ELECTRONIC INDUSTRIES

- Electronic Control of Resistance Welding—Chart
- Industrial Uses for X-Rays ★ Iron Core Loop Antennas
- Cathode-Ray Tube Testing ★ Shielded Room Construction

NOVEMBER

Caldwell-Clements, Inc.

Metallurgical Help for "The Little Man Who Isn't There"

The gyro-pilot is aptly nicknamed the "Little Man Who Isn't There." The device provides marvelous relief for pilots on distance flights, keeping the plane on its course with uncanny accuracy, despite wind and weather.

Developing the newest and most efficient gyro-pilot posed some pretty problems for the maker, including a design that called for unusual rotor rings. They required a metal with the greatest weight that could be contained in the smallest possible area.

Having worked with Mallory on other applications, the manufacturer asked Mallory to find the metal—and without delay.

A Mallory material — Mallory 1000 — was suggested. It is a material of high specific density and provides maximum mass weight in minimum space. It filled the bill exactly.

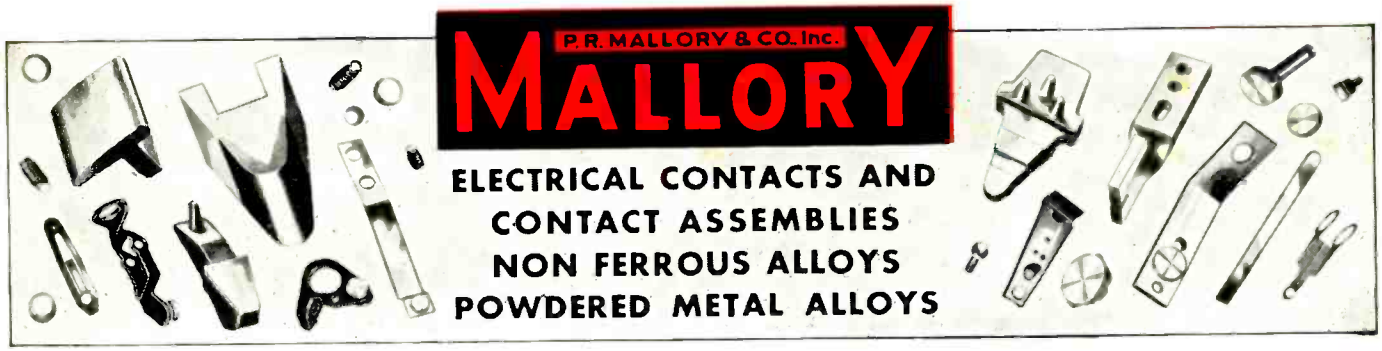
Here again was proof that metallurgical progress grows from meeting the service needs of many industries. Mallory 1000 was developed originally to shield the gamma radiation in radium beam therapy. Now its applications extend not only to gyro-pilots but to fly wheels and counterweights in aircraft where space is at a premium.

Where product plans call for experience and "know-how" with contact designs and materials, Mallory engineers and metallurgists may give real help. Bring your problems to them.

While the design is still in blueprint form

CONSULT MALLORY
for Contacts and Contact Assemblies

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



FOR A LONG, LONG TIME

One reason why Tobe Capacitors have forged to the front is their consistently long life. But there's another reason — the successful pioneering work of Tobe engineers.

Take as an example the CA—355, shown below in streamlined, hermetically sealed drawn container. It is being used in large quantities by the U. S. Army Signal Corps in front line telephones.

Tobe is the only manufacturer furnishing this capacitor in a drawn container.

The CA—355 is just one instance of Tobe engineering ingenuity in developing and perfecting new devices. However tough your own condenser problems we invite the opportunity for our engineers to help you solve them. Please get in touch with us.

LONG-LIFE ASSURED

For This Unique Capacitor

SPECIFICATIONS—CA—355

Wax impregnated, wax filled capacitor

Capacity Rating: .....2.0—0.5—0.3 mfd.
Voltage Rating: .....200 D C
Power Factor: ..@ 1000 cycles .01 maximum
Resistance: ....2000 megohms per microfarad
Dimension: 1" depth—2½" length—2⅛" height

Meets requirements of U. S. Army Signal Corps

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

***A small part in victory today*—A BIG PART IN INDUSTRY TOMORROW**

LISTED ON PAGE 4, EDITORIAL CONTENTS AND ARTICLES

WHY AMPEREX

WATER AND AIR COOLED

TRANSMITTING and RECTIFYING TUBES

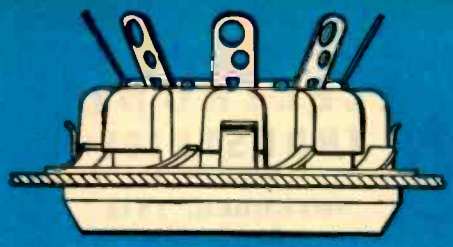
The usual idea of a transmitting tube plant, even among many engineers, is that of a mass production factory. Contrary to such notions, this is not the case at Amperex. Ours is a scientific laboratory on an enlarged scale where production operations are skill-fully handled by trained technicians. If you could stand alongside the bench where large air-cooled or water-cooled Amperex tubes are assembled, you'd see just what we mean. It's the "Amperextras" that make our tubes more desirable . . . more satisfactory.

One of a series showing Amperex tubes in the making

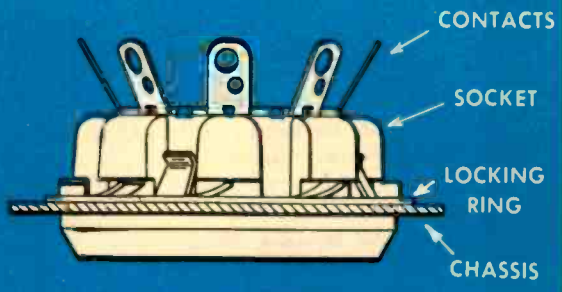
AMPEREX . . . THE HIGH PERFORMANCE TUBE

AMPEREX ELECTRONIC PRODUCTS

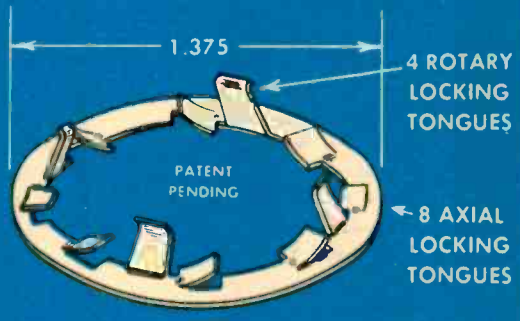
79 WASHINGTON STREET · BROOKLYN 1, N. Y.



LOCKING RING IN
UNLOCKED POSITION



LOCKING RING
IN LOCKED POSITION

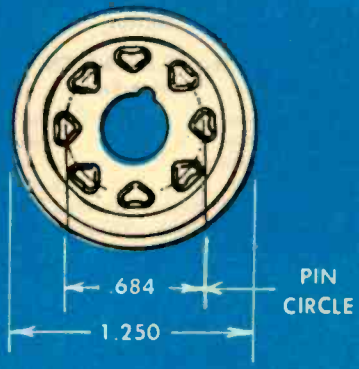


NEW TYPE LOCKING RING

Assures POSITIVE LOCK to Chassis.

⅛ turn with simple tool
permits assembly or removal.

Assembly part No. 65-3



OCTAL CERAMIC SOCKET

Assembly part No. 65A-1

Grade G Steatite body

Phosphor Bronze, Silver
Plated, Contacts

THE NEW FRANKLIN LOCKING RING is much more than a labor saving device. In addition to its labor saving feature it assures a POSITIVE LOCK of components to chassis.

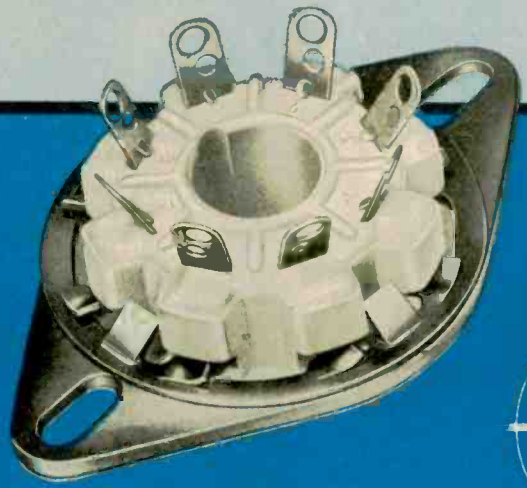
The Franklin Locking Ring fits between the chassis and the component to be locked; a simple tool is placed over the component and a ⅛ inch turn of the tool, by wrist action, does the locking — a further ⅛ inch turn does the unlocking.

While the Franklin Locking Ring was developed to lock sockets to chassis for the Radio and Electronic industries the use of this Locking Ring need not be confined to this work. The Franklin Locking Ring can be applied throughout industry, wherever components need to be locked to parent bodies.

Illustrated are various features of the Franklin Locking Ring.

A. W. FRANKLIN MANUFACTURING CORP.

175 VARICK STREET, NEW YORK 14, N. Y.



The one piece Ceramic Socket, illustrated, has been designed to embody the Franklin patented Bow Spring Action Contact. This Contact is a feature of Franklin Sockets which enjoy such favor throughout the Radio industry.

ELECTRONIC INDUSTRIES

NOVEMBER, 1943

In this Issue

Electronic Industries, November, 1943, Vol. II, No. 11. 35 cents a copy. Published monthly by Caldwell-Clements, Inc., 480 Lexington Avenue, New York 17, N. Y. M. Clements, President; Orestes H. Caldwell, Treasurer.

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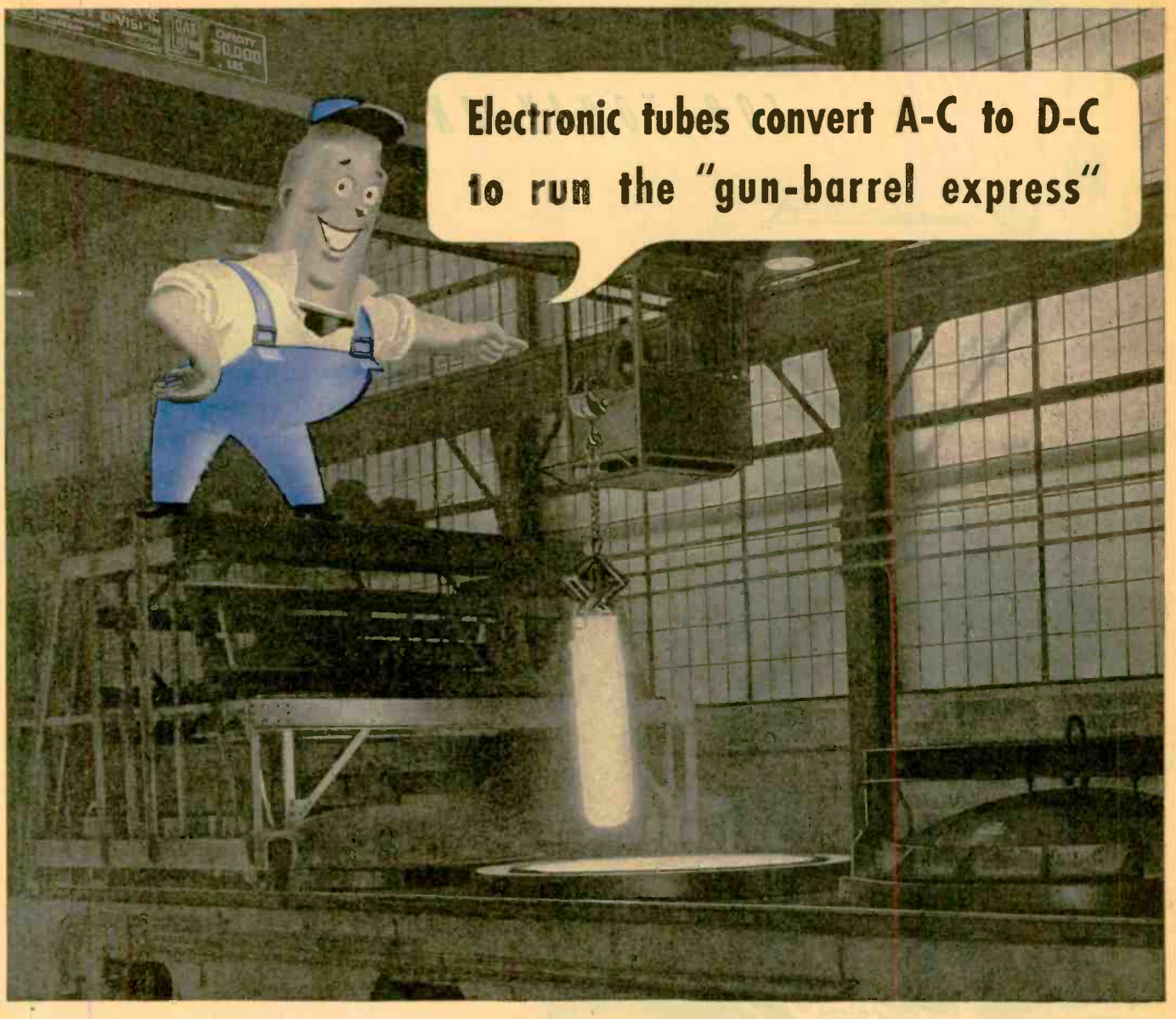


The General Electric sealed ignitron is used instead of rotating machinery

THIS traveling crane, 100 feet long, is suspended from the sides of a war plant turning out gun-barrels for destroyers. Its power supply offers an excellent example of electronic tube application.

Direct current is essential for precision crane operation. Here, rectifiers using the G-E steel-jacketed ignitron (available in ratings from 20 amp to 200 amp) provide D-C at about the same installed cost as rotating machinery, but at lower operating costs.

This electronic tube has no moving parts. It requires no special foundation. It is quiet in operation. Overall efficiency is high, and practically constant over the entire load range.

The steel-jacketed ignitron is only one of a complete line of G-E electronic tubes now working for industry in a thousand different jobs.

It is the purpose of the G-E electronic tube engineers to aid any *manufacturer* of electronic devices in the application of tubes. Through its nation-wide distribution system, General Electric 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 Hour of Charm" at 10 P.M. E.W.T. over NBC.

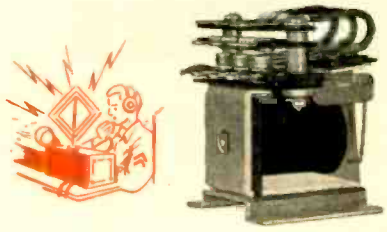
THERE IS A G-E ELECTRONIC TUBE FOR EVERY OCCASION

GENERAL ELECTRIC

182-814-8850

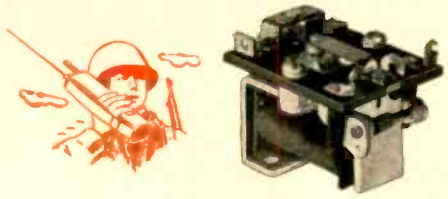
Relays by GUARDIAN

FOR EVERY CONTROL NEED



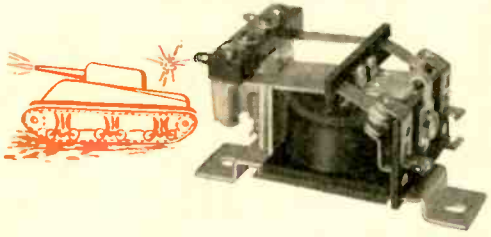
SERIES 345 RADIO RELAY

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.

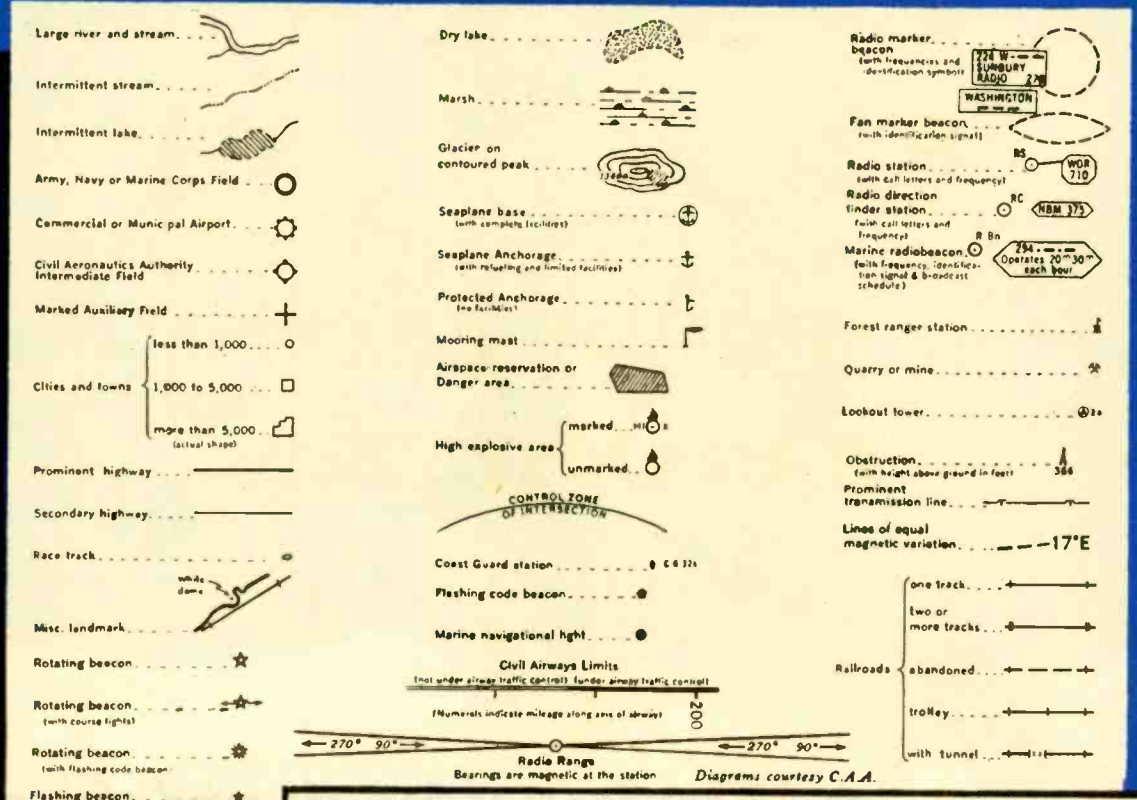
BULLETIN O-F—112

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-M WEST WALNUT STREET CHICAGO, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY



SYMBOLS . . .

some of safety and some of danger... all are aids to navigation of the airways—the "Highways Of The Air".

Another symbol— RRC —the trademark of RADIO RECEPTOR CO., INC.—stands for advanced design, honesty in manufacture and reliability of operation on all types of airline and airport radio equipment.

AIRPORT TRAFFIC CONTROLS
RADIO RANGES • MARKERS • LOCALIZERS
COMMUNICATION TRANSMITTERS AND RECEIVERS

Please do not ask us *now* for catalogs or technical literature because all of our efforts are concentrated on war work. We shall, however, have off the press shortly an interesting non-technical booklet, "HIGHWAYS OF THE AIR", which we will send on request.

EXECUTIVE OFFICES, 251 WEST 19th STREET, NEW YORK 11, N.Y.

Keep It Up—Buy More War Bonds

RADIO RECEPTOR CO., INC.

ARMY NAVY

Awarded for Meritorious Service on the Production Front

SINCE 1922 IN RADIO AND ELECTRONICS

to lift another mist from the mind of man

War's necessity mothers tomorrow's blessing. War-born electronic devices which now strengthen and sharpen a war pilot's radio signal may, some happier tomorrow, guard the glory of a symphony.

Who knows the future of these discoveries which keep our pilots in clear communication, even through the deafening crackle of a tropical storm? Who knows what undreamed comforts, undreamed glories flicker in the electronic tubes? Or in any of the modern miracles so familiar to us at Sylvania?

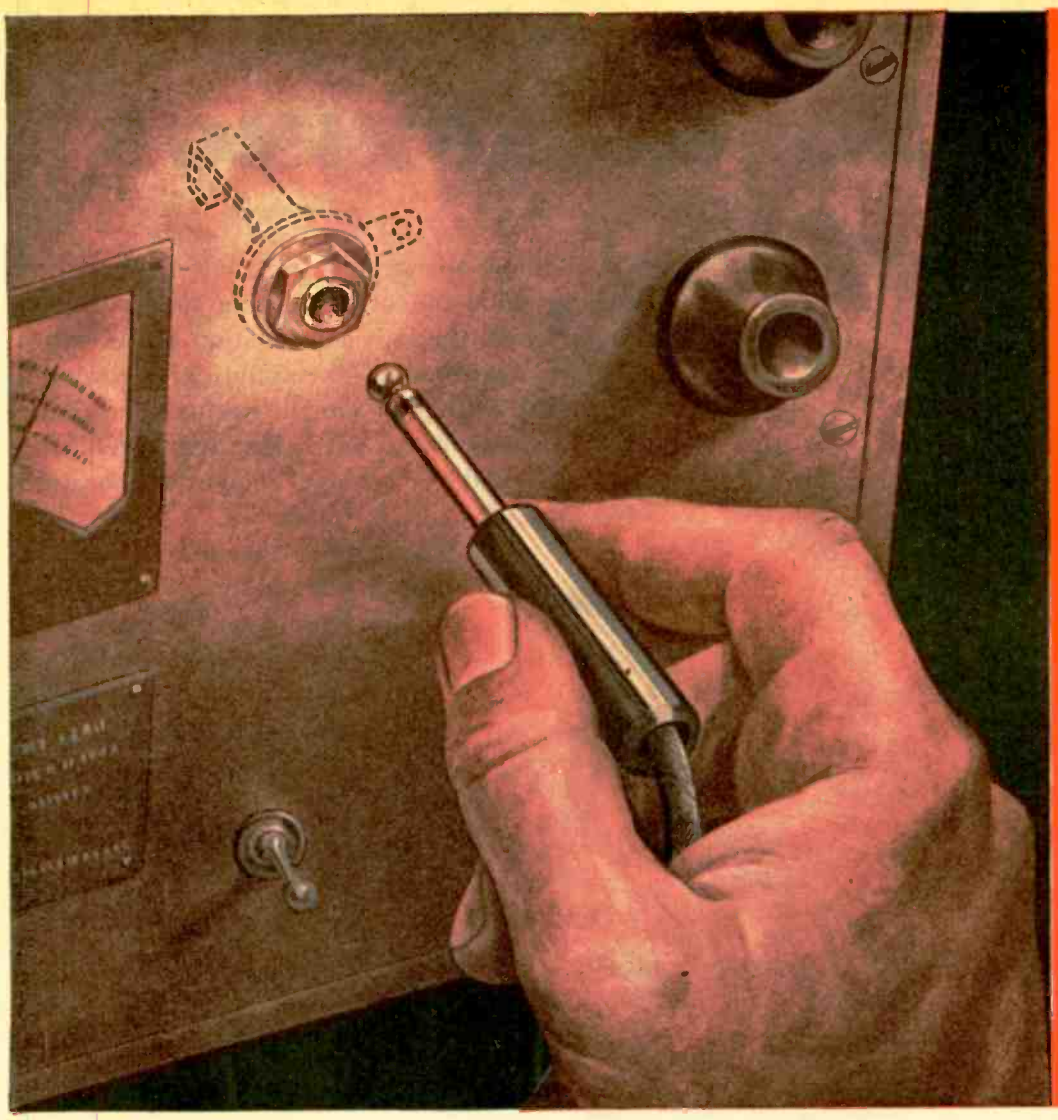
New sound for the ears of the world. New knowledge for the eyes of the world. More mists of ignorance swept away! Those are the potentials which inspire us, in everything we do, to work to one standard and that the highest known.

SYLVANIA ELECTRIC PRODUCTS INC.

