1943, No. 2,329,570.

CR Deflection Generator

In observing transient conditions, it is sometimes desirable to deflect the cathode ray beam a single time and relatively slowly in one direction. According to the invention, any interference from the return stroke is prevented, as the cathode ray beam remains in the full deflected position until manual opening of switch 24. Upon a trigger pulse applied to grid 14, tube 10 starts conducting and its plate



potential immediately drops considerably. This causes condenser 28 to charge at a rate depending on the time constant of the condenser 28 and resistor 26 combination. The deflecting voltage originated by the condenser charging may be taken off terminals FA or terminals AC. As tube 10 remains conducting even after condenser 28 has been fully charged, no return stroke will occur until switch 24 is opened. Then the tube will stop conducting and condenser 28 will discharge through resistors 26 and 22; upon closing of switch 24 the device is ready for another cycle of operation. P. A. Richards, RCA, (F) May 23, 1941, (I) Sept. 7, 1943, No. 2,329,137.

Phase Indicator

The cathode-ray-tube impedance-bridge balance-indicator described shows the amount and direction of in-phase and quadrature unbalance components of an impedance network, as well as the condition of quadrature balance with considerable in phase unbalance and of in-phase balance in the presence of strong quadrature unbalance. It also affords a qualitatively unique indication of complete balance of both the resistive and reactive components of bridge impedances. A voltage controlling the vertical deflection plates and a 45 deg. out-of-phase voltage controlling the electron beam intensity are derived from the known voltage. The unknown voltage across the impedance bridge is amplified and applied to the horizontal deflection plates. D.G.C. Luck, RCA, (F) October 31, 1941, (I) September 7, 1943, No. 2,328,985.

Piezo-electric Pickup

Rochelle salt crystals are apt to break, and the pickup device according to the invention therefore makes use of a rubber holder to prevent injury to the crystal. A simple construction is described. A. D. Burt, RCA, (F) March 31, 1941, (I) September 7, 1943, No. 2,328,952.

IRC TYPE MP RESISTORS

Keeping America's newest broadcasting F M and television transmitters operating with a minimum of interruption or distortion is a challenging job. There's no room for chance with thousands of dollars of air-time and talent services at stake. To make certain that transmitters and control instruments will function perfectly under their full power loads—often running to 50 kilowatts—daily tune-up tests at off-time periods have become standard practice. But to throw this unbridled wattage out over the regular antenna could conceivably cause air-signal havoc . . . squeals . . . crashes . . . shot noises.

So, one of the early F M and television problems faced by broadcast engineers was the development of a dummy antenna simulating the high frequency characteristics of the regular antenna, in order to obtain informative and accurate check-readings.

ANOTHER IRC APPLICATION

I R C's M P Resistors, when water-cooled, furnished the ideal solution. These sturdy units embody all the required features while readily dissipating the tremendous heat factors involved.

Tests indicate that water-cooling at tap pressure increases their rating by as much as 90 times.

If resistances will play a part in your post-war products, consult I R C. You'll obtain unbiased engineering counsel, for I R C makes more types of resistors in more shapes for more applications than any other manufacturer in the world.

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Proudly we fly the Army-Navy E flag with *two* white stars . . . symbol of maintained excellence in production of war materiel.

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ASSOCIATION NEWS

Prof. Turner Heads IRE for 1944

Hubert M. Turner, of New Haven, Conn., has been elected president of the Institute of Radio Engineers for the coming year. He is associate professor of electrical engineering at Yale University, and as president of IRE succeeds Dr. Lynde P. Wheeler, of the Federal Communications Commission, Washington.

During the first World War, Professor Turner organized technical instruction for the U. S. Army Signal Corps at the University of Minnesota, and later at the Signal Corps School for Officer Candidates at Yale. He is noted for his methods of experimental and laboratory technics in teaching radio engineering.

The election of Ralph A. Hackbusch, of Leaside, Ontario, as vice-president was also announced. He is vice-president in charge of Radio, for Research Enterprises, Ltd.

Guy, Horle, White, directors

Directors elected for three-year terms were: Raymond F. Guy, radio facilities engineer of National Broadcasting Co., New York; Lawrence C. F. Horle, of New York, consulting engineer and authority on television; and William C. White, engineer of General Electric's Electronics Laboratory, Schenectady, N. Y.

The Institute traces its beginnings back to 1912, when the selection of its name was prophetic of the development of radio out of wireless, as it was generally called at that time. The presidents of the Institute have been a succession of noted radio engineers and scientists, of whom Professor Turner is the thirty-second. The present Institute membership of 11,000 constitutes a worldwide association of radio engineers, with headquarters in New York City, and with 24 Sections in key radio centers of the United States, two in Canada, and one in Argentina.

Electronic Gun Director

Another of the Army's electronic devices, hitherto veiled in secrecy, was revealed last month when Bell Telephone Laboratories and the Army demonstrated the latest type of gun director at a gathering of press representatives brought together at Murray Hill Laboratories for the purpose. The new equipment, understood to involve the use of more than 100 vacuum tubes, automatically computes elevation and azimuth and sets a shell fuse on ack-ack guns to explode the lethal charge right on the target.

Conventions and Meetings Ahead

Institute of Radio Engineers (330 West 42nd Street, New York), Dec. 1, Jan. 5, New York.

National Association of Manufacturers (G. G. Geddis, 14 West 49th Street, New York), Dec. 8-10, Waldorf-Astoria Hotel, New York.

Radio Club of America (11 West 42nd Street, New York), Dec. 9, Columbia University, New York.

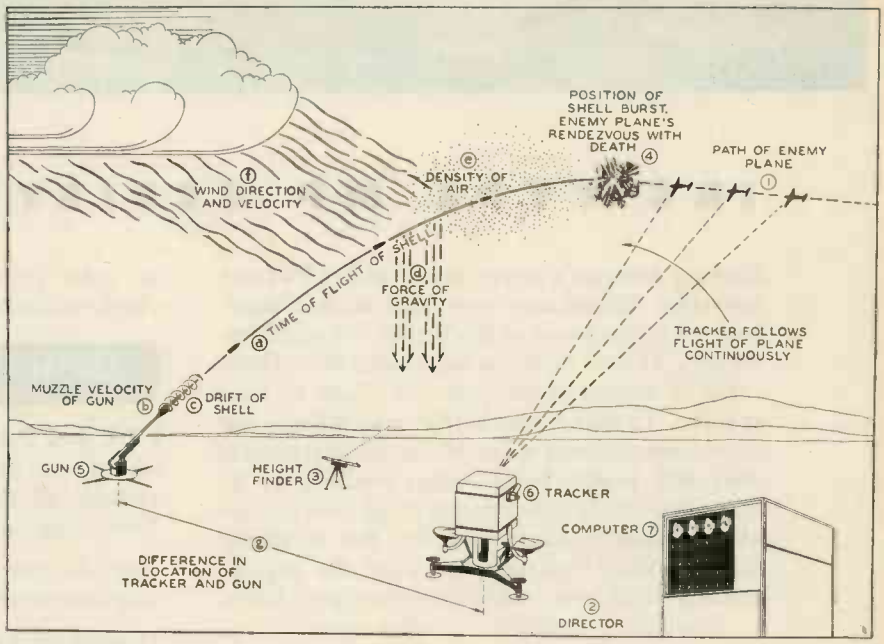
Society for Measurement and Control (New York Section Meeting), Dec. 28, New York.

American Physical Society (Karl K. Darrow, Columbia University, New York), Dec. 27, Pasadena, Calif.; Jan. 13-15, New York.

American Institute of Electrical Engineers (H. H. Henline, 29 West 39th Street, New York City), National Technical Meeting, Jan. 24-28, New York; joint meeting with Institute of Radio Engineers, Jan. 27, 28, 29, New York.

Electrochemical Society (Colin G. Fink, Columbia University, New York), Spring Convention Meeting, April 12-15, Milwaukee.

How the Electronic Gun Director Works



An enemy plane (1) looms in sight. The crews of the tracker (6) and of the height finder (3) spot the target and follow it in its flight. The computer (7) of the director instantly measures the position of the target and then predicts where the anti-aircraft gun (5) is to be aimed and how the fuse of the shell is to be set so that the shell will burst in the path of the plane at the predicted position (4). The electrical information derived by the computer is translated into mechanical movement at the gun to swing its muzzle automatically to the correct horizontal and vertical angle to score a hit. The time of flight of the shell (a) to the predicted position of the target (4), is dependent upon the muzzle velocity of the gun (b), which in turn is governed by the temperature of the powder and the number of times the piece has been fired. The path of the shell is also influenced by its drift (c) which is the spin caused by the rifling of the gun, curving the shell to the right. At the same time the pull of gravity (d) deflects the shell downward, and the varying density of the air (e) slows down the projectile more or less, while the direction and the velocity of the wind (f) either retards or pushes the shell ahead or to one side. To add to the complications of the problem, the difference in the location of the tracker and the gun (g) must also be taken into account.

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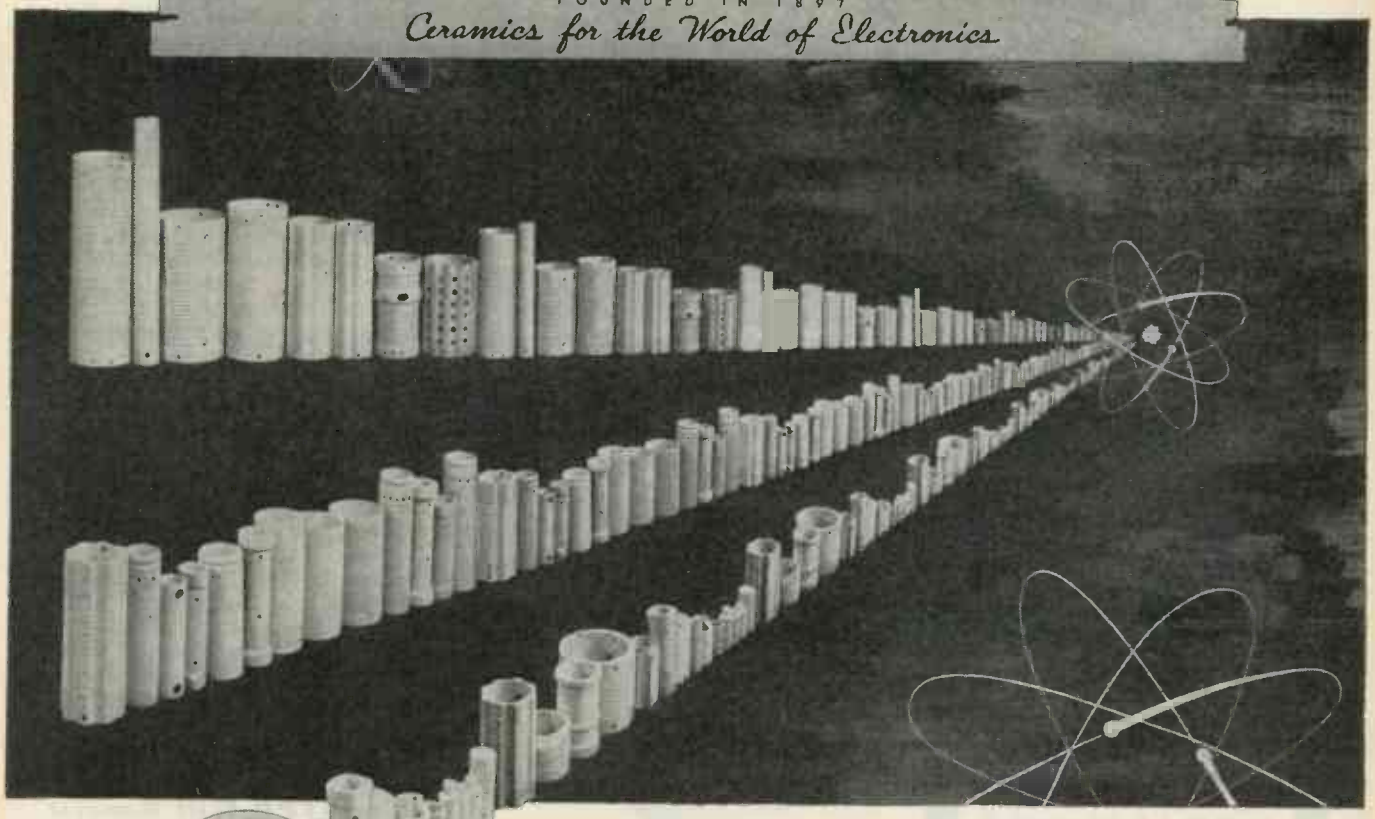

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PRECISION MADE . . . of Steatite and other materials—glazed or unglazed—any size or shape—to your exacting specifications.

Years of experience—wide technical and engineering knowledge—modern manufacturing facilities enable STUPAKOFF to produce every type of ceramic for the electronic industry.

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Crystals on Parade

An informative review of quartz crystals was held at The Radio Club of America's meeting November 11, in Havemeyer Hall, Columbia University, New York. The meeting was divided into two parts: first, a joint paper by Dr. William Parish, Research and Development Engineer of the North American Philips Co., and Robert Brown of the Engineering Department of the same organization, covered "The Manufacturing Test and Use of Quartz Oscillator Plates" in a paper dealing with methods of grading and the selection of raw quartz crystals, as well as the processing of crystals through to the finished product. A second section of the paper dealt with methods of testing the crystals and a discussion of the test apparatus.

The second part of the meeting included a Kodachrome sound motion picture film entitled "Crystals Go to War," presented by the Reeves Sound Laboratories. The film was prepared under the direction of Dr. Clifford Frondel, formerly Chief Crystalographer of the U. S. Army Signal Corps, who, with Dr. Harry Berman, is head of the Development Department of the Reeves Sound Labs.

How RTPB Will Benefit from Experience of NTSC

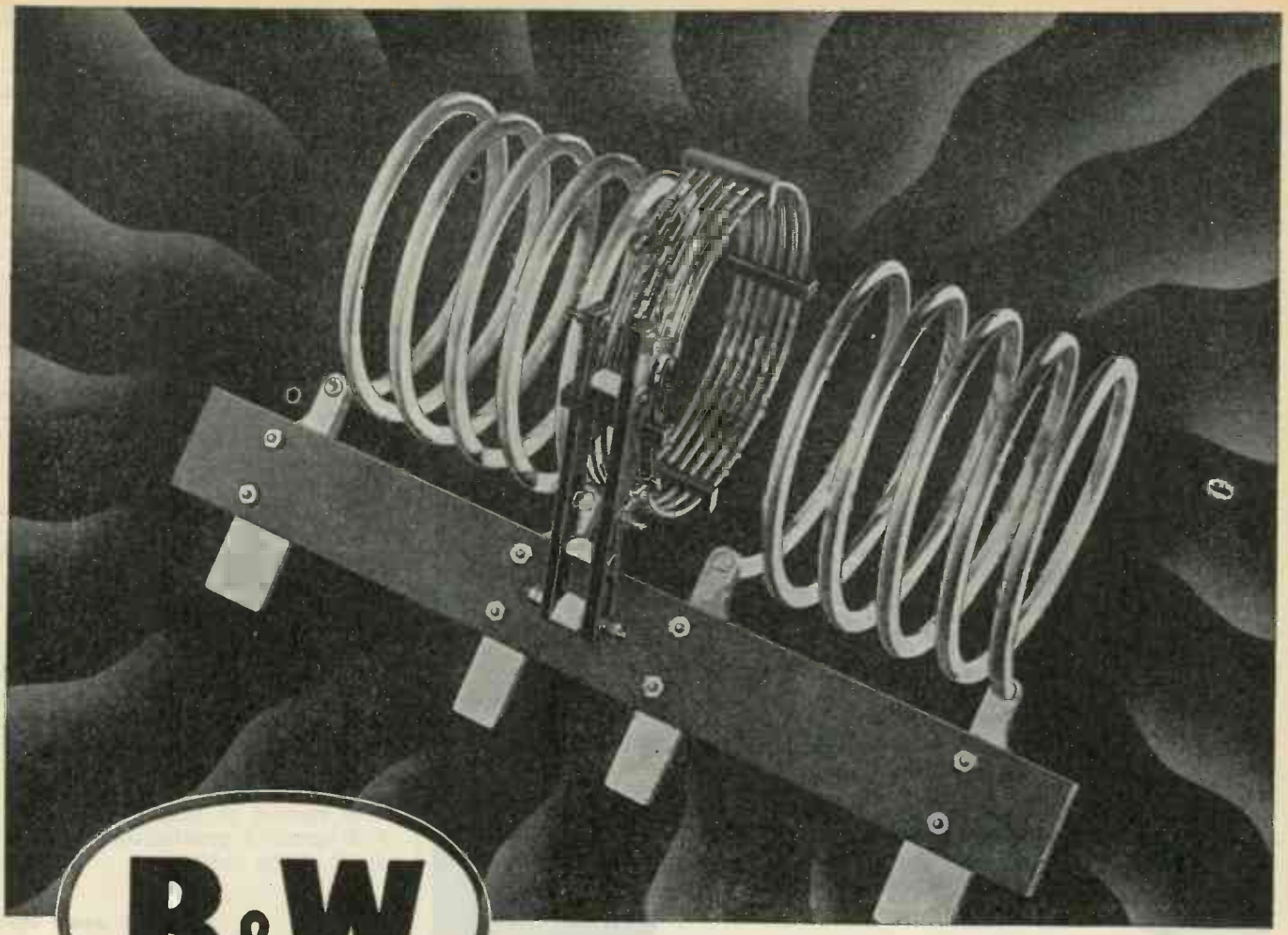
Dr. W. R. G. Baker, chairman of the Radio Technical Planning Board, addressing a group of technical editors at New York, Nov. 3, told how the new organization, already at work on postwar planning, will profit from the prewar experience of the National Television Standards Committee, of which Dr. Baker was also chairman. Said Dr. Baker:

The electronic industry, and particularly that segment of the industry dealing with mass entertainment, is faced with two basic problems which must be resolved as quickly as possible without interfering with the war effort.

1. The review and agreement on such fundamental factors as system standards and frequency allocations. There is included in these determinations due consideration to the technical advances in the past three years and the requirements of the various governmental agencies for frequency allocations.

2. The transformation of these determinations into equipment for the operators of mass-entertainment transmitters and receivers for the consumer.

In general, the basic determinations are not the final decision of the electronic industry but rest with various governmental agencies. Offhand, it might appear that such a condition would result in



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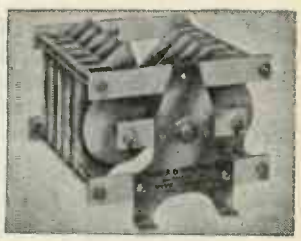
DOZENS OF STANDARD TYPES — OR SPECIALS

Need coils for Electronic heating equipment?

Dozens of standard B &W heavy duty coils have long since proved their effectiveness for such applications—but if the standard line cannot match your specifications, then B & W engineers are well equipped to produce whatever special units may be indicated.

Standard coils are available for Electronic heating requirements up to 1 Kw. Of famous B & W "Air-Wound" design, these are exceptionally sturdy, light in weight, adaptable to numerous mounting arrangements, and have low dielectric loss. Moreover, they are wound to uniform pitch, afford greater design adaptability, and lend themselves readily to mechanical and electrical revisions in circuits that must be adjusted, or which are still in an experimental stage.

Bring your Coil Problems to Coil Specialists!



VARIABLE CONDENSERS

One of the few high-powered types on the market, B & W Type CX Variable Condensers are ideally suited for Electronic heating uses. Available to 12,500 volt rating. Write for Data Bulletin.

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AIR-WOUND, CERAMIC, AND PHENOLIC FORM INDUCTOR COILS

confusion and delay. I would like to give you two case-histories which disprove the fact that either confusion or delay is a necessary part of this problem.

In the early part of 1940 and the latter part of 1939, the electronic industry awoke to the fact that it was not in agreement with respect to television standards. Unfortunately, the industry found this condition when it appeared before the FCC. It found it was impossible to resolve its problems at the various hearings of the FCC, and to a large extent the industry discredited itself by being unable to resolve its own problems. The result was the formation of the NTSC —the National Television System Committee.

The object of the formation of the NTSC was that the industry could formulate its own plans and resolve its problems within the confines of the industry before it appeared before a Government agency. It took about 18 months for the NTSC to arrive at a solution. The solution involved a large portion of the time of some 140 engineers. The final result, however, was that the industry appeared before the FCC with unanimous recommendations with respect to standards and the FCC granted practically every request of the industry.

Started year ago

The second case-history originated just about one year ago at the Rochester meeting of the Radio Manufacturers Association. At this meeting James Lawrence Fly, Chairman of the Federal Communications Commission, recommended that industry take some steps towards formulating its postwar policies and plans. From last November until about one month ago, the industry went through a considerable amount of difficulty in order to formulate its own ideas as to how it should attempt to solve its own problems.

The result of this struggle was the establishment of the RTPB. The scope of the RTPB (Radio Technical Planning Board) is far greater than the NTSC. The NTSC represented just the problem of television,—the RTPB will consider the problems of the entire industry on communication, VHF (Very High Frequency), regardless of whether it is FM or AM, television, communications of all classes, that is, ship-to-shore, police and emergency and any other communication regardless of the application. It will cover relay systems for all classes of service, including FM and television and will recommend the standards and frequency allocation for such relay systems. In general, it will cover the systems standards

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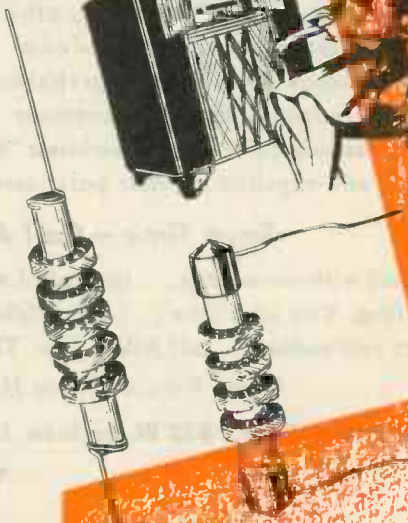
Again, Guthman experience, engineering, skill and complete manufacturing facilities are co-ordinated to produce a wide variety of Guthman Super-Made Chokes. Universal Guthman Chokes are available in unlimited ranges of inductances. They are wound on ceramic or bakelite with pigtail connections or standard resistor mountings



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and the frequency allocation for every service that the electronic industry will offer the people of the United States. You can, therefore, see that the problems are many and the responsibilities are great.

The point to be noted is that both of these plans — NTSC and RTPB — represent an orderly approach toward resolving problems so basic that failure to reach a solution might have serious adverse effects on the employment of people, the rendering of the best service to the consumer and the healthy growth of certain segments of the electronic industry.

This seems to us to represent the most effective type of postwar planning wherein an industry presents its considered opinion to the various govermental agencies.

But these plans are not the end result; they do not complete the responsibility of industry. The RTPB represents only the beginning. For such companies as General Electric, there remains the important job of making available equipment conforming with the framework established by the RTPB and at the same time incorporating, as rapidly as sound engineering practice will permit, the vast technical advances occasioned by the war. General Electric assumed this responsibility after World War I and it will do it again after World War II.

Providing equipment

Again there is required an orderly approach to the problem. Not only on the part of the manufacturer but also on the part of the present or prospective transmitter operator. In addition to the rapid postwar growth of FM transmitters and the perhaps somewhat slower growth of television stations, there remains the job of modernizing the existing AM stations.

The General Electric postwar transmitter plan points the way for present and prospective station operators to plan their job. It also will permit us to plan our facilities so as to make available at the earliest possible date, equipment incorporating such advanced designs as will make possible the maximum service to the station operator and the consumer.

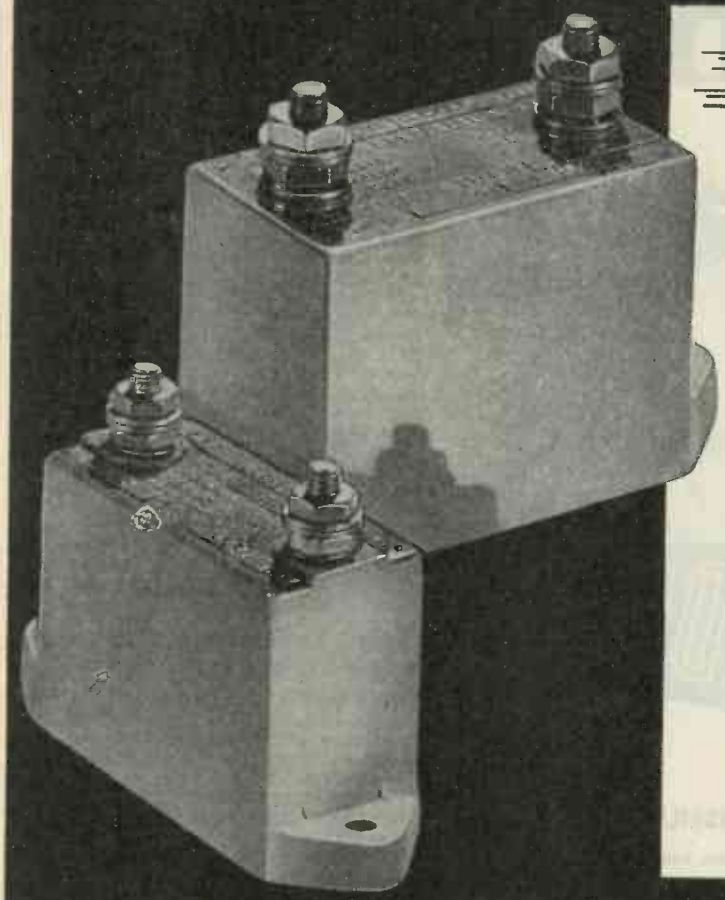
RTPB Panel Chairman

Supplementing the chart and photographs appearing on Pages 66 and 67, following is a complete list of chairmen and vice-chairmen of the thirteen panels into which the Radio Technical Planning Board has been divided for study and recommendations regarding various phases of the general task of the entire body:

Spectrum Utilization: Chairman Dr. A. N. Goldsmith, Consulting Engineer, 580 Fifth Avenue, New York; vice-chairman Dr. Ray H. Manson, Stromberg Carlson Mfg. Co., Rochester, New York.

MOLDED-CASE POTTED MICA CAPACITORS

Made to American War Standard Specifications



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Need medium-power mica transmitting-type Capacitors to match today's exacting specifications? Then write for details—or samples—on Types CM-65 (Sprague MX-16) and CM-70 (Sprague MX-17). These sturdy units are specifically designed to meet American War Standard requirements for Capacitors of this type and, as of the date this message is written, deliveries are surprisingly prompt, thanks to Sprague's greatly increased plant capacity.

SPRAGUE SPECIALTIES CO.
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Frequency Allocation: Chairman Dr. C. B. Jolliffe, RCA-Victor Division, Camden, N. J.; vice-chairman F. M. Ryan, American Telephone & Telegraph Co., 195 Broadway, New York.

High Frequency Generation: Chairman Roger Wise, Sylvania Electric Products, Inc., 500 Fifth Avenue, New York; vice-chairman H. F. Argento, Raytheon Production Co., Waltham, Mass.

Standard Broadcasting: Chairman Howard Frazier, National Association of Broadcasters, 1760 N Street, Northwest, Washington, D. C.; vice-chairman Burgess Dempster, Crosley Corp., Cincinnati, Ohio.

VHF Broadcasting: Chairman G. E. Gustafson, Zenith Radio Corp., 6001 Dickens Avenue, Chicago, Ill.; vice-chairman C. M. Jansky, Jansky & Bailey, National Press Building, Washington, D. C.

Television: Chairman Dave B. Smith, Philco Corp., Philadelphia, Pa.; vice-chairman I. J. Kaar, General Electric Co., Bridgeport, Conn.

Facsimile: Chairman John V. L. Hogan, 730 Fifth Avenue, New York; vice-chairman C. J. Young, RCA-Victor Division, Camden, N. J.

Radio Communications: Chairman Haraden Pratt, Mackay Radio and Telegraph Co., 67 Broad Street, New York; vice-chairman H. H. Beverage, RCA Communications, Inc., 66 Broad Street, New York.

Relay Systems: Chairman E. W. Engstrom, RCA Laboratories, Princeton, N. J.; vice-chairman Ralph Bown, Bell Telephone Laboratories, 463 West Street, New York.

Radio Range, Direction and Recognition: Chairman W. P. Hilliard, Bendix Radio Corp., Baltimore, Md.; vice-chairman C. G. Fick, General Electric Co., Schenectady, N. Y.

Aeronautical Radio: Chairman and vice-chairman unappointed.

Industrial, Scientific, and Medical Equipment: Chairman C. V. Aggers, Westinghouse Elec. & Mfg. Co., Baltimore, Md.; vice-chairman H. B. Marvin, General Electric Co., Schenectady, N. Y.

Police and Emergency Service: Chairman D. E. Noble, Galvin Mfg. Corp., 4545 Augusta Blvd., Chicago, Ill.; vice-chairman Frank Walker, International Assn. of Chiefs of Police, Detroit, Mich.

Radio Technical Planning Board Organization and Procedure

I. Designation

The name of the organization shall be the "Radio Technical Planning Board."

II. Objectives

The objectives of the RTPB shall be to formulate plans for the technical future of the radio industry and services, including frequency allocations and systems standardization, in accordance with the public interest and the technical facts, and to advise Government, Industry, and the Public of its recommendations. Such planning shall be restricted to engineering considerations.

III. Functions

The RTPB will be representative of the many branches of the radio field and will call upon technical experts from all branches to assist in the work of planning in conformity with its objectives.

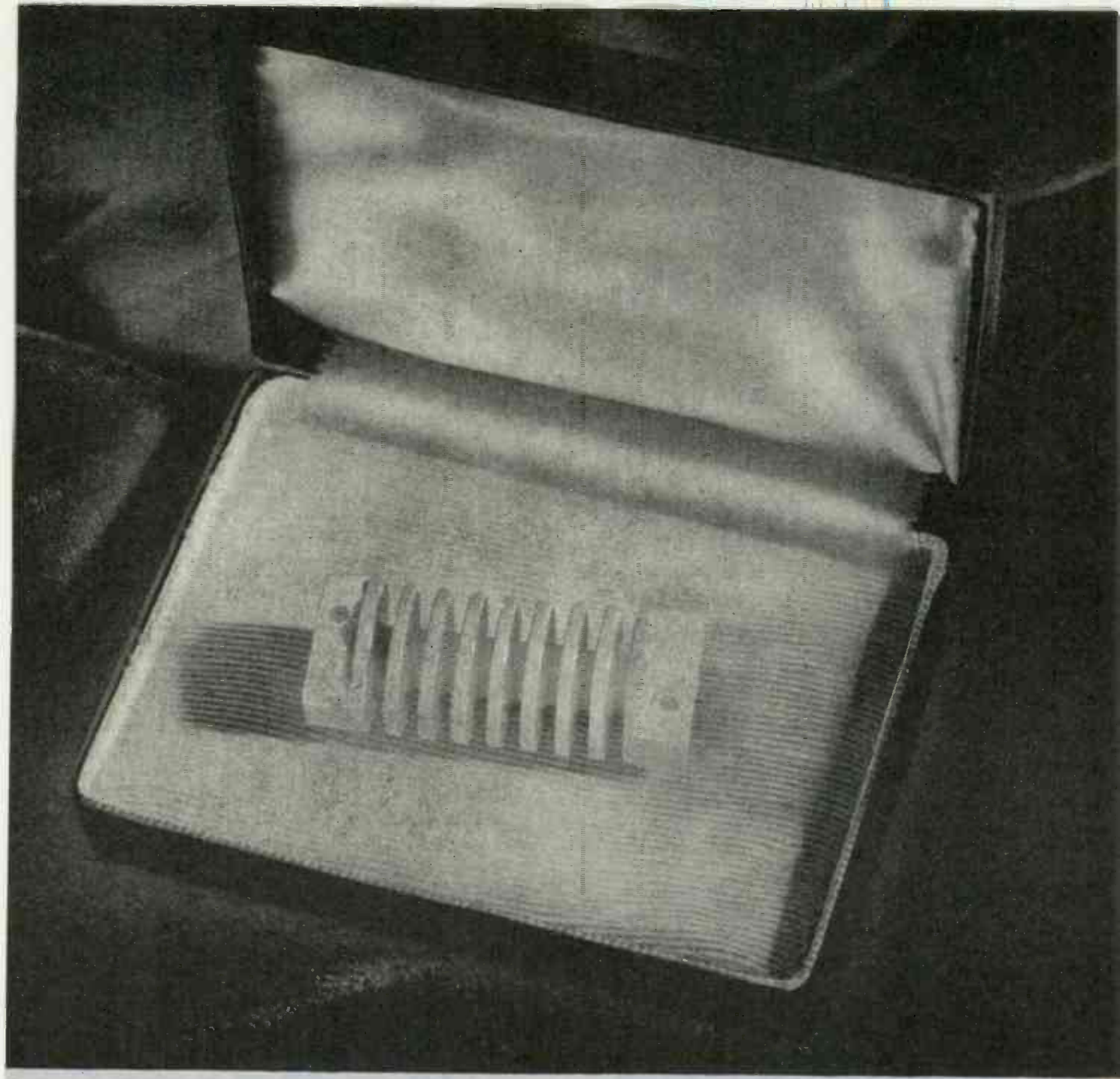
The RTPB will develop such studies, investigations, recommendations, and standards as are required to attain its objectives.

The RTPB will also consider and appropriately act upon suggestions or requests for recommendations from branches of the Government or important groups in the radio field.