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

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

IN ACTION ON THE HOME FRONT . . . Sylvania Fluorescent Lamps and Equipment are helping our war factories speed production. Sylvania Radio Tubes are helping bring information and entertainment to homes throughout the land. Sylvania Incandescent Lamps are serving long and economically in these same homes. As always, the Sylvania trade-mark means extra performance, extra worth.



OPEN CIRCUIT JACK

CLOSED CIRCUIT JACK

MICROPHONE JACK

TU-WAY PHONE PLUG

ONE-WAY PLUG

FLAT PLUG

utah CAN HELP YOU MAKE THE RIGHT "CONTACTS"...

THE right "contacts" are always important. In electrical and electronic applications a poor contact can mean costly losses. By using Utah Jacks and Plugs you can be sure that your equipment will not fail from the want of proper contact. They have been tested in the laboratory and in actual use thousands of times, answering every test successfully—under all types of conditions.

UTAH PHONE JACKS are everything that selected materials and human ingenuity can make them. They are available in Imp, Short and Long frame types to fit the standard phone plugs. Special Jacks are also made to meet Navy and Signal Corps Specifications.

UTAH PHONE PLUGS can be supplied in two or three conductor types—for practically every type of application. Compact, sturdy and dependable—they're all a plug should be. Utah standard plugs are being used on many products destined for use by the Armed Forces. In addition, special plugs are being manufactured.

Investigate today the possibilities of using Utah Jacks and Plugs in your electrical applications. You'll be assured of absolute dependability—and you'll be cashing in on Utah's extensive electrical and electronic experience. Write today for full information on Utah's Jacks and Plugs—it may save you considerable time and money.

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

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

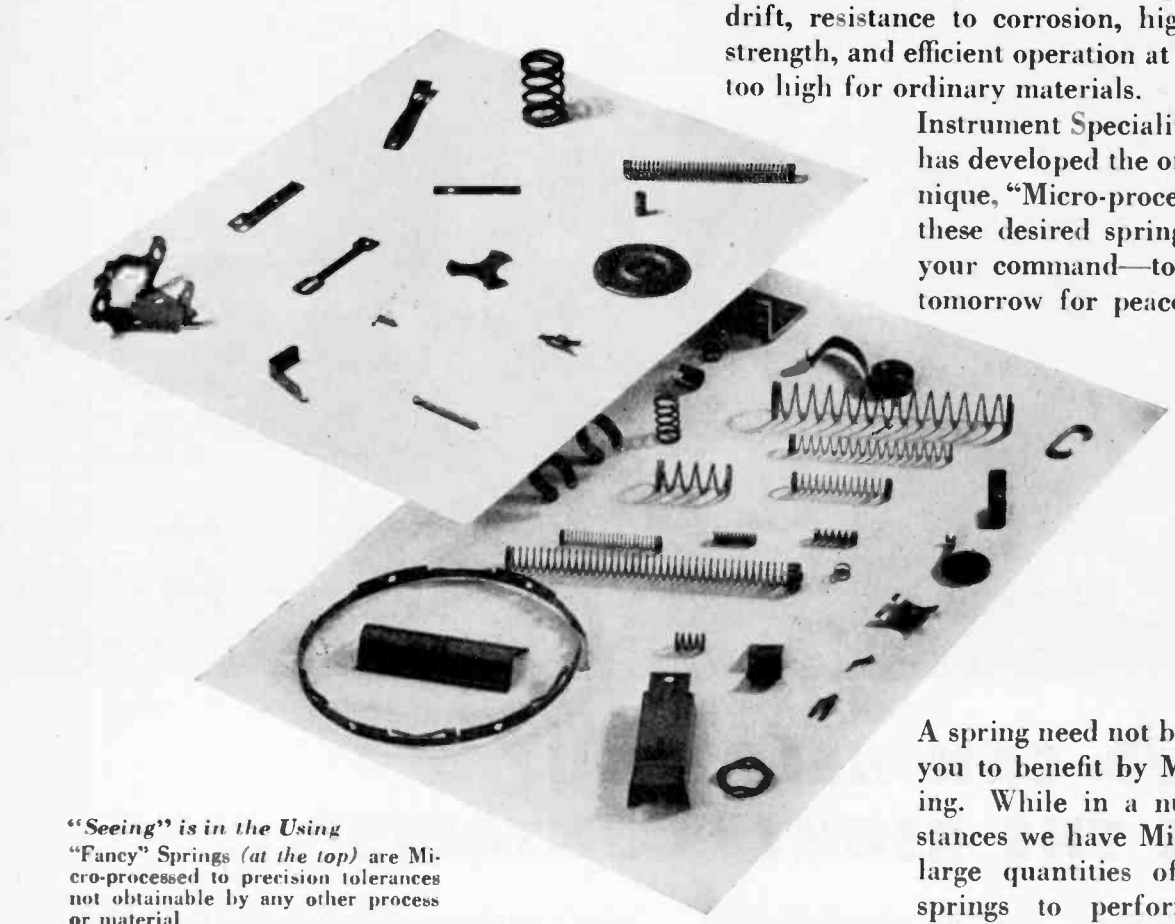
utah

CABLE ADDRESS: UTARADIO, CHICAGO

We expect you to expect more of your SPRINGS

The tough spring jobs go to beryllium copper in this war, for of all spring materials, this metal offers the best combination of all critical spring requirements—maximum electrical conductivity with high tensile strength, minimum drift, resistance to corrosion, high endurance strength, and efficient operation at temperatures too high for ordinary materials.

Instrument Specialities Company has developed the one exact technique, "Micro-processing," to put these desired spring qualities at your command—today for war, tomorrow for peace.



"Seeing" is in the Using

"Fancy" Springs *(at the top)* are Micro-processed to precision tolerances not obtainable by any other process or material.

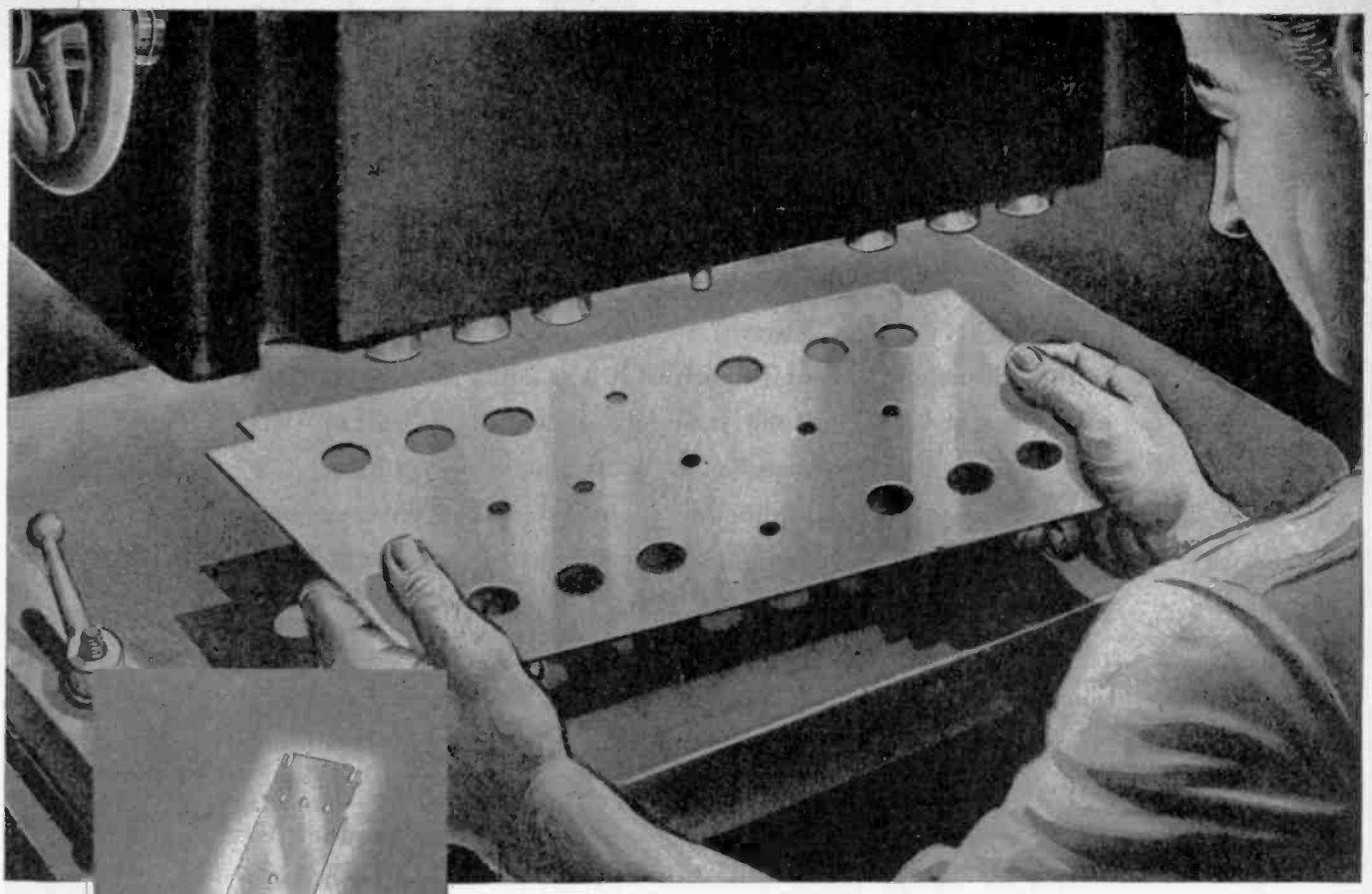
For "Average" Springs *(below)* Micro-processing delivers closer tolerances and better physical properties than obtainable by ordinary processing methods.

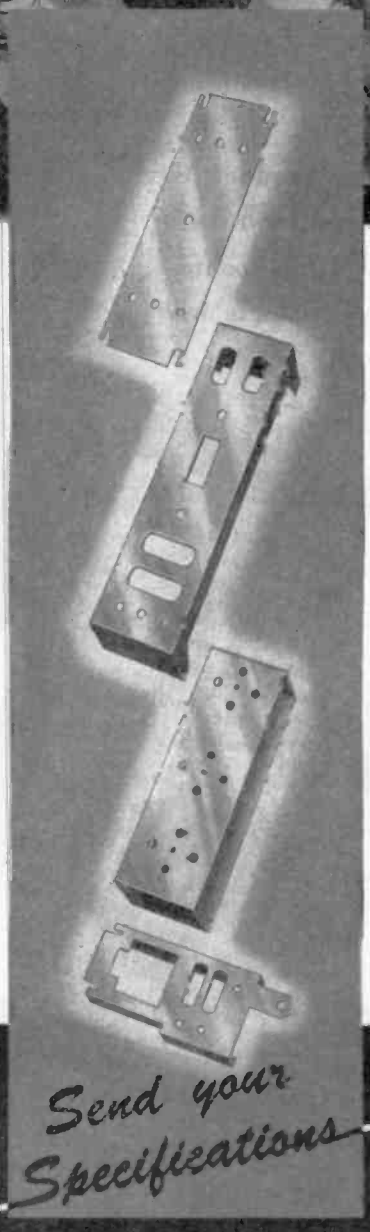
A spring need not be "fancy" for you to benefit by Micro-processing. While in a number of instances we have Micro-processed large quantities of exceptional springs to perform functions never before expected of any springs; in hundreds of other cases we have added materially to the life of such every day products as brushes, motors, instruments, etc., by improving the quality of "average" springs.

I-S gets the most out of springs by putting the required maximum into them. We stand ready to prove our statements on your own springs. A time-saving data sheet is available on request, or send drawings and specifications for Micro-processed samples. Why not expect more of your springs?

INSTRUMENT SPECIALTIES CO., INC.

DEPT. E-2, LITTLE FALLS., NEW JERSEY





SHEET METAL HOUSINGS, CHASSIS AND ASSEMBLIES FOR ELECTRONIC APPARATUS

Prompt delivery of precision units built to pass rigid government inspections

IF you're looking for a source of sheet metal housings, chassis, cabinets, panel and shelf assemblies or chassis mounting suspensions, Corry-Jamestown offers you many advantages. A large modern plant with its own engineering department, experimental laboratory and tool and die shop. A successful record of producing equipment from steel, stainless steel or aluminum for America's leaders in the manufacture of electronic apparatus. A reputation for precision that readily meets rigid Government inspection. A habit of meeting delivery dates on time!

We would welcome an opportunity to supply your needs.

Send your Specifications

Steel Age

CORRY - JAMESTOWN

MANUFACTURING CORPORATION, CORRY, PA.

SPEED VICTORY ★ *BUY WAR BONDS*

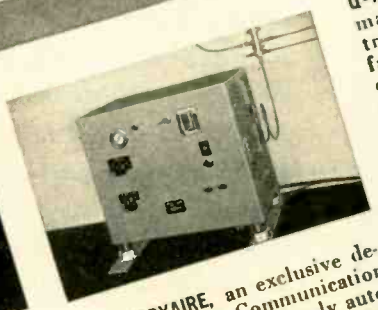
Ever "Call up" a Locomotive?

In the railroad systems of Tomorrow, it is possible that locomotives will be reached by telephone—as easily as you would "call up" the drug store today. By means of radiotelephony a yardmaster, for example, may contact locomotive engineers in their cabs, or conductors, yard foremen and other supervisory personnel in direct two-way communication.

Indeed, the postwar potentialities for expansion of communications through new applications of radio and television have only begun to be explored. In precisely what new directions this expansion may go, and how soon, is of course still anybody's guess.

Right now, the entire output of Communication Products is needed for war purposes. But with Victory, the items shown here will again be available for peacetime purposes. And if their contribution to the war program is any indication, these products will have a vital part to play in Tomorrow's applications.

COMMUNICATION PRODUCTS COAXIAL TRANSMISSION LINE provides a radiation-free line of copper or aluminum, designed according to sound engineering principles. Four sizes are available: A flexible 1/4-inch line with spun-glass insulation for receiving or low power purposes; a new and improved 3/8-inch semi-flexible ceramic insulated line for low power applications; a 7/8-inch rigid type; and a 1 5/8-inch ultra high frequency line for high power use.



AUTO-ORYAIRE, an exclusive development of Communication Products, is a completely automatic device for maintaining coaxial transmission lines at pre-set pressures of moisture-free air. It will function for indefinite periods at the rate of 1000 cubic inches per minute. It is independent of critical gases and heavy cylinders.

Q-MAX A-27 is a remarkable new, extremely low-loss, fast air-drying lacquer for use in treatment or impregnation of radio frequency components. Applied by dipping and brushing.

WHERE does Stackpole Molded Powder Metallurgy Fit into *YOUR* Picture?

. . . it pays to know!

Iron powders made from non-critical mill scale and ore, solidly molded to close tolerances represent an important source of easier-to-obtain and less costly components for a wide variety of products.

From molded gears, to pole pieces for small motors, magnetic yokes for circuit breakers, and iron cores, to large parts and unusual shapes where much machining is ordinarily involved, Stackpole Molded Powder Metallurgy is already outstandingly effective in many industries—and this is barely the beginning.

So far-reaching are the possibilities of these molded materials, it is safe to say that there are few products indeed wherein the possible use of such components should not be considered. Stackpole engineers welcome the opportunity to cooperate—and to tell you frankly whether or not Stackpole Powder Metallurgy methods may be of service.

STACKPOLE CARBON COMPANY, ST. MARYS, PENNA.

"EVERYTHING IN CARBON BUT DIAMONDS"

Brushes for all rotating machines—Anodes—Electrodes—Brazing Blocks—Bearings—Welding Rods, Electrodes and Plates—Pipe—Packing Piston and Seal Rings—Rheostat Plates and Discs—Brake Lining, etc.

MOLDED METAL CONTACTS

. . . also Fixed and Variable Resistors, Iron Cores, and Switches for the Electronics Industry

STACKPOLE

MOLDED CARBON AND METAL PRODUCTS

WESTINGHOUSE ELECTRONIC TUBES

Kenotrons—Half-Wave Vacuum Rectifier Tubes

Tube Type Number	Peak Inverse Volts	Average Anode Amps.	Peak Anode Amps.	FILAMENT	
				Volts	Amps.
RO-585	1500	.003	.005	5.0	1.1
WL-5793	20000	.025	.27	2.5	6.0
WL-608	60000	.06	.20	10	10
WL-613	140000	.06	.20	11	10
WL-456	140000	.06	.20	11	20
WL-612	150000	.24	.75	10	50
WL-660	230000	.03	.10	10	10

Ignitrons—Water-Cooled—Rectifier Service

Tube Type Number	Nominal D-C. Volts Output	Peak Forward and Inverse Volts	Average Anode Amps.	Peak Anode Amps.	Ignitor Volts Typical	Max. Ignitor Amps.
WL-653-A	{250 {600	900 2100	300 225	1800 1200	150 150	40 40
WL-679	{250 {600	900 2100	150 100	900 600	150 150	40 40

Phanotrons—Gas Rectifier Tubes

Tube Type Number	NOMINAL			Gas	Half or Full Wave	FILAMENT	
	Peak Inverse Volts	Average D. C. Amps.	Peak Anode Amps.			Volts	Amps.
WL-786	1500	30.0	150.0	Mercury	Half	2.5	100.0
WL-669	1000	2.0	3.1	Mercury	Full	2.5	12.0
WL-670	1000	6.0	9.5	Mercury	Full	2.5	24.0

Pliotrons—Therapy and General Purpose Triodes

Tube Type Number	PLATE			Max. Freq. Megacycles Full Input	Amp. Factor	Cap G-P uuf.	FILAMENT	
	Volts	Milla.	Diss. Watts				Volts	Amps.
WL-469	1500	200	100	20	12	13.5	10	3.25
WL-471	1500	200	100	20	12	13.5	10	3.25
WL-195	3000	125	125	30	12	2.8	10	3.25
WL-196	3000	125	125	30	35	3.0	10	3.25
WL-468	2000	200	150	20	18	7.0	10	4.1
WL-460	2500	200	150	50	18	7.5	10	4.1
WL-463	2500	275	200	50	22	7.5	11	5.0

Ignitrons—Water-Cooled—Welder Service

Tube Type Number	Supply Volts R. M. S.	Max. Peak Inverse Volts	Max. Demand Kv.a.	Max. Avg. Anode Amps.	Max. Peak at Max. Avg. Amps.	Max. Peak Anode Amps.	Avg. Amps. at Max. Peak	Max. Averaging Time Seconds	IGNITOR	
									Typical Volts	Typical Amps.
WL-681	400–500	720	300	22.4	282	850	12.1	11.0	200	25
WL-686	200–250	360	300	22.4	565	1700	12.1	22.0	100	25
WL-652	400–500	720	600	56.0	565	1700	30.2	9.0	200	25
WL-657	200–250	360	600	56.0	1130	3400	30.2	18.0	100	25
WL-651	400–500	720	1200	14.0	1130	3400	75.6	7.1	200	25
WL-656	200–250	360	1200	14.0	2260	6800	75.6	14.0	100	25
WL-655	400–500	720	2400	35.5	2260	6800	192.0	5.6	200	25
WL-658	200–250	360	2400	35.5	4520	13600	192.0	11.0	100	25

Pirani—Pressure Indicating Tube

Tube Type Number		No. of Electrodes	Fila. Volts	Fila. Amps.
WL-762	Pirani Tube for Vacuum Measurements	1	1.0	0.1

Thyratrons

Tube Type Number	Peak Inverse Volts	Average Anode Amps.	Peak Anode Amps.	Gas	Control	FILAMENT	
						Volts	Amps.
WL-629	350	0.04	0.2	Inert	Neg.	2.5	2.6
KU-636	350	0.1	0.4	Inert	Neg.	2.5	7.0
KU-610	500	0.1	0.4	Inert	Pos.	2.5	6.5
KU-627	2500	.64	2.5	Mere.	Neg.	2.5	6.0
KU-634	7500	1.25	5.0	Mere.	Neg.	5.0	11.5
KU-628	2500	2.0	8.0	Mere.	Neg.	5.0	11.5
WL-631	1000	2.5	15.0	Mere.	Neg.	5.0	4.5
WL-632	1000	2.5	15.0	Mere.	Neg.	5.0	4.5
KU-677	7500	4.0	16.0	Mere.	Neg.	5.0	9.5
KU-676	1000	6.4	40.0	Mere.	Neg.	5.0	9.5

Phototubes

Tube Type Number	Spectral Range	Typical Micro Amps. Per Lumen	Description	Cathode Surface Material
SR-50	Deep Red—Violet	15	Vacuum	Cs-O
SR-53	Deep Red—Violet	25	Vacuum	Cs-O
SK-60	Deep Red—Violet	60	Gas	Cs-O
SK-63	Deep Red—Violet	125	Gas	Cs-O
WL-734	Deep Red—Violet	15	Vacuum	Cs-O
WL-735	Deep Red—Violet	60	Gas	Cs-O
WL-770	Visible	0.75	Vacuum	Cs-Mg
WL-767	2000—3250 Angs.	....	Vacuum	Titanium
WL-773	2000—3750 Angs.	....	Vacuum	Thorium
WL-775	2000—3000 Angs.	....	Vacuum	Tantalum
WL-789	Below 2000 Angs.	....	Vacuum	Platinum

Grid Glow Tube

Tube Type Number	Peak Inverse Volts	Average Anode Amps.	Peak Anode Amps.	Gas	Contral	FILAMENT	
						Volts	Amps.
KU-618	800	0.015	0.10	Inert	Pos.	Cold	Cathode

Series Ballast Tubes

Tube Type Number	Type	Gas	Base	Range Volts	Nominal Controlled Amps.
WL-896	{Constant	Hydrogen	{Med.	5–8	.25
WL-788	{Current	Hydrogen	{Screw	9–18	.25
WL-710		Hydrogen		20–28	.25

Supervisory Control Protector Tube

KX-642	230 and 115 V.A-C. Circuit Protection. 3 Electrodes, Breakdown 300–500 Volts r.m.s.

Pliotron—Electrometer Tube

Tube Type Number	Plate Volts	Plate Milla.	Amp. Factor	No. of Electrodes	Fila. Volts	Fila. Amps.
RH-507	4	0.2	0.8	3	2.0	0.06

Westinghouse ELECTRIC & MANUFACTURING COMPANY

SPECIAL PRODUCTS COMMERCIAL DEPARTMENT BLOOMFIELD, N. J.

WESTINGHOUSE RADIO TRANSMITTING TUBES

To Engineers

This 4 page data sheet of Westinghouse Radio Transmitting and Industrial Electronic Tubes is designed to assist you in specifying and replacing electronic equipment. We suggest you remove it and keep it for your files.

Water-Cooled Types

Type Number	No. of Elec. trodes	CATHODE		PLATE			MAX. FREQ. MC.		Mu
		Volts	Amps.	Max. Volts	Max. Amps.	Max. Dissi-pation Watts	At Max. Plate Input	@50% Max. Plate Input	
WL-207	3	22	52	15000	2	10000	1.6	20	20
WL-846	3	11	51	7500	1	2500	50.0	150	40
WL-858	3	22	52	20000	2	20000	1.6	40	42
WL-862	3	33	207	20000	10	100000	1.6	....	48
WL-880	3	12.6	320	10500	6	20000	25.0	100	21
WL-889	3	11	125	8500	2	5000	50.0	150	21
WL-891	3	11x	60x	12000	2	6000	1.6	20	8
WL-892	3	11x	60x	15000	2	10000	1.6	20	50
WL-893	3	10y	61y	20000	4	20000	5.0	40	36
WL-898	3	16.5y	70y	20000	10	100000	1.6	....	44
WL-899	3	14.5	154	18000	4	30000	5.0	60	33
WL-899A	3	14.5	180	18000	4	30000	5.0	60	33

xSingle or two-phase filament (Two units); voltage is per unit; current is per unit.
ySingle, three or six-phase filament (Six units); voltage is per unit; current is per unit.

Rectifier Types

Type Number	Kind	No. of Elec-trodes	CATHODE		Crest Inverse Volts	Avg. Plate Amps.	Crest Plate Amps.
			Volts	Amps.			
WL-214*	Vacuum	2	22	52	50000	2.4	7.5
WL-217C	Vacuum	2	10	3.25	7500	0.15	0.6
WL-531**	Vacuum	2	11.5	20	50000	0.29	0.75
WL-857B	Gas	2	5	30	22000	10.0	40
WL-866A/866	Gas	2	2.5	5	10000	0.25	1
WL-869B	Gas	2	5	18	20000 15000#	2.50 5.00#	10 15#
WL-872	Gas	2	5	10	7500	1.25	5
WL-872A	Gas	2	5	6.75	10000	1.25	5

*Water cooled.
**Forced-air cooled.
#Quadrature Filament Excitation.

Air-Cooled Types

Type Number	No. of Elec-trodes	CATHODE		PLATE			MAX. FREQ. MC.		Mu	Gm
		Volts	Amps.	Max. Volts	Max. Amps	Max. Dissi-pation Watts	At Max. Plate Input	@50% Max. Plate Input		
WL-203A	3	10	3.25	1250	0.175	100	15	80	25	....
WL-204A	3	11	3.85	2500	0.275	250	3	30	23	....
WL-211	3	10	3.25	1250	0.175	100	15	60	12	....
WL-800	3	7.5	3.25	1250	0.080	35	60	180	15	....
WL-802	5	6.3**	0.90	500 600*	0.060 0.060*	10 13*	30	110	....	2250
WL-803	5	10	5.00	2000	0.175	125	20	70	....	4000
WL-805	3	10	3.25	1500	0.210	125	30	85	....	....
WL-806	3	5	10.0	3000 3300*	0.200 0.300*	150 225*	30	100	12.6	....
WL-807	4	6.3**	0.90	600 750*	0.100 0.100*	25 30*	60	130	....	6000
WL-809	3	6.3	2.50	750 1000*	0.100 0.100*	25 30*	60	100	50	....
WL-810	3	10.0	4.50	2000 2250*	0.250 0.275*	125 150*	30	100	35	....
WL-811	3	6.3	1.00	1250 1500*	0.125 0.150*	40 55*	60	115	160	....
WL-812	3	6.3	1.00	1250 1500*	0.125 0.150*	40 55*	60	115	29	....
WL-813	4	10.0	5.00	2000	0.180	100	30	120	....	3750
WL-814	4	10.0	3.25	1250 1500*	0.150 0.150*	50 65*	30	100	....	3300
WL-828	5	10.0	3.25	1250 1500*	0.160 0.180*	70 80*	30	90	....	4500
WL-833A	3	10.0	10.00	3000 #4000 #4000*	0.500 #0.500 #0.500*	300 #300 #450*	30 20 20	110 100 100	35	....
WL-834	3	7.5	3.25	1250	0.100	50	100	350	10.5	....
WL-837	5	12.6**	0.70	500	0.080	12	20	80	....	3400
WL-838	3	10.0	3.25	1250	0.175	100	30	120	54	....
WL-843	3	2.5**	2.50	450	0.040	15	6	200	7.7	....
WL-845	3	10.0	3.25	1250	0.175	100	....	....	5.3	....
WL-849	3	11.0	5.00	2500	0.350	400	3	30	19	....
WL-850	4	10.0	3.25	1250	0.175	100	13	100	....	2750
WL-851	3	11.0	15.50	2500	1.00	750	3	15	20.5	....
WL-860	4	10.0	3.25	3000	0.150	100	30	120	....	1100
WL-861	4	11.0	10.0	3500	0.350	400	20	60	....	2100
WL-865	4	7.5	2.0	750	0.060	15	15	70	....	750

Ratings given are typical for continuous commercial service (CCS). For design purposes complete ratings should be requested.
*These ratings are for intermittent commercial and amateur service (ICAS).
**Heater type cathode.
#Ratings with forced air-cooling.

Forced-Air Cooled Types

Type Number	No. of Elec. trodes	CATHODE		PLATE			MAX. FREQ. MC.		Mu
		Volts	Amps.	Max. Volts	Max. Amps.	Max. Dissi-pation Watts	At Max. Plate Input	@50% Max. Plate Input	
WL-889R	3	11	125	8500	2	5000	25.0	100	21
WL-891R	3	11x	60x	10000	2	5000	1.6	20	8
WL-892R	3	11x	60x	12500	2	5000	1.6	20	50
WL-893R	3	10y	61y	20000	4	20000	5.0	40	36

xSingle or two-phase Filament (Two units); voltage is per unit; current is per unit.
ySingle, three or six-phase filament (Six units); voltage is per unit; current is per unit.

Westinghouse
ELECTRIC & MANUFACTURING COMPANY
SPECIAL PRODUCTS COMMERCIAL DEPARTMENT BLOOMFIELD, N. J.

at this demonstration of Farnsworth Television

Near where Ben Franklin revealed his electrical discoveries, other American scientists in 1934* first demonstrated to the public a new modern-day wonder . . . *electronic television.*

Using equipment developed and built by Farnsworth engineers, the showing drew crowds to Philadelphia's famed Franklin Institute to see a practical exhibition of electronic television.

Today, the original Farnsworth Dissector Tube, cathode ray tubes, synchronizing devices and circuits have been brought to high perfection. Parallel research in both tubes and circuits has produced important developments in Farnsworth transmitting and receiving equipment.

Hastening the day of country-wide television are Farnsworth's 100% war production, Farnsworth consumer advertising, and Farnsworth research (which has continued uninterruptedly for 18 years). After the war, which has slowed television's public growth, but advanced its technical development, we'll be well equipped to help and serve you.

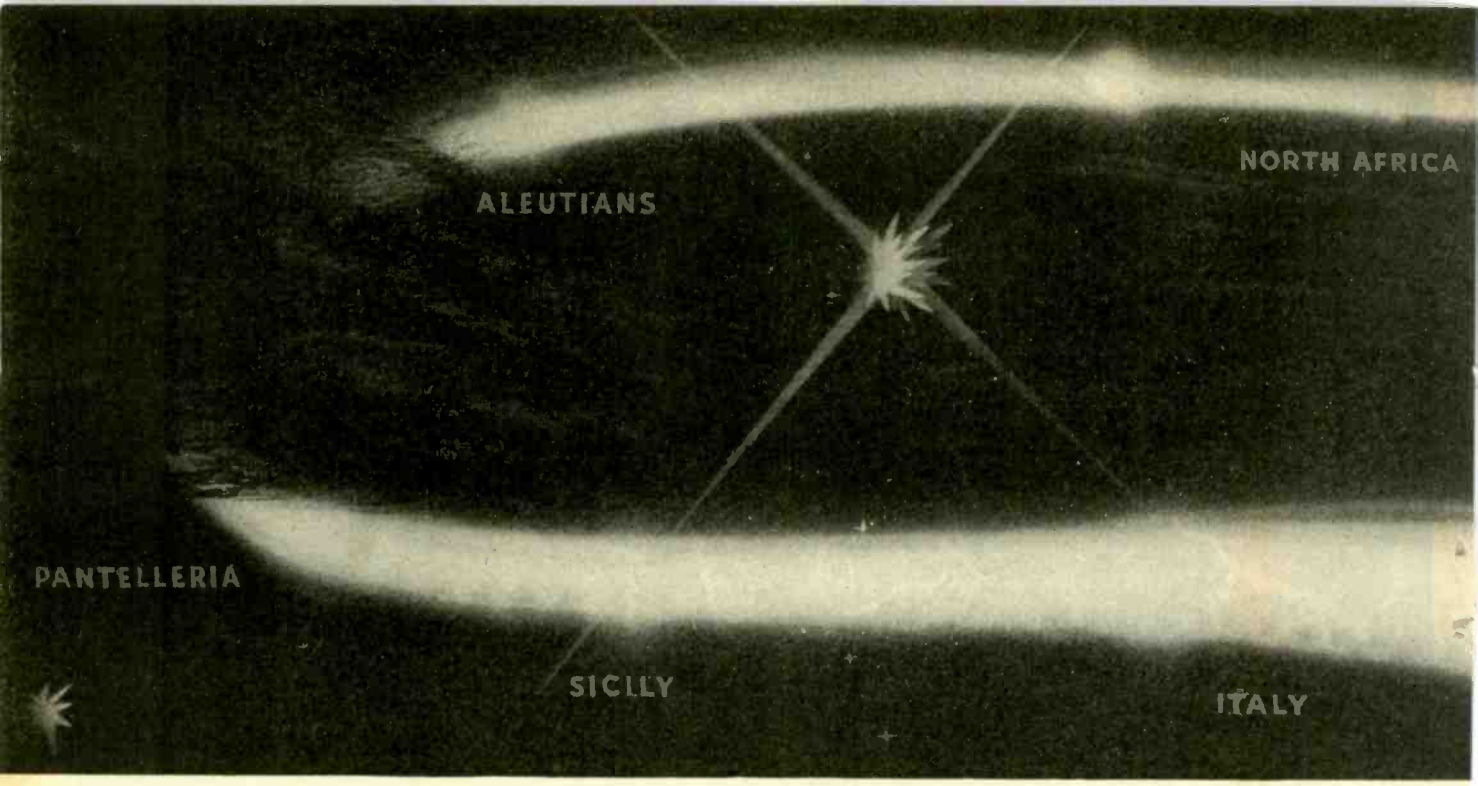
** Another in a series of advertisements depicting milestones in the history of television.*

LOOK FOR the Farnsworth Television advertisement in: November 15 *Newsweek* and November 27 *Collier's.*

FARNSWORTH TELEVISION

ARMY (E) NAVY

• Farnsworth Television & Radio Corporation, Fort Wayne 1, Indiana. Farnsworth Radio and Television Transmitters and Receivers; Aircraft Radio Equipment; the Farnsworth Dissector Tube; the Capehart, the Capehart-Panamuse; the Farnsworth Phonograph-Radio.



In our nine years, Superior has become a strong company, through careful management with inherent economy as our watchword.

As we start our tenth year, we are interested more in winning the War than in plans for Post War.

Let us, as we work to win, keep our Domestic House in order. When we come out of this conflict as winners, we can then, with high purpose, work together to go forth in the Peace.

H. L. Gabel

SUPERIOR PRODUCTS IN SMALL TUBING

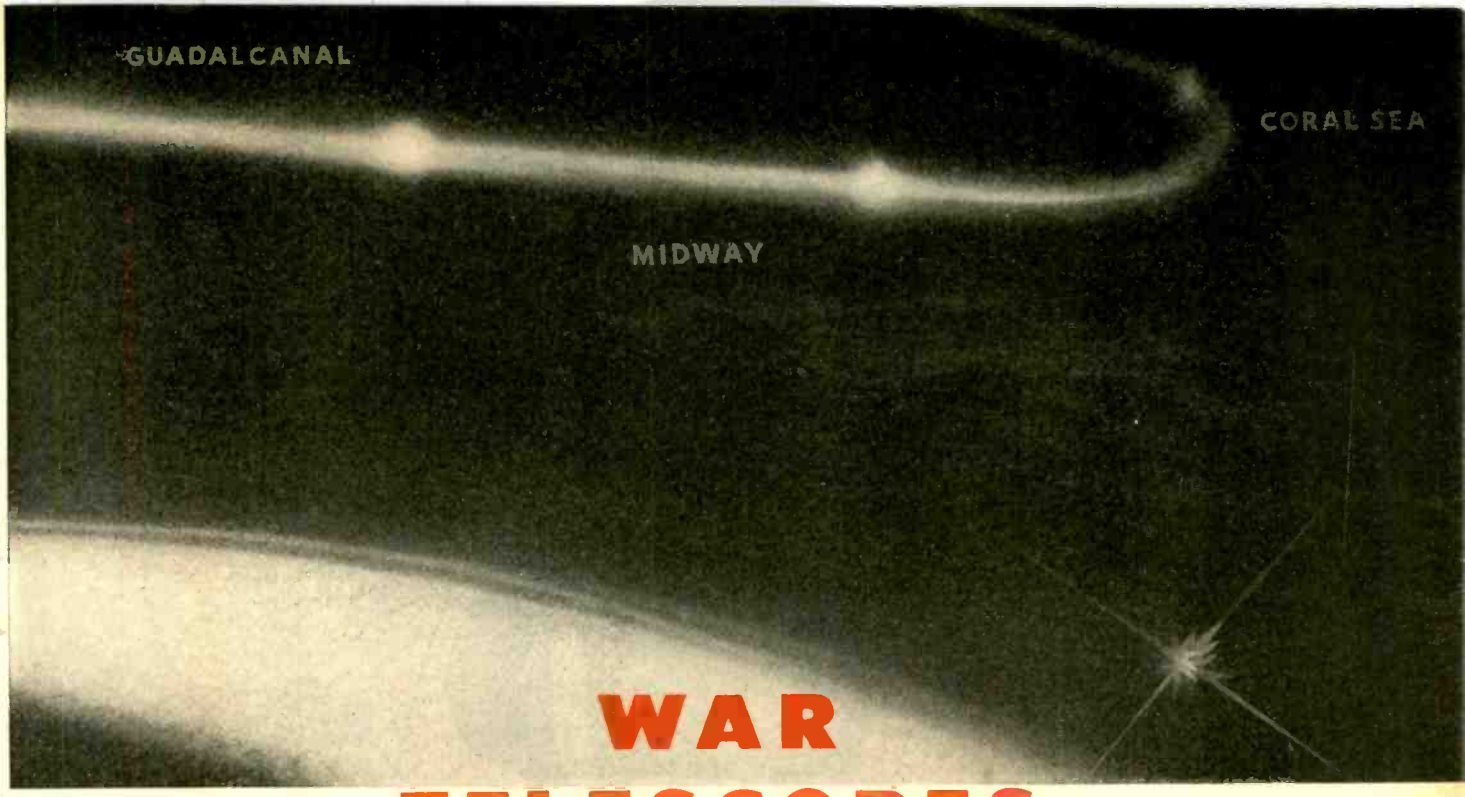
(⅝" OD and Smaller)

CARBON STEELS
ALLOY STEELS
STAINLESS STEELS
(Seamless and Weldrawn*)
NICKEL AND "INCONEL"
"MONEL"
(Seamless and Brawn*)
ALUMINUM
COPPER AND BERYLLIUM COPPER

SUPERIOR is the only American producer of pure nickel cathode sleeves in both Seamless and Lockseam.**

* Registered U. S. Trademark ** U. S. Patented

SUPERIOR



WAR TELESCOPES TIME

ONE YEAR AGO, we at Superior thought our sights were set and that we were ready for war-time production. But in this year since our eighth birthday, we have successfully recast our ideas to a program which far exceeds our earlier expectations.

Superior fine small metal tubing, sometimes erroneously called "specialty" tubing, is being produced today in a mill which has upheld quality standards in the face of labor shortages and greatly increased demands for a wide variety of tubing.

In electronics, aviation, instruments, and hundreds of mechanical applications, the fruits of our labor are going out to do battle as radio equipment, aircraft engine and structural parts, surgical and other instruments, fire alarm systems, and a myriad of tubular parts for tanks, ships, and industry.

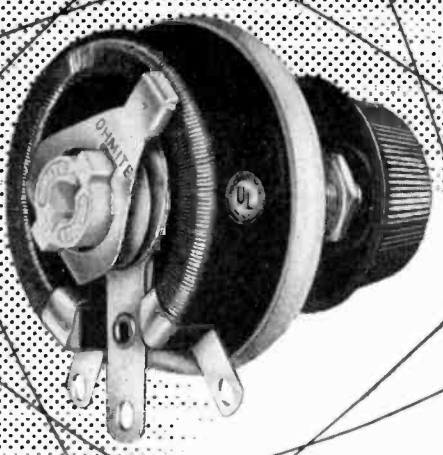
What is just as important is the healthy impact that the past year has had on our organization and our plant equipment. Today we are ready for any task for tomorrow—capable and tried in the heat of battle production. *Superior is doing a big job in small tubing.*

SUPERIOR TUBE CO.

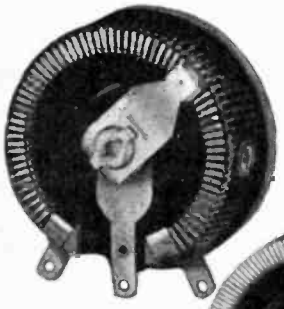
NORRISTOWN, PENNSYLVANIA

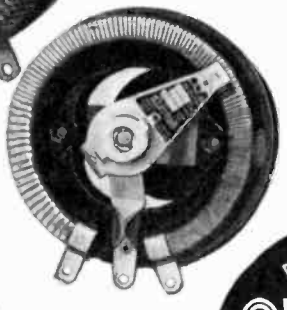
THE BIG NAME IN SMALL TUBING for Uncle Sam!

OHMITE RHEOSTATS



Keep Electrons Under Control, *Smoothly, Accurately*





Busy electrons obey . . . when you turn the knob of an Ohmite Rheostat. You can always be sure of smooth-action, close-control, trouble-free service. Because of their time-proved design and construction, Ohmite Rheostats serve day-in and day-out in all types of electronic devices—under all kinds of climatic conditions. Ohmite produces ten sizes from 25 to 1000 watts, in straight or tapered windings, in stock or special designs, for every requirement. *Approved types for Army and Navy specifications.*

OHMITE MANUFACTURING COMPANY
4983 FLOURNOY STREET, CHICAGO 44, U.S.A.

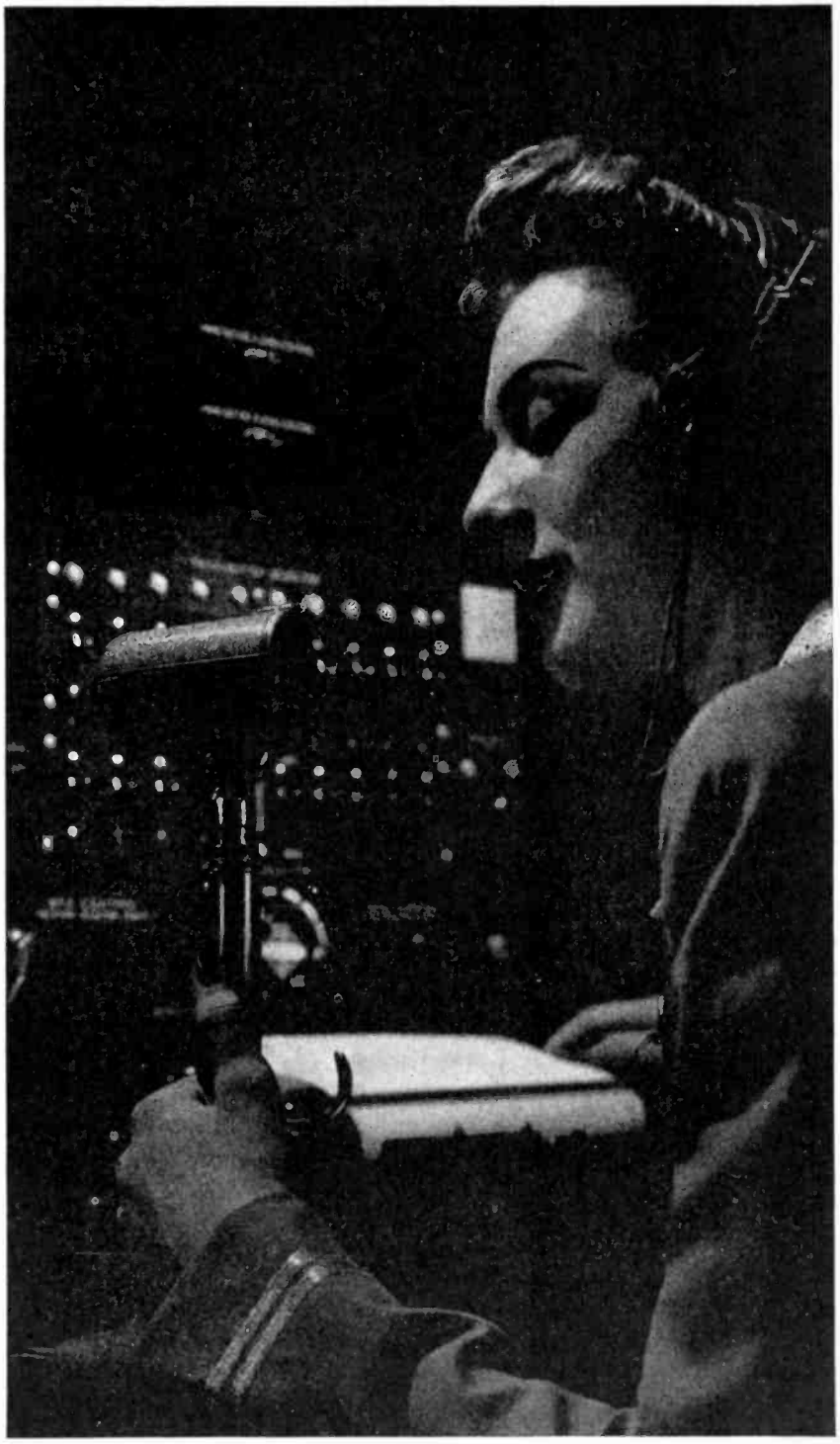
SEND FOR CATALOG and ENGINEERING MANUAL No. 40

Write on company letterhead for this helpful 96-page guide in the selection and application of rheostats, resistors, tap switches, chokes and attenuators.

WILCOX EQUIPMENT

used by major Airlines throughout the United States

Proof of quality and dependability is in performance. Wilcox radio equipment is installed on major Commercial airlines throughout America, and in addition it is being used throughout the entire world in connection with military operations. For airline radio communications, depend on Wilcox!



WILCOX ELECTRIC COMPANY

Quality Manufacturing of Radio Equipment

14th & Chestnut ☆ Kansas City, Mo.

WORN WITH *Equal Honor*

Awarded for distinguished service . . . to employees of

SCIENTIFIC RADIO PRODUCTS COMPANY

The fighting man with the Distinguished Service Medal on his breast is proud. For it denotes exceptional bravery beyond the call of duty—a personal EXTRA contribution toward Victory.

Our workers can be proud that their exceptional contribution too has been recognized. For the "E" pins they now wear signifies distinguished service, individual excellence on the production front. To them, not we, must be given credit for outstanding service to the nation.