IV. Organization

A. Sponsors

The Sponsors of the RTPB shall be those non-profit associations and societies which have an important interest in radio and which indicate a willingness to cooperate in achieving the objectives of the RTPB. At the time of formation of the RTPB the following is the list of



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PRIDE of craftsmanship which produced the exquisite steatite cameos and intaglios of the ancient Greeks and Romans lives today in the fine workmanship, characteristic of ALSIMAG Steatite Ceramic insulators for electronic uses.

And the imperishable qualities of those ancient steatite gems that have survived thousands of years are present in greater measure in ALSIMAG Steatite Ceramics.

Permanent in their hardness, strength and rigidity . . . impervious to heat up to 1000°C . . . insulating qualities unimpaired even with arc-overs . . . impervious to moisture . . . ALSIMAG Steatite Ceramics perform in a manner impossible of perishable organic materials.

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ALSIMAG is produced in a variety of bodies with electrical properties to fit your requirements. Our Research and Engineering staff will gladly cooperate in designing Steatite Ceramic insulation for economy in production.

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Sponsors: American Institute of Electrical Engineers; American Institute of Physics; American Radio Relay League; FM Broadcasters, Inc.; Institute of Radio Engineers; International Association of Chiefs of Police; National Association of Broadcasters; National Independent Broadcasters; Radio Manufacturers Association. Additional Sponsors may be added on favorable vote of a majority of the representatives of the Sponsors as provided in Section IV B below. A Sponsor may withdraw from the RTPB on thirty-days' notice.

Those Sponsors who agree to contribute in the first year of operation a sum of one thousand dollars or more to the financial support of the RTPB shall be designated Contributing Sponsors. The minimum qualifying sum for subsequent years shall be set by the Administrative Committee not less than sixty days before the close of the operating year and a statement thereof made immediately to all Sponsors.

No Sponsor shall be obligated for a contribution greater than that to which it agrees in advance, nor shall the RTPB incur financial obligations at any time exceeding the total sum of contributions previously agreed upon by the Sponsors.

B. RTPB

The Radio Technical Planning Board shall be composed of one person or his alternate selected by each Sponsor, both to be selected by each respective Sponsor, and of the Chairmen of all Panels. It shall have all powers of management of its affairs not otherwise specifically assigned.

Each member of the RTPB, with the exception of the Chairman, shall have one vote.

The Chairman of the RTPB shall be elected by majority vote of the persons selected by the respective Contributing Sponsors (the Administrative Committee). He shall not serve as a person selected by a Sponsor. In the event that a person selected by a Sponsor is elected Chairman, such Sponsor shall be requested forthwith to appoint a person in replacement. The meeting to elect the first Chairman shall be called jointly by the Presidents of the Radio Manufacturers Association and the Institute of Radio Engineers on ten-days' notice to all Contributing Sponsors.

Administration

C. Administrative Committee

There shall be an Administrative Committee composed of the persons selected by the respective Contributing Sponsors, each having one vote. The Chairman of the RTPB shall be Chaiman of the Committee, without vote.

The Administrative Committee shall approve the budget of the RTPB in advance. It shall have control of all expenditures of the RTPB. It shall make such regulations governing fiscal matters as it deems appropriate. It shall account to the Sponsors for all expenditures. It shall provide for a monthly report by a Certified Public Accountant which report shall be submitted to the Sponsors as received.

With the advice of the Chairman, the Administrative Committee shall appoint a Vice Chairman, a Secretary, a Treasurer, and other personnel not otherwise provided for as required for the proper functioning of the RTPB. Such persons appointed shall not be members of the Board or of the Administrative Committee and shall have no vote.

The power of appointment as given herein carries with it the power of removal.

The Treasurer of the RTPB shall receive the funds contributed by the Sponsors and shall have charge of the accounts, and shall disburse the funds upon the approval of the Chairman. The Treasurer shall be appropriately bonded.

Twenty-four Hour Vigilance

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TWENTY-FOUR hours every day Hammarlund radio receivers aid in defending the United Nations against air attack. Sound electrical and mechanical design, together with accurate workmanship, make the "SUPER-PRO" superior in performance under the most adverse operating conditions.

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D. Panels

The RTPB shall establish and direct Panels as required to achieve its objectives, each of which shall concentrate its efforts on an assigned task. The Panels shall work under the admistrative supervision of, and report their findings to the RTPB. The Chairman of the RTPB, subject to the approval of the Administrative Committee, shall appoint a Chairman and a Vice Chairman of each Panel. The Chairman of each Panel shall be a member of the RTPB. The Vice Chairman shall be his alternate.

The Chairman of each Panel shall appoint the members of his Panel and designate a Secretary, both subject to the approval of the Board.

V. Meetings

A. Notification

Meetings of the RTPB and of the various Panels may be called by the respective Chairmen on notification to all members at least ten days prior to the meeting date.

Meetings of the Administrative Committee may be called by the Chairman or by any two members on notification to all members at least ten days prior to the meeting date.

B. Quorum

The quorum for any meeting of the RTPB shall be two-thirds of its voting membership. Affirmative vote by a majority of the entire voting membership of the RTPB shall be required for approval of any proposed action.

The quorum for any meeting of the Administrative Committee shall be a majority of the voting membership of the Committee. Affirmative vote by a majority of the entire voting membership of the Committee shall be required for approval of any proposed action.

The quorum for any meeting of a Panel shall be a majority of the voting membership of the Panel. Affirmative vote by a majority of the entire voting membership of the Panel shall be required for approval of any proposed action. Such vote may be taken by mail provided the matter has been fully discussed at a meeting of the Panel and further provided that ten-day's notice is given before the date set for the return of the ballots.

C. Records

Minutes of each meeting of the RTPB, of the Administrative Committee, and of the Panels shall be prepared and sent promptly to the respective members. In the case of Panel meetings, copies of the minutes shall also be sent to all members of the RTPB.

Report conclusions

VI. Reports

Each Panel shall embody its conclusion and recommendations in the form of a report, including all minority opinions, if any, which it shall submit to the RTPB. A copy of the report shall be sent to each member of the RTPB.

Each person selected by a Sponsor shall inform the Sponsor of the contents of the report and shall give the Sponsor an opportunity to express its views with respect to the report. He shall inform the RTPB of these views. The Sponsor may submit to the RTPB through its selected person a statement to be released with the report.

After consideration of the report and of the opinions of the Sponsors thereon, the RTPB may release the report or may return it to the Panel for further consideration. A report may be so returned only once, after which it must be released on resubmission by the Panel.

In releasing a report of a Panel, the RTPB shall compile a statement to be released therewith, including the statements of the Sponsors, if any, a report of the vote of the RTPB, and the majority and all minority opinions of the RTPB, and in any event it may be released within 45 days after submission to the Sponsors.

A complete record shall be kept and preserved of all votes in Panels and in the RTPB in consideration of any report,

If you believe in the future of America as we do, then we're asking for an appointment immediately after the victory has been won . . . when a bright new era awaits us all.

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 that your operations require.

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's service and the benefits derived from the single product control "from mine to consumer" backed by years of continuous metallurgical experience.

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Magnet wire and coils

ANACONDA WIRE & CABLE COMPANY

and of all correspondence relating thereto.

Upon release, copies of each report and of the accompanying statement shall be transmitted on request to Governmental agencies and industrial and professional organizations. At its discretion, the RTPB may distribute copies of reports more widely.

VII. Termination

The Radio Technical Planning Board may be dissolved on affirmative vote of the Administrative Committee.

VIII. Amendments

The above rules of Organization and Procedure may be amended on approval by a majority of the Sponsors.

Approved and adopted Sept. 15, 1943 in New York by representatives of all Sponsors named herein.

Engineer at Buenos Aires

R. H. Siemens has been appointed chief engineer of RCA Victor, Argentina, wholly-owned RCA subsidiary company in Buenos Aires, it has been announced by J. D. Cook, managing director of RCA Victor's International Division. He succeeds Paul Bennett, who has returned to Camden.

Westinghouse Tube Output Up 1100 Per Cent

Reflecting the important part electronics is playing in the war, the Westinghouse Lamp Division at Bloomfield, N. J., reports its production of electronic tubes is 11 times as great as it was just two years ago. Total sales of Westinghouse electronic tubes this year will exceed $22,000,000, as compared with $1,873,000 in 1941, according to an estimate by Ralph C. Stuart, division manager.

Ninety-eight per cent of all electronic tubes being produced by the company are for war use, either in communications equipment or for industrial applications in war plants, such as welding of planes and tanks and the reflowing of tin.

For all products of the Lamp Division, Mr. Stuart estimated 1943 sales would exceed $53,000,000 compared with $38,908,000 last year. Besides electronic tubes, the products include incandescent, fluorescent and miniature lamps, and parts and materials sold to other manufacturers of electronic tubes and lamps.

Despite labor shortages, which are particularly acute in the northern New Jersey area, Mr. Stuart revealed, employment at the division's seven plants—in Bloomfield, Belleville and Trenton, N. J., and in Fairmont, W. Va.—has increased to 10,134 from 3,225 in 1939.

Ghirardi Sells Book Company

Alfred A. Ghirardi, author of widely-used texts on radio theory, maintenance and repair, has sold his Radio & Technical Publishing Co. to Farrar & Rinehart, Inc., publishers, 232 Madison Avenue, New York, whose subsidiary, the new Radio & Technical Division of Murray Hill Books, Inc., will continue to publish the present "Ghirardi" radio books, as well as new ones. Mr. Ghirardi will also continue in close touch as editorial consultant in electronics for Farrar & Rinehart, who plan to expand their business in the radio-electronic book field.

Sylvania Research Center

The purchase of a 28½-acre tract of land adjoining the Clearview Golf Course at Bayside, Long Island, for a research center was announced Nov. 1 by Sylvania Electric Products, Inc., manufacturers of radio, electronic and lighting equipment.

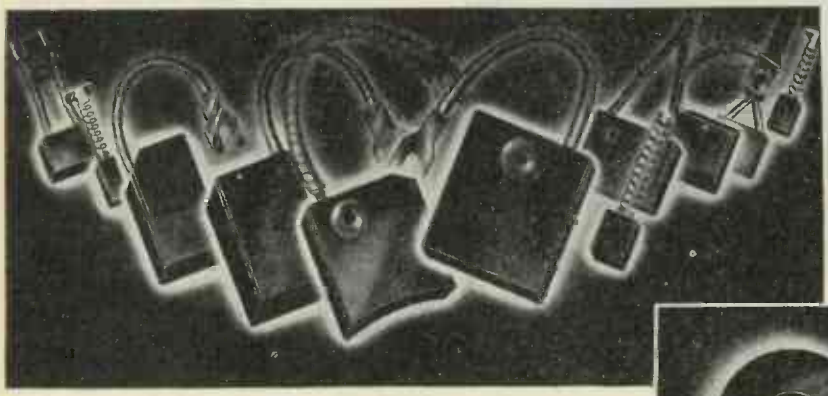
The realty transaction was handled by Ernest A. L'Ecluse and others of the firm he heads, L'Ecluse, Washburn and Company, 15 East 41st St., New York.

Because of wartime restrictions there will be no immediate building program, although two structures now on the property will be renovated for use by a small research group.

Plans have been approved by the City for the eventual creation of a campus-like U-shaped center with a number of buildings to house administrative and executive offices as well as engineering and laboratory facilities. Further announcements will be made as detailed plans progress.

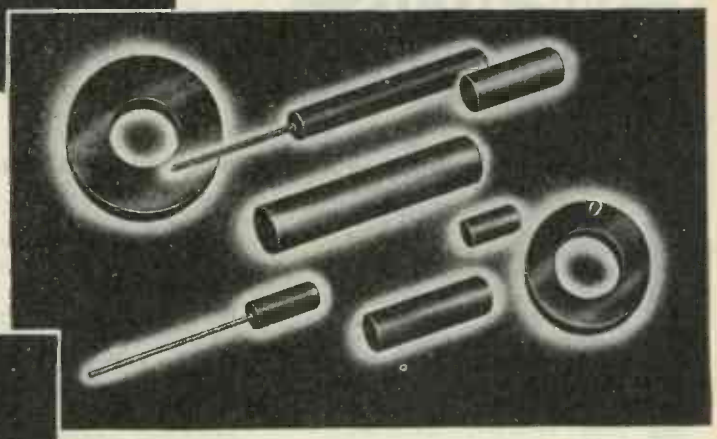
Sylvania's new laboratory, soon to occupy a 28½-acre plot on Long Island, N. Y., eventually will look like this.

MOLDED CARBONS, GRAPHITES, METALS and COMPOSITIONS



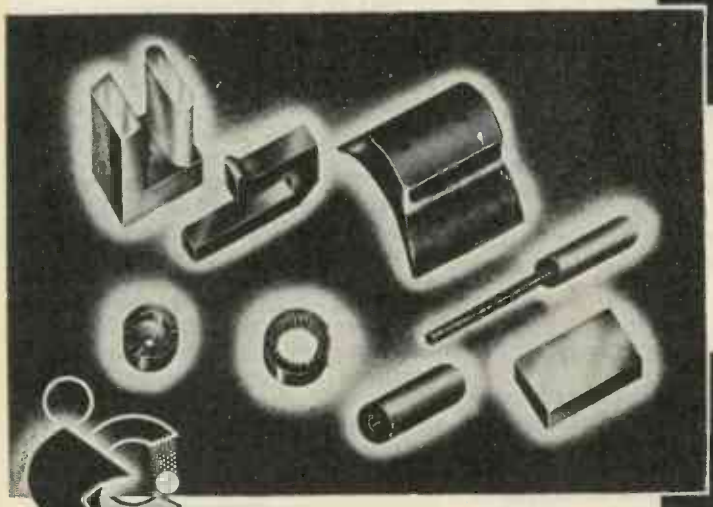
BRUSHES

From the latest, most dependable high-altitude brushes to standard and special types for all rotating electrical equipment, Stackpole produces a complete line for original equipment manufacturers. Stackpole engineers are in constant touch with brush problems and will gladly make recommendations based on this broad, highly-specialized experience.



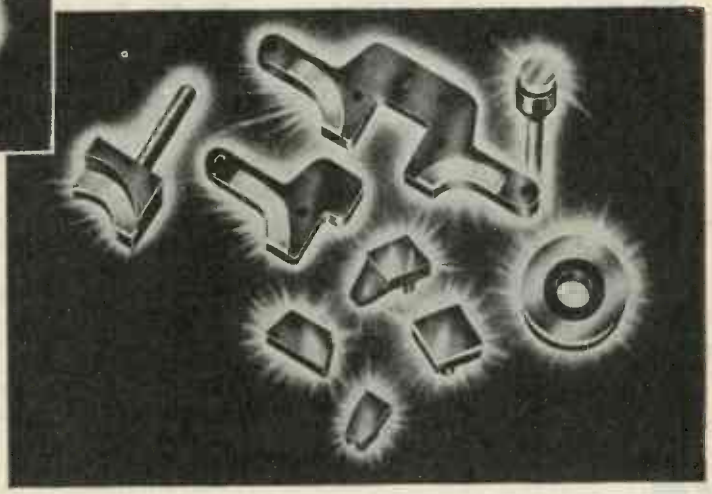
IRON CORES

Recent Stackpole developments include molded Iron Cores for radio equipment operating at frequencies as high as 175 megacycles. Other Stackpole Iron Cores are available in a variety of grades and sizes for frequencies up to 50 megacycles. Molded from metal powders to match your specifications.



POWDER METALLURGY

Stackpole's specialization in molded products has resulted in important progress in the field of molding solids from powdered iron, iron-nickel, and other metal powders. Few recent developments hold such great promise to so many industries as a source of easier-to-obtain, accurate, yet less costly components.



CONTACTS

Stackpole offers suitable contacts for almost every application—from the various silver compositions to dozens of special alloys. Equally important is the Stackpole engineering service that not only helps you select the right contacts, but, if necessary, adapt your equipment to utilize them most efficiently.

Other Stackpole Products
Bearings • Anodes • Electrodes • Battery Carbons • Packing, Piston, and Seal Rings • Brake Lining, etc., etc.

Electronic Components
Fixed and Variable Resistors • Iron Cores • Line Switches, etc.

STACKPOLE

STACKPOLE CARBON COMPANY, St. Marys, Pa.

R. E. Gillmore, Sperry Gyroscope president, and Brigadier General Frank T. Hines at Vose memorial laboratory dedication

Sperry Dedicates Laboratory

Impressive Armistice Day ceremonies marked the dedication of the Frederic Blin Vose Memorial high altitude laboratory at the Great Neck, L. I., plant of the Sperry Gyroscope Co., where Brig. Gen. Frank T. Hines, Administrator of Veterans' Affairs, delivered the principal address. The purpose of the laboratory, designed to simulate stratospheric conditions at a height of 60,000 ft. and a temperature of —100 deg. F., is to study the performance of the man-instrument team at high altitudes.

Radio Location Device

A highly complex equipment for electronic measuring of distance has been patented by Francis H. Shepard, Jr., and assigned to the Radio Corp. of America. The invention is a system for determining the distance between a transmitting station and any reflecting object. The invention uses an electron discharge device which emits wave impulses and an electrical device which can pick up the reflective waves as they bounce back to the transmitting station. Distances are calculated by the beat of the return wave. The invention, it is deemed, could be valuable in locating hidden radio stations by obtaining fixes from a number of points.

Sylvania Adds 18th Plant

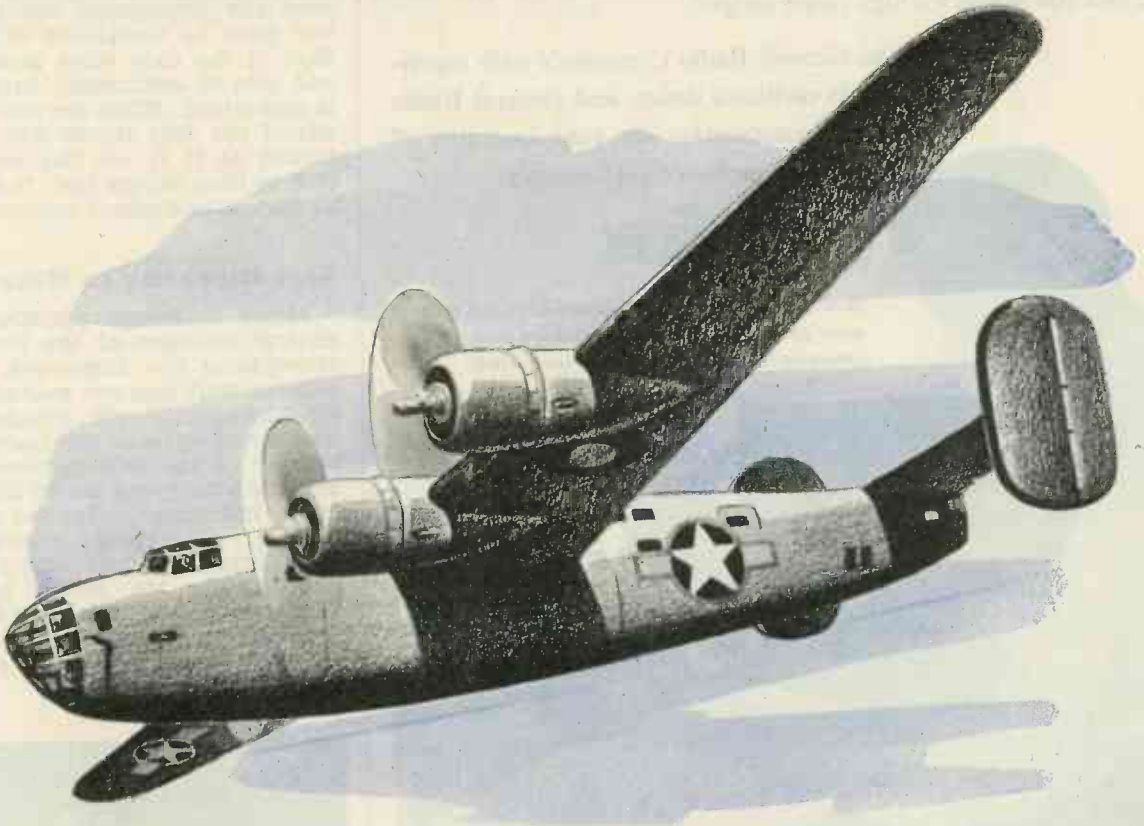
A new plant for the manufacture of radio tube parts has been acquired at Wakefield, Mass., by Sylvania Electric Products, Inc., and is already in production. It is a four-story structure containing 35,000 sq. ft. of floor space. Internal assemblies of radio tubes made in the new plant will be shipped to the Salem plant for completion. And in Williamsport, Pa., a five-story former furniture factory has been taken over for the production of manufacturing and testing equipment. The new establishment is the eighteenth plant of the company.

Hoffman to Expand Further

Hoffman Radio Corp., Los Angeles, currently a prime contractor for various types of military communications equipment including special types of variable condensers, crystal frequency indicating equipment, antenna-elevating box kites, etc., represents a merger of two companies long and favorably known in the radio industry that has brought together a number of well-known radio executives and engineers. When the Mission Bell Radio Mfg. Co., originally incorporated in 1932 by H.G.Schmieter and P. L. Fleming was reorganized in 1941, H. L. Hoffman became president, P. L. Fleming became vice-president, W. D. Douglas and G. G. Davidge became treasurer and secretary, respectively. Shortly thereafter the Mitchell-Hughes Co., a manufacturer of radio-phono combinations was acquired and with it the company gained W. S. Harmon, vice-president in charge of engineering, formerly chief engineer of Emerson, and R. McNeely, sales manager, formerly eastern sales manager for Gilfillan. At present the company is occupying quarters, acquired last year, which provide nine times as much space as formerly used, and further expansion is planned for the near future.

H. L. Hoffman, president, and W. S. Harmon, vice-president in charge of engineering, Hoffman Radio Corp., Los Angeles

FOR LIBERTY'S SAKE...



WILCOX ELECTRIC COMPANY

Manufacturers of Radio Equipment

14th & Chestnut ☆ Kansas City, Mo.

Our Liberators are winging global routes, chartered and uncharted, in the fight to make all men free. Wherever military or civilian planes fly, Wilcox Radio equipment is helping maintain dependable communications.

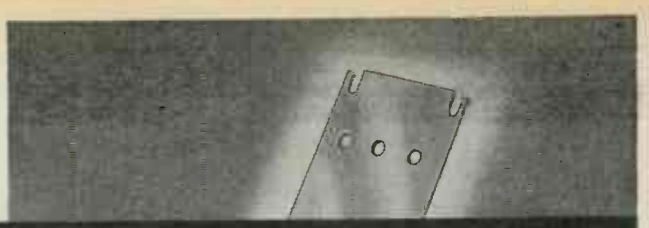
War Bond Priority Reservation Plan by G-E

By way of helping broadcasters to obtain earliest possible delivery of AM and FM transmitters, antennas and allied equipment, General Electric Co., Schenectady, has put in force a "reservation plan", under which prospective purchasers buy War Bonds and deposit them with G-E to entitle them to priority on deliveries. The Bonds and any income from them remain the property of the purchaser. Priorities for each type and rating of transmitter are to be based entirely on the hour and date appearing on the envelope containing the equipment reservation form. War Bond deposits (maturity value) required are: For AM transmitters, 5 kw-$1250; 50 kw-$5000; 500 kw-$15,000. For FM transmitters, 250 watts $250; 1 kw-$400; 3 kw-$700; 10 kw-$1200; 50 kw-$3500. Orders for equipment need not accompany reservations, but must be completed within 90 days of the date when production and sale of commercial equipment is authorized. When the contract is signed the War Bonds will be returned as it is not the desire of G-E to have buyers cash the bonds as partial equipment payments.

Sees Diversity in Mikes

James L. Fouch, president and general manager of the Universal Microphone Co., Inglewood, Calif., believes that postwar manufacture of microphones will broaden the number of styles of the instrument because of the new electronic era and the widespread use of this precision instrument. Instead of the general, all-purpose microphone, and perhaps a half dozen types and models, Mr. Fouch believes that there will be more than a score of styles, with each one a fast-moving item from the jobbers into consumer hands.

James L. Fouch, president of Universal Microphone Co., Inglewood, Calif.

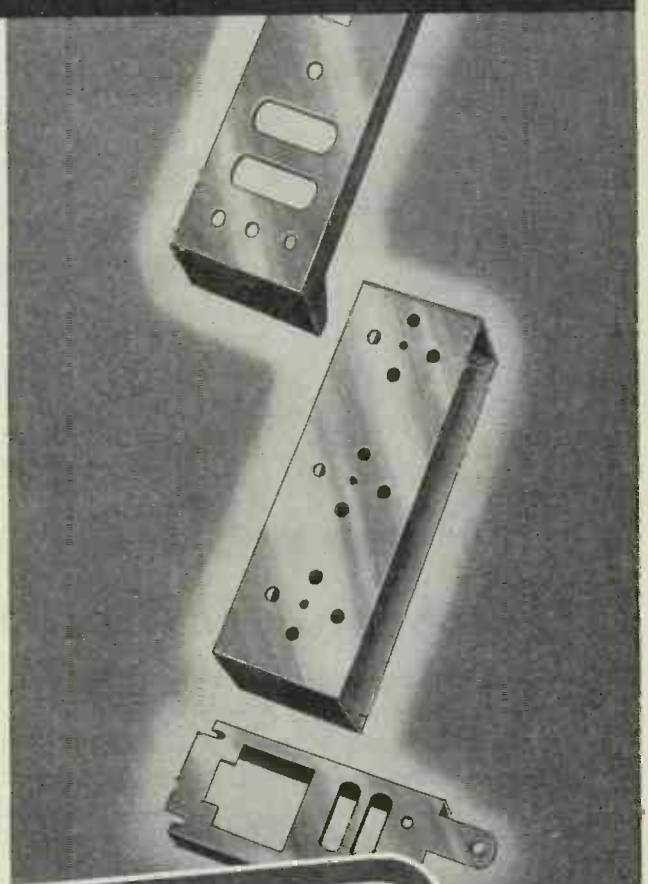


LOOKING FOR A SOURCE OF SHEET METAL HOUSINGS • CHASSIS • ASSEMBLIES FOR ELECTRONIC APPARATUS?

Read our qualifications

Here's what Corry-Jamestown offers manufacturers of electronic apparatus. Adequate modern production facilities that have already proven their worth in meeting the precision needs of leaders in the electronics field. Our own research laboratory. Ability to work in steel, stainless steel or aluminum. Accuracy that passes rigid Government inspection. The manpower and the machine power to assure prompt deliveries.

What is your need? Sheet metal housings? Chassis or chassis mounting suspensions? Cabinets? Panel or shelf assemblies? We've built them all for others. We'd like an opportunity to build them for you!



Send us your specifications . . . Today

CORRY - JAMESTOWN

MANUFACTURING CORP. Steel Age CORRY, PA.

SPEED VICTORY . . . BUY WAR BONDS

Ferranti Expands

Ferranti Electric, Inc. which maintains offices at 30 Rockefeller Plaza, New York, has moved its factory buildings from New York to Brooklyn. The manufacturing division of the corporation will occupy a modern building providing three times more space than was previously available.

Pacent Joins Powers

Louis G. Pacent, Jr., has been appointed factory manager for Powers Electronic & Communication Co., Glen Cove, N. Y. He will be in charge of production and will be associated with A. J. Buchtenkirch, in charge of engineering, under A. J. Sanial, general manager and chief engineer. The company is currently manufacturing a high power electronic megaphone for the armed forces.

Leland Advances Three

Leland Electric Co., Dayton, Ohio, has advanced Paul D. Dale to the position of Sales Manager. He was formerly district manager of the company's Chicago territory. Mr. Dale takes the place of W. F. Lisman, who has been made vice-president and general manager. F. E. Schumacher succeeds Mr. Dale in Chicago.

Mayer Turner Engineer

Rollins H. Mayer has been appointed engineer in charge of research for the Turner Co., Cedar Rapids, Ia. Latterly he has been associate radio engineer at the Navy radio and sound laboratory, Los Angeles, and previously was associated with the Civil Aeronautics Administration. He has served as an officer in the Navy; was a radio engineer with the CAA at Wright Field. He is a member of IRE, AIEE and the U.S. Naval Institute.

Rollins H. Mayer, appointed Research Engineer for Turner Co.

GUIDING AIRCRAFT—AmerTran Wave Filters are essential components of a number of types of navigation and communication equipment used by military and civilian aircraft.

MAINTAINING FIDELITY — Improved performance in audio circuits may be realized by the incorporation of AmerTran Wave Filters in critical circuit locations.

"COVERING" JAPS—Our Armed Services use AmerTran Wave Filters in many control and communications devices aboard ship and in land installations from the poles to the tropics.

UNCOVERING "BUGS" — AmerTran Wave Filters have made the sound analysis system of locating faulty parts in machinery far more efficient than older methods.

. . . . FOR ALL TYPES OF PRECISION CONTROL EMBODYING FREQUENCY DISCRIMINATION

THE increasing use of AmerTran Wave Filters in precision control apparatus involving frequency discrimination is due to their uniformity, accuracy, low loss ratio and minimum distortion. Compact, rugged, impervious to climatic conditions, they serve on widely varying fronts. Comprising High Pass, Low Pass, Band Pass, Band Rejection, Combinations and Equalizers, AmerTran Wave Filters have a wide variety of applications.

While AmerTran Wave Filters are restricted to war equipment today, we invite inquiries regarding post-war applications.

AMERICAN TRANSFORMER COMPANY

178 Emmet Street, Newark, New Jersey

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

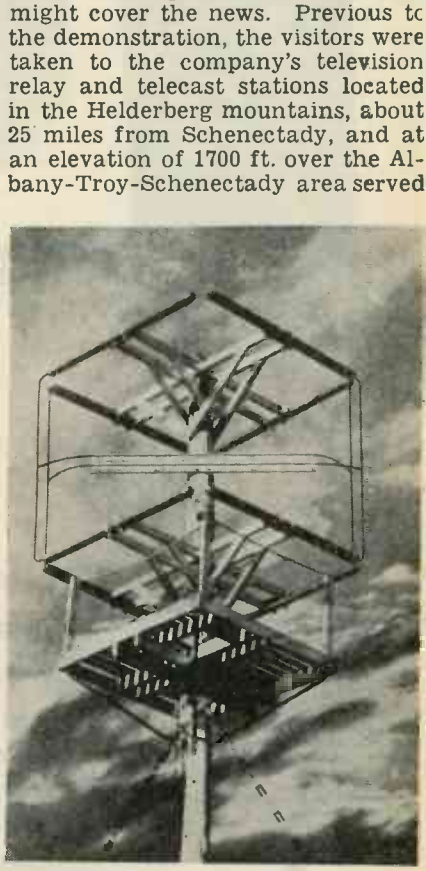
MANUFACTURING SINCE 1901 AT NEWARK N. J.

WPB Census of Radio Shortages

Data on radio shortages amor consumers is being secured in th present War Production Board cor sumer survey by the Bureau of th Census. In the nationwide surve of 7,000 households by census enu merators, of shortages of critic: civilian requirements, the public being asked to detail its shortage of radio sets, excluding automotiv sets; radio tubes, farm-radio bat teries, and also radio repair servic The extent of shortages of refrig erators, irons, washing machine and other electrical appliances an services also are included amon home goods and services of 11 types of civilian products, as a basi for future civilian production to b authorized by the WPB Office o Civilian Requirements, headed b vice-chairman Arthur D. White side. The questionnaires inquir whether there has been real hard ship, inconvenience, or no difficulty in the supply of the 115 items.

G-E Television Brings Newspaper to Life

Host to a group of about fifty magazine, trade publication and newspaper editors, General Elec tric early last month put on a tele vision demonstration slanted to show how picture transmission might cover the news. Previous to the demonstration, the visitors were taken to the company's television relay and telecast stations located in the Helderberg mountains, about 25 miles from Schenectady, and at an elevation of 1700 ft. over the Al bany-Troy-Schenectady area served



One of two cubicle antennas used at WRGB, Schenectady, for voice, pictures

by this station. While at the relay station; a special half-hour program originating at the NBC television station in New York was transmitted to show how well pictures were received without intermediate relays or boosters over an air line distance of 129 miles from the Empire State tower and 7,900 ft. below the line of sight.

In reviewing the newspaper, first the printed page was televised; then the same event was enacted by television. To portray the war news, Seymour Berkson, noted war commentator, with a large map pointed out and explained exactly what had happened on the European front according to the latest bulletins. For the feature page "Bugs" Baer was shown at his typewriter, wisecracking as he wrote his daily column; for the comics, "Believe-it-or-Not" Ripley, Russ Westover, creator of "Tillie the Toiler" and Otto Soglow, creator of "The Little King" were televised as each engaged in his favorite creation. For the advertising, girl models wearing the latest style creations and pictured in a full newspaper page display, "came to life" on the television screen.

Western Electric Shows Military Equipment

Under sponsorship of the Labor-Management War Production Committee at the Western Electric Kearny Works, a series of large dioramas flanked by noteworthy exhibits of wartime communications equipment, was thrown open to Company employes and the press in the middle of November. Housed in four circus tents, this "War Communicade," brought to the assembled workers the sights and sounds of the world's battlefronts in one of the most striking and dramatic exhibitions ever to be presented by industry.

Three dioramas, each nearly 60 ft. long and authentic to the last detail, present in three dimensional form reproductions of actual land and sea battles in which equipment of Western Electric manufacture played a vital role. First to be presented is the striking portrayal of home front protection facilities in action during a possible air raid on a typical American city.

This study in the coordination of spotters, interceptor command and other air raid defense services is a tribute to the part played by the telephone and teletype in the war.

In viewing the navy scene, the observer has the illusion of being aboard a naval vessel escorting a convoy of troop transports through dangerous South Pacific waters. The sinister general quarters alarm sounds and the air crackles with

Sit in with Majestic's post-war planning conference

Majestic's "post-war planning conference" in form of a $1,000 idea contest was announced last August. It's been going, going—soon it will be GONE. But where's the bid from YOU?

Men, this is your opportunity to express yourself on what you consider sound technical developments for post-war years.

You probably have ideas about the devices and developments which you think should be embodied in the radio of the future. Let this contest be an incentive to put your ideas down on paper. Your reply may win a prize and you may have the satisfaction of helping to create a better radio and a better industry for the years to come.

Put on your thinking cap. If you can't answer all the questions below, answer the one on which you feel qualified to speak and your reply will still be considered. These questions should stimulate your own post-war thinking—and will be a valuable check against Majestic's Post-War Plans.

$1,000 PRIZES IN WAR BONDS FOR MOST HELPFUL ANSWERS TO THESE THREE QUESTIONS

1st Prize $500 maturity value; 2nd Prize, $250 maturity value; 3rd to 13th, $25 maturity values. Every one is eligible. Contest ends December 31, 1943. To stimulate YOUR post-war thinking, and to check OUR post-war plans, Majestic offers prizes for the most helpful answers to these questions: (1) What types of radios will be in large demand in YOUR locality immediately following victory? (2) In what new features or new merchandising policies are you most interested at present? (3) What kind of advertising support do you believe will be most helpful to you?

Competent judges will read your answers. It's facts and ideas, not rhetoric, that will count. If any two prize-winning letters are considered by the judges to have equal merit, duplicate awards will be made. Write your answers to these three questions—mail them to me personally, today!

E. A. TRACEY, President

Majestic MIGHTY MONARCH OF THE AIR

MAJESTIC RADIO & TELEVISION CORPORATION
2600 WEST 50th STREET CHICAGO 32, ILLINOIS

Builders of the WALKIE-TALKIE, "Radio of the Firing Line"

crisp orders and a real approximation of the tenseness which precedes a naval engagement. Subsequent action, in which submarine detectors, battle announcing systems, radio and a number of other Western Electric war products features includes the realistic depth bombing of a submarine, and a convincing engagement between American and Japanese task forces.

The crescendo of the War Communicade is a land battle scene in which the observer looks through the ruins of a bomb-shattered house upon a countryside over which a battle between American and Nazi tanks is taking place. Expertly conceived narrative, sound effects, and the artistry of lighting make this scene, in which Western Electric tank radios help turn the tide of battle, an eloquent finale.

Italian Fleet "Distressed"

Resourcefulness has always been an attribute of radio engineers, and it is no stranger to Morrie Pierce, at present on leave from his post as chief engineer of WGAR, Cleveland, and Chief of the Psychological Warfare Branch, Allied Force headquarters in Algiers. When it came time to notify the Italian fleet of the unconditional surrender of Italy, Pierce figured the best way to do it would be to put the notification on the air on the international distress frequency of 500 kc. He had to re-build a transmitter, normally operating at 1100 kc, to do it, but that is the way the notification reached the fleet.

Jesse B. Hawley, known to radio as president of Hawley Products Co., St. Charles, Ill., and to all America as one of its really great football coaches, presided as master of ceremonies when the Ro'n Co., Inc., Cleveland, recently received its Army-Navy "E"

Echophone Model EC-1

(Illustrated) a compact communications receiver with every necessary feature for good reception. Covers from 550 kc. to 30 mc. on three bands. Electrical bandspread on all bands. Six tubes. Self-contained speaker. 115-125 volts AC or DC.

Echophone Radio Co., 540 N. Michigan Ave., Chicago 11, Illinois

Temple University Teaches Industrial Electronics

With some 100 men and women studying part time, day and evening, Temple University, Philadelphia, has inaugurated a course in "Industrial Electronics" under its Engineering, Science and War Training Program, which altogether has enrolled 900 students. The course comprehensively covering tubes, circuits and equipment, runs for 12 weeks, two nights a week, three hours a night. It is tuition-free, full or part time, for men and women and may be conducted at plants, nearby school buildings or at the University. In calling attention to the course, Director Charles E. Metzger comments on the four-color chart "Resistance Welding with Electronic Control" which appeared as a supplement with the November issue of Electronic Industries. The chart is available for the use of schools, universities and colleges.

Siegel Honored

David T. Siegel, founder and president of the Ohmite Mfg. Co., Chicago, was elected to the board of trustees of Illinois Institute of Technology at the annual meeting. He was one of five new members named to the Institute's board: the others are: Whipple Jacobs, president of the Belden Mfg. Co.; Claude A. Knuepfer, president and general manager of the General Engineering Works; T. Albert Potter, president of the Elgin National Watch Co.; and Harold B. Smith, president of the Illinois Tool Works. Siegel was elected as an alumni representative to the board, having been nominated by the Illinois Tech Alumni Association. In addition to his newly-elected position on the Illinois Tech board of trustees, Siegel is a member of the Fixed and Variable Resistor Industry Advisory Committee of the War Production Board.

David Siegel, made member of board of Illinois Institute of Technology

C-D RESEARCH DEVELOPED IT . . .

radio engineers accept it as a symbol of efficiency and dependability in high power mica capacitors

TO THE PERSISTENCE OF CORNELL-DUBILIER RESEARCH IN CAPACITORS, CREDIT SUCH DEVELOPMENTS AS...

Low loss, glazed ceramic cylindrical case

- minimum physical size for safe rating
- eliminates corona troubles
- impervious to climatic conditions
- mechanically sturdy

Patented series mica stock

- eliminates corona
- uniform voltage gradient
- uniform loading
- low losses

Cast aluminum end-cap terminals

- low resistance contacts
- permit space-saving mounting for series, parallel and series-parallel connections

Special low-loss filler

- reduces stray field losses
- protects against humidity
- no air voids

Type 59 Mica Transmitting Capacitor typical of Cornell-Dubilier reliability, proven time and again under severe operating conditions.

In 1910 William Dubilier produced his first transmitting capacitor. Thirty-three years of persistent research, and exacting production standards have made C-D the insignia of outstanding quality. Next time you specify capacitors, remember, there's good reason for this fact: there are more C-D capacitors in use today than any other make. Inquiries welcomed. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

Cornell Dubilier Capacitors

NEW BOOKS

Patent Law

By Chester H. Biesterfeld, published by John Wiley & Sons, Inc., New York, 1943. 201 pages. Price, $2.75.

The volume is the outgrowth of a series of lectures on the substantive patent law, given at the University of Delaware. The basic principle underlying the subject under discussion is illustrated by the citation of leading cases and by quotation of pertinent rulings.

The standard of invention is now materially higher than a decade ago, and the courts have been holding invalid about 80 to 90 per cent of the patents coming before them in recent years, so it behooves the reader and student to approach the subject of validity of a patent with a critical eye.

The book provides easy reference to details covering proof of originality and all the other terms which he runs into after he starts to take out a patent. Although the style is largely that of the legal art, the subject matter is easily understood.

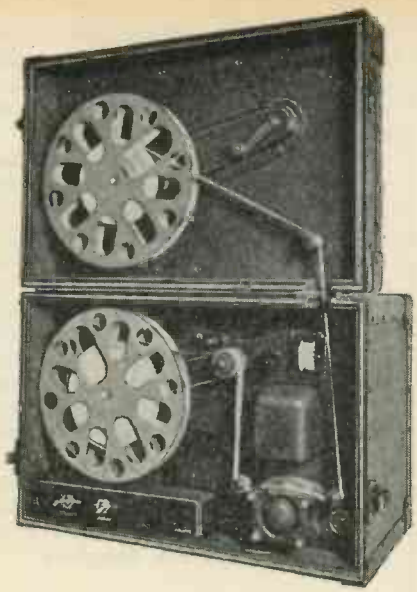
Industrial Radiology and Related Phenomena

By H. M. Muncheryan, Chief Physicist, Aircraft X-ray Laboratories. Published by Aircraft X-ray Laboratories, 5216 Pacific Blvd., Huntington Park, Calif. 525 pages. Price $7.50.

This reference volume contains a rather complete treatment of industrial uses of X-ray apparatus and also details of metallurgical analysis of photomicrographic, magnetic, and mechanical testing of materials.

The first few chapters of this volume give the necessary atomic and electrical background for appreciation of X-ray apparatus and phenomena. Three chapters are devoted to X-ray apparatus, X-ray tubes and X-radiations. Here physical and electrical details of typical installations are illustrated and their characteristics discussed. X-ray tubes are treated from a practical standpoint of operation and the various designs, cooling systems and other features are well covered. The chapter on X-radiations covers the characteristics of X-rays, absorption, secondary X-radiations, measurement of X-ray intensity, electrical and X-ray protection.

A chapter is devoted to the technic of making a radiograph for odd shaped objects where masking, shielding and special handling because of wide variations in part thickness are required. The photographic effects of X-rays and the



Men in our Armed Forces quickly learn how to receive international code on this Portable Keyer made by Waters Conley. It takes an inked record from paper tape and converts it, by the magic of electronics, into audible code signals.

This companion to the Waters Conley Recorder is another of the war-vital products that take all our time these busy days. But much of the knowledge and experience we are gaining in wartime will help to enrich civilian life when peace comes again... and will open profitable new markets for you.

Phonola

Waters Conley COMPANY

WATERS CONLEY COMPANY

In peacetime, America's oldest and largest manufacturer of portable phonographs

ROCHESTER, MINNESOTA

17 East 42nd Street, New York 224 South Michigan Avenue, Chicago

diagnosis from radiographs are well covered in separate chapters with a large number of photographic illustrations along with cause and cure discussion.

The last chapters in this book are devoted to other testing methods as applied to materials common in the aircraft field. One chapter is devoted to a discussion of machines for measuring ductility and hardness, constituents of alloys, thermal treatment of metals, etc.

The technic of preparing samples and making photomicrographs with a discussion of the interpretation of microstructures is covered in Chapter Ten.

Radiography with gamma rays, and the inspection of metals with a magnetic technic are subjects covered in separate chapters.

Treatment of Experimental Data

By Archie G. Worthing, University of Pittsburgh and Joseph Geffner, Weirton Steel Company, published by John Wiley & Sons, Inc., New York, 1943. 342 pages. $4.50.

The text book is an outgrowth of a course for graduate students, and has been written with the physicist, the chemist, and the engineer in mind. Examples, problems, and summaries make it extremely suitable for self-study and as a reference book to be consulted when the occasion arises.

Two closely related problems are dealt with in the text: to present the results of measurements in a convenient form, and to analyze experimental data to obtain final results and probable errors.

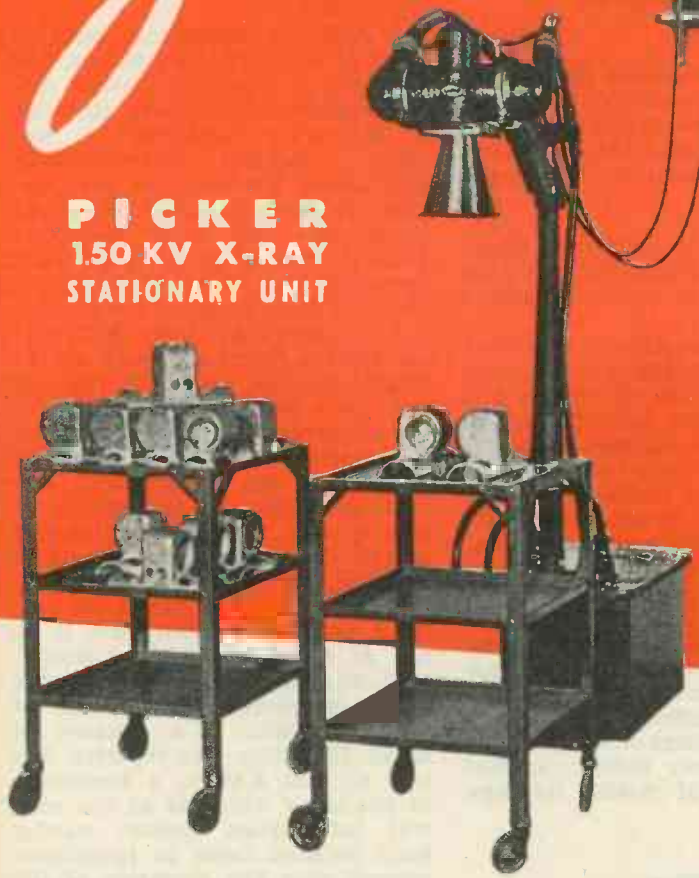
The three devices for representing experimental data, i.e. tables, graphs, and equations, are systematically treated, and rules to be observed when compiling tables, drawing graphs, or setting up equations are extensively explained. Different approaches are possible for setting up an empirical equation or for finding the constants involved should the form of the equation be known. Successive approximation, graphic methods, and methods of selected points and of least squares may be employed.

One chapter is devoted to tabular and graphical differentiation and integration, another to Fourier series. About one third of the text is concerned with statistical methods for computing the most probable value from series of equally reliable experimental results or from results which are of unequal reliability and must be given different weight, or for finding the means for quantities that though determined separately are related by a known law.

The text may be highly recommended to anyone who wants to

fault detective

PICKER
150 KV X-RAY
STATIONARY UNIT



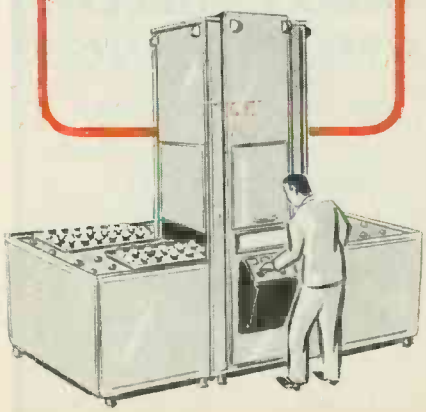
DETECTION OF FAULTS through X-Ray examination has demonstrated so many practical manufacturing advantages that it is fast becoming routine practice in the inspection of electronic devices.

Radiography provides *precise* spot-weld control...*checks* on accuracy of tube filament and grid alignments, as in high-frequency and transmitting triode tubes . . . *discloses* broken leads, imperfect joinings, loose solder, and similar common defects occurring in impregnated and oil-sealed condensers, resistors and assemblies.

Picker 150 KV X-Ray Units, rated at 150 KVP, 10 ma operation, are available either on stationary or mobile mounts, providing flexible, powerful equipment ideally adapted to the radiographic requirements of electronic industries. Your local Picker Engineer will be glad to discuss their application to your particular inspection problems.

PX

When thousands of parts must be checked daily, the Picker Production X-Ray unit, completely ray-proof and shock-proof, provides ample flexible capacity for mass radiographic and fluoroscopic inspection.



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find the method best suited to evaluate experimental data. He will find simple and more complicated methods to choose from according to the problem on hand and the degree of precision desired.

X-rays in Research and Industry

By H. Hirst, Assistant Director of Metallurgical Research, University of Melbourne. Published by Chemical Publishing Co., Inc., Brooklyn, N. Y. Approximately 150 pages, price $2.50.

This volume is a compact treatment of the applications of X-rays in industrial and physical research fields.

The first chapters in this book discuss the production of X-rays, the basic structure of crystals and the various X-ray methods used in the study of crystallized materials including the Laue method, the rotating crystal method and the powder method. In connection with the X-ray crystal analysis a number of photographs, useful charts and tables are presented.

Considerable emphasis is given to X-ray methods of studying metal alloys through crystallization patterns. The effect of cold-working on crystalline structure is illustrated.

The last chapters of the book are devoted to X-ray technic applied to inspection of welds, forgings, castings, etc.

Science at War

By George W. Gray. Published 1943 by Harper & Brothers, 49 E. 33rd Street, New York. Approximately 284 pages. Price $3.

This timely volume by an experienced scientific writer, surveys the whole field of science and physics as applied to modern warfare. Tremendous mechanical forces, electrical and electronic controls, chemistry, new materials, mathematical analysis, medicine and surgery, air conditions, and the "war of ideas" are chapter topics which indicate the wide scope of the subject matter.

To electronic readers, one of the most interesting passages reports the events at Pearl Harbor, Dec. 7, 1941, told as follows:

There was a r. . . . installation at Pearl Harbor on the "date that will live in infamy." It told of the approaching Japanese planes, but its warning was not heeded. The official account of this neglect is contained in the reports of the commission of inquiry, headed by Justice Owen J. Roberts, which President Roosevelt appointed to visit Hawaii and find out the facts. Among the facts, which were published in Senate Document 159 of the 77th Congress, are the following:

1. The army was responsible for the installation and operation of "an aircraft warning system for the detection of waterborne and airborne craft at a distance from the coast."

2. Although permanent installations of this detection system had not been completed, "certain mobile equipment had been installed at temporary locations," it "was being operated intermittently throughout the day for the purpose of training personnel in its operation," and after November 27th it had been operated each morning from 4 to 7 o'clock by order of the commanding general.

3. In accordance with this order, the system closed at 7 A.M. on the fateful Sunday, December 7th, and our story would end here but for the perservering interest of a Signal Corps sergeant. He was being instructed in the mysteries of aircraft detection. As the official report tells it: "A non-commissioned officer, who had been receiving training, requested that he be allowed to remain at one of the stations, and was granted leave to do so. At about 7:02 A.M. he discovered what he thought was a large flight of planes slightly east of north of Oahu at a distance of about 130 miles. He reported this fact at 7:20 A.M. to a lieutenant of the army who was at the central information center, having been detailed there to familiarize himself with the operation of the system. This inexperienced lieutenant, having information that certain United States planes might be in the vicinity at the time, assumed that the planes in question were friendly planes, and took no action with respect to them."

Warning of attack

It was not until 7:55 A.M. that the Japanese raiders reached Pearl Harbor. The sergeant got his indication of them at 7:02, fifty-three minutes before they struck. He reported his finding to the "inexperienced lieutenant" at 7:20, thirty-five minutes before they struck. A great deal of alertness, preparedness, interception and other defensive measures might have been crowded into those thirty-five minutes, if only the warning of the farseeing radio eye had been used.

The refusal to give any credence to the possible seriousness of the signal is of course only part of the general picture which the commission characterized as "dereliction of duty." The admiral in charge of the fleet, said the commission, "assumed that the aircraft warning system was being fully operated

WASHINGTON

Latest Electronic News Developments Summarized by *Electronic Industries'* Washington Bureau

POSSIBLE REGULATION BY FCC—Even though a rosy future is in sight after the war, the electronics manufacturing industry may face a spectre of government regulation—the FCC would like to have some control over its operations. This proposal for postwar regulation of electronic devices was given out as a suggestion by FCC Chairman James Lawrence Fly in his recent testimony before the Senate Interstate Commerce Committee on the White-Wheeler Bill. The Commission chieftain only is seeking regulatory powers to curb potential interferences to television, frequency modulation and other radio communications services which he views as possibly resulting from postwar electronic developments which may be used in industry or for detection purposes by air and other transportation media.

ENFORCE ENGINEERING STANDARDS—Chairman Fly told Congress that all the Commission would want would be statutory authority to enforce engineering standards so that electronic devices could be prevented from frequency emissions which would cause interference to broadcasting and communication services. He cited that such technical regulation should be directed to require shielding and filtering devices on all electronic equipment. Although there is nothing yet on the horizon for an enlargement of such regulatory powers, it might be noted that great oaks from little acorns grow—witness the broadcasting industry, which was originally regulated only from the standpoint of technical operations.

STUDY DISTRIBUTION AND CURRENT REQUIREMENTS—To improve the distribution of electronic and radio equipment to the Army, together with a resurvey of the current requirements and study of uncompleted procurement orders, the Signal Corps held a two-day meeting in Chicago of the commanding officers of all its Depots and Field Agencies of its Procurement and Distribution Service during mid-November. Major General H. C. Ingles, Chief Signal Officer, attended the conference at which Major General W. H. Harrison, Chief of Procurement and Distribution Service of the Signal Corps, presided.

DECENTRALIZATION OF WPB RADIO AND RADAR DIVISION—The Military Radio Industry Advisory Committee was urged to utilize to the fullest extent possible the field offices of the WPB Radio and Radar Division which have been established by the very able Director of the Division Ray C. Ellis. The field offices can be of particular assistance on manpower problems, although October showed considerable improvement in that situation both in turnover and in the total number of employes. The industry has practically accomplished the objective of having 80 per cent of its employes women, but to meet increased production next year it is estimated that it will need a possible additional 75,000 workers. The deferment machinery set up by the Radio and Radar Division with Selective Service headquarters is functioning almost perfectly.

EXPLORING RECONVERSION—The eight representative electronic-radio manufacturers who make up the Military Radio Industry Advisory Committee to the WPB Radio and Radar Division had on their program for the November 30 meeting a general discussion of the reconversion problems of the electronics and radio manufacturing industries when war contracts slacken off. There was brief discussion slated on the ways and means for the orderly withdrawal of large war production companies from that field into peacetime operations. It was understood that the Committee is to furnish its recommendations for reconversion to WPB Chairman Donald M. Nelson.

EQUALIZATION PROBLEMS—Even though the industry recognizes that it is called upon to produce at a peak rate to fulfill the Army and Navy requirements, there is the problem that major companies which have the highest engineering skills and production efficiency are being asked by the Armed Services to continue military production on long-range contracts for the next year or two. On the other hand, some of their competitors in the electronics-radio field may be released for civilian production and thus get a jump not only on organizing their postwar distribution and sales forces but also actually in marketing their products while these major companies are keeping their noses to the grindstone of war production. This may well be the case, even though the Navy provides in the Pacific war a "cushion" of continued military output. At any rate, this discussion appeared to launch the first official consideration of reconversion in the industry under governmental auspices.

"LOOK-SEE" AT THE FUTURE—It may be guesswork, but one wonders whether, when peace comes, the present trend in the requirements of the Army and Navy for an increasing proportion of electronic equipment in comparison with radio apparatus may not be carried into the postwar markets. With new electronic uses mounting almost daily in industry and public services, electronic devices have in the past year become a husky rival of its industrial confrere, radio manufacturing. By way of prophesy, the trend of the armed services' requirements with increasing emphasis on the essentiality of electronic equipment seems significant—in 1942 the military requirements were 70 per cent for straight radio equipment and 17 per cent for electronic apparatus with 13 per cent for wire telephone and telegraphic equipment; in early 1943 radio equipment amounted to 61 per cent, electronics 30 per cent and telephone-telegraph 9 per cent; but at the close of 1943 electronics phenomenally jumped to 42 per cent and straight radio apparatus declined to 50 per cent with the wire communications requirements being reduced to 8 per cent. No matter what the role of electronics may be in the postwar future, it is conceded by the armed services and all other interested governmental agencies in Washington that the American manufacturers have built the finest and best electronic equipment in the world.

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Our large War Production Division has been engaged in a great amount of work for Government Purchasing Agencies and Prime Contractors. Much of the work has been in the field of Radio and Microphones, such as

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by the army, but made no inquiry after reading any of the messages of October and November from the War and Navy Departments as to what the fact was with respect to its operation." As for the general, and the use he made of his resources, the commission reports that as early as November 27 "there was sufficient partially trained personnel available to operate the aircraft warning system throughout twenty-four hours of the day, as installed in its temporary locations. An arc of nearly 260 deg. around Oahu could have been covered."

NEW BULLETINS

Antenna Towers

Harco Steel Construction Co., Elizabeth, N. J., which specializes in the design, fabrication and erection of steel towers of all types, has issued a 24-page bulletin listing, illustrating and describing a number of types of towers, booms and derricks. These include 76- and 90-ft. telescopic towers, movable towers, portable towers and erection equipment. Specifications for towers of from 40 to 200 ft. are included.

Tube Substitution Charts

A concise pamphlet containing charts and all necessary data on radio tube substitutions has been compiled by Sylvania Electric Products Inc., Emporium, Pa. The pamphlet includes substitution charts for 150 milliampere ac-dc receiver tubes, 300 milliampere ac-dc receiver tubes, and battery tube types, edited to conform with the WPB civilian radio tube program. The pamphlet shows quickly the required receiver and modifications necessary for tube substitutions, helps solve difficult tube substitution problems, and gives first and second choices in possible replacements in an easy-to-use check list. The pamphlet fits standard-size loose-leaf binders.

Control Devices

Relays in great variety, both ac and dc, as well as stepping switches, various types of control switches and miscellaneous equipment including microphones, solenoids, electric counters, spark suppressors, tube and dry disk rectifiers and battery eliminators are illustrated and described in an elaborate 104-page plastic-bound catalog issued by Automatic Electric Co., 1033 West Van Buren St., Chicago. Included is an engineering chart showing the characteristics of all types of relays, their operation and application.

Falstrom Products

Falstrom Co., Steel Fabricators, Passaic, N. J. has issued a new 8-page, 2-color general catalog which describes the company and its services and its various product lines. Latter include fabricated steel parts and finished products built to order in all quantities and in most metals from 24 gauge sheets to 3/8 in. plates and heavy structural sections, instrument mounting structures such as panel boards, unit panels, cubicles, switchgear cabinets, housings and enclosures.

Ceramic Trimmers

A new 8-page two-color bulletin has been issued by Centralab Division of Globe-Union, Inc., Milwaukee, Wis. In addition to illustrating and describing four styles of ceramic trimmers, considerable engineering information as well as dimensional specifications are included.

Cold Cathode Lighting

A new bulletin issued by the Acme Electric & Mfg. Co., Cuba, N. Y., describes the differences between cold cathode lighting and fluorescent lighting. The bulletin briefly discusses the utility, adaptability, color harmonics, safety, efficiency and the future possibilities of the continuous tube (cold cathode) light source. Illustrated are eight installations of this form of lighting in retail stores, factories and business offices. Specifications and dimensions of four standard industrial type cold cathode lighting transformers and twelve commercial type cold cathode lighting transformers are included.

AN Connector Information

Cannon Electric Development Co., Los Angeles, has issued a 10-page supplement of latest information on type AN electrical connectors. Supplement contains layouts of new insert arrangements, tabular matter and special plugs. Pages are loose-leaf to be used in current Cannon general catalogs.

Stainless Steel Fabrication

The Jessop Steel Co., Washington, Pa., has published a new catalog on Jessop stainless-clad steel. Included in this literature is information on analyses, applications, manufacture, fabrication, styles of heads and standard size of sheets and plates. It also gives an explanation of the assembly method used in producing the stainless-clad material. There are sections on deep drawing, grinding, polishing, cleaning, gas-cutting, riveting, soldering, welding, etc.

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Seamless or welded* in many metals from .0019" up to .625" O D to your specifications.

*WELDRAWN, Superior's Trademarked Welded Stainless Tubing

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The big name in SMALL TUBING *for Uncle Sam!*

SUPERIOR TUBE COMPANY, NORRISTOWN, PENNSYLVANIA

FOR EVERY SMALL TUBING APPLICATION

Tubing from 5/8" OD down...SUPERIOR Seamless in various analyses. WELDRAWN Welded and drawn Stainless.

BRAWN Welded and drawn "Monel" and "Inconel". SEAMLESS and Patented LOCKSEAM Cathode Sleeves.

Baltimore Conference Considers Military-Radio Standardization

The importance of standardization of components, nomenclature and end products, as a means of increasing military radio production and facilitating field maintenance was the subject of a two-day conference at Baltimore, Nov. 17 and 18, participated in by Army and Navy officers, officials of the WPB Radio Division, and engineers from principal manufacturers of military radio equipment.

During a visit to the Bendix Radio plant at Towson, Md., the conference members witnessed separate Army-Navy handling of identical components covered by differing identification schemes, and also observed the vastly complicated stocking problem caused by non-standard systems of component identification. Inspection of production lines also showed the advantages of standard components and identification.

S. K. Wolf of WPB headed the conference which included Generals R. B. Colton, H. M. McClellan, H. C. Minton and G. H. Gardner, as well as Admirals Earl W. Mills and C. A. Jones, Capt. J. B. Dow, and Comdr. D. R. Hull. Ray Ellis, director WPB Radio Division; E. K. Jett, FCC chief engineer, were in attendance, together with about 100 engineers from radio manufacturing organizations.

At a panel discussion on standardization problems, E. R. Crane of WPB presided, and there were talks by H. B. Rockwell, D. J. Conner and Frank H. McIntosh, all of WPB; H. P. Sparkes, Westinghouse; D. F. Schmit, RCA; and W. A. Bischoff, Bell Laboratories. Col. G. C. Irwin and Col. Harris also took part in the discussion.

Hugh Benet and W. P. Hilliard of Bendix acted as hosts to the standardization conference, which was held under the auspices of the War Committee on Radio.

MILESTONES TOWARD THE ELECTRONIC ERA

Network Broadcasting Started 21 Years Ago

Chain broadcasting, which has made radio the nationwide educational and entertainment medium it is today, has come a long way from the first chain program, which broadcast the World Series ball games direct from the playing field in New York in 1922, to this day when worldwide hookups are not uncommon to the listening public.

Its development in America can be attributed to that partnership of interest between listeners and stations in which the important question of

supply and demand was paramount, according to Kolin Hager, manager of General Electric's station WGY which, with WJZ in New York, introduced and pioneered chain broadcasting 21 years ago.

Two-station "chain"

The original two-station "chain," which broadcast the world series in 1922, grew and later included WRC, Washington; WFBL, Syracuse; WHAM, Rochester; WMAK, Buffalo; and WTAM, Cleveland.

When WGY began broadcasting in 1922, the lack of any number of professional or non-professional musical or dramatic groups or single performers within the station's area, the listener's urge for elaborate broadcast productions, and the fact that everyone, from school children to radio engineers, was tuning in, made broadcasting officials look beyond the immediate vicinity of Schenectady, realizing that program sources must be many and perhaps at long distances from the studios.

NBC formed in 1926

With the joining of WGY and WJZ in 1922, listeners to WGY heard symphonies and Broadway musicals and dramas from New York, while the WJZ audience heard talent from upstate and talks from the electrical and radio wizards, such as Dr. Charles P. Steinmetz and Dr. E. F. W. Alexanderson from Schenectady. Then WRC, station for the nation's capital, joined the two-station "chain." This enabled listeners to WGY and WJZ to hear radio programs from Washington, while listeners to WRC benefited by the broadcasts from New York and Schenectady.

In 1924 and 1925, wire-line facilities were completed to Syracuse, thence to Rochester, and finally into Buffalo, drawing on the rich resources of the western part of New York state, adding stations WFBL, Syracuse; WHAM, Rochester; WMAK, Buffalo, to WGY, WJZ and WRC. WTAM, in Cleveland, was next added, and a station in Chicago was contemplating joining the network when from this nucleus the National Broadcasting Company was formed in 1926.

Laboratory Rectifier for Sale

The Daven Co., 158-160 Summit St., Newark, N. J. has a Sylvania laboratory rectifier, Model 541-A for sale. Input: 220V — 3 PH - 60 Cycles;

Output	AMP.	DC
3500V—2.0	"	"
1750V—0.4	"	"
600V—0.3	"	"
11V—31.0	"	"
10V—6.6	"	"
10V—6.6	"	"
7.5V—6.0	"	"

Movable—on casters.

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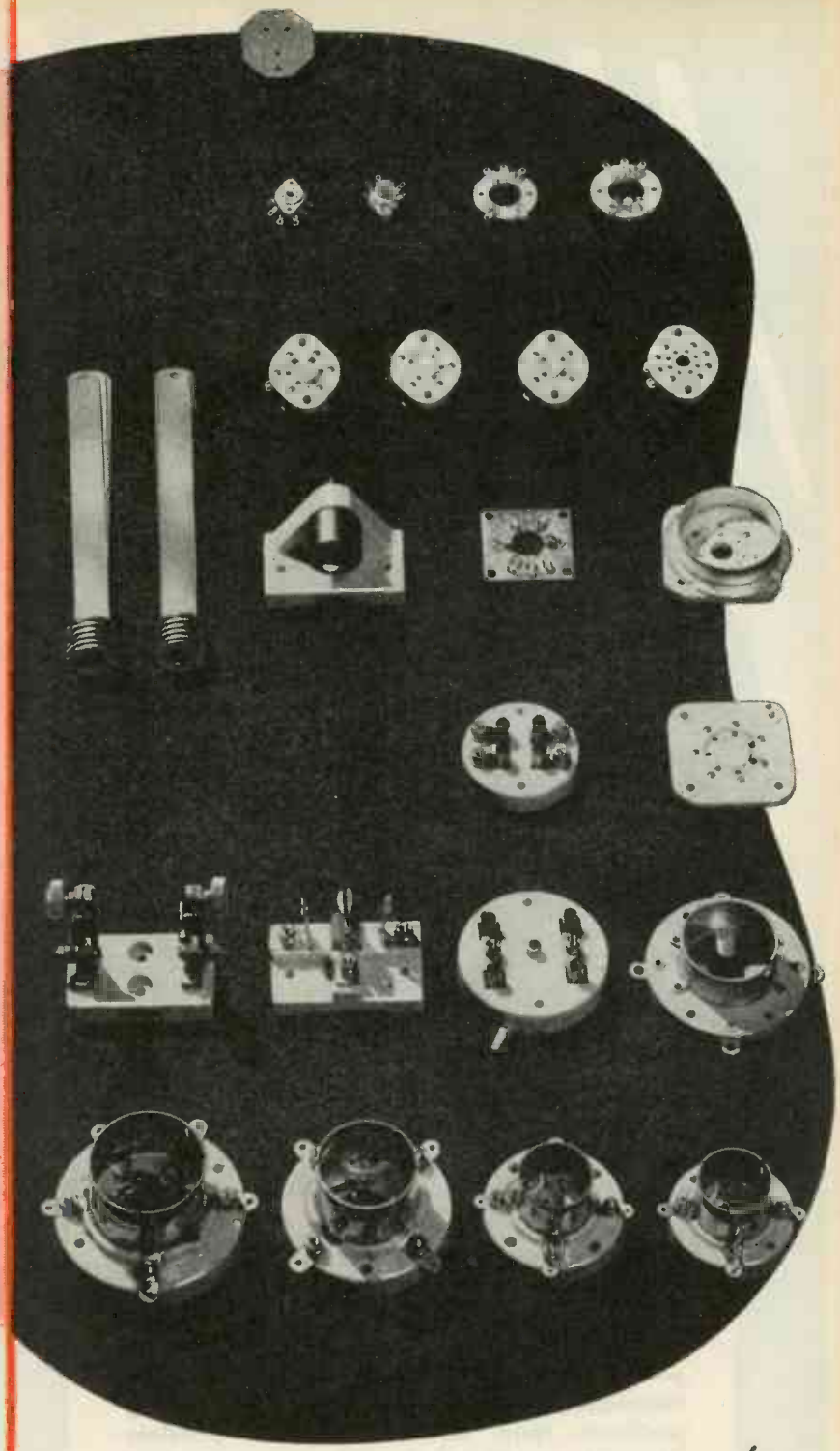
COMPLETE LINE OF TUBE SOCKETS

There is a Johnson socket for nearly every transmitter requirement. For more than twenty years, Johnson Engineers have been designing and manufacturing transmitter parts, transmitters, and equipment. They are thoroughly familiar with all the problems of sockets themselves plus an intimate knowledge of the requirements and relationship with other transmitter components.