SCIENTIFIC RADIO PRODUCTS COMPANY ★

738 West Broadway — Council Bluffs, Iowa

MANUFACTURERS OF PIEZO ELECTRIC CRYSTALS AND ASSOCIATED EQUIPMENT

A Banana

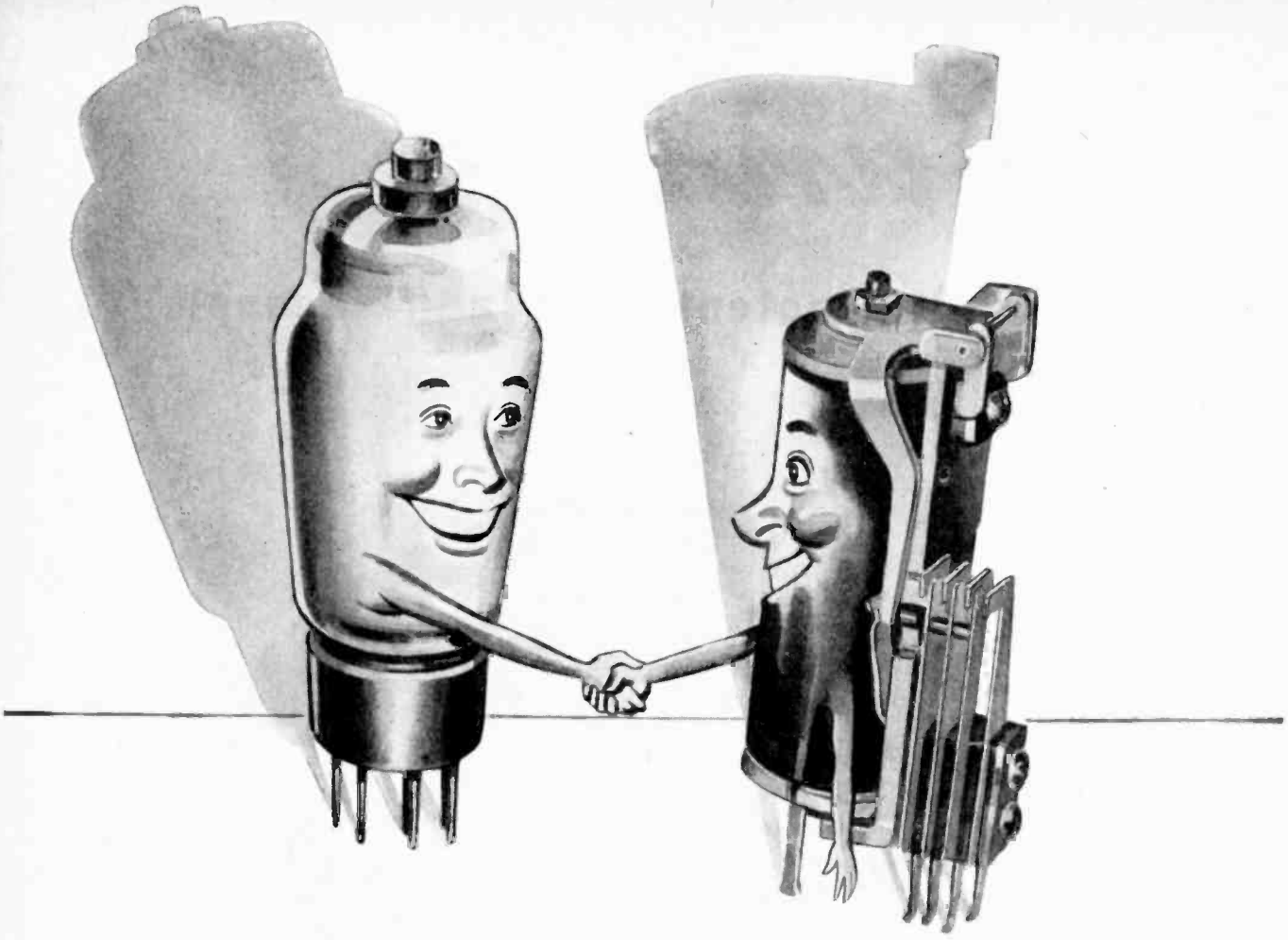
that packs the potential of a "Pineapple"

CINCH Banana PINS

★ . . . we did not invent the pin. Any more than we created the banana. Nor did we perfect it. But we did produce it when needed . . . in quantities as specified. And starting from scratch, we are producing it as rapidly as the need is developing. Another illustration of the adaptability of CINCH facilities—and an example of its ability to produce what and when (a metal plastic part) is needed.

CINCH MANUFACTURING CORPORATION • 2335 West Van Buren St., Chicago, Ill.

SUBSIDIARY: UNITED-CARR FASTENER CORPORATION, CAMBRIDGE, MASS.



LET'S POOL OUR KNOWLEDGE

WORKING with electronic engineers in scores of industries has taught us a lot about electronic science—what it is doing to increase the effectiveness of our tools of war—how it is speeding up war production—about the miracles it promises for our postwar world.

We have learned, for example, how much this "new-old" science depends on the right electrical controls—the important part that relays, stepping switches, solenoids and other control devices play in putting electrons to work.

And that's *our* strong point. We know electrical control because that has been our sole business for over fifty years. So why not pool our resources? Let's apply *our* experience in electrical control to *your* problems in making electronic developments do a better job at lower cost.

First step in this direction is to make sure you have the Automatic Electric catalog of control apparatus. Then, if you need help on any specific electronic problem, call in our field engineer. Behind him are Automatic Electric's fifty years of experience in control engineering. His recommendations may save you time and money.

AUTOMATIC ELECTRIC SALES CORPORATION

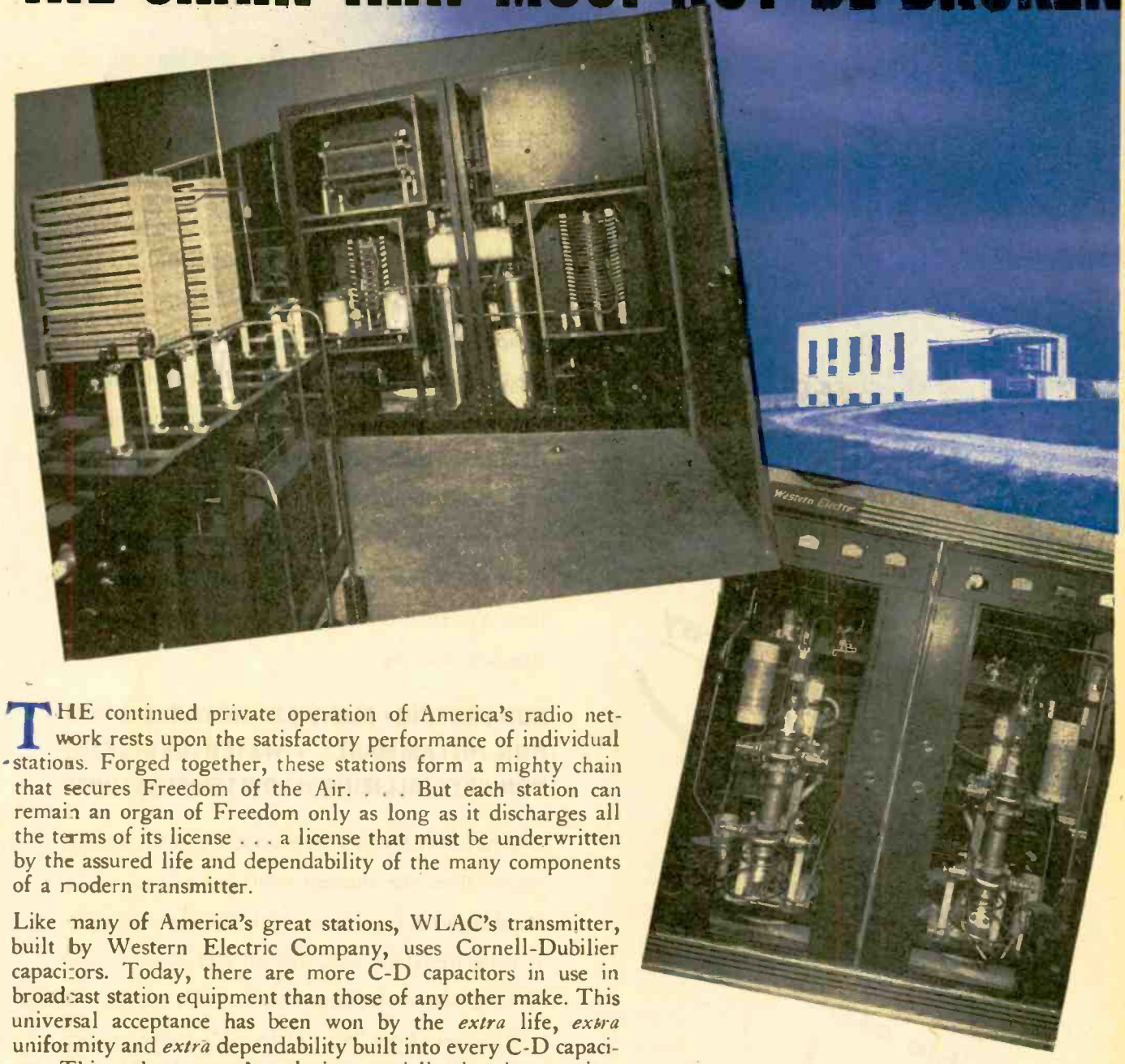
1033 W. Van Buren St. Chicago

In Canada: Canadian Telephones & Supplies, Ltd., Toronto

Relays
AND OTHER CONTROL DEVICES
by AUTOMATIC ELECTRIC

MUSCLES FOR  THE MIRACLES OF ELECTRONICS

THE CHAIN THAT MUST NOT BE BROKEN



THE continued private operation of America's radio network rests upon the satisfactory performance of individual stations. Forged together, these stations form a mighty chain that secures Freedom of the Air. . . . But each station can remain an organ of Freedom only as long as it discharges all the terms of its license . . . a license that must be underwritten by the assured life and dependability of the many components of a modern transmitter.

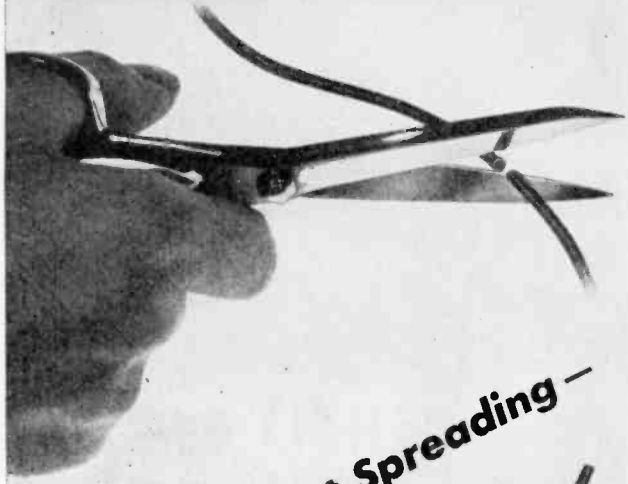
Like many of America's great stations, WLAC's transmitter, built by Western Electric Company, uses Cornell-Dubilier capacitors. Today, there are more C-D capacitors in use in broadcast station equipment than those of any other make. This universal acceptance has been won by the *extra* life, *extra* uniformity and *extra* dependability built into every C-D capacitor. Thirty-three years' exclusive specialization in capacitor manufacture is a significant guarantee of fine performance. Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

A complete range of C-D capacitors is available for all transmitting, receiving and electronic applications. Send for catalog No. 160R describing the complete line of C-D CAPACITORS.

Cornell-Dubilier Capacitors

MICA • DYKANOL • PAPER • WET AND DRY ELECTROLYTICS

NEW BH FIBERGLAS SLEEVING



Cuts Without Spreading—

Fuzzes but Doesn't Fray

Flexible as String

You've waited a long time for a sleeving that was *both* flexible and non-fraying. Now it's here—BH Extra Flexible Fiberglas Sleeving.

As an example of the hundreds of uses for this new product, let's look at a typical brush shunt job. Sleeving for this application should be flexible. When cut to length, the ends should not fray or spread. Formerly, brush manufacturers stiffened the ends of the sleeving to prevent fraying and also to facilitate threading onto the pigtail. BH Extra Flexible Fiberglas cuts cleanly without spreading, eliminates the extra dipping operation. Furthermore, in service the ends do not fray. Constant vibration produces only the slightest fuzz. Yet even these are but a few advantages of this new sleeving.

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

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

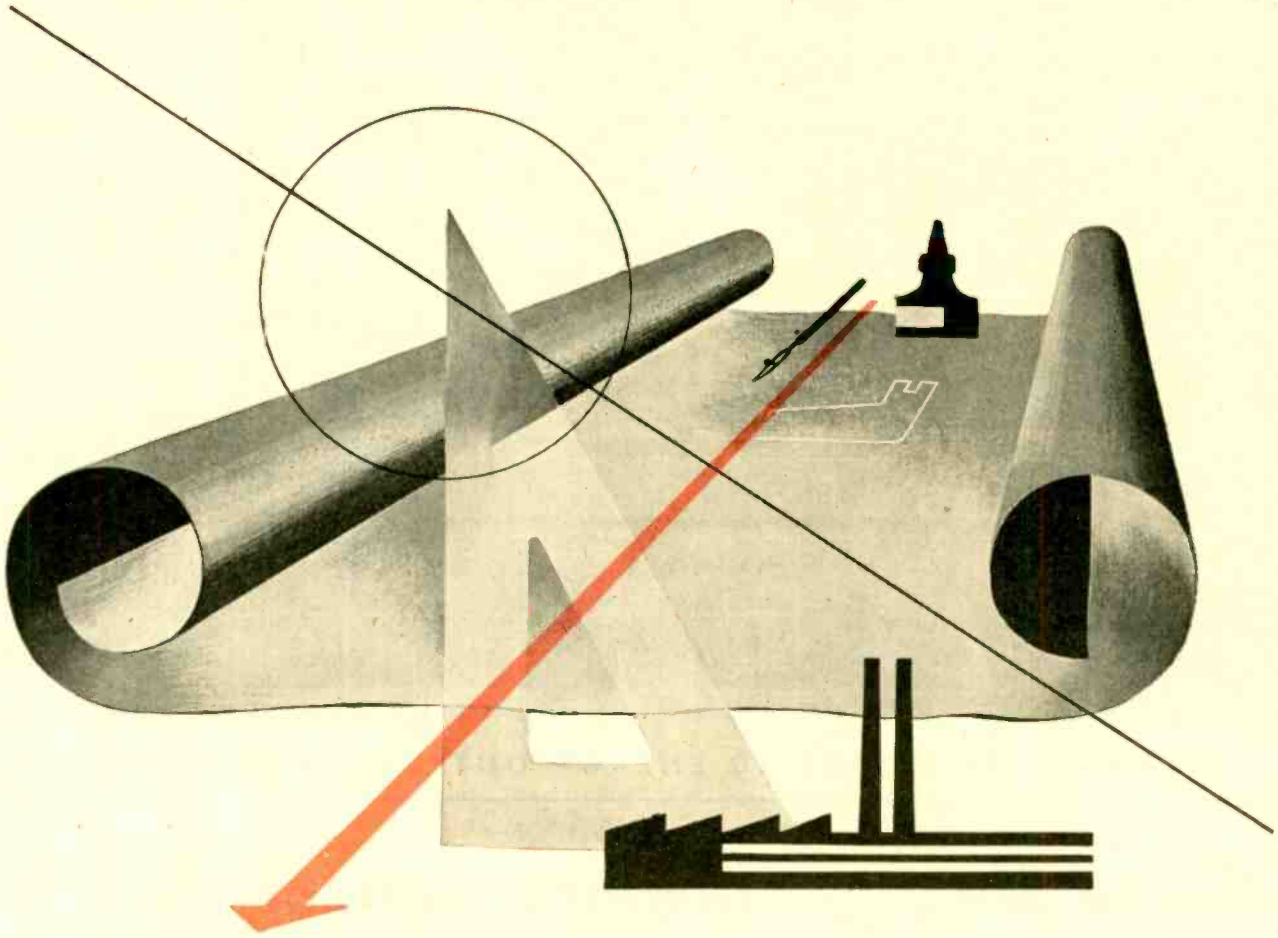
All sizes, from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. I, Conshohocken, Pa.

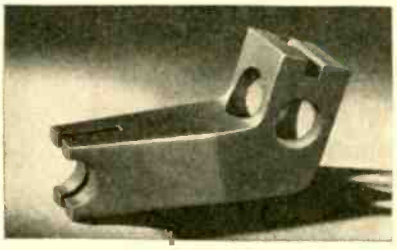
BH PRODUCTS

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

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

YOU DESIGN IT...
WE'LL MAKE IT!





If you think of Phenol Fibre as a plastic that can be used only for the simpler types of insulation, look at this high-finished radio slider that is drilled, slotted, and beveled into just about as complicated a piece of equipment as you'll find in any electrical device. Taylor ingenuity and Taylor equipment turn out such pieces by the thousands at remarkably low cost. Before you decide "it can't be done," Take it to Taylor.

There are, of course, certain limitations as to what can be made of Vulcanized or Phenol Fibre. *But those limitations are probably much less than you think!* If you are now wrestling with a problem that calls for speedy production of a strong, tough, lightweight, economical part with high dielectric strength, resistance to extreme temperatures and to chemical action, Take it to Taylor.

In the industry's most modern plant, straightline production, from the manufacture or processing of the raw materials to the finished product itself, assures production-economies and quality-control that result in many a modern manufacturing miracle. This Verifibre Process, in which Taylor Fibre is checked and verified at every step in production, produces a product of dependable and uniform quality.

With your blueprints before us, we can tell you in a jiffy how we can help you. Let's talk it over.

TAYLOR FIBRE COMPANY

NORRISTOWN, PENNSYLVANIA

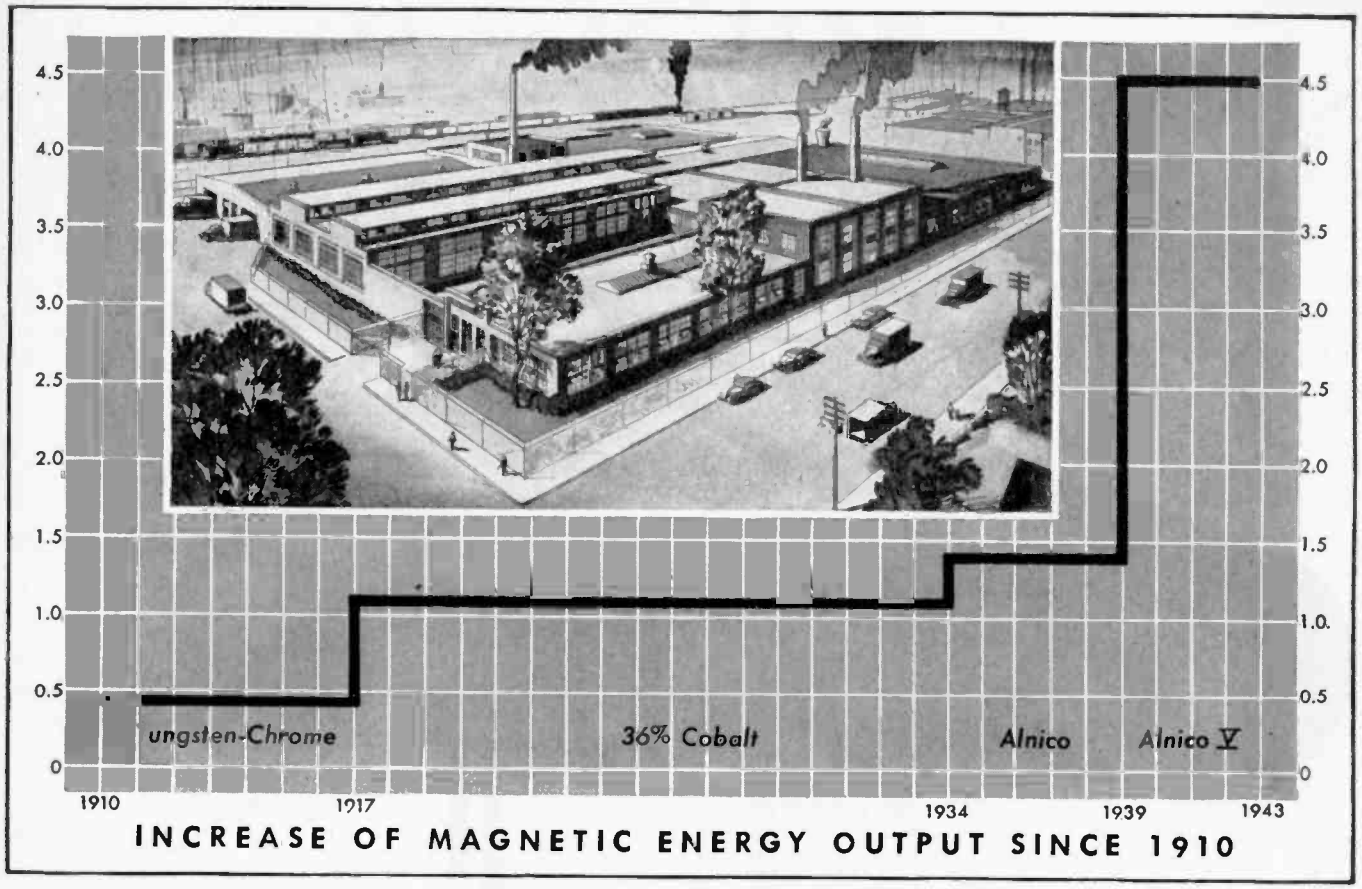
OFFICES IN PRINCIPAL CITIES

PACIFIC COAST HEADQUARTERS: 544 S. SAN PEDRO ST., LOS ANGELES

LAMINATED PLASTICS: VULCANIZED FIBRE • PHENOL FIBRE

SHEETS, RODS, TUBES, AND FABRICATED PARTS

PERMANENT MAGNETS MAY DO IT BETTER



INCREASE OF MAGNETIC ENERGY OUTPUT SINCE 1910

GOING UP . . . . THROUGH DEVELOPMENT!

THIS CHART shows the increase in permanent magnet energy due to metallurgical research during the past 33 years.

From 1910's conventional horseshoe magnets to today's intricate rotor magnets, we've constantly developed new shapes and new applications from these new metals. And doing this one job especially well has made possible countless new products, including some of the war's most complicated devices.

If you are planning war or post-war products, we'd like to suggest that you consider incorporating the principle of the permanent magnet—and that you utilize the services of the largest exclusive maker in this field. Chances are that permanent magnets will improve the functions and increase the uses of your products, and they may even bring to light possibilities that you hadn't thought of before.

Though our plant is devoted entirely to war orders, our engineers will be glad to consult with you. Write for the address of our office nearest you and a copy of our 30-page "Permanent Magnet Manual."

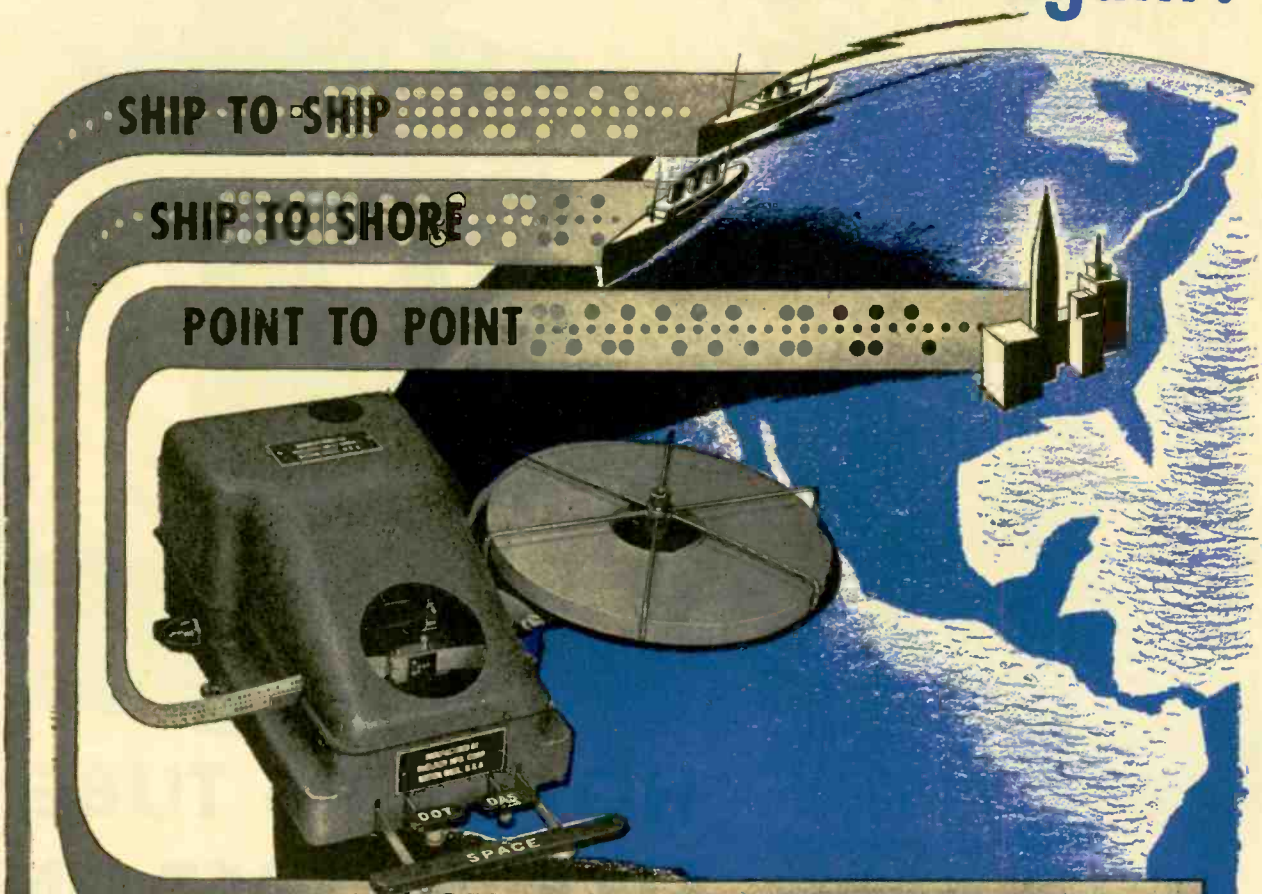
Two Ways to Back the Attack: Buy More War Bonds and Increase Production!