You cannot buy a better socket than Johnson. Finest materials, superior workmanship, exclusive design, precision manufacturing, skilled engineering, and quantity production all mean the best sockets, and usually the lowest priced on the market.

Most Johnson sockets are Government approved as standard. Perhaps you have noticed how frequently the phrase "Johnson or equivalent" appears as part of Army or Navy specifications. If you are not already doing so, you will find your socket troubles over, if YOU specify "JOHNSON." May we send you information or samples?



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CATALOG 9670

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a famous name in Radio

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Simplify Instruments

To further the program of simplification of industrial type instruments, industrial and special purpose thermometers have been added to Limitation Order L-272 by the WPB Radio and Radar Division. The new schedule eliminates a number of sizes, types and special features of industrial and special purpose thermometers which will conserve production man-hours and increase the quantity output by as much as ten percent. The schedule by providing cases and case fronts shall not be made of copper or copper alloy other then copper tubing, copper alloy tubing or cylindrical extruded shapes, will conserve a small quantity of critical materials. The scale in industrial thermometers ranges between —40 deg. and +950 deg. F. are restricted to a definite list.

Field Offices Handle M-293

Radio and radar component manufacturers are advised by the WPB that reporting under Order M-293, governing critical components, will be handled by Field Service Branch representatives in WPB Regional Offices. In a letter from the WPB Radio and Radar Division, manufacturers were informed that Forms WPB-2467 (PD-901), WPB-3002 (PD-902) and associated instructions will be distributed by Regional offices. When completed, the forms should be returned to the Regional office from which they were obtained.

WPB Rewards Labor for Production Ideas

In recognition of the tremendous potential worth of practical ideas for improving the job from the men who do the job, the War Production Board, under the leadership of Donald Nelson, has set up a system of national honors for the suggestions which in actual industries' usage prove to be of value in increasing production. Labor-Management committees have been established in 2400 plants in which 5,000,000 war workers are fighting the "Battle of Production." Union representatives comprise the labor half of the committees in all plants where there is a recognized labor organization.

Throughout the country, Labor-Management committees have been encouraging workers to write out their ideas, and drop them in suggestion boxes conveniently located in the plant. Both management and labor representatives on the committee review suggestions for merit. If they are found to be useful, they are adopted in the plant. If the committee considers the suggestion to be of enough value to

Winning THE WAR ... on the BATTLE FRONT and HOME FRONT alike

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.

• Our Army, Navy, Air Forces, function with clockwork precision, thanks to perfected radio coordination. Meanwhile, by spotting and ranging approaching aircraft even a hundred miles distant, regardless of weather, by night or by day, radio eliminates another Pearl Harbor sneak attack. Lurking U-boats are losing their concealment. To cap it all, up-to-the-minute world news is available at the twist of a dial in millions of American homes whose radio sets keep functioning through proper servicing and replacement parts. We remain the best informed people. Our morale is unbeatable. Victory is in sight.

Thus a truly radio war. Radio means capacitors. Capacitors spell Aerovox. Today, working at an all-time production peak in meeting military needs and civilian replacements, Aerovox contributes its full share towards winning the war on battle and home fronts alike.

• Consult our local jobber regarding your wartime capacitor needs. Ask for latest catalog; also free subscription to the Aerovox Research Worker. Or write us direct.

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have promise of broader application throughout industry, it is submitted to War Production Drive Headquarters, where it is reviewed by the Board for Individual Awards, composed of technicians and engineers in various industrial fields. Four grades of awards are given, proportionate to the breadth of application of the idea. Almost 1000 workingmen have already received recognition from the government. Of these, 14 have received the highest award—the Citation for Production Ideas, which is "a citation for a suggestion making an outstanding contribution to the war production program of the United States."

So that these building blocks in the country's War Production program may be available to every plant in every industry, War Production Drive Headquarters has a nation-wide exchange service. A pamphlet briefly describing the award-winning suggestions is available on request, and war plants interested in specific items may write in for a fuller description, and blue prints if necessary.

ELECTRONIC TOMORROWS

Sarnoff Outlines "New Frontiers" of Open Space in Creating Postwar Jobs

Ten thousand jobs which did not exist in 1940 must be found to solve the postwar problem of employment. One great hope in helping to meet this unprecedented challenge will be found in the fertile and unexplored frontiers of space. Science, offering new incentives, is beckoning capital to venture into the open skies.

We are challenged to look upward to our future. Horace Greeley, if here today, might say, "Go up, young man! Go up, and grow up—in space." There lies the unfathomed West of this century, with no last frontier. The Forty-Niners of the present decade will be prospectors in research. They will travel through the air to stake their claims to fame, fortune and freedom.

Radio vision

When this war ends, we shall be on the threshold of a new era in radio—an era in which man will see, as well as hear, distant events. . . . The day may come when every person will have his own little radio station tucked away in his pocket, to hear and to communication with his home or his office as he walks or rides along the street.

We have much to learn about the microwaves, in which is wrapped up this new world of individualized radio. Tiny electron tubes may make it possible to design radio receivers and transmitters no larger than a fountain pen, a cigarette case, a billfold,

The Sta-Kon* Way

FOR rapid, permanent installations of STA-KON Pressure (Solderless) Wire Terminals, correctly engineered T&B STA-KON Tools are indispensable. • All T&B Tools are quick and easy to operate. • There are different models for whichever type of power you prefer: manual, air, hydraulic or electric. • In fact, the STA-KON Way has been called the speed way of assembly line production by many electronics manufacturers who have changed over from solder. • The electrical joint made by the staking tool is vibration and corrosion proof and is today performing on fractional current, high frequency circuits. • STA-KONS are made in hundreds of shapes and wire capacities, with and without Insulation-grip. • Under the T&B Plan, STA-KONS and STA-KON Tools are sold only through T&B Distributors, who reduce the manufacturer's selling costs, thereby reducing the cost of all electrical equipment to the user.

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THE THOMAS & BETTS CO.

INCORPORATED

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

ELIZABETH 1, NEW JERSEY

In Canada: Thomas & Betts Ltd. Montreal

E Flag awarded April, 1943
White Star awarded October, 1943

For Every 3 in '43— They Must Have 4 in '44!

Faced with increasing our current military-radio production of three billion dollars per annum, to four billion dollars in 1944, using present facilities and manpower, the Radio Division WPB and the War Committee on Radio are promoting the slogan above as outlining production necessities for next year.

or a lady's powder-box. Some day people may carry television screens on their wrists as they now carry watches. As the useful spectrum of radio approaches the frontiers of light, the apparatus will become simpler and more compact.

Radio vision will have many uses. It will serve wherever sight is needed. For instance, it will be used to prevent collisions on highways and railroads, on sealanes and on the airways of the world. Applications of radio optics are unlimited.—David Sarnoff, president, RCA, before Lancaster, Pa., chapter, A.A.A.S.

Electrochemical Engineer

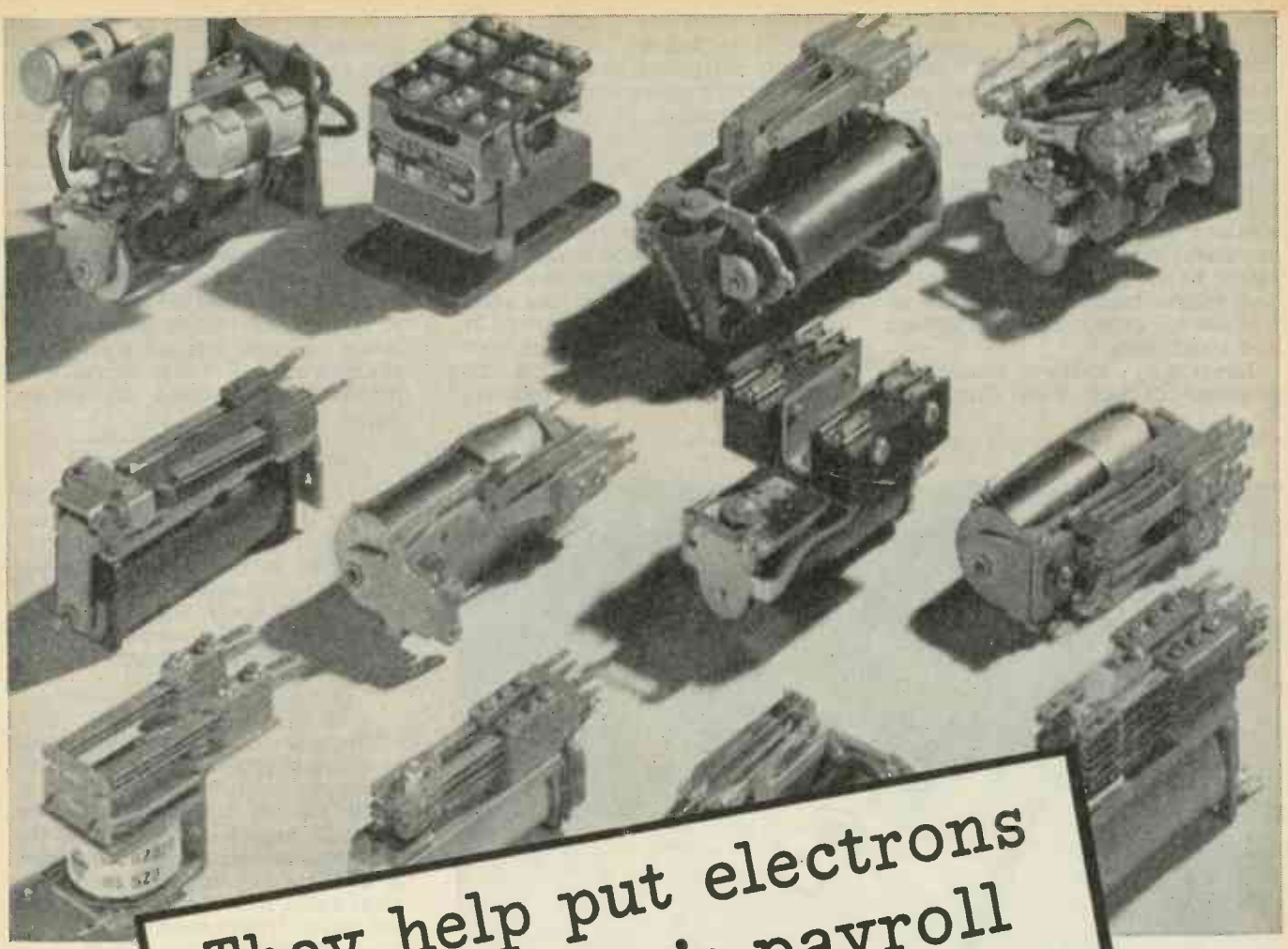
Electrochemical engineer, 4F, 37 years, 10 years' experience supervisory, industrial planning of electrochemical plants, knows organic, inorganic chemistry, including electrolytic oxidation, electroplating, electrocoating, metallurgy. Inclined toward electronics, 1 year practical experience bolstered by recent training. Wants position permitting growth and display of capabilities, salary desired dependent upon opportunity. Address Box E17, "Electronic Industries."

IRE-RMA MEETING

(*Continued from page* 73)

other cases, the losses are excessively large if voltages larger than a few volts RMS are applied. The capacitance is directly affected by the polarity and amplitude of impressed dc voltages, and also exhibits rather large variations of capacity with time, in one case dropping of 10 per cent in a year.

While these super-dielectrics do not possess the characteristics which will make them useful in all radio services, the studies are opening up new concepts in the matter of dielectric phenomena and more useful applications of the effects so discovered may bring about worthwhile improvements in capacitors. Meanwhile, many ceramic compounds having dielectric constants of a less ambitious magnitude are finding many uses. (*Turn page*)



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WITH the aid of Automatic Electric relays and other control devices, electronic science is helping industry do a thousand new jobs—speeding new electronic ideas through the laboratory and putting them to practical use on the production line.

Automatic Electric field engineers, armed with the technique which comes from long experience in electrical control applications, are working daily with the makers of electronic devices of every kind—offering time-saving suggestions for the selection of the right controls for each job.

Let us pool our knowledge with yours. First step is to get a copy of the Automatic Electric catalog of control devices. Then, if you would like competent help in selecting the right combination for your needs, call in our field engineer. His recommendations will save you time and money.

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IN CANADA: AUTOMATIC ELECTRIC (CANADA) LIMITED, TORONTO

MUSCLES FOR  THE MIRACLES OF ELECTRONICS

A report of the work of the Rochester C. of C. War Research Committee, a non-profit group made up of many technical and scientifically trained men who are cooperating in the study of certain military equipment problems that they have heard about, was presented by K. C. D. Hickman of Distillation Products Inc. This work as conducted in the spirit of patriotism, as the hobby of its members, and suggestions were given as to how similar groups could be started and conducted.

Lawrence C. F. Horle, Consulting Engineer of New York City, presented a report on the work of the RMA Data Bureau, in correlating and standardizing the products of manufacture wherever possible, and the maintenance of type designations and coding, so that similar characteristics can be expected from items from all manufacturers, which have the same code designations. This work has been particularly devoted to tube designations.

A report on the relative characteristics of hf ceramic insulations was given by Ralton Russel, Jr., with L. J. Berberich, both of Westinghouse Electric & Mfg. Co. The difficulties of making measurements of losses on ceramic and similar materials were attributed to the use of foil electrodes with a petroleum film binder. Fused on silver coatings were recommended.

A simplification of the problems attending the design of if transformers to meet actual communication needs was disclosed by J. E. Maynard of the General Electric Co. His plan is based on the physical interpretation of a family of selectivity curves which were shown to cover all practical problems relating to radio frequency amplifier characteristics. These curves were prepared by plotting on log-log paper the relation:

$$U = \frac{\sqrt{(1+C^2-S^2)^2+4S^2}}{1+C^2}$$

where: U is an attenuation factor, representing the reduction ratio between the output at the resonance frequency and some other signal of an equal intensity. Here C is a factor related to the coupling and S is a function of frequency, i.e.:

$$S = 2\Delta f Q / f_0$$

The convention was terminated by a dinner presided over by George Lewis of the International Tel. & Radio Co., at which some of the scientific papers left over from the technical sessions were delivered, in addition to numerous non-technical talks which served to round out this fifteenth meeting at Rochester. In the first class, a talk about measurements with a Lurometer by Krahl of Sylvania might be mentioned. A capacity crowd attended the dinner. Throughout the convention, a variety of captured enemy communication equipment was exhibited by the Signal Corps. The items shown included:

ITALIAN

Pedal generator for supplying power to operate field radio.

Six-line cordless switchboard used at infantry division headquarters.

Tank radio set copied from German model.

Tank radio set interchangeable with German equipment.

Artillery pack transceiver for infantry uses.

GERMAN

Field line telephone set.

Charger for tank batteries.

Frequency meter.

Commercial type receiver for entertainment and propaganda.

Medium frequency armored car set used in reconnaissance.

Complete bomber installation from an HE-111 bomber-fighter.

Infantry pack transceiver.

JAPANESE

One-man pack transceiver.

Portable transmitter-receiver.

Pack transceiver.

MORE POWER TO ELECTRONICS AT WAR . . .

A high-powered Machlett x-ray tube with rotating anode on internal vacuum bearings. Operating voltage, 100 kilovolts; instantaneous loading capacity, approximately 50 kilowatts.

The role of the leading
X-RAY TUBE MAKER

The war program has led to the development of wonderful new electronic devices for waging war. The successful operation of these devices depends on an adequate supply of the necessary electron tubes—not just the common garden varieties of radio tubes, large numbers of which are also required, but amazingly intricate, high-powered new tubes.

Where can the enormous quantities of these tubes, such as the radio tube industry has never produced, be obtained? A large part of the answer to this question is being provided by the leading x-ray tube manufacturer. X-ray tubes are the only form of electronic tubes of comparable power characteristics and intricacy which have been commercially produced in large quantities. High operating voltages (50,000 volts upward into the millions), high power requirements (up to 50 kilowatts instantaneous demand), are commonplace to the x-ray industry. In this industry, likewise, tube production is the keystone. Only an exceedingly few organizations have developed the necessary skills and techniques.

Of these few, one leader, the Machlett Laboratories, America's earliest and today's largest producer of x-ray tubes, has loaned a part of its technical skill, has developed enormous additional productive capacity, to break the bottleneck in tubes for the government's wartime electronics program.

MACHLETT
Laboratories Inc.

THE LARGEST PRODUCER OF X-RAY TUBES

SPRINGDALE CONNECTICUT

POWER TUBE DIVISION: NORWALK, CONN.

CALIBRATING SPRINGS

(*Continued from page* 99)

voltages 120 degs. leading and lagging the shifted R-Y phase voltage as shown in the vector diagrams.

The push-push amplifier (Fig. 5) operates in a manner similar to the preamplifier stage, but uses the voltage across the output transformer secondary for a signal voltage. The grids are connected phase-opposed, and the tubes are biased class C near cut-off. Since the plates are connected in parallel, a reversal of phase of the input signal does not cause a reversal of polarity of the voltage across the plate load resistance of this stage. The condenser C-4 again here does the integrating of the plate current pulses. (See Fig. 5.)

In Fig. 6, the thyratron grid is biased negatively (by the preceeding stage plate-load voltage) to above or below the firing threshold as the signal voltage dictates. However, if the grid voltage should drop to a low value before the plate voltage (across C-5) has increased to a sufficient value, the firing will be delayed until the charging is completed.

In this application it was found that under the conditions of plate-voltage maximum being reached before grid-voltage minimum occurred, neither the threshold bias voltage nor the firing time-interval were the same as for the reversed succession, i.e., grid-voltage minimum preceding plate-voltage maximum, due in part to tube and condenser leakage, and in part to the innate characteristics of the circuit.

Since, from the viewpoint of precision sorting, it was always desirable to have the three-phase motor at rest before spring release, the charging rate was set excessively low to delay the plate voltage maximum until after the thyratron bias was a minimum. It was not feasible to apply the thyratron dc bias also to a charging-rate limiter tube (for C-5 current). The circuit (Fig. 7) therefore produced faster production sorting.

In this circuit the 400-cycle ac output voltage from the power amplifier is applied through transformer T-4 to a triode which biases itself by grid rectification to near-cut-off allowing only a very small

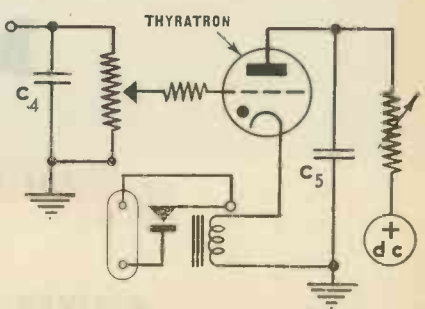


Fig. 6.

BLILEY CRYSTALS
RIDE WITH THE SCR-299
Built by hallicrafters

ONE of the outstanding achievements in wartime radio transmitter design is the SCR-299. Serving equally well as a mobile or stationary radio station, this now famous equipment is doing a real job on our battle fronts.

This war is run by radio. The vital importance of maintaining reliable communications necessitates the selection of quartz crystal units that are accurate and dependable. Bliley Crystals are engineered for service . . . they are used in all branches of military communications and are, of course, supplied for the SCR-299.

BACK THE ATTACK WITH WAR BONDS

BLILEY ELECTRIC CO., ERIE, PA.

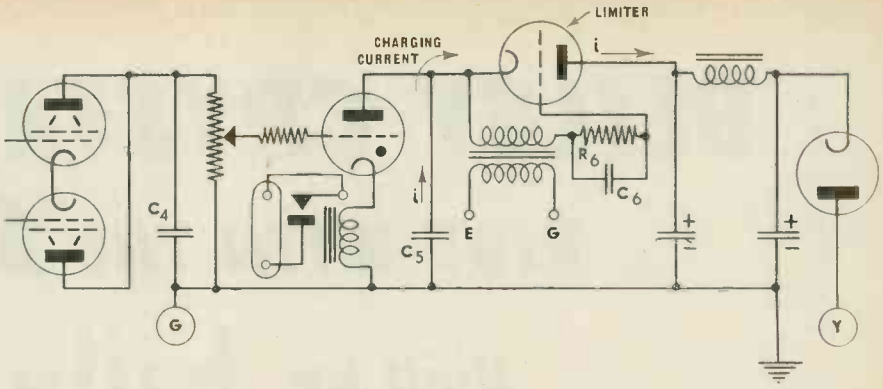


Fig. 7

charging current rate until the power amplifier output voltage goes to zero. The tube bias then drops, the tube resistance decreases, and the charging rate rises rapidly. Additional lag may be obtained by raising the C-6-R-6 product.

The spring sorting mechanism and associated electronic control has sorted to date over a million and a quarter springs uneventfully. The ratio of present machine production rate over manual is about 1000 per cent. The precision is equal or better since there is no human error in the actual sorting action. No better proof is needed that this electronic application is a successful one.

Dogs of War!

Talk about dogs of war! WJZ has them—eight of the fiercest protectors of property that ever drooled at the sight of even a thin editor's legs. They are chained close to the bases of the various towers grouped around the Blue's key transmitter tower that up to a short time ago reached up 640 ft. toward the stratosphere over Bound Brook, N. J. There's a Labrador Retriever, a Great Dane and half a dozen husky and always hungry German Shepherds. Only one of the guards, the one charged with feeding the brutes, dares go within chain length of the dogs. Between them they eat about 12 lbs. of meat a day, in addition to a breakfast snack of bread, cereal, dog biscuits and any intruders who happen near enough.

FLUX GATE COMPASS

(*Continued from page* 95)

made, its dimensions, the value of the exciting current, and the number of turns in the primary windings are so chosen that the core is entirely saturated whenever the excitation rises toward a peak, twice for each cycle of the current. At these points of saturation, no further magnetic effects can be produced in the core by the exciting current, the earth's magnetic field, or any other electric or magnetic influence.

At all other times, whenever the exciting current falls toward zero as it changes in direction, outside magnetic influences are free to produce an effect in the Flux Gate core. At such instants, the earth's magnetic field flows through the core, and, as it does so, electrical effects are induced in the secondary windings of the Flux Gate. As a result, voltages differing in value and dependent for their values on the direction in which the Flux Gate element is held with reference to the earth's field, are set up at the three points on the Flux Gate from which leads are taken. The voltages rise, fall, reverse polarity, and rise and fall again as the earth's magnetic field is permitted to pass through the Flux Gate core. Their frequency is twice that of the exciting current.

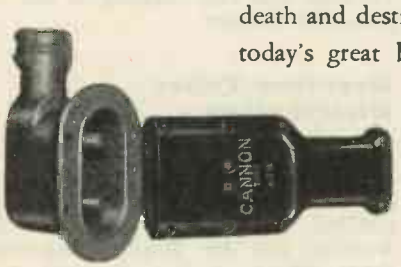
The three leads from the Flux Gate are passed, through a distributing panel on the amplifier, to the three stator windings of an Autosyn in the master indicator.

The Autosyn consists of a three-phase, "Y" connected, stator within which turns a single-phase, two-pole rotor. When interconnected with the Flux Gate, the three voltages set up on the Flux Gate are reproduced on the stator of the Autosyn. This results in the creation of an oscillating magnetic field, within the Autosyn, whose direction at all times is dependent upon the angle the Flux Gate makes with the earth's magnetic field. Consequently, there is induced, in the rotor of the Autosyn, a signal which is dependent upon

In this war of many fronts, half-ton block busters are lifted by winch and motor into the yawning bellies of giant bombers . . . to spread death and destruction on our axis enemies. But today's great bombers, destruction bent, may seem puny in the light of tomorrow's aircraft, pursuing peacetime missions.

Great loads . . . entire boxcars in fact, may be the given load of aircraft in future peacetime years. And whether it's a carload of broccoli from California, a boxcar of bananas from the Tropics or pineapples from Hawaii . . . the energy expended in loading, lifting and also in flying will unquestionably be dependent in part on electrical circuits.

And wherever electrical circuits are involved, there you will more than likely find Cannon Connectors. For Cannon Connectors are used wherever electrical connections must be made quickly and with absolute certainty . . . in planes, tanks, communications, motion picture studios and hundreds of other civilian and military uses.



The two Cannon battery connectors above are a part of the complete line as shown in Cannon's latest Battery Connector Bulletin. Write today on your business letterhead for a copy.

BUY U. S. WAR BONDS AND STAMPS

ARMY E NAVY

CANNON ELECTRIC

Cannon Electric Development Company, Los Angeles, California

Canadian Factory and Engineering Office: Cannon Electric Company, Limited, Toronto

REPRESENTATIVES IN PRINCIPAL CITIES — CONSULT YOUR LOCAL TELEPHONE BOOK

Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

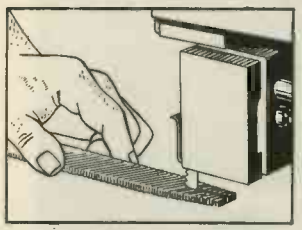
Hard Steels Cut by Heat Generated by Super High Saw Speeds

Ordinary band-saws, when operated at unbelievable high speeds up to 12,000 feet per minute, cut through hard steels and alloys by heat generated from the friction of the saw against the metal to be cut. The cutting effect is more that of burning through the metal than actual cutting. The heat generated is sufficient to melt or burn out the metal in the saw cut but not enough to draw the temper on the sides.

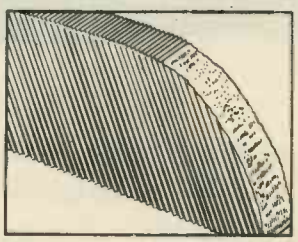
The hardness of either saw or metal to be cut is of little importance. Thin metal sheets are cut like paper, and plates up to one inch in thickness can be cut at speeds of ten inches per minute.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for Victory.

You can get complete information about this method from Bell Aircraft Corporation, Buffalo, New York.



Proof of ability of new method to cut hard materials is demonstrated by operator cutting a file.



The temper of curve cut section shown above is unaffected.

X-60

the angle with which the rotor cuts the field. At all angles, other than one perpendicular to the field, a signal will be induced. At the perpendicular or null position, however, no effect will be produced.

One phase of the induction motor in the master indicator (known as the fixed phase), is constantly excited by an alternating current at a frequency equal to the output frequency of the Flux Gate supplied by a second oscillator circuit in the amplifier.

The signal induced in the rotor of the Autosyn is carried to the amplifier. Within the amplifier it is stepped up in order to provide sufficient power to supply the second (variable) phase of the induction motor. The induction motor, through a gear train, is made to turn the rotor of the Autosyn. It will, therefore, do this until it has brought the rotor into a position perpendicular to the magnetic field within the Autosyn.

Since the rotor can pick up no signal at this point, the amplifier will receive no current, and, as a result, supply no power to the second phase of the induction motor. It is at this point that the induction motor and the movement of the rotor of the Autosyn stop. The position in which it stops will be dependent on the position of the Flux Gate with reference to the earth's magnetic field. Therefore, it is to the rotor of the Autosyn that the indicating system is geared. Correction for the effects of the ship's magnetic field, known as deviation, is introduced in the following manner:

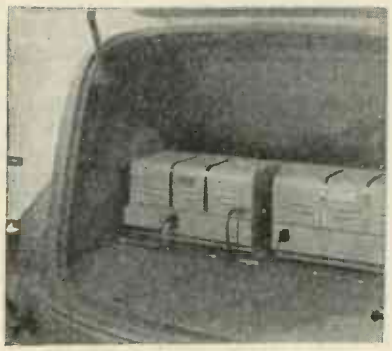
An uncorrected dial, visible through the cut out window in the dial of the master indicator, is geared to the rotor of the Autosyn. This dial, reading from 0 deg. to 360 deg., gives the uncorrected heading of the ship. By means of a cam follower riding on a circular cam strip, a spread can be introduced between this uncorrected compass reading and the reading of the indicating pointer.

Receiver Tubes Distribution

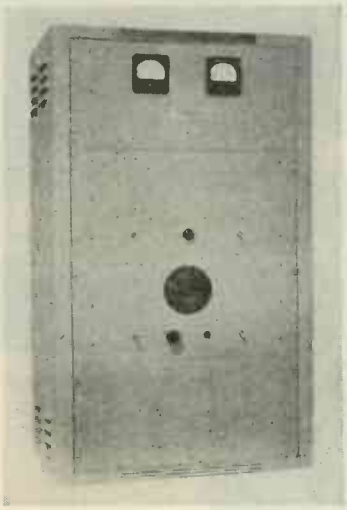
A plan for the interchange of home receiver tube types among manufacturers carrying on limited civilian production was recently worked out by Frank McIntosh, WPB Chief of the Foreign and Domestic Branch of the Radio and Radar Division, as the result of a conference with the Division's Electronic Distributors Committee. The scheme will mean, it is anticipated, a more balanced distribution of home receiver tubes; the present production of civilian tubes is felt to be sufficient for satisfying essential replacements in home receivers.

RADIOTELEPHONE EQUIPMENT

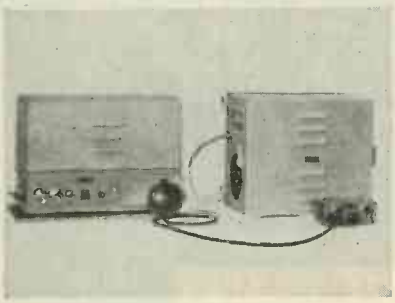
FOR *Your* APPLICATION



Complete 22 Watt High Frequency Mobile Installation

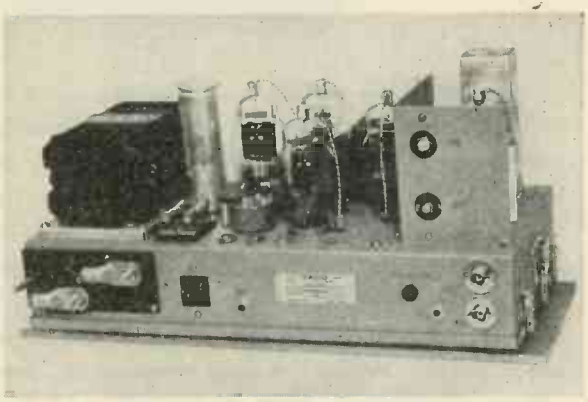


★ ★ ★ ★ ★ ★ Complete 50 Watt Central Station Installation. ★ ★ ★ ★ ★ ★



Type 11X Receiver and PTL-10X Transmitter for Mobile Applications.

Type PRS-9X, 30-40 MC Mobile Receiver with Dust Cover Removed.



Type PTS-22X, 30-40 MC Mobile Transmitter with Dust Cover Removed.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

PARTIAL LIST OF TYPICAL PRODUCTION MODELS

SERIES 17	10 Watt Multi-Channel Transmitter, Receiver and Power Supply in 8¾" x 15" x 11" Cabinet. 6 and 12 Volt DC and 117 Volt AC Models available.
SERIES 26	20 Watt Multi-Channel Transmitter and Receiver available for operation from 6, 12, 32 and 110 Volts DC or 117 Volts AC.
SERIES 56	50 Watt Multi-Channel Transmitter and Receiver available for operation from 12, 32 and 110 Volts DC or 117 Volts AC.
SERIES 6	Includes Tunable and Multi-Channel Fixed Tuned Receivers for Mobile, Marine or Central Station application.
TYPE 11A	Single Frequency Crystal Controlled Station Receiver for frequency ranges up to 8,000 KC.
TYPE 11X	Crystal Controlled Mobile Receiver, for frequency ranges up to 8,000 KC.
TYPE PTL-10X	Instant Heating 10 Watt Mobile Transmitter, for frequency ranges up to 8,000 KC.
TYPE PTL-22X	Instant Heating 22 Watt Mobile Transmitter for frequency ranges up to 8,000 KC.
TYPE PTS-22X	Instant Heating 22 Watt Mobile Transmitter, range 30-40 MC.
TYPE PR-9X	Crystal Controlled Mobile Receiver, range 30-40 MC.
TYPE PRS-9A	Crystal Controlled Station Receiver, range 30-40 MC.

WRITE FOR QUOTATION ON STANDARD OR SPECIAL EQUIPMENT YOU REQUIRE!

KAAR ENGINEERING CO.

PALO ALTO, CALIFORNIA

Manufacturers of High Grade Mobile and Central Station Radiotelephone Equipment

Injection Molding

Arnold Brilhart, Ltd., 435 Middleneck Rd., Great Neck, N. Y., has recently published a 4-page bulletin which illustrates and explains their new process for injection molding of component plastic and metal parts.

QUARTZ ORIENTATION

(Continued from page 103)

alignment for X-sections, however, the Y-axis must be vertical in the mounted quartz. To accomplish this the operator may continue to indicate angular rotation of quartz and holder and the mounting operator compensate for the error by setting the quartz 30 deg. either clockwise or counter-clockwise from that indicated angle.

In the alignment, preparatory to cutting Z-sections, the regular routine and equipment as used under "X-sections," may be used by omitting entirely the X-ray operation. However it is advisable when starting to saw Z-sections to check a test cut by X-ray on the 0003-plane.

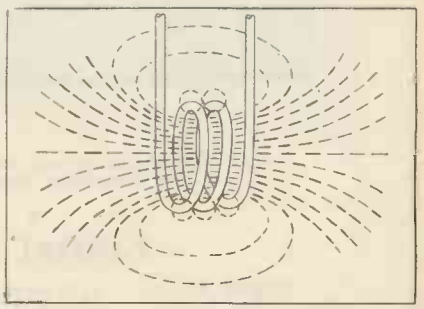
ELECTRONIC HEATING

(Continued from page 81)

placed with I^2N^2 (times a constant) where I equals the coil current and N is the effective number of turns in the coil.

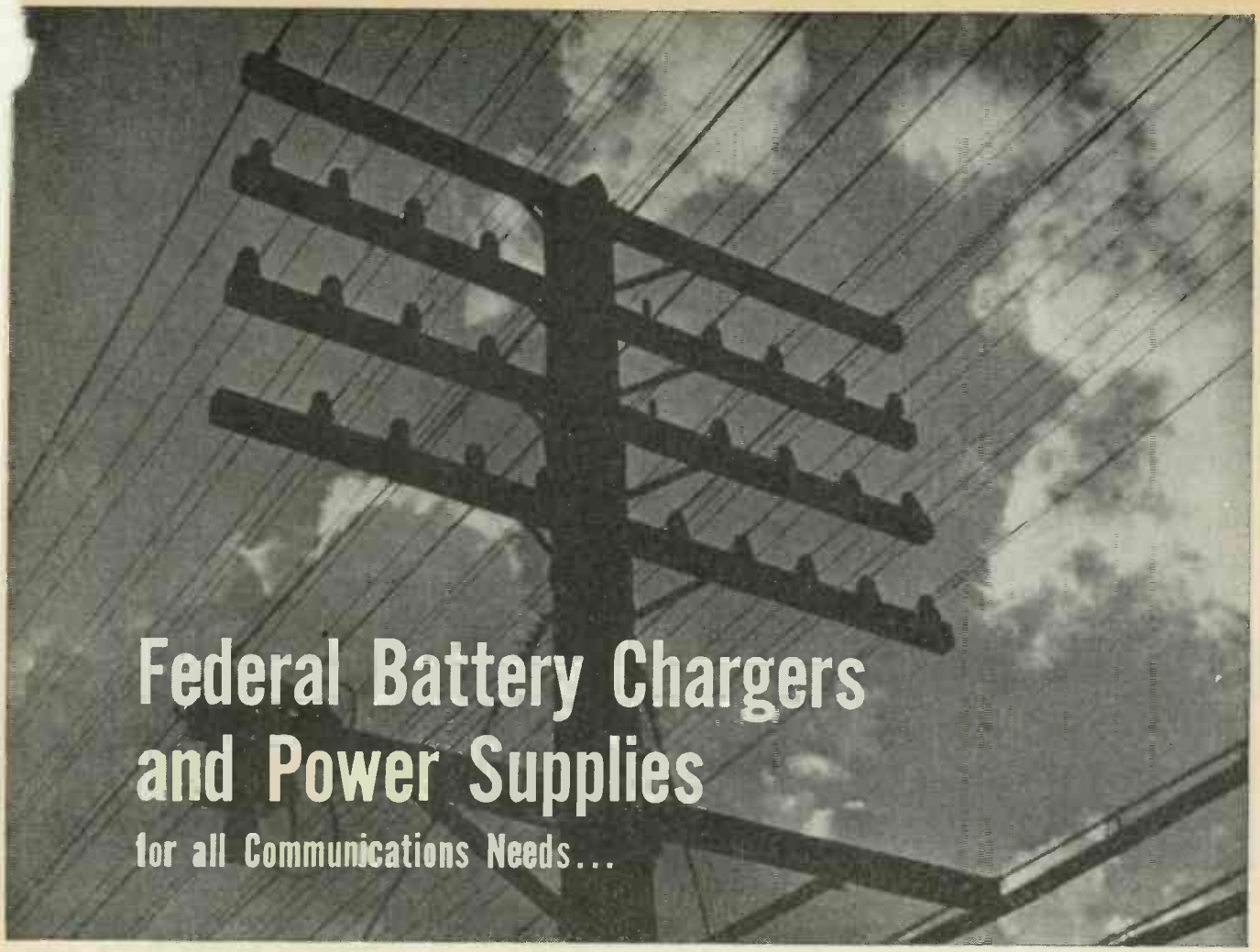
Examining Equations 1, 2, and 3, it can be seen that the rate of heat

(Continued on following page)



Magnetic flux density outside a coil is less than within it

E = Applied voltage (R.M.S.)
A = Area of one electrode in sq. inches
C = Capacity in microfarads
p = Depth of heat penetration, assumed to be $\frac{1}{e}$ or 37% of the surface magnitude
K = Dielectric constant
D = Electrode separation in inches
H = Energy required in watt-minutes
f = Frequency in c.p.s.
μ = Permeability of material of charge
Δ P = Power dissipated as eddy currents
P F = Power factor
W = Power loss in watts
ρ = Resistivity of material of charge
S = Specific heat
H_t = Tangential component of magnetic flux at surface of charge
Δ T = Temp. rise in deg. (Fahr.)
W = Weight of material to be heated in pounds



Federal Battery Chargers and Power Supplies

for all Communications Needs...

. . . powered by I. T. & T. Selenium Rectifiers

Typical Automatic Noiseless Telephone Battery Charger

Built for highest efficiency and powered by long-life I. T. & T. Selenium Rectifiers, Federal Battery Chargers and Power Supplies are available in all types and sizes, in a wide range of ratings, to meet every communications requirement — telephone, telegraph, signaling and alarm systems. The many types include automatic regulated noiseless chargers and battery eliminators, manually operated units and non-filtered types.

Federal Battery Chargers and Power Supplies provide important operating advantages: no routine maintenance; no radio interference; hum-free output; high overall efficiency. They are for use on commercial AC circuits; they are rugged and compact and have a minimum of critical materials.

The "power unit"—the I.T.&T. Selenium Rectifier introduced and manufactured by Federal — is standard in the electrical field. Its freedom from moving parts, its wide temperature operating range, its capacity for overload and unlimited life, assure stable and satisfactory performance. *Consulting engineering services available from Department F.*

Federal Telephone and Radio Corporation

SELENIUM RECTIFIER DIVISION

AN IT&T ASSOCIATE

1000 Passaic Ave.
East Newark, New Jersey

(1) $$\Delta P = \frac{H_t^2 \sqrt{\rho \mu f}}{8\pi}$$

(2) $$p = \frac{1}{2\pi} \frac{\rho}{\mu f}$$

(3) (combining [1] and [2]) $$\Delta P = \frac{H_t^2 \rho}{16\pi^2 p}$$

(4) $$C = \frac{2248AK}{10^{10} d}$$

(for parallel plates)

(5) $$W = \frac{2\pi f C E^2 \text{ P.F.}}{10^8}$$

(6) $$H = \frac{MS \Delta T \ 10^3}{56.9}$$

input is directly proportional to the square root of the frequency and of the resistivity. The permeability, which is a measure of the magnetic properties of the metal, is unity for all non-magnetic materials but can be of major importance when heating magnetic metals below the "curie temperature" (1420 deg. F. for low-carbon steel) above which magnetic properties effectively disappear.

Dielectric heating theory

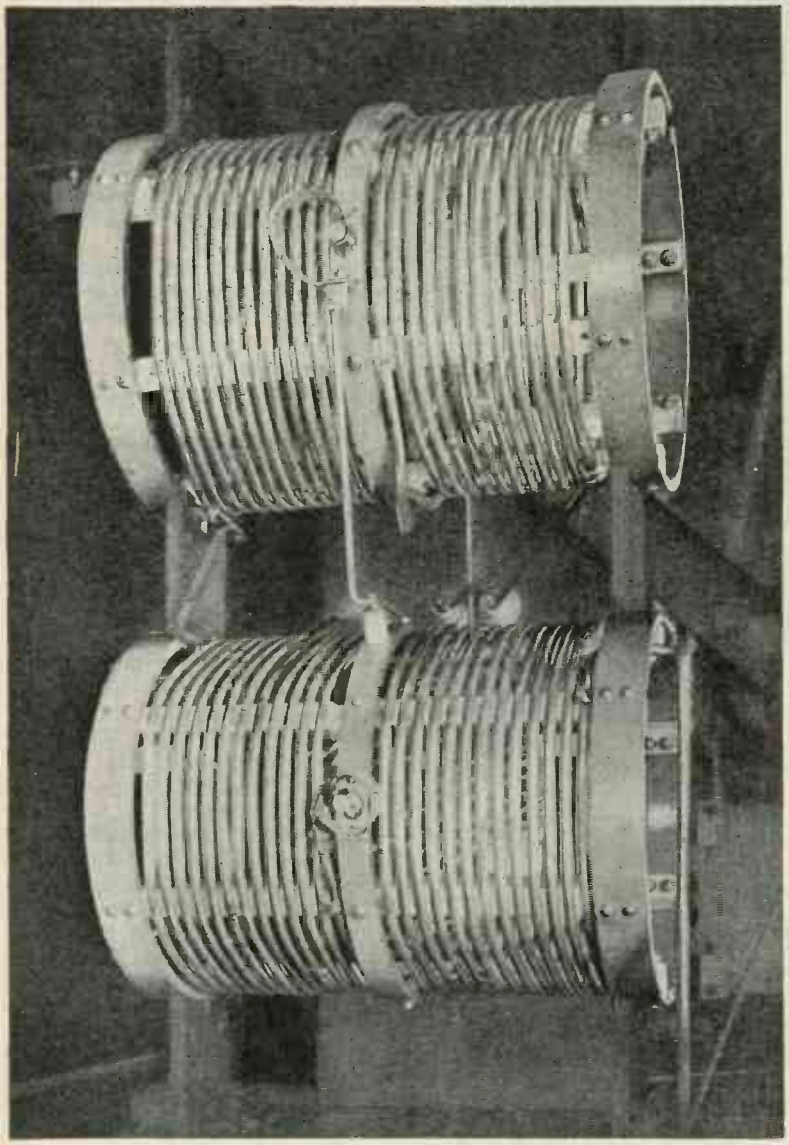
Dielectric heating is the name generally applied to the generation of heat in non-conducting materials by their losses when subjected to an alternating electric field. The term "electrostatic heating" is a misnomer, since it is impossible to generate heat with an electrostatic field.

All capacitors in general use in industry for power-factor correction, motor starting, etc., are imperfect in that heat is generated when an alternating voltage is applied. While some of this heat is caused by resistance losses in the leads, the remainder is generated within the insulating material itself and is uniform throughout the mass.

The cause of this loss is thought to arise from two sources—actual current flow through the material because of the potential gradient existing across it, and the dielectric hysteresis which is somewhat analogous to magnetic hysteresis in iron. In practice, no effort is made to differentiate between them, and the ratio of the total loss to the total impressed volt-amperes is known as the power factor of the material. This loss is directly proportional to the impressed volt-amperes. Since the impedance of a capacitor drops as the frequency is increased, the applied volt-

How Good

are Bunnell Transmitters?



*W*ell, we don't make the biggest transmitters. And we don't make the most.

But every one we build is especially designed for its special purpose. And every detail of every part of every transmitter must be meticulously correct.

Call it idealism. Or perfectionalism. It's good business for us. And better performance for you!

JB
SINCE 1878

J. H. BUNNELL *& Co.*

GENERAL OFFICES: 215 Fulton St., New York City · FACTORIES at Brooklyn, N. Y.

Designing Engineers and Manufacturers of:

ELECTRONIC INDUSTRIAL DEVICES ★ INDUSTRIAL RECTIFIERS
HIGH POWER RADIO FREQUENCY GENERATORS ★ TRANSMITTERS
RECEIVERS ★ AUTOMATIC TELEGRAPH EQUIPMENT

amperage, and thus the losses, are directly proportional to the frequency at any given voltage.

Unlike induction heating, the heat loss in any insulating material due to dielectric losses can be calculated to a fair degree of accuracy. When an alternating voltage is applied to any two electrodes, an alternating potential gradient exists in the intervening space. If these electrodes are flat, parallel plates and the insulating material fills the volume between them as is most generally the case, the total capacitance can be calculated. From the capacitance, voltage, power factor and frequency, the impressed volt-amperes give the heat generated in watts. Equations 4, 5 and 6 can be used for estimating purposes.

In applying these equations, the following precautions should be observed:

1. The power factor of most materials varies with frequency and temperature. Thus, the power factor used in the above equations should be measured at or near the operating frequency and at a known temperature.

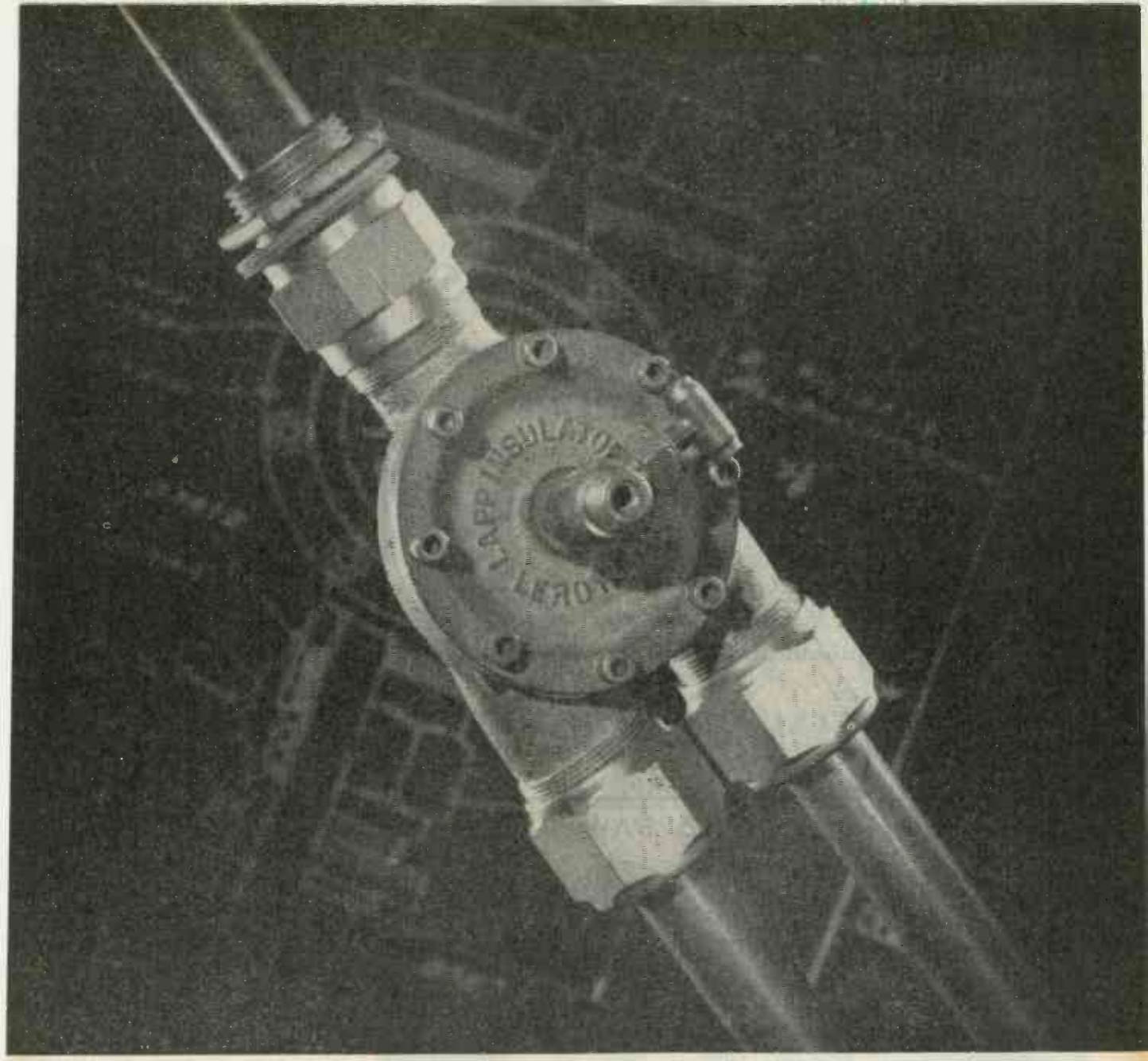
2. The dielectric constant changes relatively slowly with frequency and temperature, and can be taken from published tables with fair accuracy.

3. The equations hold only for uniform electric fields—and since the field at the edges of the electrodes is always distorted, a good approximation is possible only when the diameter is large compared to the distance between plates. The use of plates somewhat larger than the material to be heated will reduce non-uniform heating at the edges.

4. Because of corona and arcing effects, the maximum voltage that can safely be applied to any electrodes is approximately 14 to 15 kv rms, with 2 to 3 kv rms per in. of separation being the maximum allowable for smaller spacings.

An analysis of the above equations will, for some materials, indicate the desirability of very high frequencies. However, the tubes and equipment commercially available at this time limit the maximum frequencies obtainable to approximately 100 megacycles for power outputs up to 100 watts; 30 megacycles for power outputs to 40 kw; and 4 megacycles for the higher power ratings.

At the higher frequencies, the maximum electrode dimensions must be limited to less than one-eighth of a wavelength to avoid standing waves, which will cause non-uniform heating. The charge to be heated must be of uniform analysis throughout and must contact each plate. An air gap between the electrodes and the work results in a series-capacitor effect and in-



Electronic Parts: ENGINEERING AND PRODUCTION

The gadget above is a junction box for a co-axial gas-filled transmission line. It is one of a series of coupling units, end seals and other fittings for high-frequency transmission—designed and built by Lapp.

To this type of construction, Lapp brings several innovations and improvements. For example, such a line from Lapp parts is genuinely leak-proof. Every gasket is under spring loading, so there's no leakage created by vibration or thermal change.

Whether or not you're interested in gas-filled transmission lines, you ought to know about Lapp. Here is an organization of engineers and manufacturers with broad basic knowledge of ceramics and their application. With experience in hundreds upon hundreds of special-purpose electronic parts, we have been able countless times to improve performance, or reduce costs, or cut production time through the application of our specialized skills to design and manufacture of parts involving porcelain or steatite and associated metal parts.

For quick and efficient assistance on a war production subcontract—or for the competitive advantage Lapp-designed and Lapp-built parts will give to you in the postwar battle—an inquiry to Lapp now may pay you dividends. *Lapp Insulator Co., Inc., LeRoy, N. Y.*

Lapp

ARMY E NAVY

troduces serious errors in the abov equations.

However, it is sometimes desir able to provide an air gap betwee electrodes and the work. In suc cases, the voltages employed mus be much higher to provide the sam potential gradient across the charg as would exist with contact elec trodes.

The dielectric constants for mos materials fall in the range of 2 t 6, but may vary from unity fo gases up to 1000 for some ceramics while the power factors usually li between .02 and .07 but may be a low as .00015 (mica, polystyrene) o as high as .15 (asbestos). Gase and pure water have power factor essentially zero and cannot b heated.

Electronic heating equipmen

A vacuum tube oscillator is ar ideal power source for many induction and dielectric heating applications. However, the original costs and the maintenance costs are definitely higher than for motor-generator equipment, thus limiting their application to those jobs where higher frequencies are advantageous. The very high frequencies required for dielectric heating can be obtained from no other source, but many induction heating applications can be done as well, or better, by using frequencies below 10,000 cycles supplied by motor-generator equipment.

The melting of metals, through heating of large masses for annealing or forging, and the deep surface hardening of shafts and other parts over approximately 2 in. in diameter having no sharp contours are definitely low-frequency applications. But, surface hardening—where a very thin case is required (less than 1/16 in.) or where it is desired to conform to relatively sharp contours—and the heating, in general, of parts less than approximately ½ in. in diameter require the use of the higher frequencies. When work can be done equally well with either type of equipment the deciding factor must be either the ease of application to larger or smaller parts, or the power requirements (electronic heaters are generally more economical below 15 kw).

Electronic heater operation

All G-E electronic heaters for induction heating are provided with four controls which require adjustment for proper operation.

1. The filament voltage control, a rheostat in the primary of the filament transformer. The filament voltage of the 5-kw electronic heater should be maintained within 5 per cent of the

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rated value since it uses thoriated-tungsten filaments and operation outside of that range would seriously reduce the tube life. The 15-kw electronic heater shown uses pure tungsten filaments which should be operated at as low a value as is consistent with proper operation. Too low a filament voltage will result in limiting the plate current and thus the power output obtainable.

2. The coarse power control. A tap switch operating through an auto-transformer to vary the voltage applied to the oscillator. Since the current in the resonant circuit is proportional to the voltage, the power output will thus be varied.

3. The fine power control. A rheostat in the grid circuit of the oscillator increases the dc bias voltage impressed on the grids, and reduces the operating efficiency of the oscillator, and thus the current flowing in the resonant circuit when it is loaded.

4. Output taps to permit use of widely differing coil sizes. These taps are connected directly to the turns of the resonant circuit inductance. Since the frequency and the current in the resonant circuit are functions of the total inductance, it is advisable to maintain it at approximately the correct value. If the heater coil is large, less of the internal inductance is required and vice versa. A mean operating frequency of 550 kc plus or minus 30 kc can easily be maintained by this means. As far as operation of the equipment or the application of it is concerned, a variation of even 100 or 200 kc is unimportant. However, in some cases radio interference may be created by these oscillators, and the frequency band between 501 kc and 560 kc is the least used for communication purposes.

Coil design

It must be borne in mind that the heat generated in a part is entirely due to the magnetic flux created by the inductor coil; only by changing the intensity of the flux pattern at the part, can the loading on the electronic heater be affected. This magnetic flux is directly proportional to the ampere-turns in the coil. Also, since the flux density is greatest at the conductors themselves, diminishing rapidly in the surrounding space, the closer the coil is to the part, the greater will be the loading.

The following notes will aid in coil design, but it must be remembered that because of the complexity of the factors involved, it is necessary in all but the simplest cases to determine the final design by actual trial and error methods.

1. The coil should roughly conform to the shape of the part if no sharp contours need be considered.

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Symmetry is important, i.e., the part should be centered in the coil as far as possible.

2. Sharp contours will heat first because of the concentration of flux and the lack of mass. Thus the coil should be farthest from the part at these points.

3. If dissimilar metals are being heated for brazing, etc., the maximum flux must be concentrated on the slowest heating metal; in general, magnetic steel heats more easily than any other material, with stainless steel, brass, copper and silver following in the order of their resistance.

4. In brazing, the joint should be at the correct temperature before the brazing alloy melts so that it will be drawn into the joint. Thus a concentration of heat on the brazing alloy should be avoided.

5. In hardening, double-bank coils are sometimes necessary because of the current limitations of electronic heaters. However, since the outside layer of turns is far less efficient than the inner layer, such coils should be used only if essential.

6. To obtain uniform heating at the circumference of a disk or bar, rotating the parts is advisable so as to avoid the heating effects of the coil leads.

7. The number and size of the coils that can be used on any equipment is determined by two factors —the power capability of the electronic heater, and the maximum inductance allowable.

In order to obtain a highly concentrated band of heat on a part or to heat zones which are not readily accessible, it is sometimes desirable to use a single-turn coil carrying a high current. Since generally it is not economically feasible to construct electronic heaters with a circulating current in the resonant circuit above approximately 300 amp., it is necessary to resort to output transformers. Obviously, it is impractical to use an iron core, so air core designs must be applied. Thus the coupling between the primary and secondary windings is poor and the overall efficiency is reduced. Furthermore, to accommodate coils of various sizes, it is often necessary for best results to use different turn ratios.

However, such transformers do permit grounding the center point of a coil, which in many cases reduces the maximum voltage to ground. Also, for small coils, the voltage between terminals is lowered. For larger coils, this is not necessarily true; in fact, for some large coils the terminal voltage is actually increased by use of single turn coils.

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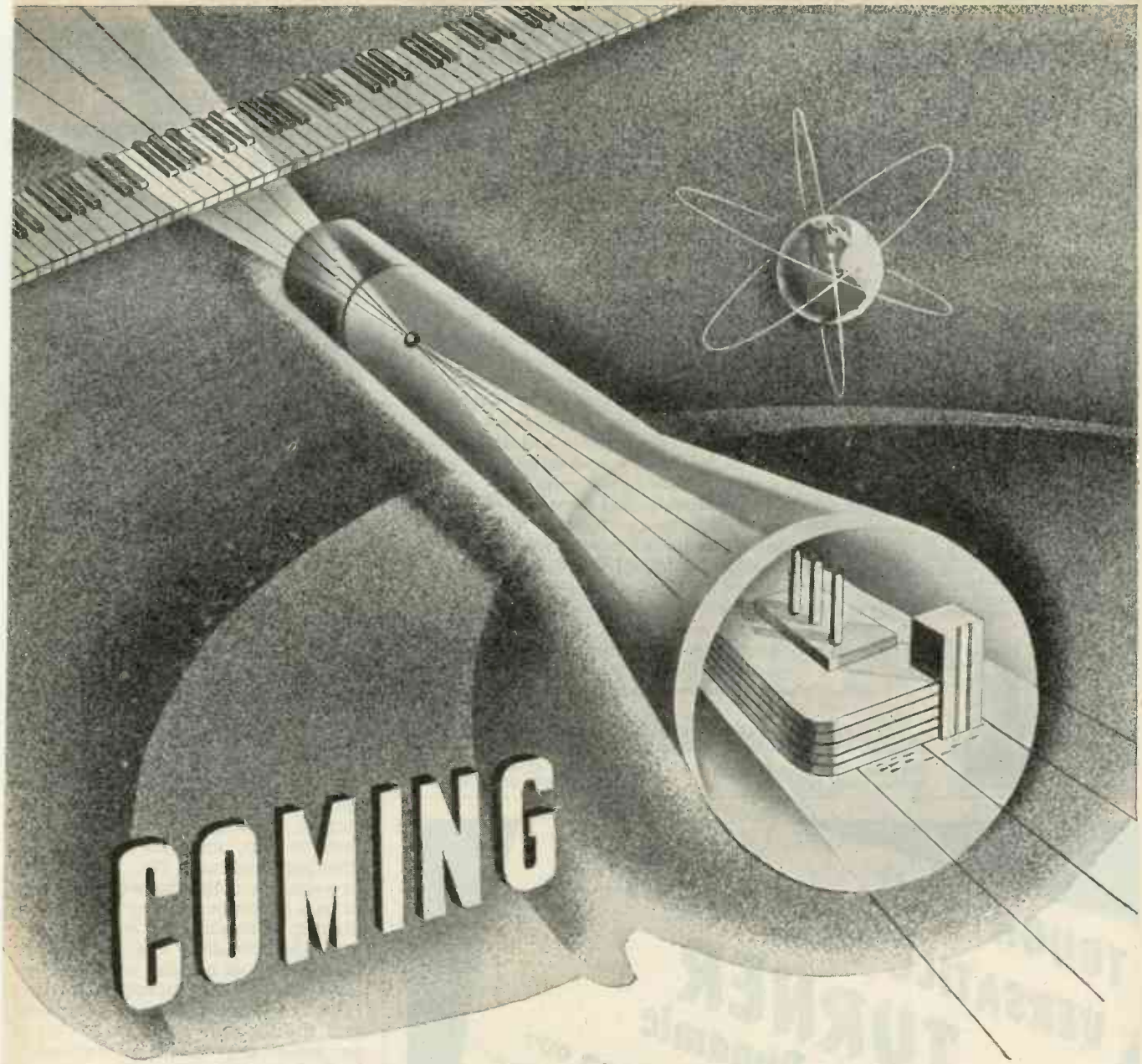

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INDUSTRIAL CONTROLS

(*Continued from page* 101)

Static control used for automatic maintenance of illumination level

matic diagram. In this circuit the filament of tube (1) is heated by the transformer winding (2), and the plate voltage is supplied directly from the winding (3) on the transformer through the coil of relay (11). The phototube (5) circuit receives dc power from the system consisting of the transformer winding (4), the half-wave rectifier (6), and the rectified ac filtering condenser (7). Across the dc voltage existing between the terminals of the condenser is a voltage divider, consisting of resistors (8) and (9), dividing the dc voltage into two equal smaller voltages. Resistor (10) is the phototube loading resistor. Shown between the grid and the filament of the tube (1) is an electrode, called a "cathode," heated by the filament, which is now a "heater." The cathode, in this instance, functions to emit the tube electron stream.

The operation of the circuit is relatively simple. When the phototube is dark, no current flows through resistor (10), and the voltage across this resistor is zero, placing the grid of the tube (1) at the negative terminal level of the dc power supply. Again, since the tube (1) cathode is connected to the midpoint of the voltage divider, the cathode is positive with respect to the negative terminal of the dc supply. Therefore, the grid of tube (1) is negative with respect to the cathode, and no current flows through the tube.

If the phototube (5) is subjected to illumination, a comparatively large current flows through resistor (10), the voltage across this resistor now approximating that existing across the dc power supply

condenser. This places the grid of tube (1) positive with respect to the cathode, and the plate current flow through the tube is accelerated to a large value, magnetizing the core of the relay (11). The relay armature (12) is then attracted to the core of the relay, and the circuit between the terminals (13) and (14) is "closed." It should be observed here that ac power is delivered in half-cycles of alternately opposing polarity, the tube (1) conducting only the positive half-cycles. Thus, tube (1) also functions as a rectifier of alternating current.

In the photo-responsive circuit described, the circuit is arranged to operate a relay or small contactor. It is obvious that the relay coil might be replaced with a solenoid, a solenoid operated valve, the armature of a dc motor, or, in fact, any one of numerous devices designed to convert electrical into mechanical power.

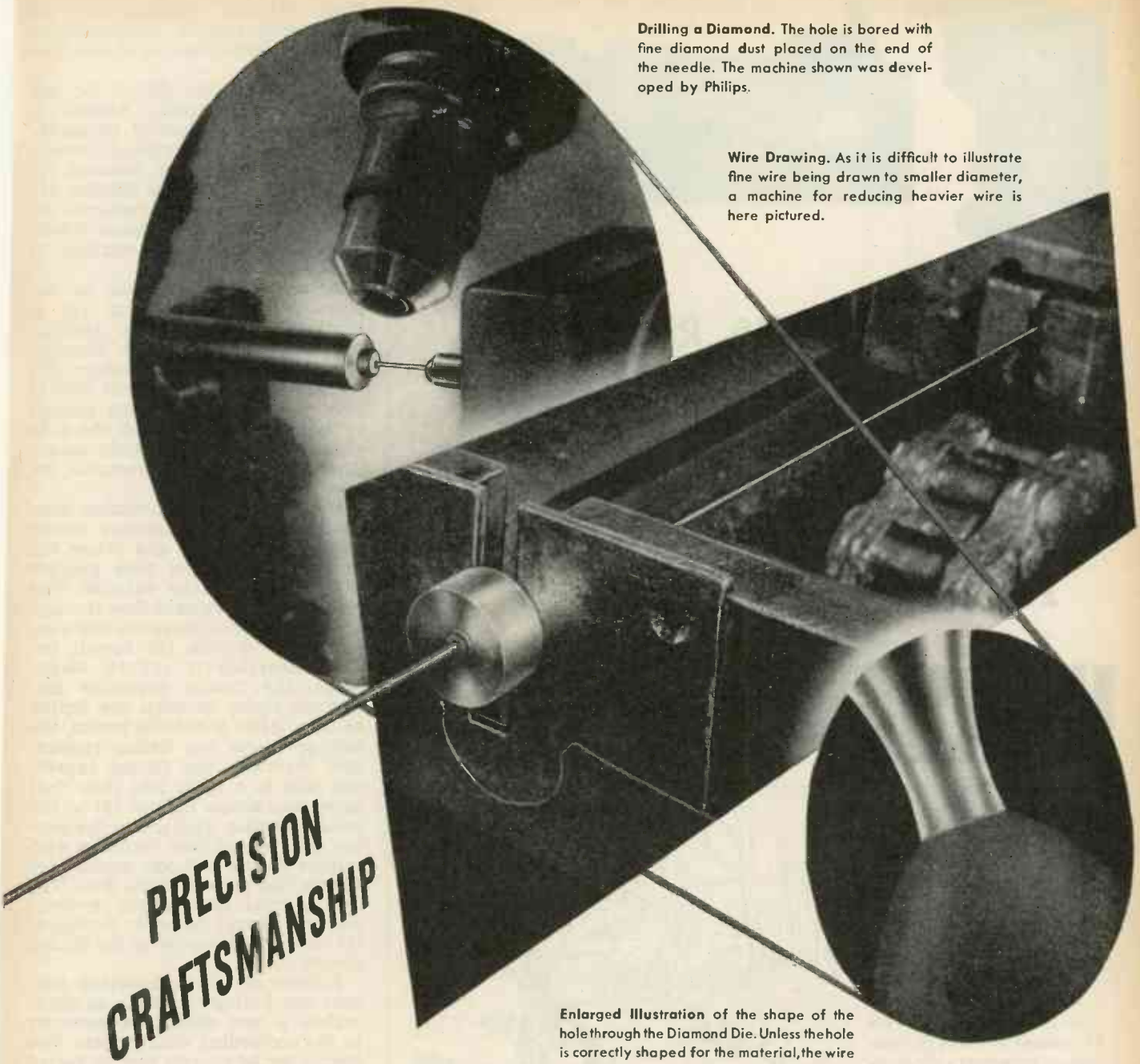
Displacement controls

A simple electronic displacement control is shown in another diagram. It will be seen that this circuit is similar to that of the photo-responsive circuit, except that the phototube is now replaced with the small potentiometer (5), the relay being replaced with the plunger type solenoid (11). Also, a condenser is placed across the operating coil of the solenoid to maintain the solenoid voltage during the negative half-cycle periods when no tube current flows. The tube heater is usually omitted in diagrams of electronic controls.