The
INDIANA STEEL PRODUCTS
Company

★ SPECIALISTS IN PERMANENT MAGNETS SINCE 1910 ★

6 NORTH MICHIGAN AVENUE • CHICAGO 2, ILLINOIS

McELROY does it again!



NEW McELROY WHEATSTONE CODE TAPE PERFORATOR

Aware of the need for an instrument that would provide more efficient marine radiotelegraph communications, Ted McElroy* and his creative engineers have perfected the Model PFR-443 Wheatstone Code Tape Perforator.

Speed limitations of hand sending coupled with certain restrictions of manual operation have oftimes proved costly in time, money, and lives. Now, because of precise electrical and mechanical features, this new Perforator practically eliminates the human margin of error. These prepared tapes feed through automatic radio telegraph transmitters.

Simple to operate, the PFR-443 performs automatically or semi-automatically. Anyone with a basic knowledge of signal codes can prepare tapes cleanly and accurately at speeds up to 50 words per minute . . . not only in International Morse, but in all other codes used throughout the world. Wheatstone Perforated Tapes also serve as file records of all transmissions. Additional information may be obtained by writing to McElroy Manufacturing Corporation.

*WORLD CHAMPION RADIO TELEGRAPHER FOR MORE THAN 20 YEARS

Hasten the peace . . . keep buying war bonds

McElroy MANUFACTURING CORP.
82 BROOKLINE AVE., BOSTON, MASS.

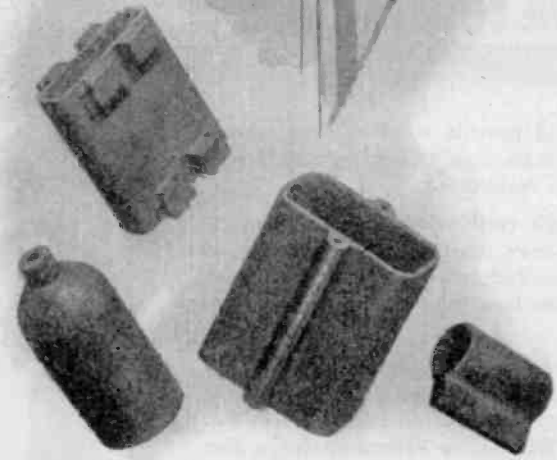
WORLD'S LARGEST MANUFACTURER OF AUTOMATIC RADIO TELEGRAPH APPARATUS

HOPE THIS TUBE'S LIKE THE LAST ONE

"Boy, that last transmitter tube was a honey! Dished out the old signals like a dream—for pretty nearly twenty thousand hours. You could pile on the power when you had to and the old tube never acted up afterwards. Seemed like the sky was the limit on high frequencies . . . Wish all tubes were like that..."

They can be, when built with SPEER graphite anodes. It's remarkable how much more life and stability you pack into rectifier and transmitter tubes with SPEER anodes. Their graphite structure dissipates heat faster, minimizes insulator leakage and gas troubles. Graphite anodes keep their original dimensions in service. Warping and fusing are impossible — even under repeated overloads. Tubes with SPEER graphite anodes materially improve the operation of any transmitter. Write for our Anode Booklet and list of manufacturers using SPEER graphite anodes.

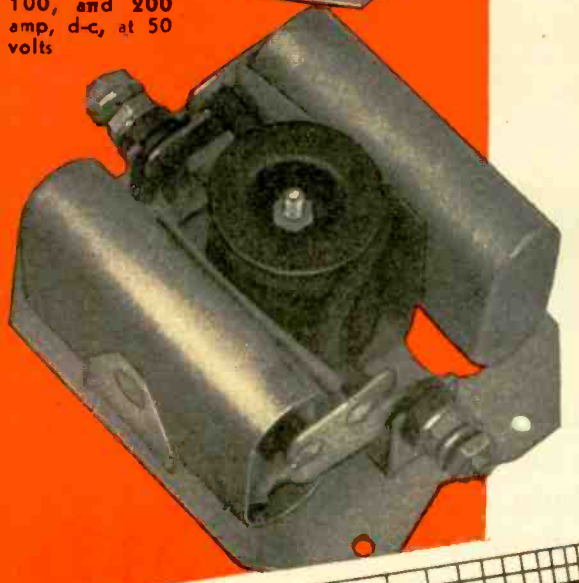
4690



SPEER
CARBON COMPANY
SCC
ST. MARYS, PA.
CHICAGO · CLEVELAND · DETROIT
MILWAUKEE · NEW YORK · PITTSBURGH

NEW G-E RADIO-NOISE FILTERS *for Aircraft*

Available in ratings of 25, 50, 100, and 200 amp, d-c, at 50 volts

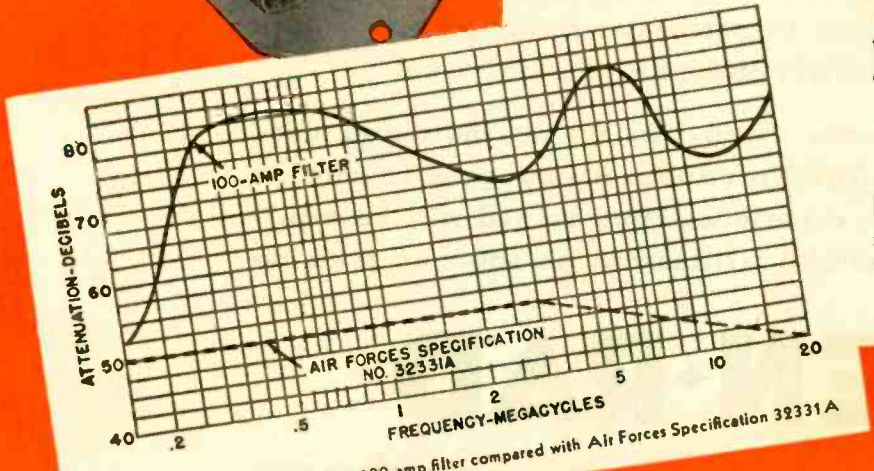


They provide excellent noise suppression —especially from 200 to 20,000 kc

THESE filters help immeasurably in providing the high-fidelity radio reception so important in aerial warfare. They attenuate radio-noise voltage on aircraft electric systems (on circuits with such equipment as generators, amplidynes, inverters, and dynamotors). They are particularly helpful in systems where open wiring is used to save weight.

FEATURES

- **High attenuation characteristic results in excellent noise reduction**
- **Compact and lightweight (For 100-amp rating, shown at left, approx 2 1/5 lb, measuring approx 5 by 4 by 2 1/2 in.)**
- **Can be mounted readily in any position**
- **Operate efficiently over a wide temperature range (— 50 C to 50 C)**
- **Comply with U.S. Army Air Forces specifications, including the stringent requirements as to vibration and acceleration**



Attenuation characteristic of G-E 100-amp filter compared with Air Forces Specification 32331 A

★ ★ ★

FOR FURTHER DATA Ask your G-E representative for Bulletin GEA-4098, or write to General Electric, Schenectady, New York.

GENERAL ELECTRIC

407-82-5200

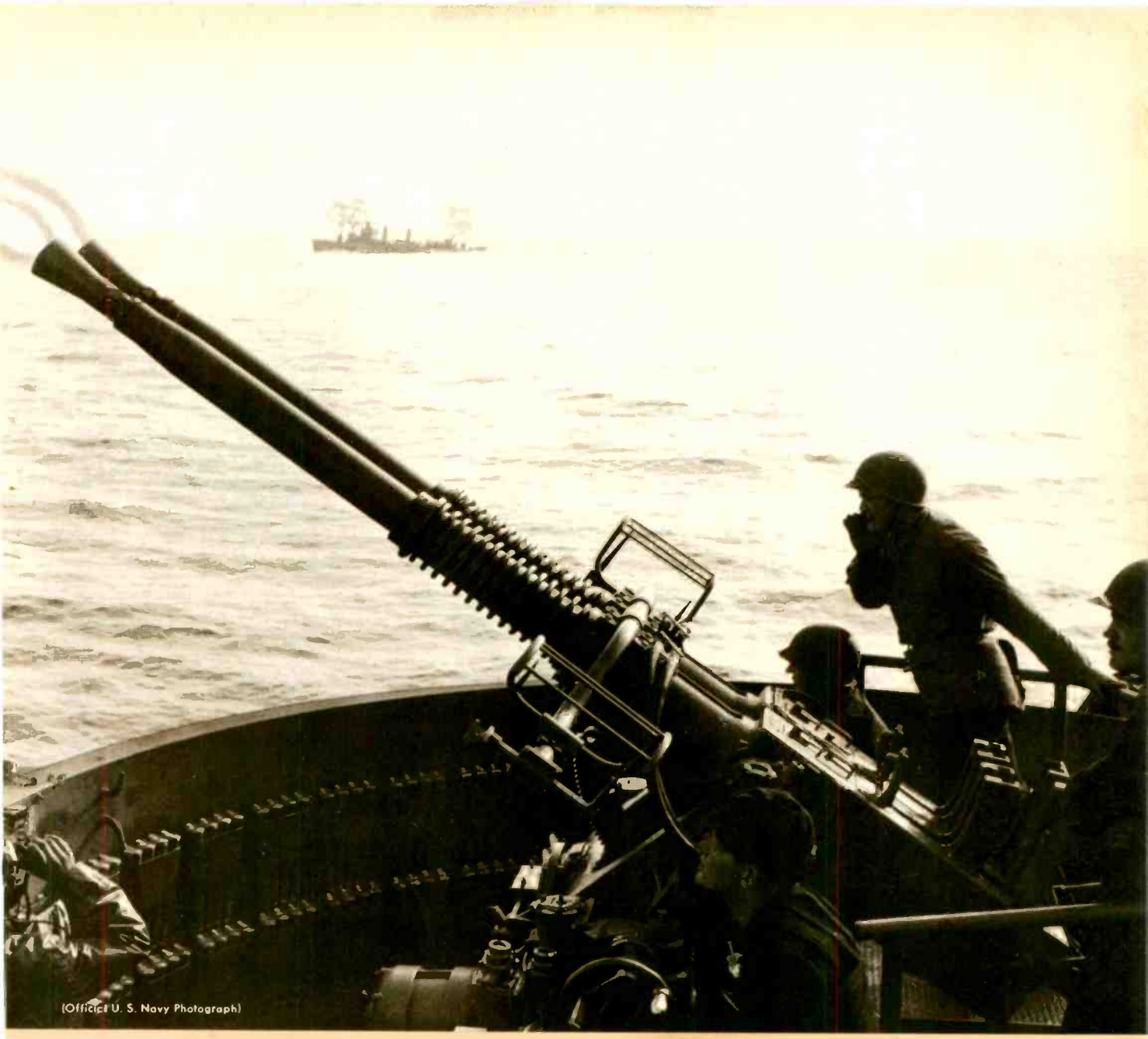
Only the industry and the military know the war-story of "shorter wave-lengths or higher frequencies" and the precision thinking and disciplined imagination going into the use-development of the fundamental electric charge of the universe

For these purposes Ken-Rad makes radio and electron tubes Total production now goes to *shorten the war* The experience thus gained will be available for commercial utilization as soon as possible

KEN-RAD

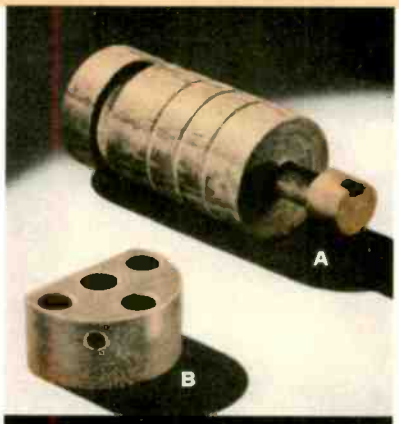
TRANSMITTING TUBES
CATHODE RAY TUBES
INCANDESCENT LAMPS
FLUORESCENT LAMPS
METAL AND VHF TUBES
SPECIAL PURPOSE TUBES

OWENSBORO KENTUCKY U S A



(Official U. S. Navy Photograph)

Scratch One Zero!



A—Airbrake piston—drilled, turned and grooved on the lathe, milled.

B—Insulator—bandsawed, turned, drilled, and counterbored.

WHEREVER Navy buzzard-busters swing into action, you'll probably find Synthane.

The reason is plain. The self-same qualities that suggested Synthane for peacetime products fit it for the implements of war. A few of these advantages worth pasting in your hat for future reference are light weight (half the weight of aluminum), excellent dielectric characteristics, resistance to corrosion, structural strength, and ease of machining. There are many more.

The time will come when ack-ack need no longer clear trouble-charged skies. Then industrial plastics, such as Synthane, will return and find many new jobs waiting. As you look forward to that day, read the data on the back of this sheet or write to us for present help on future work.

SYNTHANE CORPORATION, OAKS, PENNSYLVANIA

Plan your present and future products with Synthane Technical Plastics

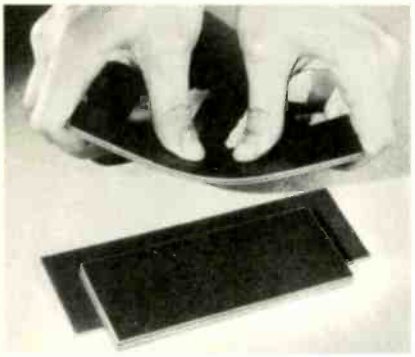
SHEETS • RODS • TUBES • FABRICATED PARTS **SYNTHANE** MOLDED-LAMINATED • MOLDED-MACERATED

SYNTHANE "Sandwich" Materials

One of the advantages of Synthane is the ease with which it can be bonded to other materials to produce a substance with the combined advantages of the partnership. Bonding takes place under heat and high pressure, during the polymerization of the Synthane; it is not a mere joining of two surfaces with an adhesive. The resulting combination, therefore, shows little or no tendency to delaminate.

Synthane combinations are familiarly known as Synthane "sandwich" materials, an appropriate name, for many different kinds of combinations are possible.

Probably the most widely used combination brings Synthane and rubber together.

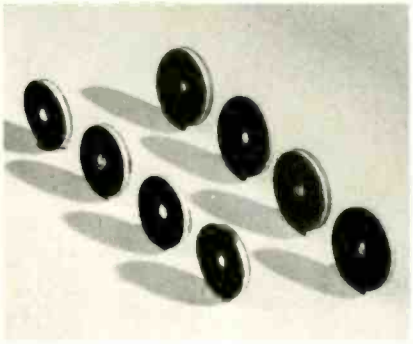


Synthane-Rubber

Synthane-rubber combinations are advantageous where the strength of Synthane is desirable to back up rubber.

An interesting application concerns a washer used in electrolytic and oil type condensers. The washer is placed on the end of tin can electrolytic condensers with the Synthane face exposed to the chemicals to prevent deterioration. The can is crimped into the rubber to make a tight seal.

A similar washer is used on "bath-tub" condensers. Tough Synthane provides a firm seat for a nut which compresses the rubber to form a tight joint.

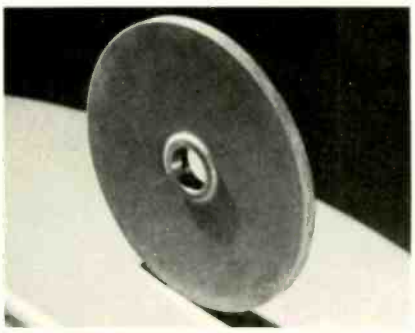


Combinations of rubber and Synthane have been furnished with rubber on one side, Synthane on the other; rubber on both sides with Synthane between; Synthane on both sides and rubber between; and alternate laminations of rubber and Synthane built up to any desired thickness.

There are many more possible uses for Synthane-rubber sandwich materials, which we cannot describe because of military censorship. There are also many important uses for a combination of Synthane and Neoprene.

Synthane-Synthane

Occasionally two grades of Synthane are combined. For instance, in certain radio tube sockets, layers of fabric and paper base Synthane are combined. The paper base has usually better electrical properties while the fabric base furnishes added strength where the stress is greatest.



Bobbin heads in the textile industry are often made of paper and fabric bases combined. The fabric base endures rough handling, whereas the paper base on the inside of the head provides a smooth wearing surface.

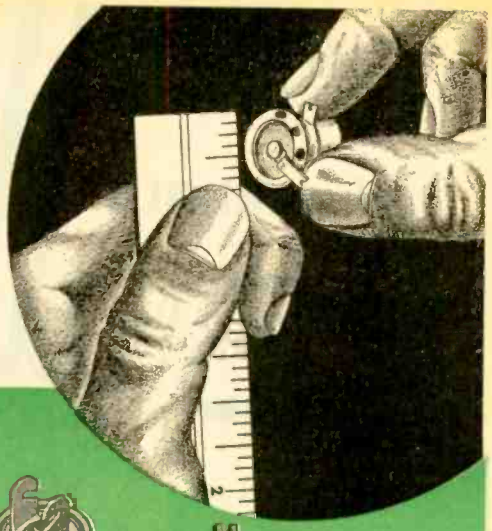
Synthane-Asbestos

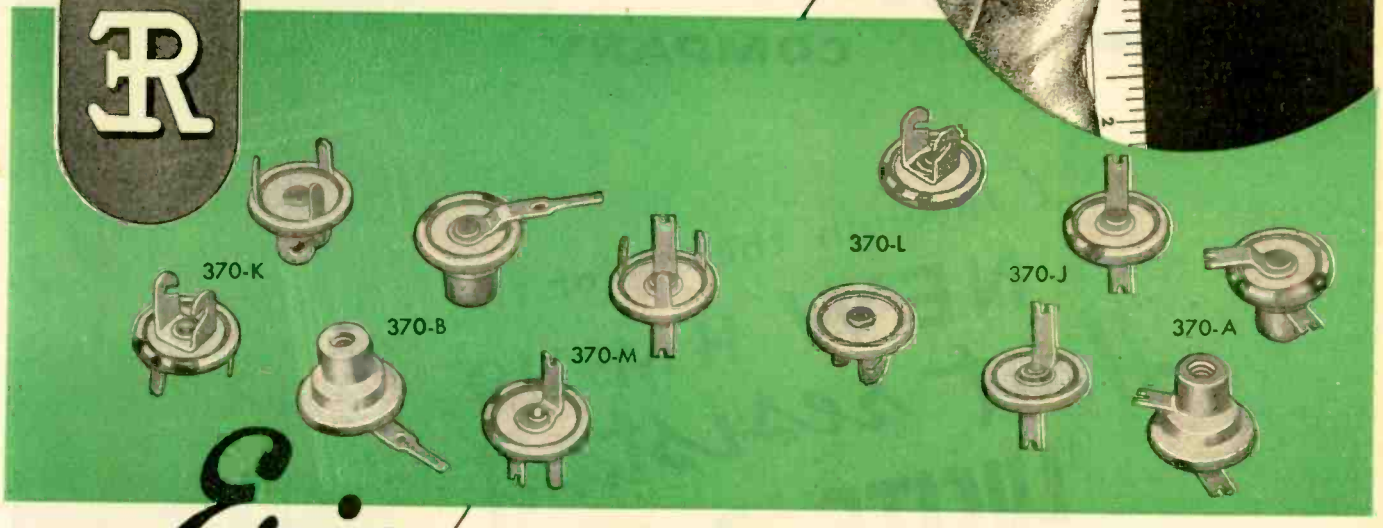
Synthane is wound about asbestos (or fibre) tubes and cured in the manufacture of tubing for large fuse cases. Synthane adds strength and rigidity to the fire resistance of the asbestos or fibre.

Synthane-Other Materials

Synthane can be united with a variety of materials to produce a variety of practical combinations. We have made or experimented with other combinations. If you have any combination in mind which we have not explored, we will be glad to investigate its possibilities for you.

COMPACT





Erie

BUTTON SILVER MICA CONDENSERS FOR V.H.F.—U.H.F. APPLICATIONS

THESE small condensers consist essentially of a stack of silvered mica sheets encased in a silver plated housing. The housing forms one terminal, the other terminal being connected at the center of the stack, thus providing the shortest possible electrical path to and from the capacitor.

For V.H.F. and U.H.F. applications where short ribbon-type leads, low series inductance, and compactness are requisite factors, Erie Type 370 Button Mica Condensers are ideal components.

A wide selection of terminal and mounting designs is available to provide both feed-through and by-pass connections. Capacity ranges and electrical characteristics are given above.

The efficiency and quality of Erie Button Silver Micas have been thoroughly proven in wartime communications equipment since before Pearl Harbor.

Write for data sheet which gives complete information.

CHARACTERISTICS

CAPACITY RANGE:
15 to 500 MMF at 1 mc.

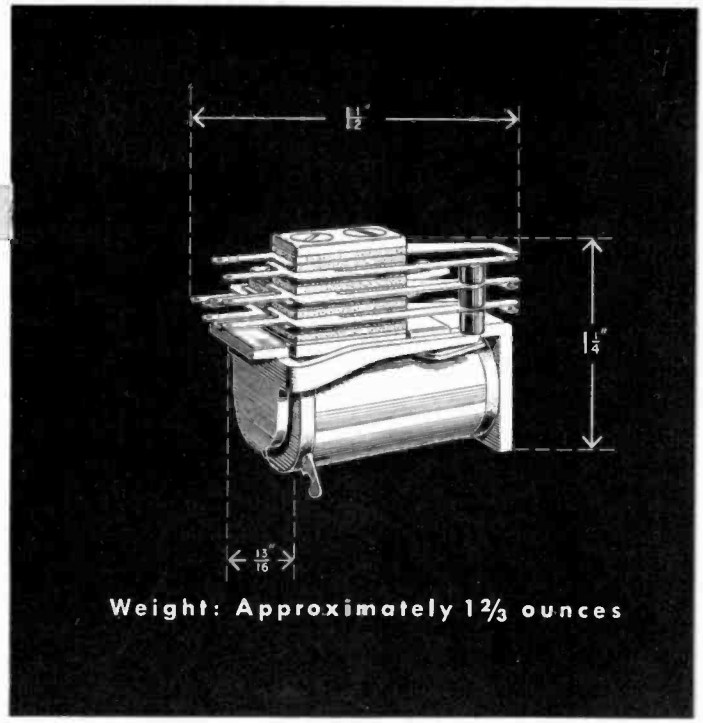
POWER FACTORS:
.08% max. for capacity tolerance ± 5% or closer (for resonant circuit applications).
.12% max. for capacity tolerance over ± 5% (for by-pass and blocking use).

MAX. WORKING VOLTAGE:
350 Volts A.C., 500 Volts D.C.
Flash Test (2 seconds) 1,000 Volts D.C.
Leakage Resistance, Over 10,000 megohms.

BACK THE ATTACK WITH WAR BONDS

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

DO YOU HAVE CHATTER TROUBLE?



Weight: Approximately 1⅔ ounces

Avoid chattering bearings and worn parts by specifying Clare Type K d.c. Relay for that heavy vibration application.

Use of a "fatigueless" beryllium copper hinge in the Type K gives a simple, compact unit that insures uniform armature movement up to millions of operations. This design makes unnecessary the use of anti-vibration springs.