This circuit operates in much the same manner as the photo-responsive circuit. Moving the sliding contact toward the positive end on the potentiometer resistance element increases the current through the tube, as also through the solenoid operating coil, and the plunger is drawn further into the coil. Conversely, moving the sliding contact to the negative end of the potentiometer resistance element reduces the current passed by the tube, reducing the magnetic pull of the coil of the solenoid.

As a result, spring (17) draws the plunger out of the coil by a proportionate amount. This circuit, then is capable of operating a large solenoid by means of a small potentiometer aided by an electronic control. Applications for electronic displacement controls suggest themselves more naturally than for other electronic devices. This is especially true when a high advantage over the controlled energy is desirable.

In general, electronic controls of the supervisory class are used in the widest variety of applications, and as a consequence are of numerous



Drilling a Diamond. The hole is bored with fine diamond dust placed on the end of the needle. The machine shown was developed by Philips.

Wire Drawing. As it is difficult to illustrate fine wire being drawn to smaller diameter, a machine for reducing heavier wire is here pictured.

PRECISION CRAFTSMANSHIP

Enlarged Illustration of the shape of the hole through the Diamond Die. Unless the hole is correctly shaped for the material, the wire will break when it is drawn through the die.

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types. Timing controls, such as that schematically diagrammed, are quite representative of this type of control.

The foundation circuit for the supervisory electronic system is quite similar to that of photo-responsive and displacement correcting electronic devices. Resistor (5) replaces the phototube loading resistor. Capacitor (2) replaces the phototube itself, and a push-button (10) provides manual starting of the timing operation.

Before the push-button is depressed, timing capacitor (2) is charged to the voltage existing across the voltage divider. No voltage appears across the resistor (5), the timing resistor, and the grid of tube (1) is negative with respect to the cathode, cutting off the tube plate current. Under these conditions, the relay (11) remains inoperative.

Depressing the push-button connects the timing capacitor across the timing resistor, and places the grid of the control tube positive with respect to the cathode. The resulting plate current flow through the control tube energizes the control relay, closing the circuit between terminals (13) and (14). Meanwhile, the timing capacitor discharges slowly through the timing resistor. After a definite period, the voltage across the timing resistor, and therefore the timing capacitor, falls to a value less than that appearing across resistor (9) of the voltage divider. This places the control grid of the tube negative with respect to the cathode, greatly reducing the plate current flow. The control relay then opens, re-opening the circuit between terminals (13) and (14), completing the timing period.

Release of the push-button permits the timing capacitor to accumulate a new charge, preparatory to the succeeding timing cycle. The timing period may be readily varied by adjusting either the capacitor or resistance (5) values.

Dependability factor

The basic forms of electronic devices discussed here educe a salient fact: that any of the three functions illustrated cannot be duplicated practically or economically in any other manner, because of the low parasitic burden that any primary indicating devices must employ. It is this fact which provides the electronic device its advantages in industrial applications.

The question arises as to the dependability or reliability of the electronic device under industrial operating conditions. Although the electronic device is primarily a precision device, it may be subjected to certain industrial conditions

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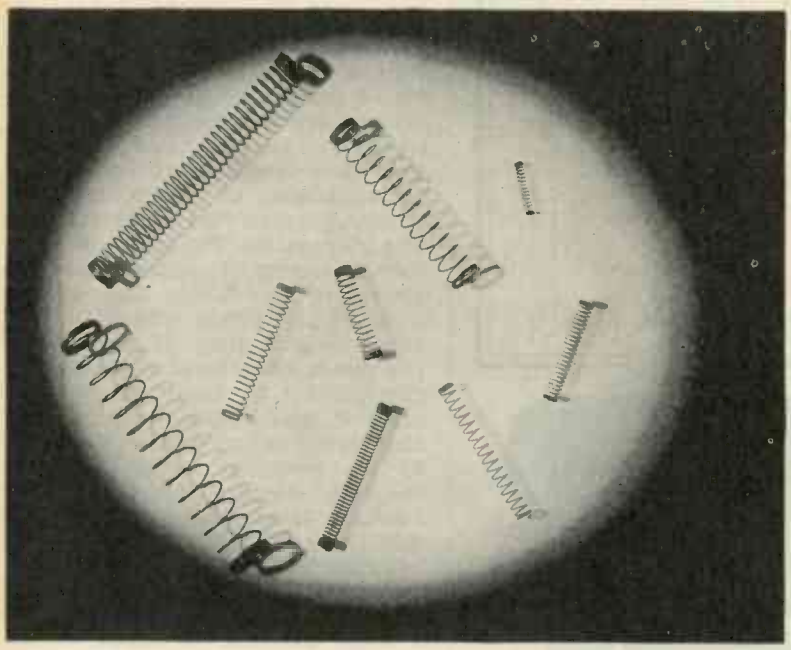

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usually permissible with other industrial types of control devices, since the electronic device is usually specifically designed for operation under such conditions.

Mechanically, the essential portions of the electronic device, with few exceptions, are usually rugged and will withstand severe abuse. However, such components as optical systems, containing lenses, lamps, and phototubes, must be protected against severe mechanical shock to prevent breakage of these vital operating components. Once suitable guards are placed into position to protect these portions of the device from chance impacts, no further mechanical attention need be accorded.

Maintenance factors

Electronic devices are responsive to extremely small voltages. Also, it is a well-known fact that dust and sediment collections, such as are usually encountered in industrial locations, are electro-conductive. Thus, it may be seen that such accumulations of conductive matter may render the electronic device inoperative. The entry of moisture, or conductive vapors, into the system of the device may aggravate the undesirable effects of dust accumulations through decrease of the resistance offered by these accumulations to small voltages. In order to guard against the eventuality accompanying loss of control by the electronic device, it then becomes necessary for the manufacturer to enclose the device so that these conditions will not occur.

Unlike the usual electrical control, the electronic device cannot operate properly in proximity to a drop hammer, or other device capable of transmitting sharp physical impulses. Such shocks are transmitted to the sensitive system of the electronic device, including the tube elements. The resulting motion between these subelements is usually sufficient to cause spurious operation of the device from the small potentials thus developed between circuit elements. Briefly, severe mechanical vibration is usually sufficient to cause undesirable operations of the electronic device. Special precautions are taken to prevent disturbances of the delicate electrical equilibrium within electronic devices by vibration or mechanical shock.

Once the electronic device has been properly manufactured and installed, reliability of operation is assured that will equal any other form of control or indication, despite the higher precision and sensitivity of the electronic device.

Proper installation includes operation of the device with stable input power conditions. Tube losses

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may be traced directly to undue variations in the power supply line potential. The modern industrial electronic tube is capable of a comparatively long life if not subjected to frequent and excessive power variations. Stable power input assures maintenance of the electrical equilibrium necessary for the proper operation of the device.

Where absolute dependability in operation is required, an electronic device can sometimes be supplied in which tubes are operated in conjunction with parallel idling tubes, so that should one of the small amplifier tubes become inoperative, the device continues to regulate by virtue of the remaining tube. This is equally true of the large thyratron tubes immediately behind the small amplifier tubes in the photograph. Loss of two of these tubes will not disrupt the operation of the regulator. This principle is applied to advantage in many forms of the electronic device.

Eliminating routine

Since the thorough dependability has been established, opportunities for the application of this device suggest themselves, from time to time. Of these, the most interesting are those involving elimination of routine or repetitive operations, such as manual correction of speed, voltage, or temperature; counting, totalizing, or sorting; routine production inspections; and, finally, routine machine operation. Each application is characterized by the permanency of the operation under consideration.

An exemplary case involves the routine task of filling glass containers to a required level with a given end product, where the container capacity is subject to change. This operation may be subjected to automatic electronic control, and speeded to the point at which the container contents, or the containers themselves, tend to leave the conveyor. The result of this application of electronics eliminates a semi-skilled operator and speeds up production. Increases in production speeds are a by-product of routine production problem applications, since the electronic device is inherently suited to high speed operation.

Applications involving the high precision of electronics include those wherein a given machine operator cannot maintain proper conditions for production at increased speed, where precision operations are subject to wide alterations, or where product handling is subject to varying conditions. A striking example of such an application is the manipulation of a plastic processing press, of the type applied in the molding of small objects from synthetic resins. The press must

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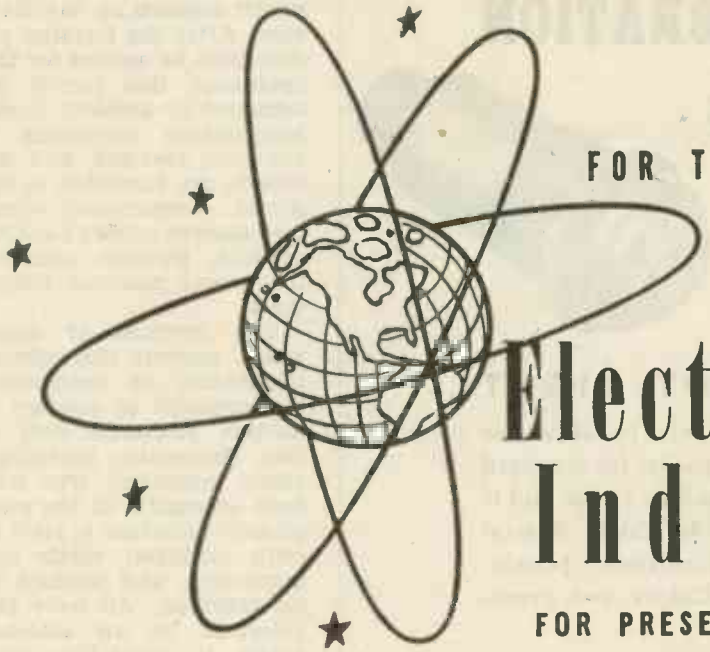

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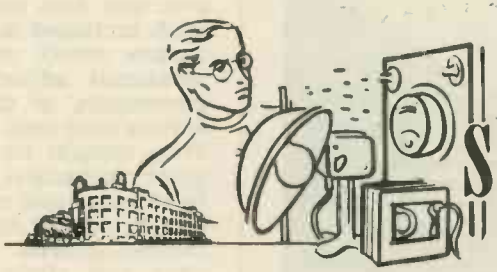

ELECTRONIC DIVISION

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open the dies for the charging operation. Once charged, the dies must close for the forming period, which depends on the die temperature. After the forming period, the dies must be opened for the gassing operation, this period being determined by ambient humidity and temperature conditions. The dies are then reclosed, and the plastic objects are subjected to the setting period. A supervisory electronic device assures proper handling of the product, through maintenance of the proper machine timing operations.

The myriads of opportunities which present themselves for the application of electronics toward improvement in product and production procedure defy enumeration. Inspection operations of the visual inspection type which have been successful in the past include pinhole detection in steel and other strip products; bottle cap gasket inspection; and product inspection for labelling. All have been characterized by an astounding increase in inspection speeds. Included in this field may be such operations as newspaper counting and package sorting.

Displacement applications

Displacement device applications range from speed and temperature controls, paper edge and product wrapping controls, to the maintenance of proper tension on rubber strip passing between processing rolls. These, also, resulted in higher production speeds through elimination of inconsistencies and lack of certainties in machine adjustments. It is also obvious that an improvement in the products involved resulted through elimination of waste and the maintenance of the proper production conditions.

An electronic device that definitely improves any normal production operation exists in one of the three basic forms. Factory alterations of any of these forms permit their application to specialized operations.

The application of the electronic device to industrial machines and processes does not necessarily preclude increased maintenance. These devices rarely require more than occasional adjustments, tube replacements, or cleaning, once the devices have been properly installed. They contain no moving parts or other mechanical contrivances subject to wear and misadjustment under high speed operation. With increased interest in electronic devices and electronic control, development of the proper maintenance personnel is assured, and capable attention by such personnel dissolves the "mystery" long attributed to these devices.

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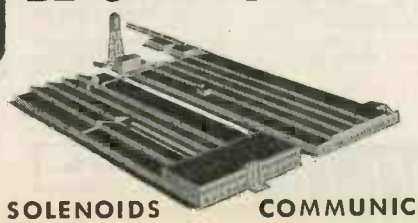

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INDUCTION RADIO

(*Continued from page 89*)

Fig. 5a. Portable receiver for paging

Fig. 5b. The receiver is worn on belt with built-in antenna

cross-talk between transmitters by proper selection and alternate use of a total of two frequencies in the broadcast band, i.e., 550 kc may serve zone 1; 570 kc, zone 2; 550 kc, zone 3, etc.

The general chassis layout of one form of zone redistribution unit, illustrated in Fig. 4, is representative of one form of carrier transmitter and receiver. This equipment may also be utilized at a central station in low frequency signal distribution. The circuits of these units are given in Figs. 9 and 10. It is believed that the circuits are self-explanatory, with the exception of a description of the function of carrier-operated relay RL1, Fig. 10, in the normally-on receiver, and a handset hangup switch MS1 in the transmitter, Fig. 9. The former, when energized by a received carrier signal from the central station automatically applies plate voltage to the transmitter, through operation of power relay RL1, Fig. 9, thereby placing the transmitter in operation only during periods in which the central station is in operation. When the equipment is used in relay, or repeater, operation, the carrier-operated relay extends the operation of the communicating circuit to a following unit in the line only when a carrier signal is received from a preceding transmitter. Handset hangup switch MS1, Fig. 9, transfers the input circuit of the transmitter from the output of its associated

Photograph taken at Sperry Gyro-Compass School

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And they know they may sail in prefabricated hulls built under conditions involving immense variation in residual magnetism. Their cargoes may be highly magnetic and their ships almost certain to be equipped with degaussing apparatus to render ineffective the sensitive magnetic mines that lurk in their path.

These factors spell the need of attaining absolute precision in navigation and call for navigation equipment that is impervious to profound and diverse magnetic influences.

That is why these sea-going men are learning about the Sperry Gyro-Compass and why it is more essential than ever in war time. In the course of their study, they learn too that the substitution of electronic circuits* for roller contacts in the follow-up system of the new compass assures even greater reliability with less care and maintenance than before.

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* The Sperry electronic Gyro-Compass is sometimes called the Sperry *Gyrotronic* (registered trade-mark) Compass.

SPERRY

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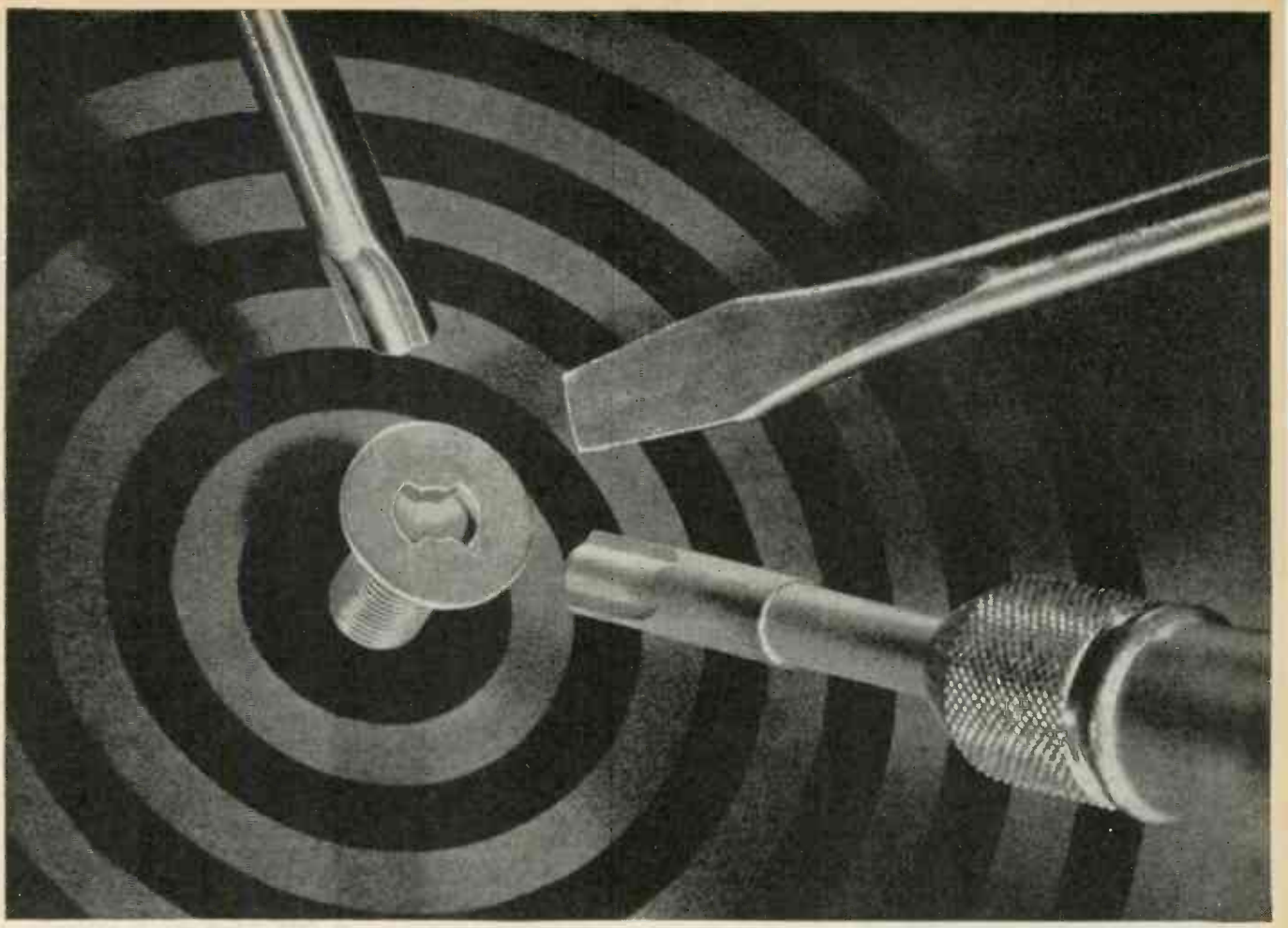
receiver to the local microphone, thereby permitting two-way communications over power-line circuits, or selective transmission to receiving points within the limits of the area served by the zone transmitter.

The output circuit of the transmitter is designed to operate into the attenuator and line coupling unit illustrated in Fig. 6. In operation the rf attenuator usually is adjusted in conjunction with a field strength meter to provide a total field strength of approximately 15 microvolts per meter at a lateral distance of $\frac{157{,}000}{f_{kc}}$ ft. $(\frac{\lambda}{2\pi})$ from the transmission-line employed in the system.

In designing and installing carrier equipment of this nature, good engineering procedure is a prerequisite. Transmitters and coupling units must be designed in such manner that harmonic emission is of extremely low order, while attenuators must be adjusted with field strength measuring equipment in accordance with the minimum useful signal requirements of various zones in the area to be served. Choice of operating frequency must be based on knowledge of other carrier-current and radio services in the vicinity in order that no interference may be caused.

When equipment of the type described in this article is properly installed, excellent coverage of areas extending for many miles may be obtained without objectionable space radiation of wave energy. Signal levels on power lines in such an installation customarily range between 50 and 500 millivolts, while at lateral distances in excess of $\frac{\lambda}{2\pi}$ from power lines signal levels below 15 microvolts per meter may be obtained.

Among the many practical industrial uses for such a system, aside from those services mentioned in preceding paragraphs, are: (1) in plant areas, for radio control of motor vehicle and railway traffic; (2) two-way, long-distance communications between control points and operators of industrial vehicles such as trucks and locomotives; (3) communications in mines, tunnels, and in the interior of steel mills, machine shops, or other enclosed spaces where noise levels are excessively high and where loudspeakers cannot operate successfully, but where light-weight, pocket-size receivers and earphones of the type shown in Fig. 5 will carry voice signals of high intelligibility; (4) in port areas, on docks, and in the holds of cargo ships for centralized control of loading operations, and (5) in construction of



Sharpshooting on the Home Front...

This is where marksmanship counts . . . where an easy-to-hit bull's-eye means the difference between "quota" production and top-score production on the assembly lines.

CLUTCH HEAD Screws provide that kind of bull's-eye. Note the width, the depth, the roominess of the Clutch recess . . . an easy target even for the untrained eye and the unskilled hand. Note also the straight walls of the Clutch, matched by the straight sides of the driver, making *bit entry automatically true and complete* for a torque drive home that is almost effortless. Note the Center Pivot section of the Assembler's Bit which prevents canting . . . vitally important at all times. By preventing side-slippage, CLUTCH HEAD Screws also safeguard manpower and materials.

May we send you fully illustrated Brochure along with an assortment of CLUTCH HEAD Screws and sample Center Pivot Assembler's Bit . . . so that you may personally *check the many exclusive features for safety, speed, and economy* which establish CLUTCH HEAD as the most modern screw on the market today.

Screwdriver Control, being operative with ordinary type screwdrivers, is proving itself to be an important CLUTCH HEAD feature in wartime field service. This applies to all CLUTCH HEAD Screws . . . Standard and Thread-forming types for every purpose.

CLUTCH HEAD · SCREWS ·

This Center Pivot Assembler's Bit delivers *longer* uninterrupted service. Requires no "back-to-the-factory" shipment for reconditioning. A brief application of the end surface to a grinding wheel restores original efficiency.

UNITED SCREW AND BOLT CORPORATION

CHICAGO CLEVELAND NEW YORK

buildings or bridges, where voice communications between a central point and supervisory personnel are desired.

In radio traffic control service, it may be stated that the induction radio communications technic has demonstrated its remarkable effectiveness in directing the movement of large numbers of trucks with minimum traffic congestion at bottleneck points, or at other locations where confusion as to routing procedure would otherwise occur. Operators of trucks may be advised of changes in routing instructions by recurrent voice signals clearly-reproduced inside the vehicle, while on the same frequency, on an intersecting lane, other instructions addressed to drivers on that route may be given simultaneously without cross-talk or heterodyne interference between the two transmitters located at wayside points. Two-way communications may also be effected by this system between control points and operators of vehicles, without radiation of wave energy beyond a lateral distance of several hundred feet from the traffic lane.

In extending the system over long distances, as is often desirable in the highway and railway field, the zone transmitters and receivers are utilized as automatic repeaters. Carrier energy is relayed from point-to-point along the traffic lane as the carrier-operated relay in each receiver automatically applies plate voltage to the vacuum tubes in its associated transmitter.

Checking system

In adapting the system to industrial railway traffic control, where movement of locomotives on mainline or adjoining trackage may be involved, protective checking technics provide continuous audio-visual indication of proper operation of the system, in locomotive cabs and at dispatching points. Safety equipment of this type is required for the reason that the sequence of locomotive movements, unlike those in other transportation fields, is not ordinarily determined by the operator of the vehicle, who will follow minutely the yardmaster's or dispatcher's orders until they are countermanded. Should radio control equipment fail after issuance of orders, or should the locomotive receiving equipment become inoperative for any reason, the engineer, if not advised of such failure, would proceed to follow the original instructions, regardless of attempts by the dispatcher to countermand these orders. The protective indicating and monitoring equipment thus prevents any serious consequences in event of failure of the radio signaling system.[9] (*Turn page*)

Engineering begins here...

FOR THE SOLUTION OF YOUR TRANSFORMER PROBLEMS

Grey matter—as measured in terms of Victory in war, or progress in peacetime—is a decisive, tangible factor Strategies, techniques and analyses —whether for military or commerce—are its by-products. Success is directly proportionate to the quality involved.

The calibre of N-Y-T engineering is proved by the thousands* of new transformer designs evolved to individual requirements over the past few years. These audio and power components are now assuming a vitally important role in World War II, in Army, Navy and Air Corps applications.

When the world crisis is over, and our present 100% Victory effort terminates, N-Y-T engineers and technicians will be available for collaboration in the solution of your transformer problems. The vast experience gained now, should be of tremendous value then.

NEW YORK TRANSFORMER CO

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*The exact number is confidential information for the duration.

(*Continued from page* 204)

Checking of communications equipment may be effected by means of automatic transmission of a tone-modulated carrier signal, of pulse characteristic, at intervals of approximately five seconds, by the central station transmitter. In the locomotive cab, and at the central control point, a visual indicator, such as a signal lamp installed within the engineer's or dispatcher's normal field of vision, is actuated by the received pulse signal, while the modulating tone signal is reproduced by the cab loudspeaker. In the event of failure of any portion of the system, the audio-visual signals will not be received, indicating to the engineer that his radio equipment cannot be relied upon for further instructions, and that precautionary measures must be observed.

As the pulse signals are transmitted only over the limited distances served by the induction radio system, the sustained emission of the pulse signals cannot cause interference with similar services on the same frequency in adjoining industrial areas not served by the wayside conductors employed in the system.

Noise reduction

In railway radio traffic control services in industrial areas, the use of FM transmitters and receivers in the induction radio system is desirable, particularly where Diesel-electric locomotives are utilized, or wherever excessive electric noise levels prevail. To meet this problem, the Halstead Corp. has recently developed low frequency induction-radio equipment operable on carrier frequencies below 100 kc, with which satisfactory voice communications may be established through noise levels of such magnitude as to render unintelligible any voice signal in conventional AM receiving equipment. As a result of extended tests with this equipment it is anticipated that the induction radio system described will be enabled to meet the majority of conditions likely to be encountered in the industrial field.

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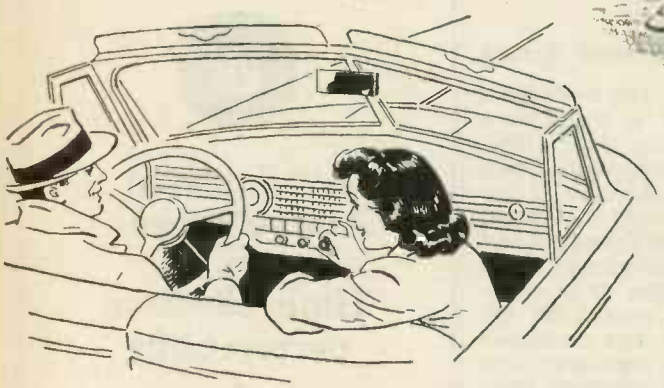


From "Music on the Road" ...a Clearer Voice for War

Few entertainment mediums operate under such unfavorable conditions as the automobile radio. It sings its arias on a "stage" that bounces and jolts. It cracks its jokes while trolley-wire "lightning" snipes at its sensitive nervous system. It reads its news reports under the savage attack of high-tension current from the automobile ignition system. Even temperature and humidity get in their licks. Talk about a "dog's life"! Rover, move over.

For years, Delco Radio technicians have applied themselves to overcoming the many problems of vehicular radio. One by one, vibration—electrical interference—humidity and temperature—and other trouble-makers fell before their relentless quest. Automobile radio lost its stutters and gained a calm, clear voice.

But more than better entertainment came with this conquest. In their eternal search for "a better way," Delco technicians were finding the answers—*years in advance*—to similar problems of war-vehicle radio communication. When war struck, they already had a sound working knowledge of the chief deterrents to practical radio communication in bombers, tanks, tank destroyers and other mobile units. The quest for better entertainment had yielded an invaluable by-product—a clearer voice for war.

Delco Radio
DIVISION OF
GENERAL MOTORS

★ ★ ★ ★ **BACK OUR BOYS . . . BY BUYING BONDS** ★ ★ ★ ★

ARMY OBJECTIVES

(Continued from page 78)

theatres, including large switchboard installations at various points which enabled the Commanding General and his staff and subordinate commanders to maintain instant communication.

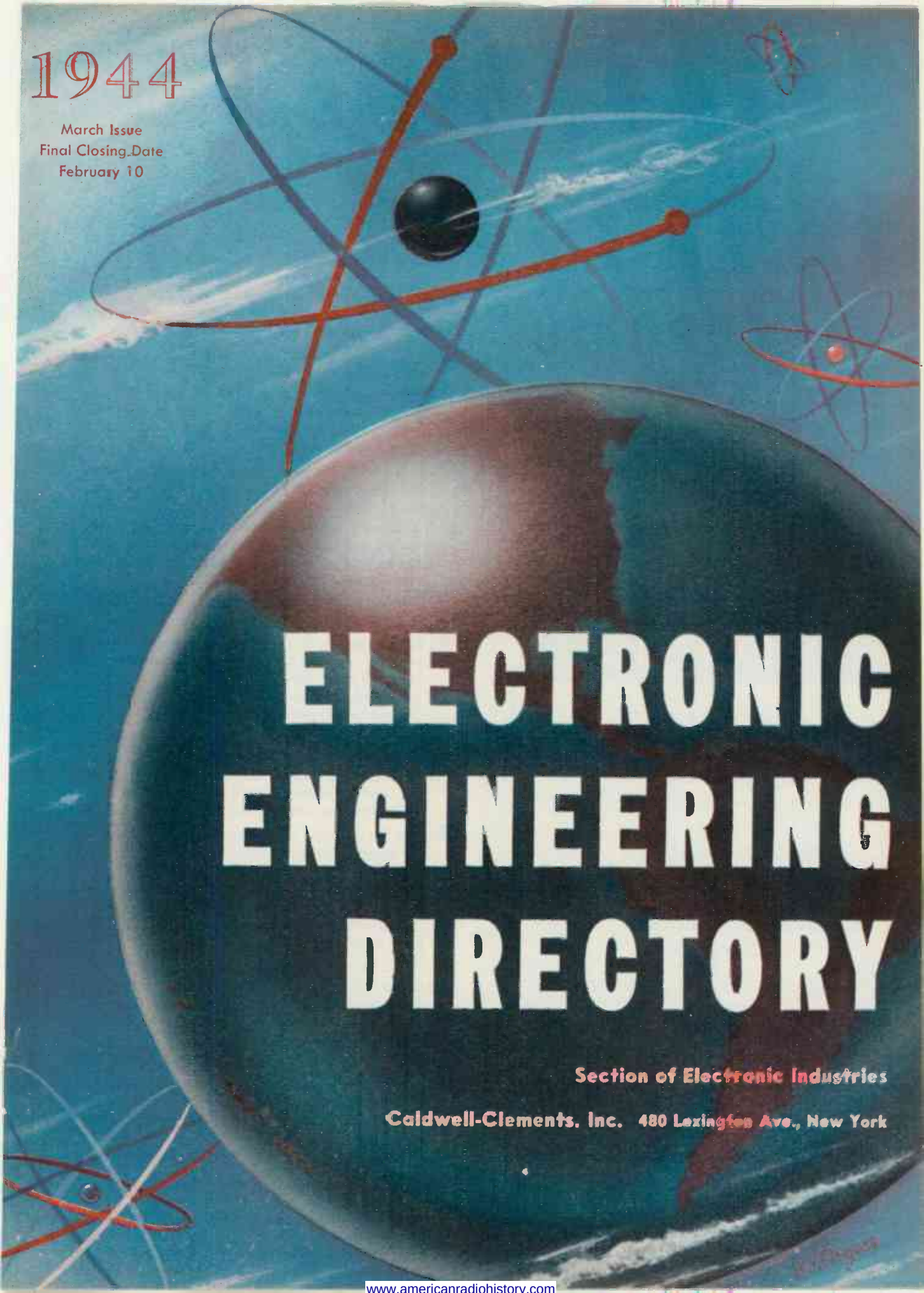
In the continental United States the problem of storing, packing, marking and issuing of equipment to insure a smooth flow of communications materiel to overseas theatres has been a particularly perplexing one. For this function, the Signal Corps has erected strategically located depots throughout the nation which store and issue all types of communications supplies, including radio, telephone, telegraph and teletypewriter, in addition to electronic and photographic equipment, to the more than 1,300 posts, camps and stations in the United States as well as to the fighting forces in all theatres of operation.

Storage depots

These depots comprise more than 100 buildings with a total open storage space of more than 3,000,000 sq. ft. Further expansion is now being planned to take care of future needs and to supply the Armed Forces with their requirements and in the shortest possible time. As an example, a requisition from overseas contained the urgent for 600 miles of rapid pole line construction materials. The components of this shipment were obtained from various depots and production lines and then shipped to the port of embarkation where arrangements were made for the "marrying" of the equipment with the 600 miles split among six boats, each vessel containing a self-functioning unit of 100 miles.

The problem of salvage and repair of Signal Corps equipment, damaged in the theatres of operation, became progressively complex as important Allied offensives got under way. The number of repair shops and repair depots in these theatres was increased and items ranging from radio tubes to entire radio sets are returned to be salvaged, or repaired or re-issued. Thousands of dollars are thus saved to the Government by this work. In the year ahead as new offensives are started, Signal Corps equipment of all types, in ever increasing quantities, must be supplied to all fighting fronts to replace that which will be lost.

In research and developmental work, the Signal Corps ranks second in the Army, being topped only by the Ordnance Department. Utilizing to the utmost the research facilities of private industry and academic institutions, besides its



Questions and Answers

ABOUT THE

1944
ELECTRONIC ENGINEERING DIRECTORY

To be published as a section of

ELECTRONIC INDUSTRIES

In March

LISTING MANUFACTURERS OF

FINISHED PRODUCTS
RAW MATERIALS
PARTS AND COMPONENTS
EQUIPMENT AND ACCESSORIES
ASSOCIATED APPARATUS
LABORATORY EQUIPMENT
PRODUCTION EQUIPMENT

Complete . . . Classified . . . Cross-Indexed

A comprehensive catalog of the products of the radio-electronic industries.

■

CALDWELL-CLEMENTS, INC.

480 Lexington Avenue, New York 17, N. Y.
Telephone PLaza 3-1340
(201 N. Wells Street, Chicago 6, Ill. Telephone RAndolph 9225)

Q. What is the 1944 outlook for war work?

A. Despite the cancellation of contracts in this and other fields, radio-radar work — especially Navy contracts — will continue through 1944 at an even higher rate. There will be little or no decrease in the needs of contractors and their suppliers.

Q. How can you get business from manufacturers who are "tied up" with specific types of war work?

A. There is constant change in the activities and needs of manufacturers, due to the completion of contracts, new or revised orders, etc. Tell them what you have to offer.

Q. If war work prevents you from making commercial deliveries, why should you advertise in this directory?

A. To contact customers and prospects with whom you are out of touch. To be represented in a directory that comes out only once a year. To accomplish dozens of other purposes.

Q. Can you build postwar business by advertising in this directory?

A. Yes, if you now have, or will have, a product that can be used to advantage by radio-electronic manufacturers, industrial electronic users, communications systems, etc. Remember — this directory will have a year-long life.

Q. Must you advertise in the directory in order to get a free listing?

A. No. The listings are a 100% editorial service. But you have the opportunity to use advertising space to amplify your listings or to catalog your products.

Q. Will the directory reach the real buying power of the government, the war plants and the industries using electronic equipment?

A. Emphatically yes. It goes straight to the men who initiate, authorize and direct electronic activity — to a greater number of responsible engineers and executives.

Q. WHO publishes ELECTRONIC INDUSTRIES?

A. Caldwell-Clements, Inc. (Orestes H. Caldwell and M. Clements, editor and publisher respectively, the pioneers and present-day leaders in radio-electronic publishing).

Q. What is the closing date for the March Directory Issue?

A. February 1, for advertisers requiring composition and proofs; February 5, for composition without proofs; February 10, for complete plates.

own Corps Laboratories at Fort Monmouth and Wright Field, some of the most amazing pieces of communications equipment have been developed or are now in the process of being developed. Many efficient pieces of equipment which have given outstanding performances in various theatres of operation have been developed by the Signal Corps. Chief among these is the mobile field headquarters radio station known as SCR-299 which has aided the American forces in many battles such as the hurling back of the Germans at Kasserine Pass in North Africa.

ENGINEER EXECUTIVE

(*Continued from page* 98)

proved upon, especially in the radio and electronic fields. The day has passed when management can allow itself to think of production operators as so many hired hands. There are rich opportunities for discovery and learning in the field of labor relations and the study of methods which make working a pleasure for operator and supervisor alike. To accomplish this, a cooperative rather than a compulsory approach to production problems is necessary. A modern plant manager must direct, among other things, the problems of personnel relations, product engineering, industrial engineering, quality control, cost analysis, and purchasing as well as production through the making of routine assemblies.

Engineer as a salesman

The field of distribution is one that offers a real challenge to the engineer. Some, perhaps, need to overcome the conviction that they would "never make a salesman" born of an adolescent association of the concept of sales work with amateur book selling and salesmen with peddlers. Distribution is one of society's great problems not only because of its magnitude in the economic spectrum but because of the social aspects related to it. There seems to be something wrong with a system that often allows as little as 15 to 20 cents of the ultimate consumer's dollar to cover raw materials, labor, manufacturing, research, development, overhead and return on invested capital, while the balance goes into selling and distribution costs. Distribution involves market research and analysis, understanding of the consumer, his wishes and his needs, advertising, transportation, communication, trade outlets, redistribution, and finally customer service and satisfaction. Yet the approach should not be much dif-

Raytheon

VOLTAGE STABILIZERS

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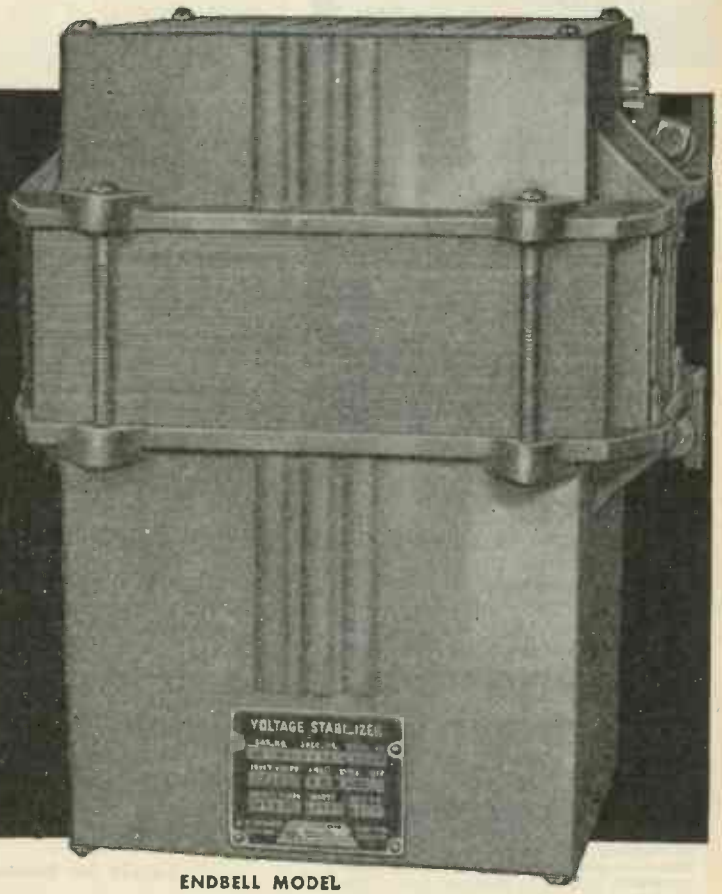
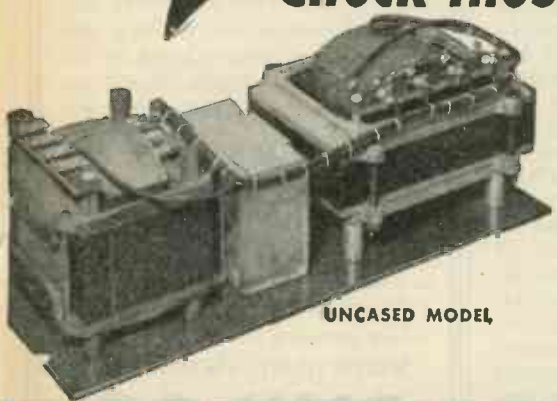
FOR

- 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

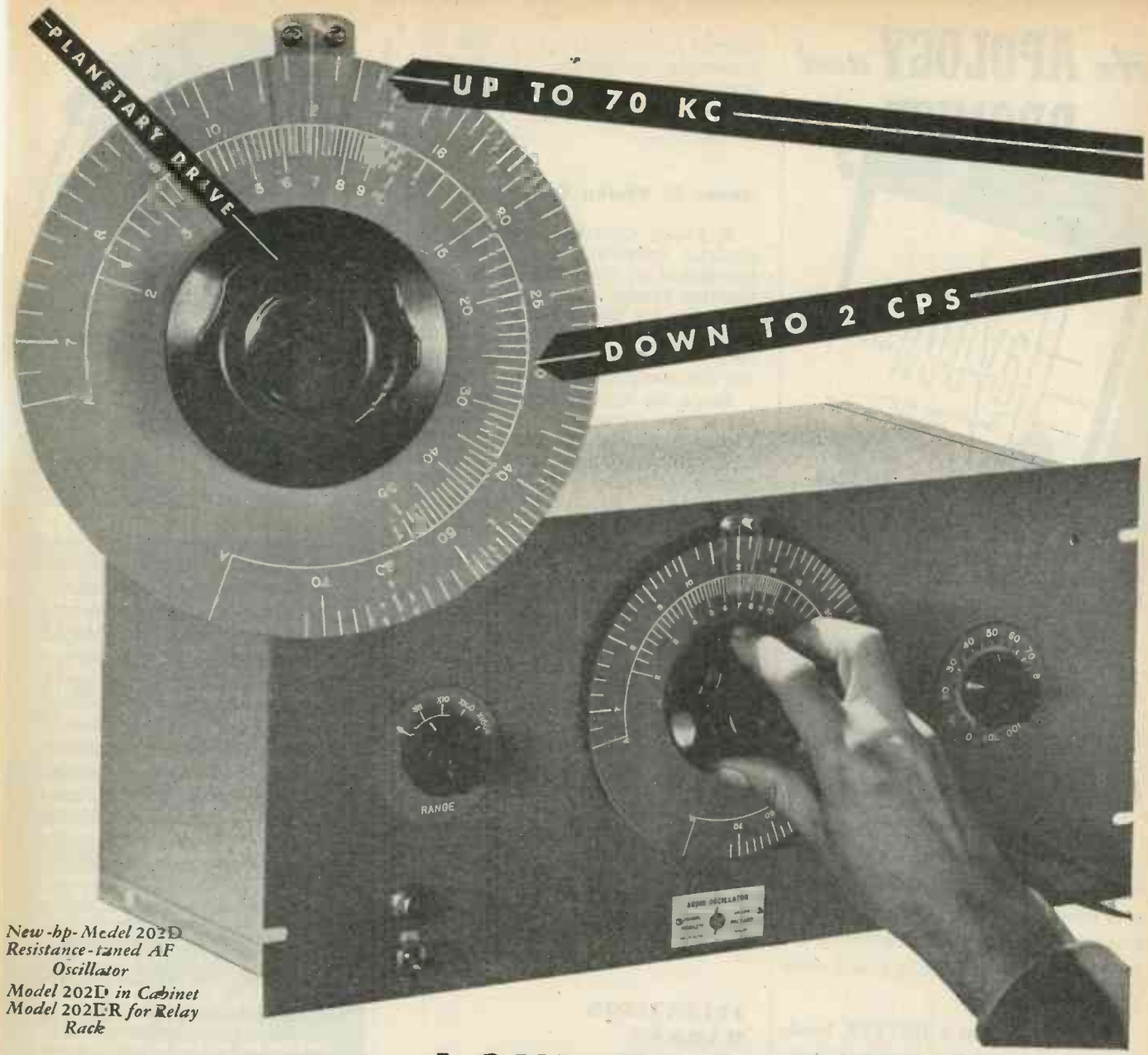
190 WILLOW ST. WALTHAM, MASS.

ferent from that to any other complex engineering problem.

Finally, we come to application. It might be said, "Surely that is right down the engineer's alley." Engineers must observe the application of products already in use in order to find new uses and get ideas for additional development. Furthermore, the operational engineer's field is one of application. This is all true and as more projects are completed and new devices put to use, there are more opportunities and jobs for engineers, but it is important to recognize the social aspects of this and observe, not alone the operation of new devices, but also their effect upon society. Let us be able to concentrate not alone on, say, improvements in shortwave transmission, but let us contemplate the results in terms of eliminating the distance, creating closer relationships, cultural as well as economic, and reducing the causes of misunderstanding between peoples. It may be asked, "What good will that do when politics and other factors beyond the engineer's control play such an important part." The answer lies in the truism that these factors will remain beyond the engineer's control just as long as he limits his efforts to observation and creation only, and does not master the phases of presentation, coordination, production, distribution, and application in its broad sense. The engineer who lifts his sights to cover the full cycle can make the greater contributions not only in the harassed industrial situations of today but will also be better able to adapt himself to the changeovers in manpower specifications that will accompany the conversion to a peacetime industry.

Logic in human relations

In conclusion, it is in order that the engineer be reminded that he has perhaps thought too much of engineering as a profession involving the combination merely of inanimate elements in accordance with known physical laws to accomplish his wishes, and point out that the wishes themselves are inspired by higher laws, also real and predictable. These social laws concern not just an arrangement of lifeless objects having no will of their own, but rather the association of thinking, free-willed human beings. Is it not, in order, therefore, that the same logical approaches that are used in the development of an engineering project be applied to a better understanding of human relationships, and the simple, though basic laws upon which they are founded? One of these basic laws, well known though not too often practiced, applies with



New -hp- Model 202D Resistance-tuned AF Oscillator
Model 202D in Cabinet
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This newest addition to the *-hp-* line of Resistance-tuned Audio Oscillators provides you with all the excellent features found in its predecessors plus a range of available frequencies heretofore not provided. Large, easy to read dial has two scales extending over 270° rotation. Smooth planetary drive with a 5 to 1 reduction makes it easy to control. The outside scale is calibrated for frequencies from 7 cps to 70 kc. The inside scale is calibrated for frequencies from 2 cps to 50 cps. All calibrations are for direct reading. A resistance-coupled power amplifier provides uniform output over the entire range. The instrument is extremely stable, having a frequency drift of less than ± 2% even during the initial warm-up period. Line variations of as much as 20% will change the frequency less than ± 0.2% at 1 kc. As with all *-hp-* AF oscillators *no zero setting is required.* Write today for more complete data. Give us details of your problem so that we can be of utmost assistance. Ask for your copy of the 24 page *-hp-* catalog which gives much valuable information about electronic instruments. There's no cost or obligation.

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691

special appropriateness to the engineering profession. It is—that greatness comes through serving others, not through being served by them.

About E. Finley Carter

E. Finley Carter, Director of Industrial Relations and member of the Board of Directors of Sylvania Electric Products Inc., was a radio engineer for 19 years prior to his being selected to organize and direct an Industrial Relations Dept. for the company.

Since his appointment as Director of this department in 1941, Mr. Carter has been in charge of crystallizing, developing, and administering industrial relations policies.

A Texan, Mr. Carter graduated from Rice Institute in Houston. Joined General Electric in 1922. After spending a year as a student engineer, he became a member of the Radio Engineering Dept. and soon after was given the responsibility of developing and designing high power metal tube transmitters for WGY Schenectady, KGO Oakland and KOA in Denver. Was Division Engineer in charge of a special development division handling television, facsimile and special receivers. Joined Sylvania in 1932 as Consulting Engineer, continuing in executive engineering positions until his appointment as Director of Industrial Relations.

Fellow and Director, IRE; associate member of AIEE; member Tau Beta Pi.

TELEVISION MARKET

(*Continued from page* 93)

were $250?" The cumulative percentage became 34.3 per cent.

To those who still said "No," we asked:

"Well, would you buy if the price were $200?" The cumulative percentage became 61.3 per cent.

From the foregoing, the conclusion seems inescapable that when, in the postwar period, the radio industry produces a good television receiver in the $200 price range, a very high percentage of the homes of the United States will be ready to buy television receivers as soon as service is available to them. Such a receiver, I believe, is possible—based on 1940 labor and material costs, and assuming no excise taxes. Of course, the postwar price would be increased by the factors of inflation and excise taxes.

We have prepared some estimates of the probable postwar rate of market development for television once there has been a complete

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PERFECT FORM—both in manufacture and performance, is more essential now than ever, if you are driven by war time speed, and the constantly growing need for greater production.

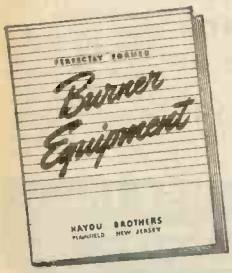
The traditionally dependable performance of Haydu Bros. Burner equipment, has been an assurance of uninterrupted economical production.

Today, thousands of Haydu Bros. Burners, in many styles and sizes, for Gas, Air and Oxygen, are used in plants of the general glass working industry from coast to coast, helping to speed those essential orders.

Specially designed Burners, Torches, Cross-fires and Mixers to meet your requirements.

HAYDU BROTHERS

PLAINFIELD, NEW JERSEY



WRITE FOR LATEST BULLETIN

agreement on standards approved by FCC which would give the industry the "green light" without any "ifs." It has been assumed for estimating purposes that there will be no changes in the standards or in the place which television occupies in the broadcasting spectrum, which might substantially delay the start of television or bring about more complicated engineering and manufacturing — thus making improbable, at least in the immediate postwar period, a $200 television receiver as previously described.

Present facilities

The estimated postwar television market projections that follow are based on television as we know it today and assuming that it can go forward without undue delay in the postwar period:

Television broadcasting facilities exist in New York, Philadelphia, Albany-Schenectady, Chicago and Los Angeles. I believe that a television station in Cincinnati could begin broadcasting shortly after the war when the needed equipment to complete this station is made available.

The foregoing cities, assuming no radical change in broadcasting standards or allocations, would logically be the first television market. This first television market has 25,907,600 people, 7,410,922 wired homes and 28.46 percent of the U. S. buying power. Television coverage of only 10 per cent of these homes would in itself constitute a very important new advertising medium, particularly when one considers that the effectiveness of television advertising per unit of

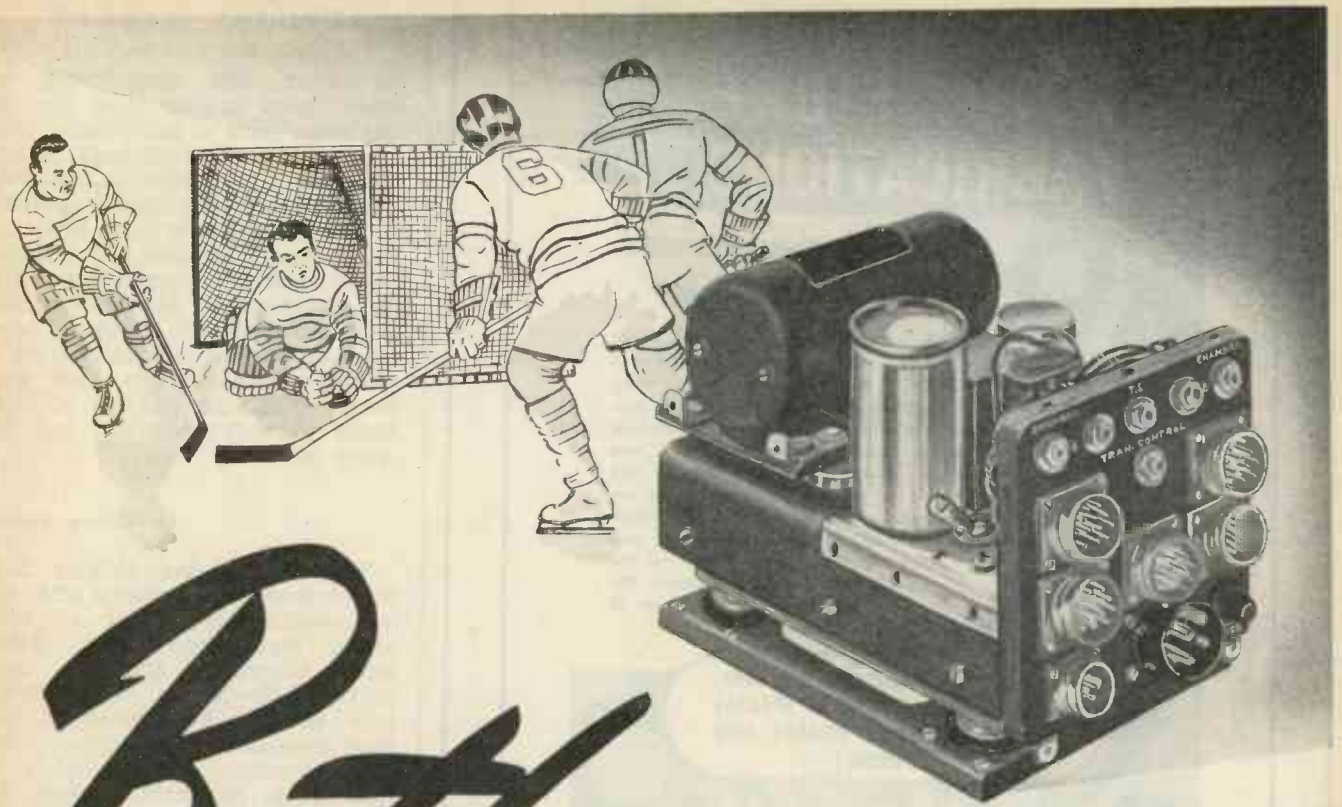
(*Continued on following page*)

RADIO SYSTEM STANDARDS

(*Continued from page* 83)

The ingenuity of our research laboratories has contributed many technical advances to the communication art during the past two years, mainly in the uhf field. There are millions of 10-kc communication channels available in the ranges already in use, but this does not mean that there will be millions of channels that can be put to use, at least in the present state of the art! A puff of air will shift the frequency through many of such bands in some cases, under present design rules.

This matter of frequency stability together with the development of a system for locating a particular channel from among these millions, are challenges to every radio engineer. Any contribution to their solution no matter how small, is a step toward ultimately satisfying every demand for channels.



Both MUST "TAKE IT"

No sport makes more exacting demands than ice hockey. The professional team must possess both precision and timing and a high degree of ruggedness as well.

Radio amplifiers manufactured for Navy aircraft by Sound Equipment Corporation of California must meet similar requirements. They too combine high accuracy with the sturdiness to "take it" when the going gets tough.

The same engineering and manufacturing skill, which provides this wartime dependability will assure years of faithful service to our peacetime products.

Send for our new booklet "Sound"

Sound Equipment

Corporation of California

6245 LEXINGTON AVENUE, HOLLYWOOD 38, CALIFORNIA

Manufacturers of ***AIRCRAFT RADIO EQUIPMENT • AMPLIFIERS • PRECISION COILS***

TELEVISION MARKET

(*Continued from page* 218)

circulation will undoubtedly be many times greater than that of any other form of advertising. Ten per cent would represent 741,000 homes with television. In my opinion this could be attained approximately two to three years after the full commercialization of television. Three of these markets, New York, Philadelphia and Albany-Schenectady, have already broadcast television programs originating at a central source—that is, NBC, New York. Thus, the nucleus of television network operation has already begun.

In three years

We can assume further that within three or four years after the commercial resumption of television, Washington, D. C.; Baltimore, Maryland; Hartford, Connecticut; Providence, Rhode Island, and Boston, Massachusetts will have television transmitters. These cities, together with Philadelphia, New York, Schenectady and Albany, could be interconnected with a television network circuit about 600 miles long. This network circuit would make television broadcasting service available to 33,336,000 people, 9,379,039 wired homes, representing 36.62 per cent of the total U. S. buying power.

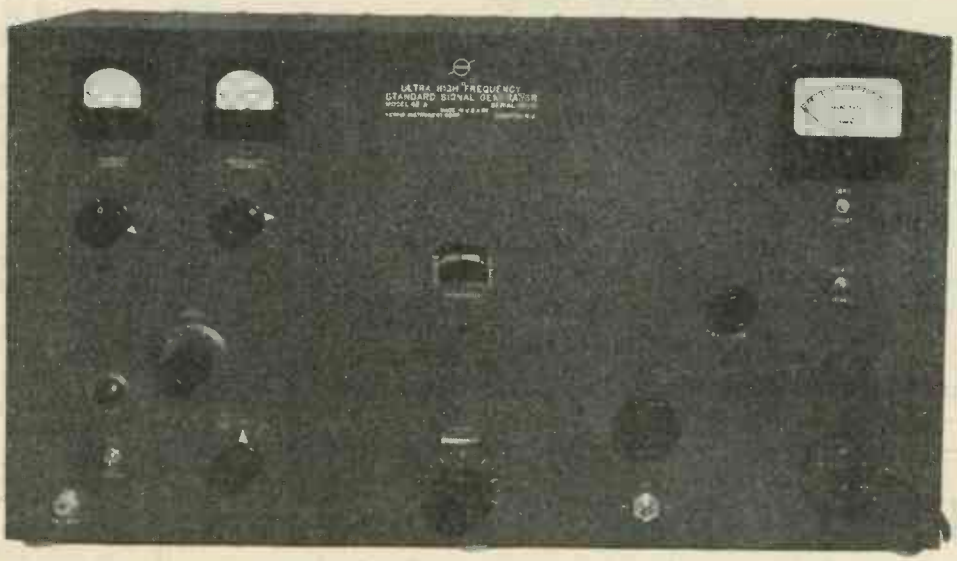
An additional 1,300 miles of network circuits could link the Middle West with the Atlantic Seaboard, bringing television service to Pittsburgh, Cleveland, Cincinnati, Detroit, Chicago, St. Louis and Milwaukee. This would make television broadcasting service available to an additional 10,725,400 people living in these key cities—bring the total market served by about 2,100 miles of network facilities to 44,061,500 people and 47 per cent of the U. S. purchasing power.

This trunk line television network just outlined, with the secondary networks that would be offshoots from it, would serve the 19 state-area bounded by Illinois and Wisconsin on the West and Virginia and Kentucky on the South. There are approximately 70,000,000 people in this area. It represents approximately 62 percent of the purchasing power of the country. All of this development can be expected to take place approximately five years after the full commercialization of television.

In approximately five years after the commercial resumption of television, television transmitters located in 157 key cities of the United States should be making television program service available to a primary market consisting of 72,159,000 people, 17,252,000 wired

FERRIS INSTRUMENTS

for LABORATORY STANDARDS AND NEW DEVELOPMENT WORK



The Model 48A shown above is a precision UHF Signal Generator incorporating a modulated R. F. amplifier giving negligible frequency modulation.

Provision for special types of external modulation on request.

Range of this instrument is 200 to 500 mc with output from 1.0 to 100,000 microvolts at end of 30 ohm terminated transmission line.

FERRIS

FERRIS INSTRUMENT CORPORATION

110 CORNELIA STREET, BOONTON, N. J.

homes, or 59.6 per cent of the total and 61.5 per cent of the United States purchasing power. An additional ten million people should have television available to them by secondary television network developments. When television service is available to this area, television receiver sales should be at the rate of approximately 2,500,000 units per year at an average retail price, based on 1940 costs, of about $200.

It would also be reasonable to expect that by the end of the fifth year, after the full commercialization of television, the engineers of the industry should be able to develop a low cost automatic rebroadcasting television transmitter which could be located in the areas which are outside the broadcasting scope of the television transmitters located in the 157 key cities of the United States. This transmitter would be automatically turned on at the beginning of the network broadcasting day and automatically turned off when the program service for the day was completed. Once a month, or as often as required, a service engineer would visit such an automatic rebroadcasting transmitter to keep it in peak operating condition.

Nationwide in 10 years

Such a development will make it economically feasible to bring television service ultimately to practically every home in the United States. Assuming such a development takes place, and we have every reason to be confident that it will, then it would not be unreasonable to assume that within ten years after the full commercialization of television, television service would be available to 23,700,000 wired homes or 80 per cent of the wired homes of the United States. This would represent a population of about 100,000,000 people and approximately 82 percent of the total U. S. buying power. Television industry sales at this point should be, approximately, 3,500,000 units per year for a total retail billing of between six hundred million and seven hundred million dollars ($600,000,000 and $700,000,000). This billing, together with replacement tubes for existing receivers, service, transmitter sales, television advertising revenue, etc., will make television the billion dollar industry that many have prophesied it will be.

Television will not spring forward as an industry the day the fighting ceases. It may be a year, or two or three years, after the war before television is ready to go forward on a commercial basis. That depends upon the character of the recommendations made by the Radio Technical Planning Board and the action taken by the Fed-

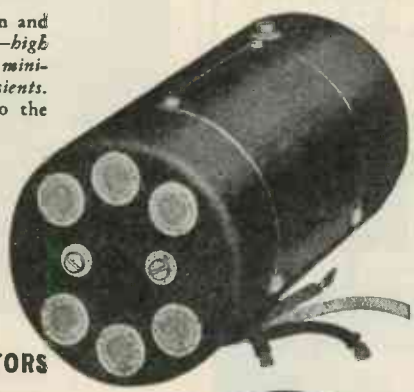
SKILL

To Meet Your Specifications

PERFORMANCE is the real measure of success in winning the war, just as it will be in the post-war world. New and better ideas—production economies—speed—all depend upon inherent **skill and high precision** . . . For many years our flexible organization has taken pride in doing a good job for purchasers of small motors. And we can help in creating and designing, when such service is needed. Please make a note of Alliance and get in touch with us.

ALLIANCE DYNAMOTORS

Built with greatest precision and "know how" for *low ripple—high efficiency—low drain* and *a minimum of commutation transients.* High production retains to the highest degree all the "criticals" which are so important in airborne power sources.



ALLIANCE D.C. MOTORS

Incorporate precision tolerances throughout. Light weight—high efficiency — compactness — continuous duty. An achievement in small size for continuous duty and in power - to - weight ratio. Careful attention has been given to distribution of losses as well as their reduction to a minimum.

Remember Alliance!
—YOUR ALLY IN WAR AS IN PEACE

ALLIANCE MANUFACTURING CO.

ALLIANCE, OHIO

Custom Machined POLYSTYRENE

Clear, transparent Amphenol polystyrene, custom machined with special equipment under ideal working conditions—parts and pieces shaped with great care to close tolerances to your specifications—here is a service that simplifies production problems —saves waste and worry in fabrication.

A Supreme Dielectric . .

Engineers agree that the useful combination of properties characteristic of polystyrene offers unlimited advantages in the field of electronics. Call upon Amphenol Engineers to help in the development of custom machined polystyrene for your specific needs.

Depend upon AMPHENOL *Quality*

Write the Synthetic Division of

AMERICAN PHENOLIC CORPORATION • CHICAGO 50, ILLINOIS

eral Communications Commission on the recommendations by that Board. Of this, though, we can be certain—that the generations that come after the war will take home television service just as much for granted as the present generation takes for granted the radio set which, at the push of a button, makes available the finest entertainment and educational programs of the United States and, instantaneously, brings us voices and music from across the seven seas. Today, we only hear those programs. Tomorrow, we will see them as well as hear them.

That is the promise of television.

PUBLIC UTILITIES

(*Continued from page* 71)

Amplifiers and relays of generator vibration control

which is combined a zero-center galvanometer, isolating transformer, resistor, battery, and lamp for scale illumination, switches, and plug receptacle. The instrument can be connected, through plugs, to a sector coil for exploring conductor current, or to the test prods for sheath-drop indications.

An interesting apparatus in general use measures phase displacements up to two degrees between two ac sources with a milliameter in a bridge-type detector circuit. Referring to the diagram, equal voltages across the grid-transformer secondaries (connected in series opposition) result in a total voltage across ab of zero, when sources A and B are exactly in phase. When A and B are slightly out of phase, the voltage across ab has a magnitude proportional to the phase angle. This voltage can be considered to be 90 degrees out of phase with either A or B.

The phase shifting bridge produces a voltage across cd 90 degrees

CONDENSERS

Every Type and Capacity Ready for Emergency Service to Industry!

NEED a particular type of capacitor *in a hurry?* There are so many varieties, made by different manufacturers, that the item of condensers alone requires streamlined efficiency if stocks are to be kept complete, and ready for speedy delivery to you!

Condensers represent but a few of thousands of Radio and Electronic products stocked and made available for you with speed and efficiency by the special Industrial Emergency Service we offer. Engineers, research workers, maintenance men, purchasing agents . . *everyone* responsible for uninterrupted vital production or research schedules . . can save time and trouble, here. Entrust all your electronic needs to our highly trained technical staffs. Send for your free copy of a big reference book and buying guide, an integral unit of our speedy industrial service. And send us your orders. We three cooperating distributors offer a new type of coast-to-coast service, tuned to the tempo of WAR. Try it!

WRITE OR PHONE YOUR NEAREST DISTRIBUTOR

TERMINAL RADIO CORP.
85 Cortlandt St., Phone WOrth 2-4416 NEW YORK 7

WALKER-JIMIESON, INC.
311 S. Western Ave., Phone Canal 2525 CHICAGO 12

RADIO SPECIALTIES CO.
20th & Figueroa, Phone Prospect 7271 LOS ANGELES 7

NATIONAL INDUSTRIAL EMERGENCY SERVICE

A MINIATURE FREQUENCY METER THAT IS RELIABLE!

This Miniature Frahm Vibrating-Reed Frequency Meter (in 3-inch diameter case) is an indicating instrument without moving system or pointer. The operating principle and the method of indication are based on resonant vibration of accurately tuned steel reeds. These instruments are easy to read, ruggedly constructed, surprisingly accurate over long periods of time and are unaffected by wave form or by ordinary changes in voltage and temperature. Available in various ranges of power frequencies from 15 to 500 cycles per second; in fact, the same instrument can have more than one range.

★ "Frahm" Switchboard Frequency Meter —9″ Diameter Case. Made with one or two rows of 31 reeds each, for indicating power frequencies, also for measuring frequency of harmonic ringer circuits in telephone work.

★ "Frahm" Portable type Frequency Meter. Mounted in polished walnut case 9¼″ x 8½″ x 4½″ overall, with carrying handle. Wide range, such as 22.5 to 90 cycles per second. Arranged for various potentials from 50 to 300 volts.