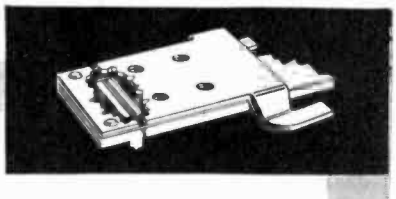
Small and compact—measures only 1½" x 1¼" x 13/16"—the Type K, shown here, weighs but 1⅔ ounces. It is a definite contribution to design problems where weight and space are important factors.

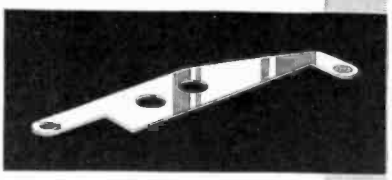
The Type K can be furnished in the contact forms shown with any number of springs up to and including 12 . . . coil voltage range is from 1.5 volts to 60 volts d.c. . . . contacts of either 18 gauge silver, rated one ampere, 50 watts, or 18 gauge palladium, rated two amperes, 100 watts can be furnished.

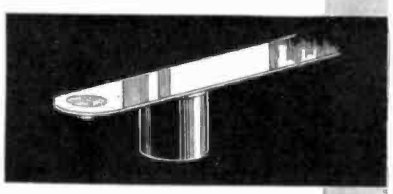
Contact spring pile-ups are fastened to the heelpiece with screws tightened under pressure and secured by a coating of Glyptol at head and foot. All metal parts are specially plated to withstand a 200 hour salt spray test.

Like all Clare Relays, the Type K can be "custom-built" to meet your specific requirements. Write us of your needs. Let our engineers advise you of the many coil contacts and adjustments that can be made up for you. Whether your requirements are large or small, we invite you to consult with us regarding your problems.

Send for the Clare catalog and data book. C. P. Clare & Company, 4719 West Sunnyside Ave., Chicago (30), Ill. Sales engineers in all principal cities. Cable address: CLARELAY.


Hinge of "fatigueless" beryllium copper insures long life under vibration.


Nickel contact springs to which contacts are overall welded by special process.


Strong, hard, long wearing Bakelite bushing insulators resist vibration and heavy contact pressures.

CLARE RELAYS

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

Centradite

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.

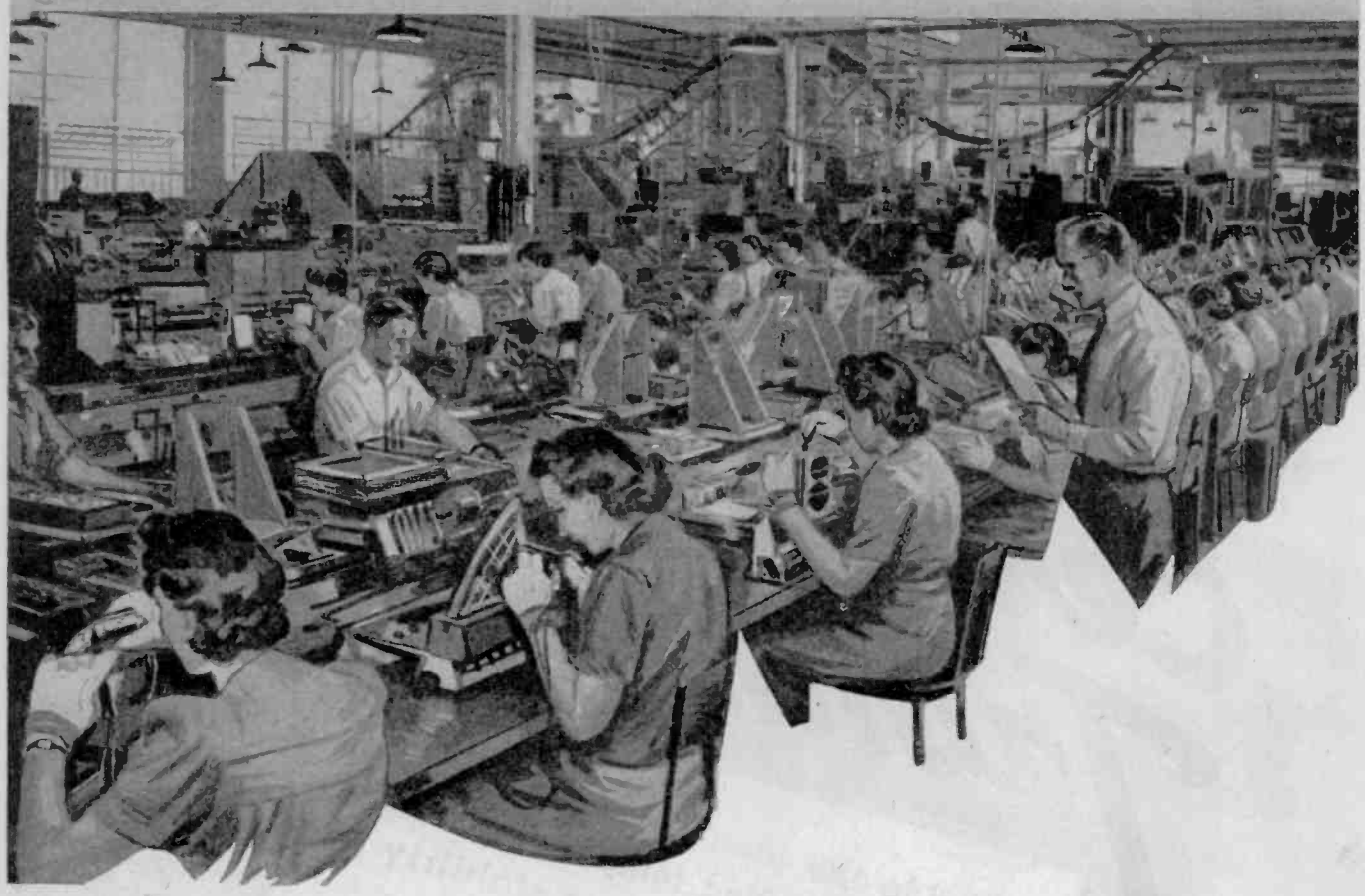
Body No. 400	Description of Material
20-100 C° 1.9×10^{-6}	Thermal coefficient of expansion per degree Centigrade
20-600 C° 3.1×10^{-6}	
13,000 lbs.	Modulus of rupture in lbs. per sq. in.
5.4	Dielectric constant
3.00 or less	Dielectric loss factor
Class "L3" or better	Grade per American Stand. C 75.1-1943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

Centralab

Division of GLOBE-UNION INC., Milwaukee


Centralab
CRL
Ceramic
Trimmers
provide the ideal trimmer capacitor where controlled temperature coefficient and mechanical stability is required.
Temperature coefficients available:
Types 820, 822, 823, 824
Maximum negative .0005 mmf/mmf/oC
Types 822, 823, 824 . . . . . Zero
Type 823 . . . Positive .0002 mmf/mmf/oC
Write for Bulletin 695
Centralab
CRL
Division of GLOBE-UNION INC., Milwaukee

There's More to Engineering than Design



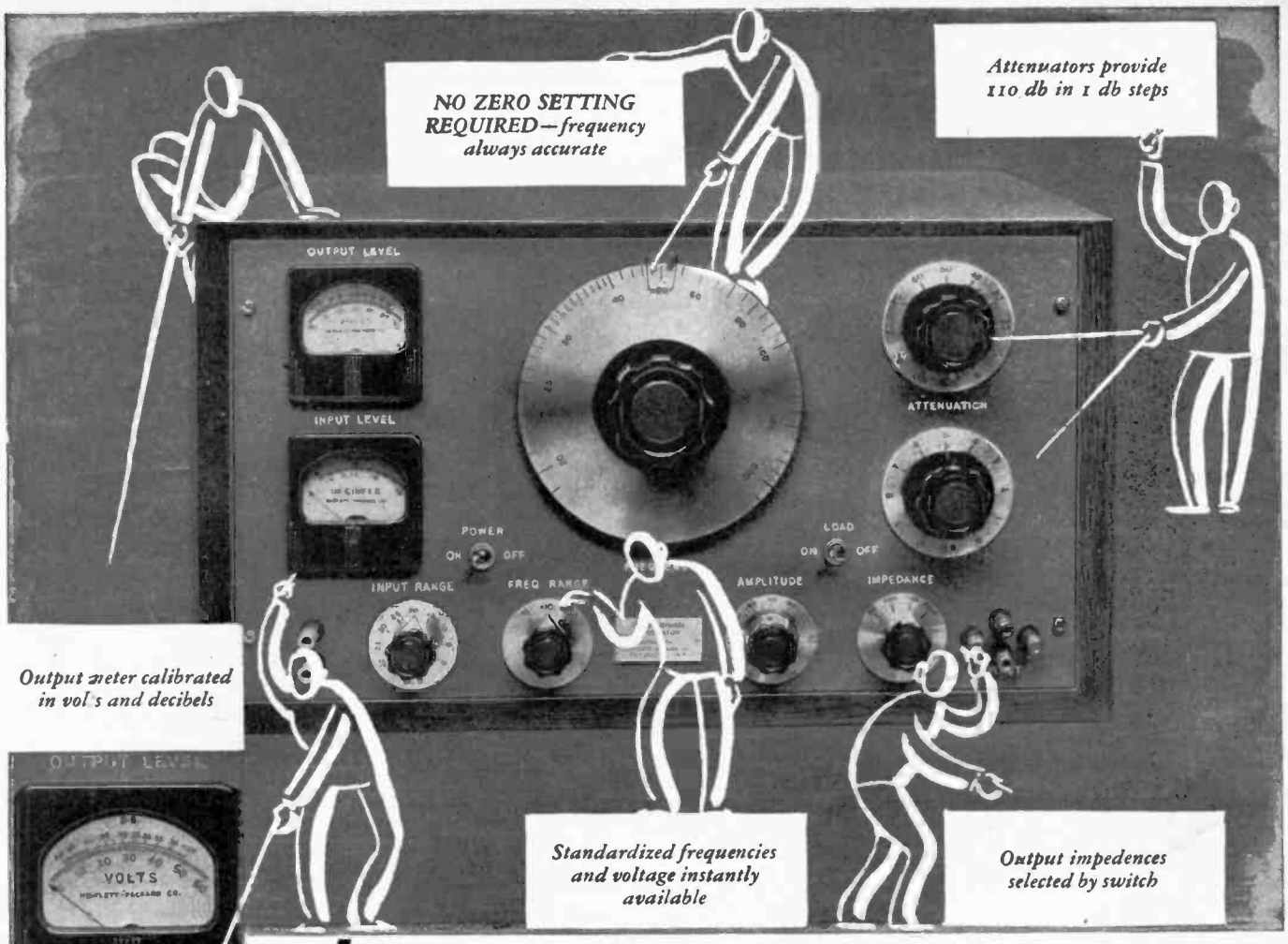
It's one thing to concentrate the combined forces of research and engineering on a problem, and thereby come up with the answer—and quite another thing to put that answer into mass production on an assembly line.

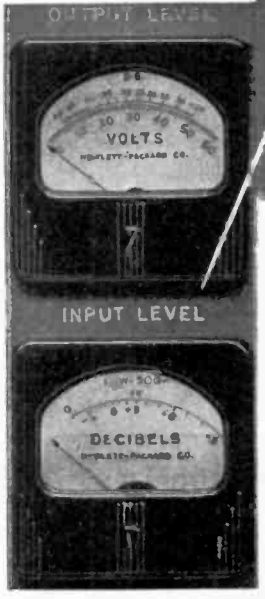
This teamwork between research engineering and mass production is a Delco Radio specialty, developed through years of experience in the exacting manufacture of peacetime automotive radios. It is being applied to highly intricate wartime assignments which include volume production of receivers and transmitters for mobile artillery and tanks . . . straight-line assembly of push-button tuning for vehicular radio receivers . . . mass manufacture of relays, plugs, receptacles, rotary switches, shock mountings . . . and volume production of components for air-borne communication and electronic navigation equipment.

Today, when the ability to discover and design must be teamed with the ability to produce in great quantity with highest quality, Delco Radio finds itself well prepared for wartime industry's needs. Delco Radio Division, General Motors Corporation, Kokomo, Indiana.

Back Our Boys By Buying Bonds!

Delco Radio
DIVISION OF
GENERAL MOTORS





Separate input meter for making gain measurements

Six reasons why this

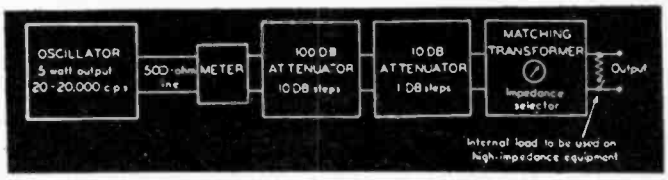
AUDIO SIGNAL GENERATOR

saves your time and insures better accuracy

This all-in-one combination of instruments insures the utmost of speed without sacrifice of accuracy in making certain laboratory and production measurements. The model 205AG consists of an *-hp-* Resistance Tuned Audio Oscillator, an output meter, attenuator and an impedence matching system. In addition a separate input meter is provided. Thus no auxiliary equipment is required in making gain measurements. It is ideal for general laboratory applications because it supplies a known voltage and a known frequency at the commonly used impedence levels.

Of outstanding importance is the fact that the Resistance Tuned Oscillator requires no zero setting. The frequency drift is negligible even during the first few minutes of operation. The constant output of this oscillator makes it ideal for checking frequency response of apparatus. Waveform distortion is very small, hence this instrument provides an excellent source of voltage for distortion measurements.

Below is a block diagram showing the arrangement of the components in the Model 205AG Audio Signal Generator. Get full information about this and other *-hp-* laboratory instruments. Ask for your copy of the 26-page fully illustrated catalog which gives valuable data on making tests and measurements as well as details of the *-hp-* line of instruments.

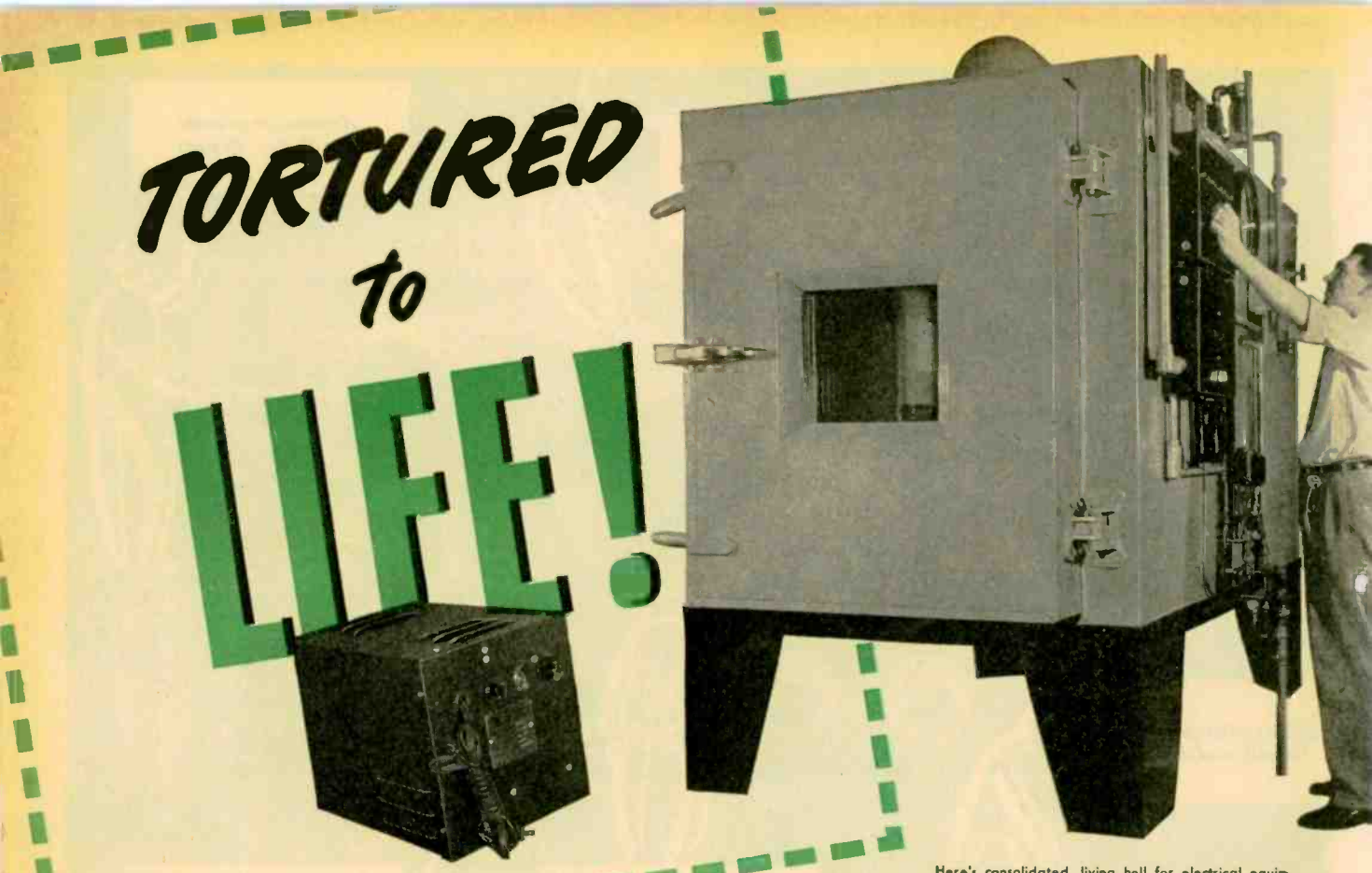


HEWLETT-PACKARD COMPANY

672

Box 1135 M Station A, Palo Alto, California

TORTURED TO LIFE!



Here's consolidated, living hell for electrical equipment. It's a "torture-chamber" that reproduces the toughest possible conditions of temperature, humidity, atmospheric pressure. It is one of the many "torture devices" at Electronic Laboratories for testing E•L products.

THE HARDEST PART of an *E•L* Power Supply's life is being born. Because then it must survive tests that make its actual service-life a bed of roses by comparison.

E•L Power Supplies have to prove their guts in temperatures more extreme than Siberia's cold or Sahara's heat . . . at altitudes higher than the Himalayas and lower than the Dead Sea . . . in dust storms . . . in salt spray . . . in humidity worse than a Solomons swamp! Severe operating conditions all, yet intentionally exaggerated in tests at Electronic so that *E•L* Power Supplies may live longer in actual service.

If you have power supply needs of converting low voltage to high voltage, obtaining a precisely regulated power output from a varying power input, or anything else, however tough—let Electronic's engineers help you find the answer.

Your problem may be radio . . . motors . . . lighting. *E•L* engineers are familiar with them all . . . and many other applications as well! They are at your service for consultation!

Only *E·L* VIBRATOR POWER SUPPLIES Offer All These Advantages:

1. **CONVERSION**—DC to AC; DC to DC; AC to DC; AC to AC.
2. **CAPACITIES**—Up to 1,000 Watts.
3. **VARIABLE FREQUENCIES**—A power supply may be designed to furnish any frequency from 20 to 280 cycles, or a controlled variable output within a 5% range of the output frequency.
4. **MULTIPLE INPUTS**—For example, one E•L Power Supply, in quantity production today, operates from 6, 12, 24, 110 volts DC or 110 volts AC, and 220 volts AC, with a single stable output of 6 volts DC.
5. **MULTIPLE OUTPUTS**—Any number of output voltages may be secured from one power supply to suit individual needs.
6. **WAVE FORMS**—A vibrator power supply can be designed to provide any wave form needed for the equipment to be operated.
7. **FLEXIBLE IN SHAPE, SIZE AND WEIGHT**—The component parts of a vibrator power supply lend themselves to a variety of assembly arrangements which makes them most flexible in meeting space and weight limitations.
8. **HIGHEST EFFICIENCY**—E•L Vibrator Power Supplies provide the highest degree of efficiency available in any type power supply.
9. **COMPLETELY RELIABLE**—Use on aircraft, tanks, PT boats, "Walkie-Talkies," jeeps, peeps and other military equipment, under toughest operating conditions has demonstrated that E•L units have what it takes!
10. **MINIMUM MAINTENANCE**—There are no brushes, armatures or bearings requiring lubrication or replacement because of wear. The entire unit may be sealed against dust or moisture.

Electronic LABORATORIES, INC.

INDIANAPOLIS

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

MEASURE YOUR FREQUENCY • DRIVE YOUR RECORDER • SEE THE ANSWER AT A GLANCE

WITH THE NEW *Norelco* DIRECT READING FREQUENCY METER

HERE is a brand new Norelco tool for industry—an electronic direct reading frequency meter remarkable for its compactness, simplicity and wide range of applications.

Six scale ranges make possible the accurate coverage of all frequencies from 0 to 50,000 cycles. The six scale ranges are:

0 — 100 cycles per second
0 — 500 cycles per second
0 — 1,000 cycles per second
0 — 5,000 cycles per second
0 — 10,000 cycles per second
0 — 50,000 cycles per second

Any standard 5 milliampere recorder may be connected to the frequency meter and be driven without the aid of an auxiliary amplifier. It operates on 110 volts AC and requires only 100 watts of power. It measures frequencies to an accuracy within 2% regardless of the input voltage, which may vary from ½ volt to 200 volts.

Adaptable for either relay rack or cabinet mounting, the new Norelco Electronic Direct Reading Frequency Meter is as useful in the laboratory as it is in the industrial plant. This instrument can be used in testing quartz crystals, or experimentally as the base of an FM modulation indicator. Combined with a photo-electric cell and amplifier, it can be made into a speed indicator. It permits the reading of high speeds, such as are encountered in *ultra*speed centrifuges. It is equipped with safety cutout to prevent meter and recorder burnout from accidental overload.

The new Norelco Electronic Direct Reading Frequency Meter is only one of several Norelco devices designed to help industry achieve better quality, flexibility and product control. Write to North American Philips engineers today and get the benefit of our wide experience in solving problems for industry.

For our Armed Forces we make Quartz Oscillator Plates; Amplifier, Transmitting, Rectifier and Cathode Ray Tubes for land, sea and airborne communications equipment. *For our war industries* we make Searchray (X-ray) apparatus for industrial and research applications; X-ray Diffraction Apparatus; Electronic Temperature Indicators; Direct Reading Frequency Meters; Tungsten and Molybdenum in powder, rod, wire and sheet form; Tungsten Alloys; Fine wire of practically all drawable metals and alloys: bare, plated and enameled; Diamond Dies; High Frequency Heating Equipment. *And for Victory we say: Buy More War Bonds.*

Norelco ELECTRONIC PRODUCTS by NORTH AMERICAN PHILIPS COMPANY, INC.

Industrial Electronics Division, 419 Fourth Ave., New York 16, N. Y.

Main factory and offices in Dobbs Ferry, N. Y.; other factories at Lewiston, Maine (Elmet Division); Mount Vernon, New York (Philips Metalix Corporation). Represented in Canada by Electrical Trading Company, Ltd., Sun Life Building, Montreal, Canada

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.

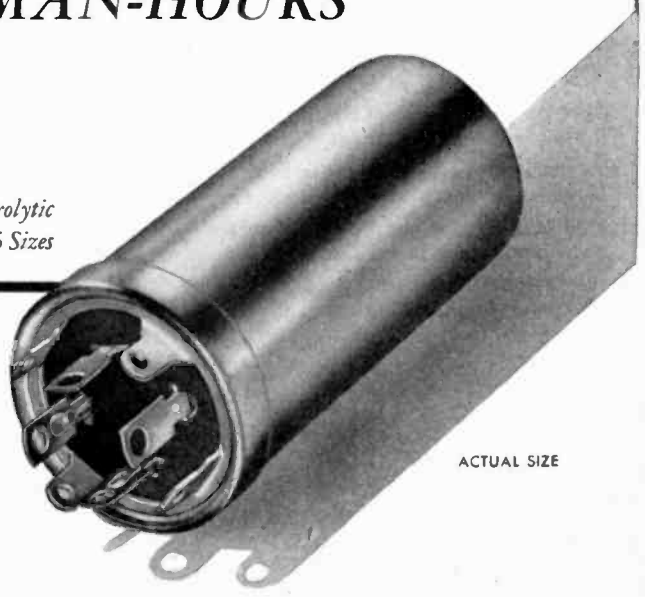
This war is run by radio. The vital importance of maintaining reliable communications necessitates the selection of quartz crystal units that are accurate and dependable. Bliley Crystals are engineered for service . . . they are used in all branches of military communications and are, of course, supplied for the SCR-299.

BACK THE ATTACK WITH WAR BONDS

BLILEY ELECTRIC CO., ERIE, PA.

☆ ☆ ☆ MAGNAVOX SAVES RADIO INDUSTRY MILLIONS IN DOLLARS AND MAN-HOURS

Magnavox Molanode Electrolytic Capacitor, Standardized in 6 Sizes



ACTUAL SIZE

REMEMBER HOW many shapes and sizes of capacitors there were before Magnavox engineers standardized them? Many were three times as large as are now used for the same capacity.

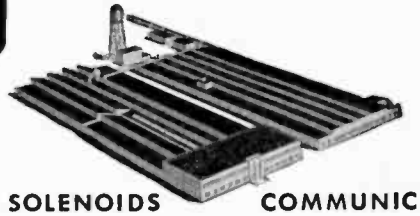
The Magnavox Molanode Electrolytic Capacitor is the end result of years of experience in this field. Through standardization of six sizes, use of a new, finely divided, fabricated aluminum anode called "Molanode" and an improved processing technique, economies were made that save incalculable money and time.

This is but one example of the problems solved day after day by Magnavox engineers, creating and manufacturing equipment for all the U. S. Armed Services and for all the United Nations. These developments range from solenoids to the most intricate types of complete radio communication systems.

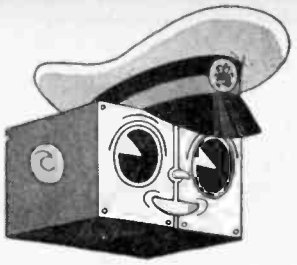
Magnavox brings to the war effort the skill and "know how" developed by 32 years of designing, engineering and manufacturing for the radio industry, the splendid facilities of the completely modern new six acre plant, finest machine tool equipment and the production economies of efficient management. The Magnavox Company, Fort Wayne 4, Indiana.

Magnavox skill and craftsmanship won the Navy "E" in 1941, among the first awarded... now with 3 White Star Renewal Citations.

FOR 32 YEARS **Magnavox** HAS SERVED THE RADIO INDUSTRY



LOUD SPEAKERS • CAPACITORS • SOLENOIDS COMMUNICATION & ELECTRONIC EQUIPMENT



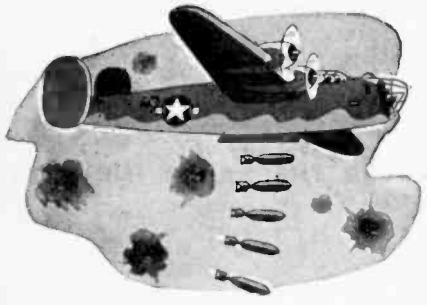
Song of Elmer... the pilot who never gets tired

He holds no place in the Officer's Mess
for he does not sleep or eat,
He's the Quietest Birdman ever took
his place in a cockpit seat—
He joins no laughter, nor shoots the breeze,
nor whistles, nor hums, nor sings,
But he's flown more planes than any man
who ever wore pilot's wings...

...has Elmer!

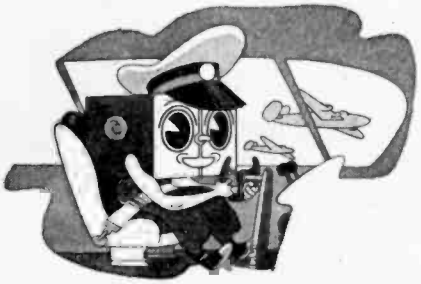
He's an old, old hand, as old hands go
in a young man's game today,
For he circled the globe in 'Thirty-three
with Post in the Winnie Mae—
He's an Army man, he's a Navy man,
and he flies with the R.A.F.,
And the Yankees say, and the British say
of pilots, he's the best...

...is Elmer!



Often when bombers have levelled off
for the last tense bombing runs,
And the bomb-bay doors are opened wide,
and the gunners man the guns,
When the flak comes up as the bombs
go down, and the target zone is clear,
Then who is the pilot who holds the course
set by the bombardier...?

It's Elmer!



He can hold a plane on a chosen course
while the crewmen rest or sleep,
He can level off for a landing glide,
or bank her sharp and steep—
He can spiral up, he can spiral down,
or hold her level and true—
His hydraulic muscles never tire
the way human muscles do...

...not Elmer's!

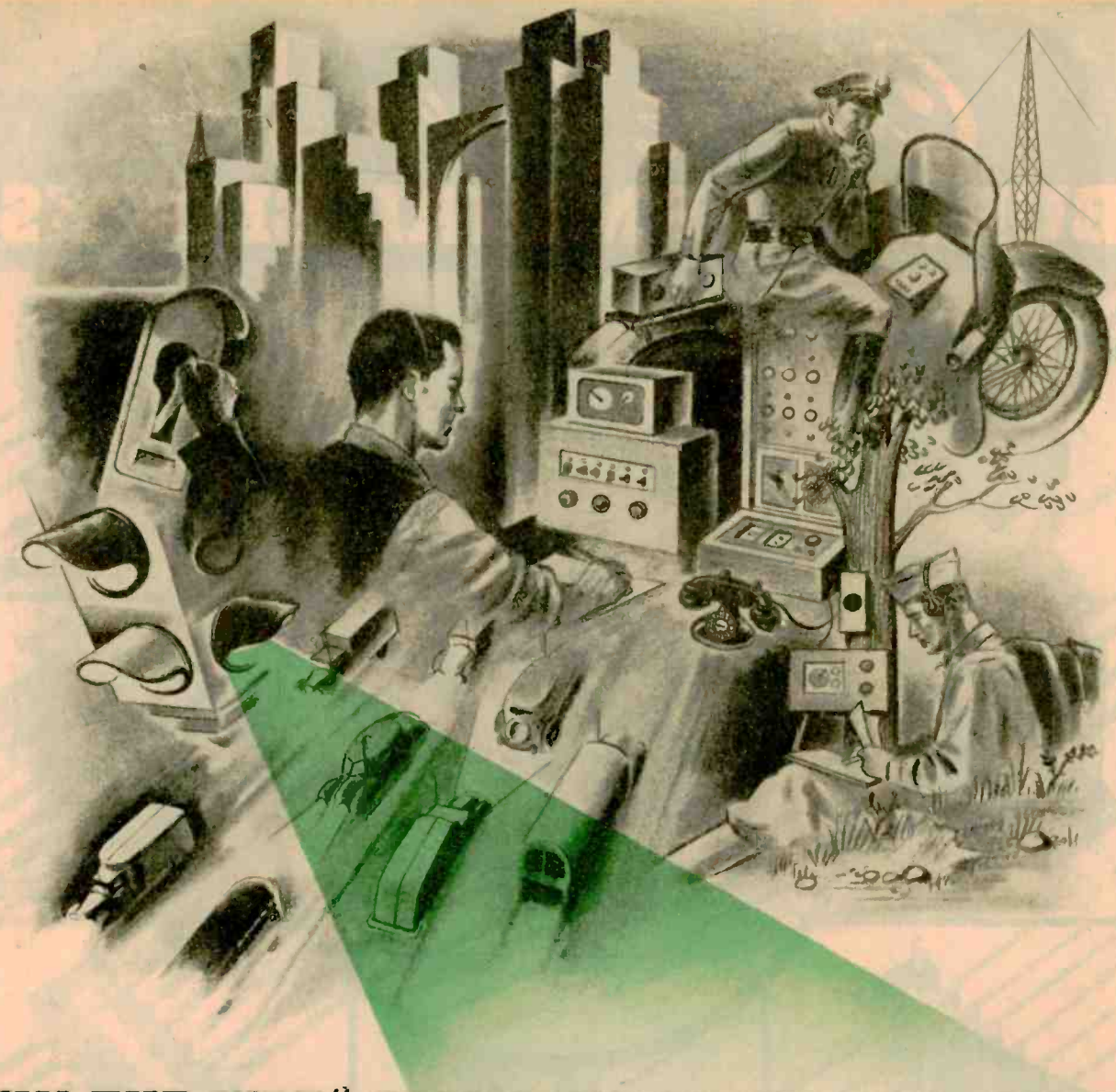
And so bombing, transport, and cargo
planes, take Elmer on every flight
To spare the pilot and rest the crew
for emergency, storm, or fight—
He needs no rest, for he never gets tired,
being only a cold machine,
Just wheels and wires and gears and cogs,
with brackets and stuff between...

...is Elmer!

He wears no medals, he holds no rank.
Why should he? He cannot feel
The courage that flares in time of need
for he's only alloy and steel!
So when *nerve* is needed, the bombardier,
the pilots, the gunners, too,
The navigator, and all the rest,
are the boys who pull her through...

...NOT Elmer!

• *Reprints of this poem — suitable for framing, with signature removed — may be obtained without charge by writing the Sperry Gyroscope Company.*



"WIN-THE-WAR" COMMUNICATION EQUIPMENT

has the green light

This company, like many others in the electronic industry, is busy twenty-four hours a day, seven days a week making war products – more and more, better and better to help win the war quickly. We are too busy to worry about post-war products just yet. We realize the great, important role radio and other electronics will play in the modernization of communication systems postwar.

Out of the laboratories of war will come electronic improvements applicable to every American home, in every city in 194V. But plans for the modernization of your city of tomorrow must wait until the war is won today.

Hudson American

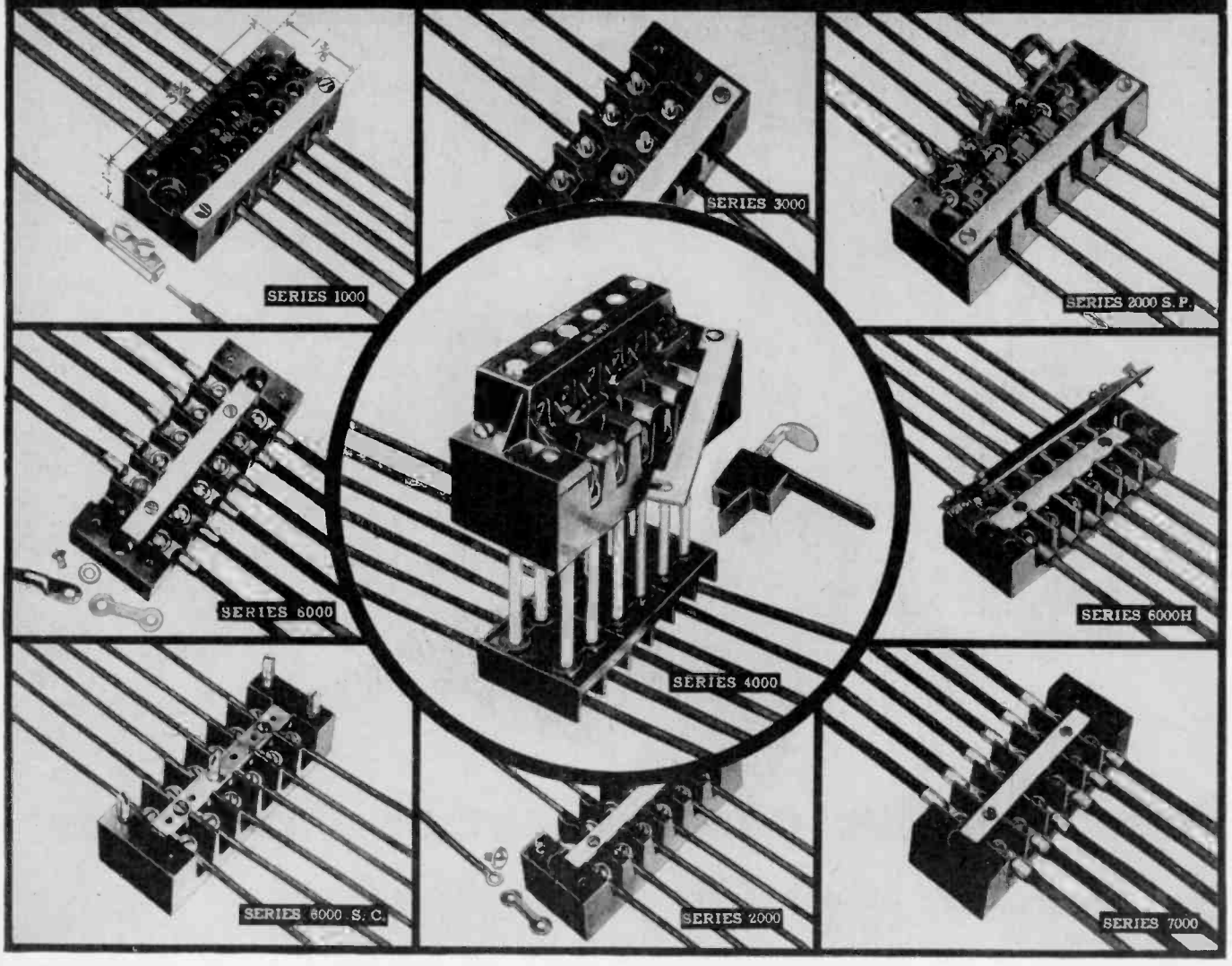
CORPORATION

Manufacturers of Electronic and Radio Devices

23 WEST 43 ST. · NEW YORK CITY

BACK THE ATTACK! BUY *MORE* WAR BONDS!

Choose from 10
BURKE TERMINAL BLOCKS

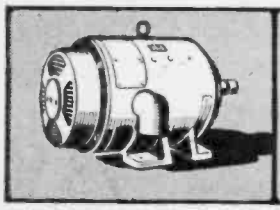


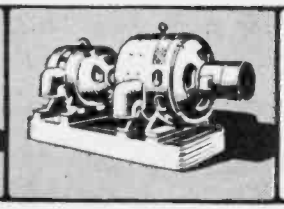
Wherever two or more wires come together there is an application for Burke Controlead Terminal Blocks. They are standardized in 10 types to meet all kinds of applications. Additional moulding capacity on a 24-hour basis permits faster deliveries to meet urgent war demands. Consult with Burke engineers for correct selection of these high quality blocks for your needs.

Write for Booklet TB-2 *Today*

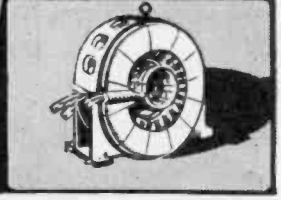
BURKE ELECTRIC COMPANY • 1209 WEST 12TH STREET

ERIE, PENNSYLVANIA





D.C. Equipment to 1500 H.P. and 1000 K.W.
A.C. Equipment to 1500 H.P. and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal Blocks



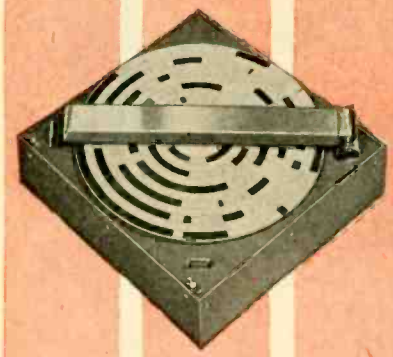
A war Hero to Consider in Your Plans for the Future

In a bomber over Berlin . . .

aboard a battleship in the far Pacific . . .

on the production lines of American factories . . .

AT EVERY WAR FRONT ELECTRONICS IS PLAYING A HEROIC ROLE



AUTOMATIC PROCESS CONTROL

For control of industrial processes from printed charts. Provides automatic control of chemical processes, also of production machinery.

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.

● There are hundreds of peacetime production jobs waiting for this war hero . . . jobs that Electronics can do better, faster, more economically.

In many ways which cannot now be told, General Electronics Industries has been helping to establish the great war record of Electronics through cooperative research with industrial organizations and Army and Navy research agencies. Our research engineers, skilled and experienced in advanced uses of Electronics, Hydraulics and Electromechanics, can give you valuable assistance in your production planning.

Remember: Today's plans mean tomorrow's profits. Write to Engineering Department, General Electronics Industries, 342 West Putnam Avenue, Greenwich, Conn.

•

GENERAL Electronics INDUSTRIES

Division of Auto-Ordnance Corporation

GREENWICH • STAMFORD • BRIDGEPORT • NEW MILFORD • NEW YORK

Over HERE-a Knock at the Door means a Neighbor Calling

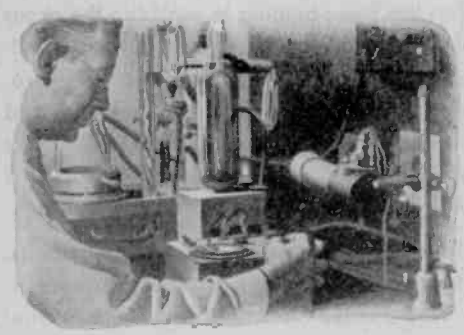
In Axis countries, that knock might be the Gestapo—and death, if you had been listening to American news from Algiers or British news from London or the underground radio.

In America, no one cares if you listen to enemy stations—their propaganda is often good for a hearty laugh. But for unbiased war news, we tune to our own stations. We know that we will hear every important news break that won't help the enemy.

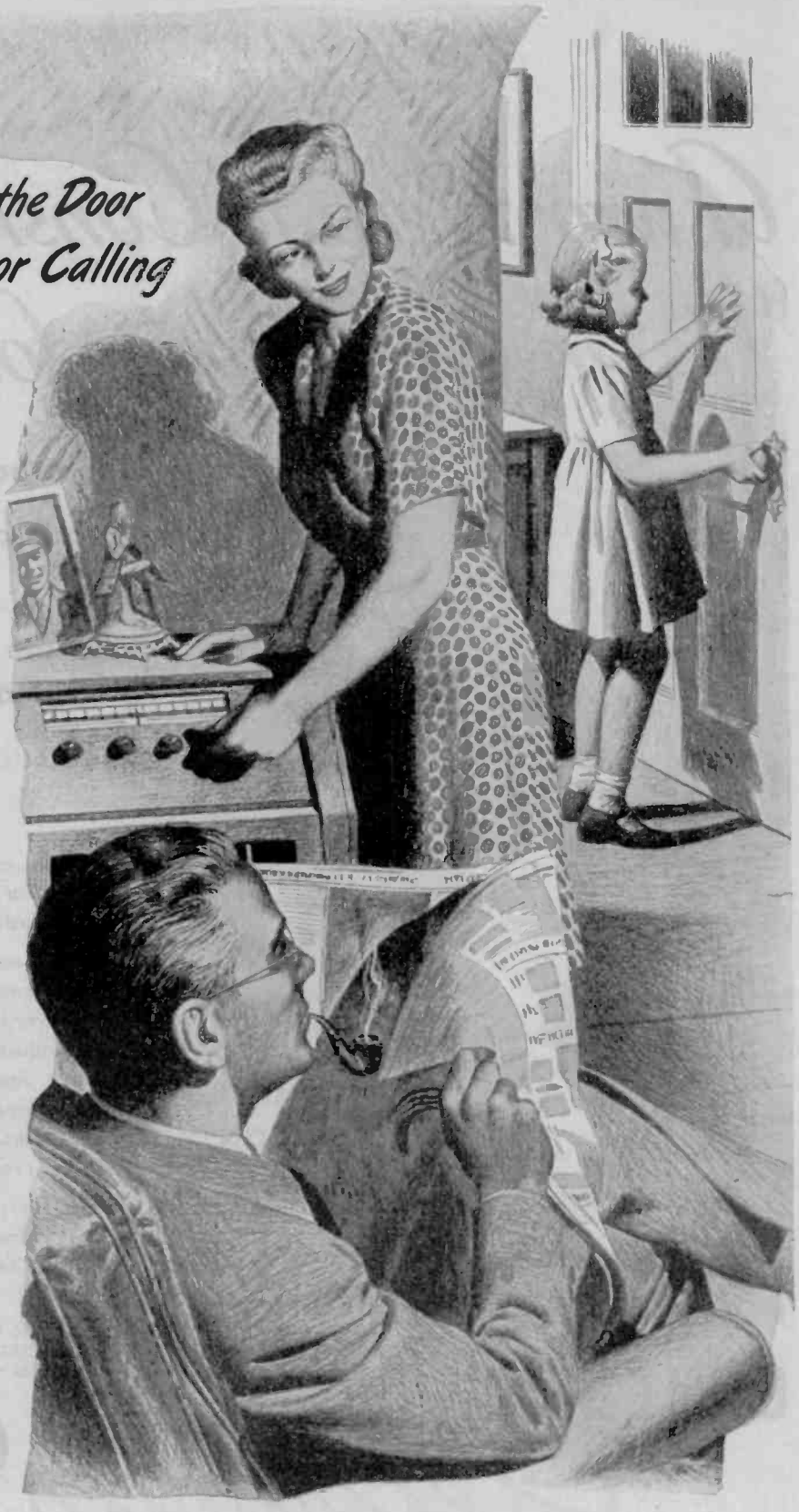
Radio has done much to make Americans the best informed people on earth. Through the ingenuity and skill of American radio manufacturers, fine-quality sets have been brought within the reach of everyone.

While today American radio makers are devoted solely to the cause of Allied Victory, important new techniques developed under stress of war will bring you finer radios and other electronic products when the war is won.

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 are proud of the privilege of serving America's great radio industry in its united war against the Axis. When the day of Victory comes, RCA, through basic research, will continue to work hand in hand with American manufacturers for better and more useful radio equipment in our peacetime world.



RCA Laboratories

A SERVICE OF RADIO CORPORATION OF AMERICA

keeps its Shape

New and more exacting problems in insulation are being solved by MYKROY, the perfect low-loss, glass-bound mica insulating material.

One of the many outstanding *mechanical* properties of MYKROY is that it will not warp, shrink or change its physical form under adverse conditions of heat, cold or humidity.

Equipment insulated with MYKROY functions with dependable efficiency in torrid jungles, polar regions, vapor-laden chemical plants . . . at sea and under the sea.

From Reports of Independent Testing Laboratories

No. 4		No. 8
6.68	Dielectric Constant (Dry)	6.75
6.73	Dielectric Constant (Wet)	6.70
.00240	Power Factor (Dry)	.00164
.00241	Power Factor (Wet)	.00231
1.60	Loss Factor (Dry)	1.11
1.62	Loss Factor (Wet)	1.54
630 Volts per Mil.	Dielectric Strength	660 Volts per Mil.

VASTLY INCREASED FACILITIES TO FILL YOUR ORDERS PROMPTLY

No more delays or bottlenecks! Increases of more than 400% in our plant and personnel now afford ample capacity to handle largest orders. We are equipped to mold or machine any type or volume of component parts to your specifications. Our specialized engineering knowledge is at your service.

Write for complete engineering data and ratings. Talk over your insulating problems with our specialists.

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

MADE EXCLUSIVELY BY ELECTRONIC MECHANICS INC.