Write for illustrated Bulletin 1695-EI describing all types shown.

JAMES G. BIDDLE CO. 1211-13 ARCH ST. PHILADELPHIA 7, PA.

out of phase with that across ab. This feeds the push-pull grids of the twin triode 180 degrees out of phase with each other. The plate voltages, however, are in phase with each other. Therefore, with grid excitation, one grid is positive in phase with its plate, and the other is out of phase with its plate voltage. The voltmeter (zero at center scale) indicates A or B is leading, by the direction of its deflection. With no grid excitation, unidirectional plate current pulses divide equally through R, placing zero voltage on the dc meter. The curves illustrate the several conditions which may obtain with this system.

Pipe-coating test

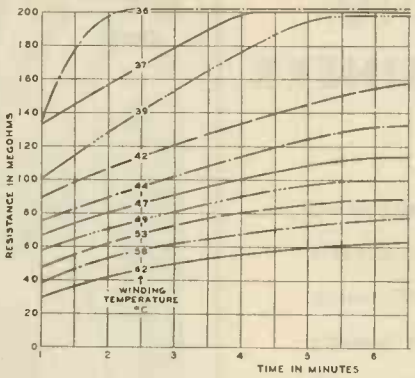
Many types of cables and pipes such as gas pipes, which are to be buried in the ground, are coated with protective compounds in order to resist deterioration by corrosion, electrolytic action, or attacks of micro-organisms.

The presence of certain minor flaws may result in rapid deterioration in service, and it is therefore desirable to detect them without risking serious enlargement of the defects in the coating material. A unit which achieves this purpose makes use of high-voltage oscillators generated by an induction-coil buzzer at about 100 kc. With the pipe or cable to be tested grounded, the "hot" glass-enclosed electrode is passed over a pipe giving an even corona discharge. At the presence of a flaw, this discharge becomes concentrated and the ionization current increases. A detector tube and amplifier operate an alarm through a relay, and, at the same time, energize the grid of an additional triode to cut off the induction-coil current instantaneously, in order to avoid further damage to the pipe coating. Many types of flaws are detected which are not sufficient to reject the section under test and it is therefore desirable to cut off the ionization current quickly. An automatic resistor-capacitor time-delay circuit prevents immediate reenergizing.

Other electronic devices

Many other types of tube-operated apparatus are commonly used. Electronic voltage-regulators find application in many forms of power generating machines. Radio interference detectors are a part of the equipment of every utility. Photoelectric door-openers and other controls, liquid-level indicators for high pressure boilers, air and fuel controls, smoke and dust precipitators, and, in coastal areas, several types of robot air raid alarms are used. Pump-type and sealed-off ignitrons are frequently used to supply dc

for railroad operation and to other services in ac districts which require dc.



8,000 volt dc insulation resistance tests on a 68,750 kva, 3-phase, 13.2 kv, 60-cycle, 1800 rpm generator; readings taken each minute while machine was cooling off

Rosan Locking System

A new standards and design data catalog which explains the Rosan locking system for threaded inserts and studs, has been published by Bardwell & McAlister, Inc., 7636 Santa Monica Blvd., Hollywood, Calif. It is fully illustrated and described throughout. Tabulated engineering data and installation instructions are included.

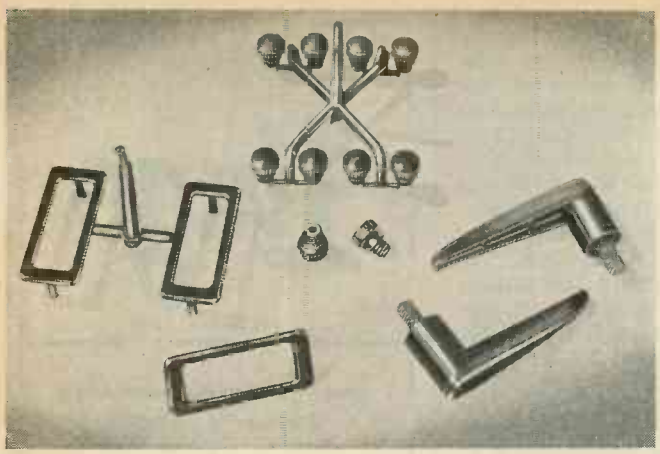
LONG WAVE SYSTEM

(*Continued from page* 77)

apparatus, duplicate sets of the equipment were sent to each point —one by plane and the other by vessel. In addition, each of the technical engineers and installation experts brought with him complete sets of tools and parts and equipment materials for their special assignments as precautionary measures to be certain that the installations were completed on schedule.

The duplicate equipment shipments and the complete complement of tools and parts meant a small extra investment for the project, but the new long wave communications system is now paying big dividends in the safety of the Army Air Transport Command and provides uninterrupted 24-hour radio communications in this North Atlantic area where short wave and high frequency service is so often unreliable and subject to atmospheric interferences.

The selection of frequencies for the new long wave system was another difficult task. In several instances after wavelengths had been chosen it was found that they met with disturbance and interference with Axis station emissions. This meant new wavelengths had to be chosen and new crystals and other



SMC

Use PLASTIC *to*

SAVE METAL AND WOOD— INCREASE PRODUCTION

Plastic is adaptable for manufacturing myriads of parts formerly made out of metal and wood. Usually plastic not only results in better looking parts, but also proves more economical to use. Door handles, knobs, flashlight cases, plumbing fixtures—these are just a few of thousands of items now being made with plastic. No matter how difficult your problem may seem, there is a good chance it can be solved with plastic. Why not consult us?

STANDARD MOLDING CORPORATION, Dayton, Ohio

100% INJECTION MOLDING

PRODUCTION DESIGN SERVICE

CRYSTALS BY

HIPOWER

Thousands of vital transmitting installations rely on the accuracy and dependability of Hipower Precision Crystal units. With recently enlarged facilities, Hipower is maintaining greatly increased production for all important services. When essential demand begins to return to normal, Hipower will be glad to help with your crystal needs.

HIPOWER CRYSTAL COMPANY
Sales Division—205 W. Wacker Drive, Chicago
Factory—2035 Charleston St., Chicago, Illinois

We specialize in supplying Highly trained, thoroughly experienced Men and Women to the *electronic* industry in all its phases.

Mechanical and electrical engineers for shop or research and development; designers for mechanical devices and instruments, electrical equipment, circuits, tubes; draftsmen; physicists and mathematicians; physical chemists and metallurgists; also testers, mechanics, technicians, etc., etc.

Please tell us exactly whom you want, and what you want him or her for.

ACCURATE PERSONNEL
E. P. Curtz
2 John Street, New York 7, N. Y.

ELECTRICITY

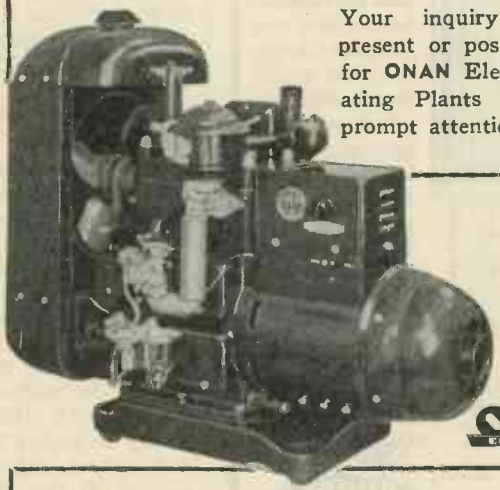
For Any Job . . . Anywhere

★ **ONAN GASOLINE DRIVEN ELECTRIC GENERATING PLANTS** provide electricity for many electronics jobs, general applications, and for emergency service.

They're doing war winning work furnishing vital power and light for scores of war tasks on all the fighting fronts.

Ratings from 350 to 35,000 watts. 50 to 800 cycles, 110 to 660 volts, A.C.—6 to 4000 volts, D.C. Also A.C.-D.C. types.

Your inquiry regarding present or post-war needs for **ONAN** Electric Generating Plants will receive prompt attention.



Awarded to each of the four Onan manufacturing plants

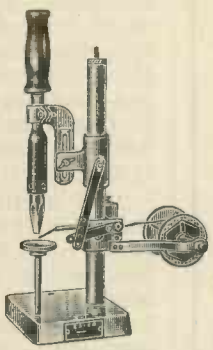
ONAN ELECTRIC PLANTS

D. W. ONAN & SONS
1897 Royalston Ave. Minneapolis, Minn.

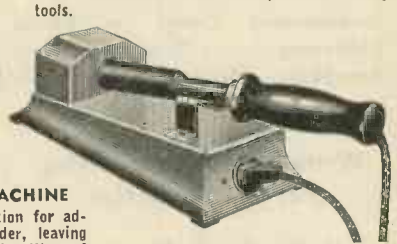
ESICO

REG. U. S. PAT. OFF.

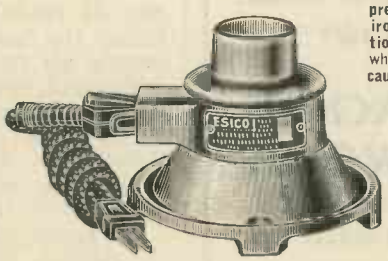
SOLDERING IRONS
are widely used in industrial plants throughout the country. They are designed to withstand the strain of continuous service required of factory tools.



SPOT SOLDERING MACHINE
designed for treadle operation for advancement of iron and solder, leaving operator's hands free for handling of product.



SOLDERING IRON TEMPERATURE CONTROLS
prevent overheating of soldering irons between soldering operations. Irons do not deteriorate when being used. The idle period causes oxidation and shortens life.



SOLDER POTS
ruggedly constructed pots of various sizes designed for continuous operation and so constructed that they are easily and quickly serviced, should elements have to be replaced.

Write for Catalog

ELECTRIC SOLDERING IRON CO., INC.
2112 WEST ELM STREET, DEEP RIVER, CONN.

components to fit the equipment already selected had to be secured. For the stations in three of the Arctic points Diesel installations to generate power, ranging from 3 to 75 kw, had to be established.

The erection of the antennas was a particularly tough job. For several of the stations the location of level ground was a problem. In Greenland and Iceland the antennas had to be set in solid rock. For the Newfoundland station the 80-ft. tower was erected while a 35-mile-per-hour wind howled about and the riggers had to fight this gale. The antenna of one Arctic station had to be constructed to withstand maximum winds of 160-miles-per-hour intensity.

The task called for a wide variety of radio station construction specialists. The group of technicians assembled for the project included Diesel power experts, radio communications, teletype and outside plant engineers and installation men, steel riggers for the antennas and technical engineers skilled in radio traffic operations. To operate the new system the Army is giving a specialized training course for operators now stationed at the six points. In connection with the furnishing of navigation information to the Air Transport Command, weather data is being assembled from several hundred points.

Just as the construction of the telephone line along the Alaskan Military Highway, which was also supervised by General Stoner, was a feat of wire communications engineering performed under the worst sort of conditions with sub-zero temperatures and located in the wildernesses, the building of the long wave stations, especially in Greenland, Iceland and Labrador, was accomplished under equally difficult hazards.

The Arctic winter meant that the job had to be done in the short period of 28 days, because construction would have been impossible when wintry weather set in. In installing the stations, the buildings and outside plant and antennas had to be constructed so as to withstand the severe Arctic storms and weather and protected against icing and the deep snows. Special roads had to be built to bring the supplies in from the nearby air fields and harbors. In Greenland, trucks bringing in materials had to ford a 50-ft. river. In the case of the special roads, cloudbursts on several occasions completely washed them out so they had to be rebuilt.

The building of these North Atlantic stations exemplifies the slogan of the Army Service Forces—"The difficult we do immediately; the impossible takes a little longer."

Allocations Conference Plans Information Exchange

Washington Meeting Between RTPB and Government Bureaus Formulates Policies

The procedure of exchanging technical information between the Radio Technical Planning Board, representing the radio industry, and the government agencies such as the FCC, the Interdepartment Radio Advisory Committee and the BWC formed the principal accomplishment Nov. 17 of the conference between the governmental and industry groups to launch the study of postwar radio frequency allocations. No date for a future meeting between the two groups was set, but it was believed that the exchange of technical information would be commenced at the earliest possible date.

FCC Chairman James Lawrence Fly who took the leadership at the conference which he had called two weeks ago emphasized the need for a speedy study of radio allocations so that radio services would have a certain place in the spectrum when the war ends and the economic considerations should be given careful attention in order to aid the radio manufacturing industry in its development of postwar apparatus to be sold to the general public. It was felt that the studies should be started as quickly as possible, subject to the priorities of work related to the war and military secrecy on radio services.

Government observers

The government departments concerned with radio problems will appoint observers to work with the thirteen panels of the Radio Technical Planning Board, it was decided.

The consensus at the conference was that the allocations studies should be pushed ahead even though the characteristics of the upper bands were not fully known. The time, it was deemed, is too short to go into prolonged studies on frequencies performance and it was urged that the industry and government groups act on the information presently available. Dr. L. P. Wheeler, retiring president of the Institute of Radio Engineers and Chief of the FCC Technical Information Division, gave a brief report on the observations of the FCC Engineering Department in regard to frequency propagation and characteristics, especially in the 60 megacycle segment, but stressed that no definite conclusions had been reached through the Commission's studies.

The various panels of the RTPB and the government groups will

study such problems as: (a) Major changes which may be required with respect to each service such as standard broadcasting, FM broadcasting, television, aviation (domestic and international), police and emergency services, international point-to-point, maritime and government; (b) Revisions to be made in the FCC's present standards of good engineering practices and other technical rules; and (c) The possibilities of utilizing frequencies above 300 megacycles. It was understood that there was no special mention of any particular services, including FM, television and aeronautical at the conference. But it was pointed out that in the case of aeronautical radio three RTPB panels were studying phases of it, including the Radio Communications panels, headed by Mackay Radio vice-president and Chief Engineer Haraden Pratt and as vice-chairman Dr. H. H. Beverage, RCA Communications vice-president and Chief Engineer, the Aeronautical Radio panel and the Radio Range, Direction and Recognition panel of which Dr. W. P. Hilliard, Bendix Radio vice-president, is chairman.

These attending the conference were: Board of War Communications—Commander Franz O. Willenbucher of Naval Communications, President George W. Bailey and executive secretary Kenneth B. Warner of the American Radio Relay League, Walter J. Damm of FM Broadcasters and Lt. Comdr. Paul Segal of Naval Communicaions; IRAC—Dr. J. H. Dellinger, Radio Division Chief of Bureau of Standards, Lt. Comdr. Paul D. Miles of Navy Department, Captain E. M. Webster, Lt. A. L. Budlong and Ensign E. J. Brumbaugh, all of the Coast Guard, Lt. Col. A. G. Simson of Signal Corps, L. H. Simson, of the CAA and E. C. Wagner of Agriculture Department; FCC Chairman Fly and Commissioners T. A. M. Craven who heads IRAC, C. J. Durr, Paul A. Walker and Ray C. Wakefield and from the Staff, Chief Engineer E. K. Jett, general counsel Charles Denny, assistant general counsel Rosel Hyde, International Division Chief P. F. Siling, Dr. Wheeler, RID Chief George Sterling, assistant chief engineer George Adair, attorneys William Bauer and Harry Plotkin, George Turner, William Krebs and James P. Veatch, all engineers.

From RTPB

From the RTPB were: General Electric vice-president W. R. G. Baker, its chairman, L. C. F. Horle, RTPB Coordinator, RMA vice-president Bond Geddes, Zenith Radio vice-president G. E. Gustafson, D. E. Noble of Galvin Corp., H. F. Argento of Raytheon Co., David B. Smith, F. D. Williams and F. J. Bingley of Philco Corp., Burgess Dempster of Crosley Corp., Dr. Beverage of RCAC, director E. W. Engstrom and C. J. Young of RCA Laboratories, H. B. Marvin of General Electric, John V. L. Hogan of Facsimile Laboratories, Ralph Bown of Bell Telephone Laboratories, vice-president Ray Manson of Stromberg-Carlson Co., F. M. Ryan, A. T. & T. radio engineer, W. B. Lodge of CBS, Dr. Alfred N. Goldsmith, Thomas Streibert and Philip Loucks of FM Broadcasters, George T. Harness of American Institute of Electrical Engineers, Frank J. Martin, National Electrical Manufacturers Association, D. W. Bentzel and Walter Murray of Aeronautical Radio and R. M. Wise of Sylvania Electric Products.

War Production Gains

One of the brightest spots in the war production picture in October was scored by communication and electronic equipment with a 9 per cent gain over September, the monthly report of WPB Chairman Donald M. Nelson, issued Nov. 20, stated. The production remained only a few per cent below the high schedule of the requirements for these items.

The record refuted the loose reporting in the current issue of a popular weekly which indicated radio and electronic equipment was way behind schedules. The WPB report stated that for October

ground electronic equipment was above September. Airborne signal equipment moved ahead, overcoming some of the technical problems which have impaired earlier production in that field. In connection with the overall production picture the WPB stated that the encouraging record of October showed the manpower situation, shortages, etc., gave less trouble than in recent months.

Double Television Transmitters

Claiming ability to produce a definition of at least 1000 lines or more, Scophony Corp. of America, 527 Fifth Ave., New York, points to a possible revolution in television technic, largely as a result of development of its Skiatron tube and a related "electron opacity television" system. Says Arthur Levey, president of the company:

"With the incorporation of the SCA television picture 'storage' methods into the postwar television receivers, many more non-interfering television transmission stations become possible within the same television broadcasting band. Experiments in the Scophony laboratory have shown that the Skiatron television receiver enables a definition of at least 1000 lines or more which is sharper than present-day motion picture standards. The definition of the Skiatron television picture is solely determined by the sharpness of the cathode ray spot which is a purely electron-optical matter which has now been successfully solved.

"Much more than in present-day radio, the transmission technic of television is linked up with the performance of television receivers. Due to certain deficiencies of current television receiving apparatus, a high field frequency of 60 per second involving a great bandwidth as well as interlaced scanning are required. By contrast, the Scophony Skiatron receivers which enable a great optical storage make the fullest use of the persistence of vision of the human eye and therefore require a much lower field frequency. In other words, the Skiatron television receiver is more 'modest' with regard to the required signal information as compared to prevalent systems, and permits a reduction of the bandwidth of at least 66 per cent, meaning that for a given total allocated frequency band in a specified city, it will permit the establishment of at least 50 per cent more transmitting stations. It should lead to a simplification of the television transmitter by reducing the field frequency to about 20 per second or less and permit straight scanning instead of the more complicated present-day interlaced scanning."

"THIS YEAR, LET'S PAY THE BONUS IN WAR BONDS

. . . and drive even harder on the pay-roll savings plan!"

Make War Bonds the Christmas Order of the Day. Urge your workers to make their personal Christmas gifts in the form of War Bonds—and practice what you preach! Make this a 100% War Bond Christmas—to insure future Yuletides of peace and prosperity.

Make up your own posters to spread the "War Bonds for Christmas" story across your plant. Tell the story again and again on bulletin boards, in your plant magazine, and on pay envelope stuffers.

But don't forget your basic, all-important Pay-Roll Savings Plan. How's it going, these days? Perhaps it needs a bit of stoking-up right this very minute, to hold its full head of steam against the competitive demands of the holiday season.

Well, you're the man to stoke it! You can't expect it to keep running indefinitely on last summer's enthusiasm. See to it that your participation percentages, and your deduction percentages, *both* end up the year at new levels.

Every month, now your Pay-Roll Savings ought to run well ahead of the preceding month. *For so many families that formerly depended on the earnings of a single worker, now enjoy the combined earnings of several.* Such *family* incomes are doubled, trebled, even multiplied many times.

Now's the time to turn as much as possible of these increased earnings into War Bonds—War Bonds for Christmas . . . and War Bonds the whole year 'round!

GIVE THE PRESENT WITH A FUTURE—WAR BONDS!

This space contributed to Victory by ELECTRONIC INDUSTRIES

This advertisement prepared under the auspices of the United States Treasury Department and the War Advertising Council

ELECTRONIC TOMORROWS!

But Don't Hold Your Breath Till Predictions Materialize, Warns Sylvania's Don Mitchell

To provide the volume of business necessary to avoid disastrous unemployment after the war, every man, woman and child must make purchases of goods and services totaling at least $1,000, *declares Don G. Mitchell, vice-president of Sylvania Electric Products Inc.*

Postwar development of the newer industries such as aviation and prefabricated housing will play an important part in maintaining this high level of expenditure, though of most promise, said Mitchell, is the electronics industry, which will find thousands of new jobs to do in manufacturing and transportation. At the same time, he scoffed at the exaggerated ideas that have grown up around this subject, declaring:

"It would seem that we would be awakened by the gentle electronic rocking of our bed; arise to have an electronic shave and shower; be dried by standing for a moment under an electronic ray. We would sit down to an electronically-cooked breakfast and proceed through an electronically-controlled day, from the automatic opening of the doors of our garage or helicopter hangar, to the walkie-talkie conversation with the wife that we had just met a couple of old friends at the club and would be a little late for dinner. When we finally did get home, we would be rocked to sleep by an electronic lullaby machine. My advice is: Don't hold your breath until that day arrives."

Recent Army-Navy "E" Awards

Hewlett-Packard Company, 481 Page Mill Road, Palo Alto, Calif.

Storage Battery Div., Philco Corp., Trenton, N. J. (second star added)

Reeves Sound Laboratories, Inc., 62 W. 47 Street, New York, N. Y.

Amperex Electronic Products, 79 Washington St., Brooklyn, N. Y.

Espey Mfg. Co., Inc., 305 E. 63 St., New York, N. Y.

McElroy Mfg. Corp., 82 Brookline St., Boston, Mass.

International Resistance Company, 403 N. Broad St., Philadelphia, Pa. (second star added)

Correction

The caption under the illustration of the three-element broadside antenna which appears on page 83 of this issue, should read 3000 mc instead of 300 mc.

assuming that the years 1945 and 1946 will be the period of demobilization. Due to the war, marriage rates, the report noted, were 13.3 in 1943, considerably above the "usual" marriage rate of 10.5.

The definition of a "family" used in the report is that a "family" comprises a family head and all other persons in the home who are related to the family head by blood, marriage or adoption, and who share common housekeeping arrangements.

High Frequency Heating

Partial List of Applications

Industrial use of tube-generated radio-frequency energy is steadily increasing in essential and "critical" industries. Experimentation points toward many new uses in other industries after the war. Here is a partial list of the chief current and the most promising future ap-

(200 to 500 kc)

Induction heating of metals (200 to 500 kc)

1. Hardening and heat treatment of steel parts
2. Melting, alloying of small quantities of metal
3. Soldering and brazing
4. Expanding parts for shrink fits
5. Annealing
6. Miscellaneous: detonating explosive rivets; "remote" heating as in electronic tubes in exhausting machines, etc.

Dielectric heating of non-metals (2,000 to 15,000 kc)

1. Bonding plywood with thermosetting resins
2. Molding small plastic parts
3. Plastic bonding jobs such as "sewing" of plastic cloth, cementing shoe leather, etc.
4. Drying powders, textiles, paper, etc.
5. Cooking (experimental stage only)
6. Killing infestation in grain—(highly successful technically, but not economically)
7. Dehydration of food—(superior to other processes; in early stages at present)
8. Miscellaneous; medical; diathermy

AIEE-IRE Winter Convention

Three days of radio-electronic engineering sessions are planned for Thursday, Friday and Saturday, January 27, 28 and 29, at New York City in connection with the 1944 winter meetings of the AIEE and IRE.

On Thursday, January 27, the AIEE communications and electronic sections will hold special discussion conferences as part of the AIEE winter convention. These AIEE meetings are scheduled, as last year, for the Engineering Building, 29 W. 39th St.

On Thursday evening there will be a joint AIEE-IRE dinner meeting at the Commodore Hotel, at which General R. B. Colton of the Signal Corps will show and discuss captured enemy radio equipment.

On Friday, January 28, the IRE winter convention sessions will be held at the Hotel Commodore, and at noon the IRE President's Luncheon will take place, when IRE officers and directors are expected to be present to meet the membership. Papers outlining the progress made by the FCC and RTPB in setting up new postwar radio allocations, are also scheduled for Friday's technical meetings. The IRE sessions will continue on Saturday, January 29. On this day, the noonday luncheon will be devoted to subjects of student-engineer interest.

Dr. B. E. Shackelford, RCA, 30 Rockefeller Plaza, New York, is general convention chairman, with Dr. Austin Bailey, A T&T, 195 Broadway, as vice-chairman. I. S. Coggeshall, Western Union, 60 Hudson St., New York, is in charge of information.

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How to Use This Index

This Index consists of three parts:

1. **An index of contents of issues by months, listing principal articles and features.**
2. **A subject index. References here are to subject-matter of all principal articles and their contents, regardless of title used on article.**

For example, if you are looking up references to the subject of Amplification, you will find a reference "'42-11-62." This means that in the issue for the 11th month of 1942 (November, 1942) an article on page 62 discusses this subject. With this information you can turn directly to the issue itself, if at hand. Or if more convenient by looking in the list of articles for November, 1942, you will find the title and author of the article "Power Transformers for Aircraft Use, by Harry Holubow."

3. **An author index.**

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RTPB's Television Problems

by DAVID B. SMITH
Chairman, Television Panel, RTPB

"Several major problems will face the RTPB with respect to television," states David B. Smith, director of research for the Philco Corp., and chairman of the Panel on Television for the Radio Technical Planning Board. Some of these are as follows:

"1. The review of the television standards adopted July 1, 1941, to bring them up to date and bring into the picture whatever improvements may have been made as a result of war research and experience.

"2. The formulation of such auxiliary standards as may be necessary for the licensing of studio to transmitter television links or relay stations and portable pickup links.

"3. The formulation of such auxiliary standards as may be necessary for the licensing of city to city relay links which will provide television with networks and chain broadcasting.

"4. The allocation to television of sufficient useful channels to permit the establishment of nationwide competitive television broadcasting and the determination as to which of these channels shall be used for commercial television broadcasts and which, if any, will be reserved for use later in the development of a deluxe system with higher fidelity, etc.

Military research

"The veil of secrecy which covers all military research and thus practically all electronic research makes it impossible to say at this time what new ideas may have been developed in the past two years which may affect television transmission. However, as of July 1, 1941, at which time the Federal Communications Commission officially adopted the standards recommended by the National Television System Committee, there was substantial agreement among the industry on nearly all standards. The proposals of the NTSC include several programs for the improvement of the then existing standards. No doubt, the RTPB will follow through on these suggestions of the NTSC. These provided principally for:

"(a) The formulation of more specific standards for synchronization.

"(b) The standardization of color television.

"In its final report the NTSC pointed out that its recommendations permitted several interchangeable synchronization systems, all, however, being receivable on a 'standard' RA receiver. These included the former RMA system, the DuMont system using a 500 kc vertical sync pulse, the Philco alternate carrier system, and complete frequency modulation of both sync and picture signals. However, there were also certain types of other receivers which could receive only selected ones of the several transmitted signals. For this reason it was urged that after sufficient field tests had been conducted to determine which of the several systems was the superior system, further standards should be adopted to permit the use only of the superior system.

Color television

"On the question of color television, the NTSC reported that although it was not then ready for commercial standardization, field testing should be encouraged and commercial broadcasting allowed as soon as final standards could be determined. Just how much work in the field of color television has been possible during the war period is not now known, but the problem will be one of the most important ones facing the RTPB.

"Some considerable experience in field operation has been obtained over the past two years. In spite of present difficulties, several stations have maintained a weekly program schedule even though on a reduced basis. Their experience in operating with the NTSC standards will be of great value in the selection of final standards.

"A considerable part then, of the work of the Television Panel of the RTPB will be to resolve the problems outlined above and formulate final and complete standards for commercial operation.

"One interesting phase of the experience of the past several years in television has been the development of radio links as a means for bringing programs to the transmitter. Philco's station WPTZ, for example, is now obtaining all of its live talent programs at points away from the transmitter and beaming them via uhf to the transmitter for rebroadcasting.

"This has succeded in freeing the studio from its transmitter to such an extent as to open up very substantial new sources of programs. It seems certain that after the war many stations will wish to locate their studios away from the transmitter since the location requirements for the two are so different, and no doubt all wish to have several portable and mobile cameras on hand to make spot pickups. Consequently, the establishment of technical standards and allocations for this new service will be an important part of the work of the RTPB.

"In similar fashion, the use of radio beams to link distant cities into television networks and thus provide for chain broadcasting has become more and more important. Both General Electric at Schenectady and Philco in Philadelphia in cooperation with NBC have good results over a period of several years in rebroadcasting programs originating at New York. This type of operation has heretofore been conducted through the use of stations with experimental licenses. It seems certain that substantial improvements in such units have been made in the past two years and that after the war it will be technically feasible to set up vast networks of relay stations to carry programs wherever they are wanted throughout the nation. The impetus that this will give to television can hardly be exaggerated. Hence, it will be of considerable importance for the RTPB to establish the necessary conditions for the existence of such links.

Field testing

"Out of the vast research that is now being carried on for war purposes, one can be sure that two things will emerge of interest to television. One is that considerable progress will have been made in opening up the higher part of the frequency spectrum, and the other, a variety of new uses will have been found which will compete with television and other services for their share of the spectrum.

"It is certain that these matters will be given earnest and sincere consideration by the RTPB for the conclusions reached in their councils will profoundly effect the future not only of the industry but of the entire national economy. The final decisions will naturally rest with the Federal Communications Commission. But the Commission in the past has rightfully relied to a considerable extent upon the best technical judgment of the industry."

ELECTRONIC INDUSTRIES

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DECEMBER 1943

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

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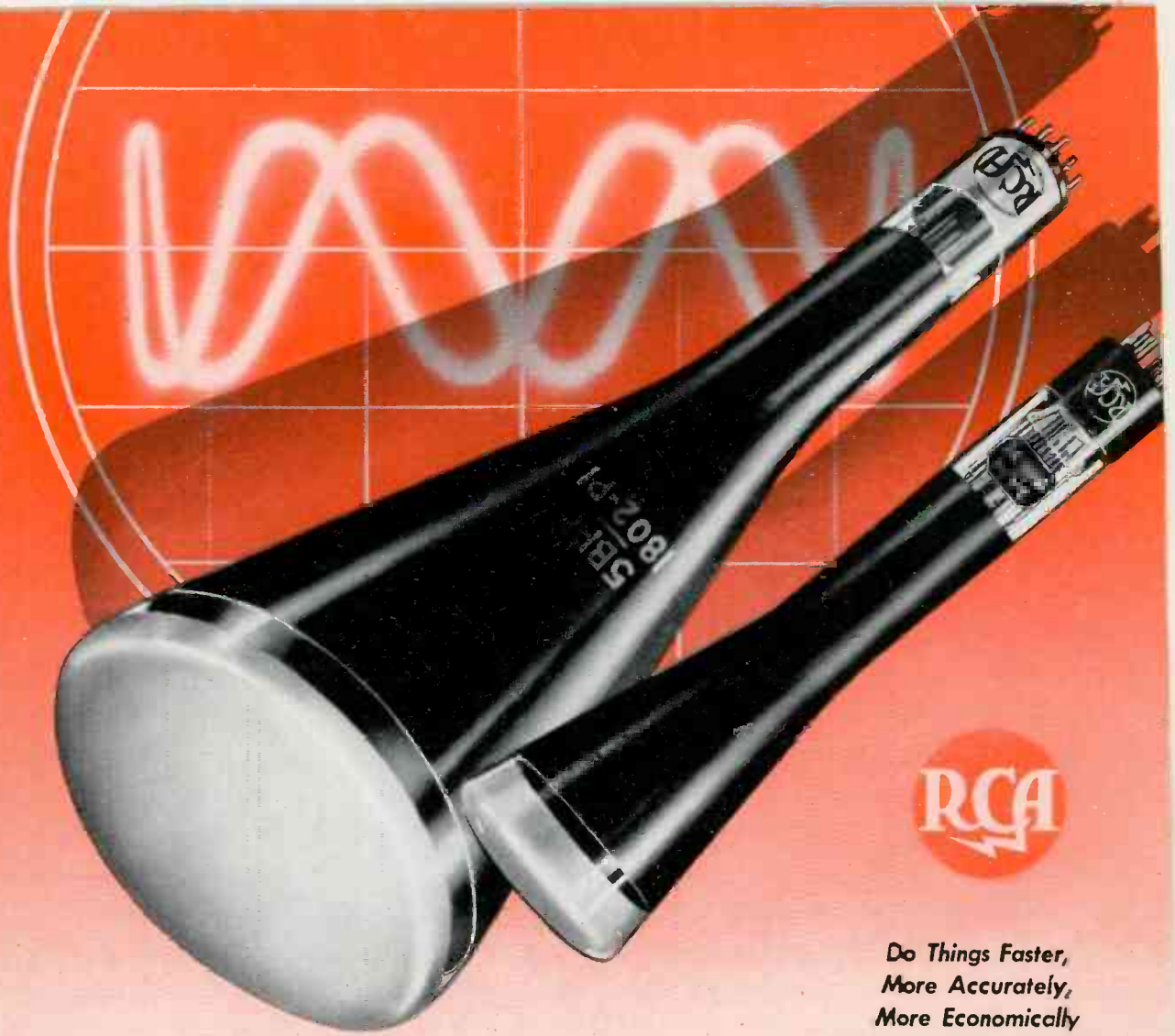

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The following RCA Tube publications are available from Radio Corporation of America, Commercial Engineering Section, Harrison, N. J.

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RCA POWER AND SPECIAL PURPOSE TUBES (catalog on request)
RCA TRANSMITTING TUBE GUIDE (Guide 35c net)

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