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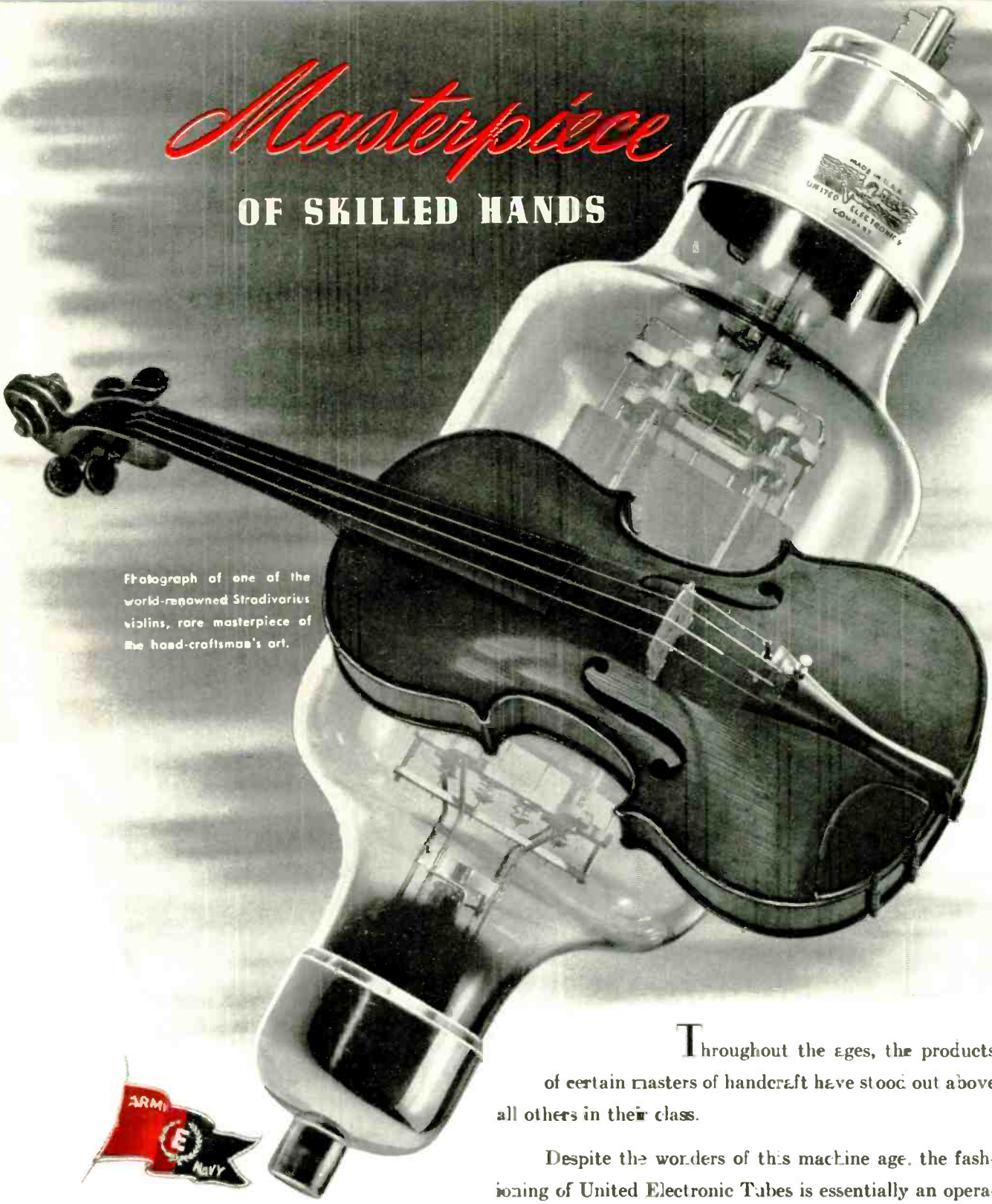
Chicago 47 - 1917 NO. SPRINGFIELD AVENUE . . TEL. Albany 4310

Masterpiece

OF SKILLED HANDS



Photograph of one of the world-renowned Stradivarius violins, rare masterpiece of the hand-craftsman's art.

Throughout the ages, the products of certain masters of handcraft have stood out above all others in their class.

Despite the wonders of this machine age, the fashioning of United Electronic Tubes is essentially an operation of unsurpassed hand craftsmanship.

Tubes by United are regarded as masterpieces in their field. One of the many reasons for this reputation is that United has been for long years a specialist and pioneer in transmitting tube design and production . . . *exclusively*.

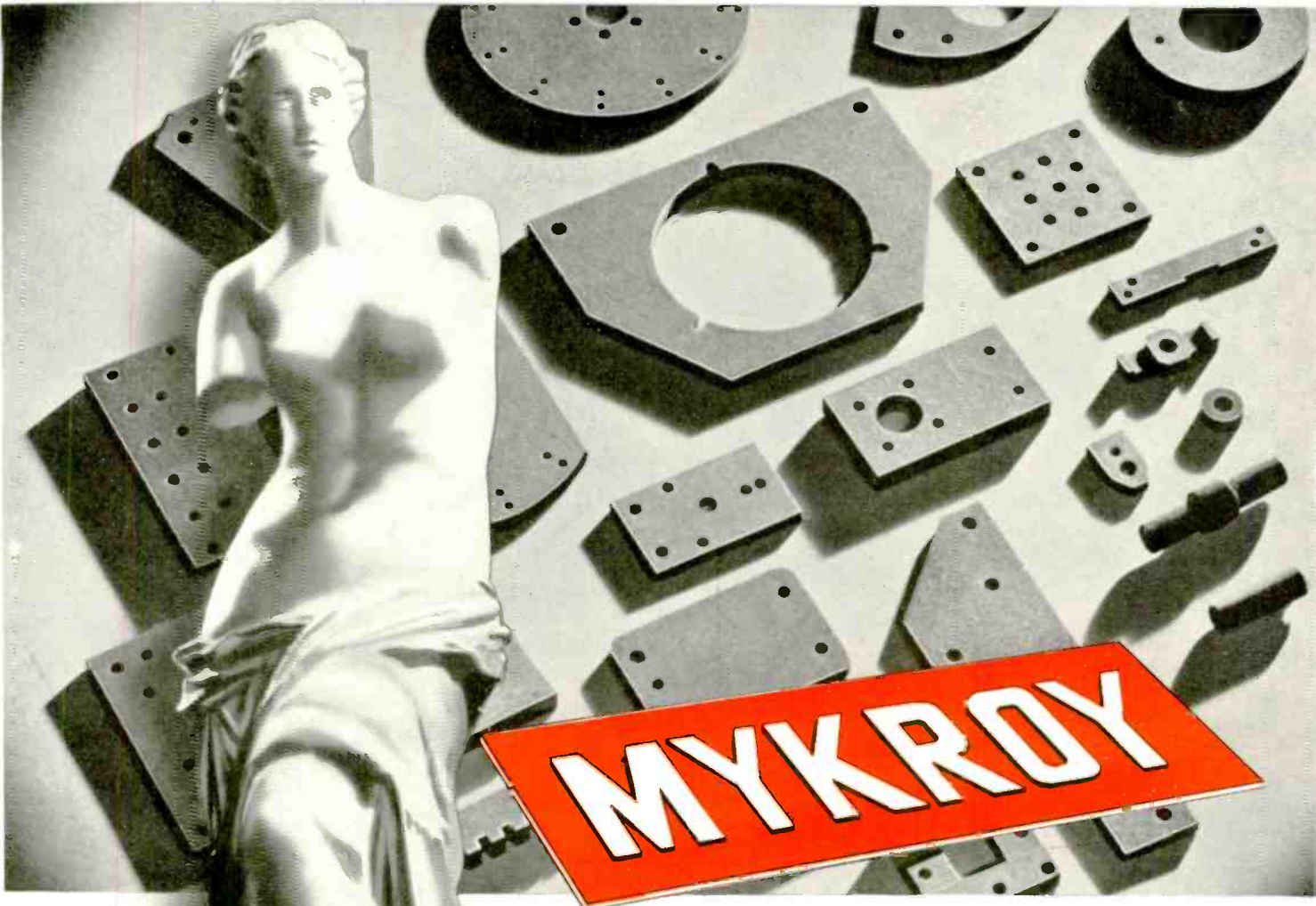
Another important reason for UNITED leadership is that the UNITED production policy never has been one of *how many*—but *how well*.

UNITED

ELECTRONICS COMPANY

NEWARK, 2 New Jersey

Transmitting Tubes EXCLUSIVELY Since 1934



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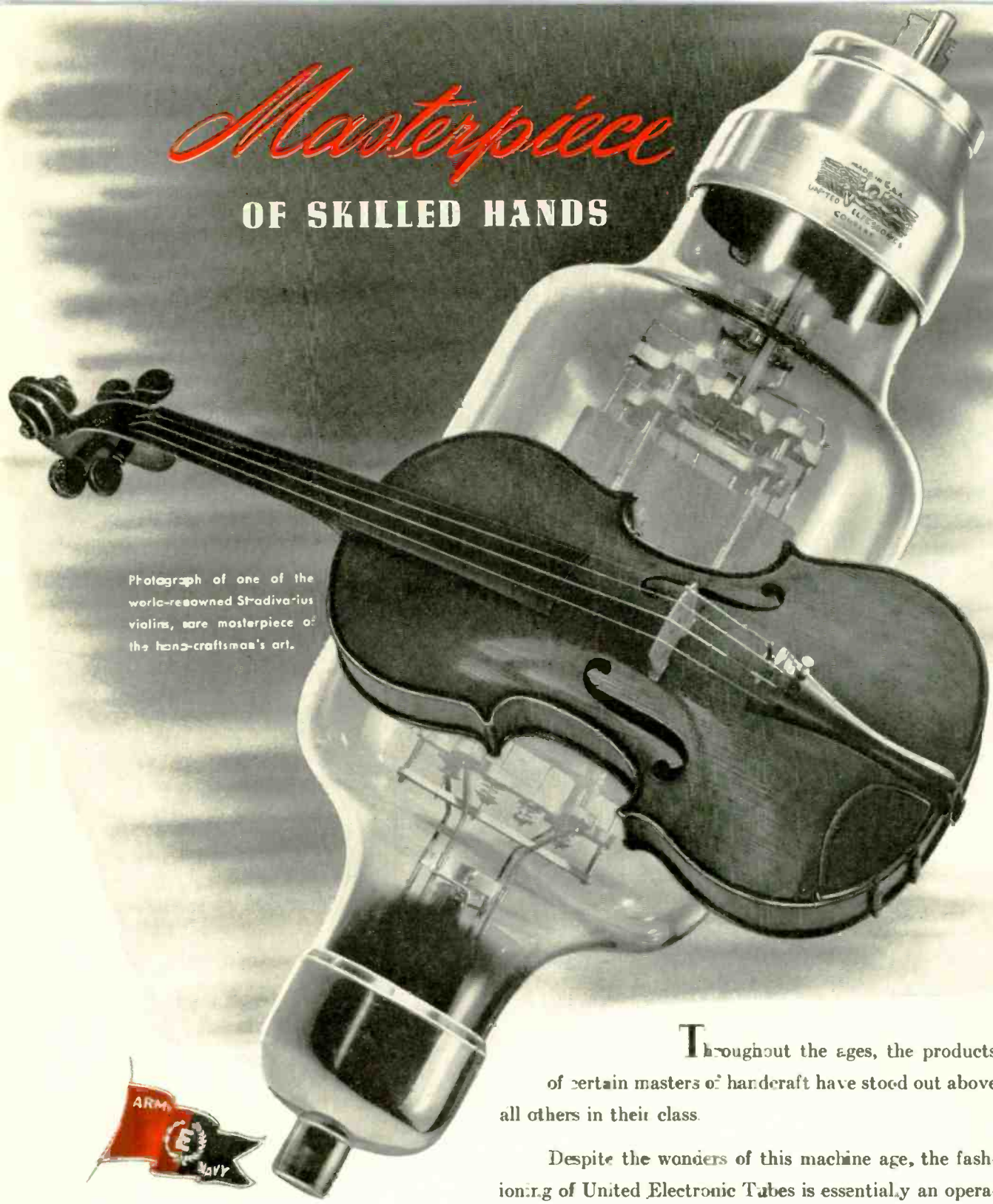

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UNITED

ELECTRONICS COMPANY

NEWARK, 2 New Jersey

Transmitting Tubes EXCLUSIVELY Since 1934

Despite our mounting offensive, men who know more about the war than any of us, warn that this is no time for complacency. We'll need stout hearts to see it through.

— and FERRANTI is firm in the conviction that any let-up on the home front is a let-down on ALL fronts. As long as our efforts are needed for war, we shall not pay too much attention to postwar matters. This will put us at no disadvantage. Our war work automatically maintains and widens our engineering — primarily for war but ultimately to the great benefit of commercial purchasers.

So this much goes without saying: When the last shot has been fired, FERRANTI will be ready . . . ready to serve you as only FERRANTI can.

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

FERRANTI PRODUCTS

TRANSFORMERS • REACTORS • FILTERS • EQUALIZERS • ATTENUATORS • MODULATION SETS
RECTIFIERS • PLATE-FILAMENT TRANSFORMERS • ELECTROSTATIC VOLTMETERS • AERO TRANSFORMERS

FERRANTI

FOR ACCURATE TEMPERATURE CONTROL

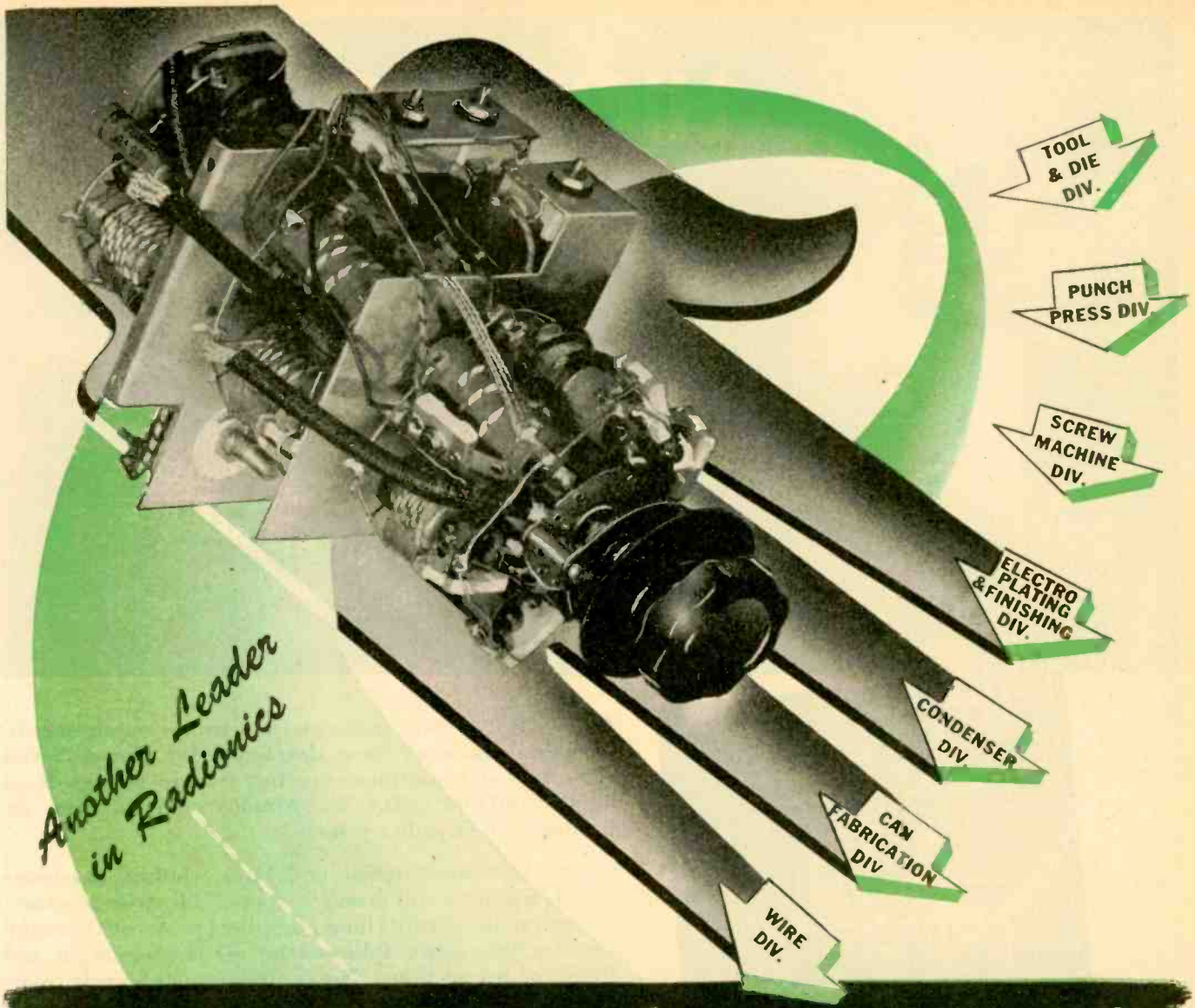
in all latitudes... in all altitudes

#1½ Blower reduces space requirements for heat dissipation. Unexcelled for applications in electronic equipment.

OUTPUT . . . *15 C.F.M. at 8000 R.P.M.*
HOUSING . . . *High impact plastic*
WHEEL . . . *Turbo type 1½" diameter*
WEIGHT . . . *Housing and wheel 2 ounces*

Bulletin including complete performance specifications available on request.

L-R MANUFACTURING COMPANY
TORRINGTON, CONN.



Another Leader in Radionics

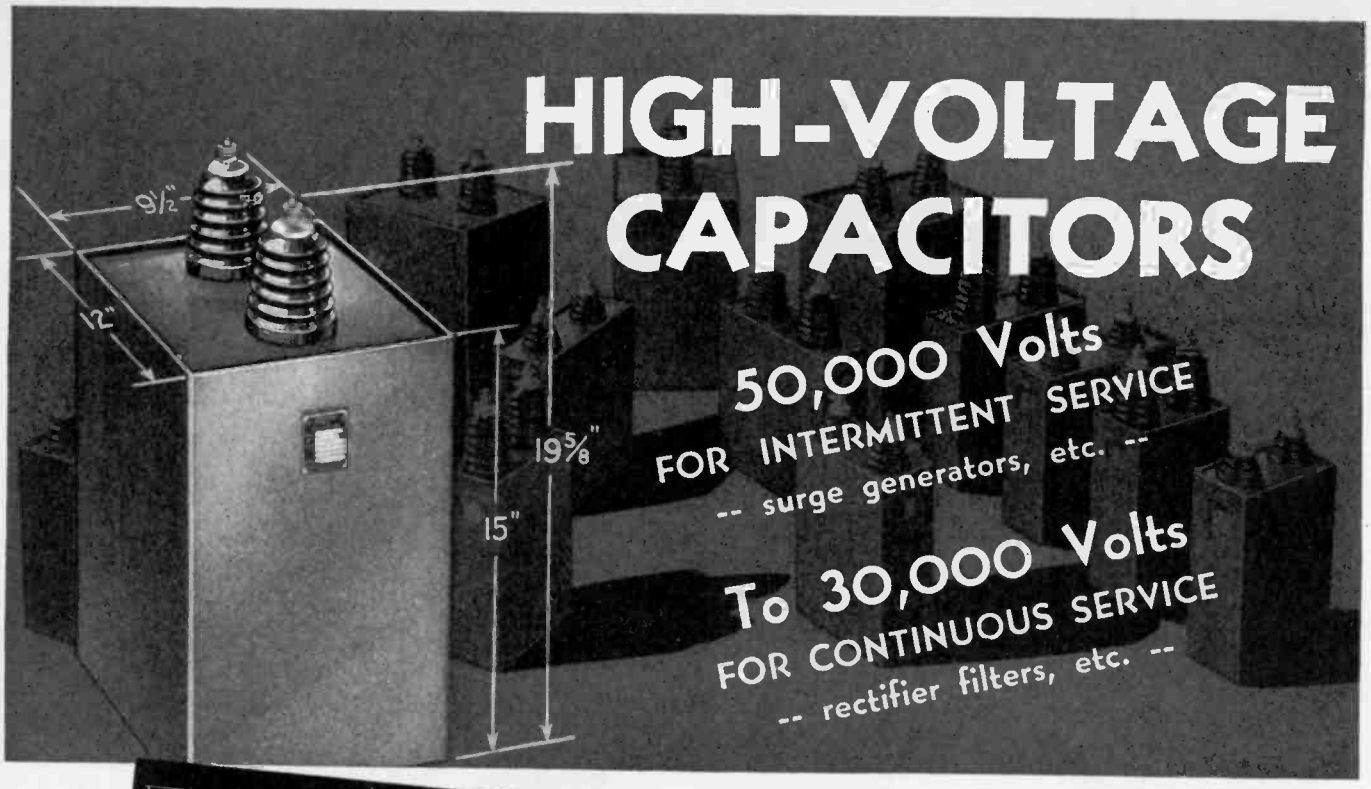
GUTHMAN *Super-Improved* COILS

For many years before the war, Edwin I. Guthman & Co. was especially known for manufacturing better coils. With war came greater demands upon our facilities... U. S. Army and Navy orders for many diversified radio parts... expansion of our plant... the addition of many new manufacturing departments. All manufacturing and assembling of these many units was done in our own completely equipped plant. Thus, our engineers and skilled personnel gained a broader experience in modern radionics. Now, we are concentrating all this technical experience in the engineering and production of Guthman Super-Improved Coils... promised leaders in peacetime radionics.

EDWIN I. GUTHMAN & CO. INC.

15 SOUTH THROOP STREET · CHICAGO

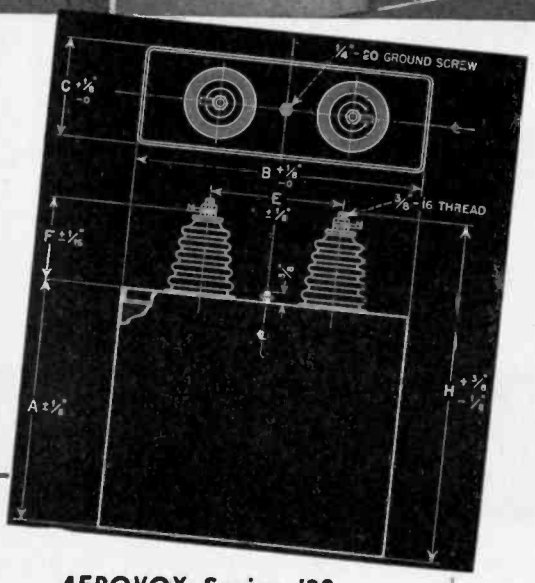
PRECISION MANUFACTURERS AND ENGINEERS OF RADIO AND ELECTRICAL EQUIPMENT



HIGH-VOLTAGE CAPACITORS

50,000 Volts
FOR INTERMITTENT SERVICE
-- surge generators, etc. --

To 30,000 Volts
FOR CONTINUOUS SERVICE
-- rectifier filters, etc. --



● To meet certain radio and electronic requirements, Aerovox engineers have developed the Hyvol Series '20 oil-filled capacitors covering voltage ratings from 6000 to 50,000 v. D.C.W. Already many of these capacitors are in military service.

Giant, Aerovox-designed and built winding machines handle up to several dozen "papers." Likewise a battery of giant tanks permits long pumping cycles for thorough vacuum treatment, followed by oil impregnation and filling of the sections. The multi-laminated kraft tissue and hi-purity aluminum foil sections are uniformly and accurately wound under critically controlled tension to avoid mechanical strain.

The sections are *connected directly across the full working voltage.* In the higher capacity units, a plurality of sections are *connected in parallel.* These capacitors are not to be confused with the series-connected sections heretofore frequently resorted to in attaining high working voltages. Sections are hermetically-sealed in sturdy welded-steel containers. Rust-proof lacquer finish. Cork-gasketed pressure-sealed glazed-porcelain high-tension pillar terminals.

AEROVOX Series '20

TYPE 6020—6000 v.
D.C. Work
2.0 mfd. to 10.0 mfd.
TYPE 7520—7500 v.
D.C. Work
0.5 mfd. to 6.0 mfd.
TYPE 10020—10,000 v.
D.C. Work
1.0 mfd. to 5.0 mfd.
TYPE 12520—12,500 v.
D.C. Work
0.5 mfd. to 5.0 mfd.
TYPE 15020—15,000 v.
D.C. Work
0.25 mfd. to 3.0 mfd.
TYPE 20020—20,000 v.
D.C. Work
0.25 mfd. to 4.0 mfd.
TYPE 25020—25,000 v.
D.C. Work
0.2 mfd. to 1.0 mfd.
TYPE 37520—37,500 v.
D.C. Work
0.1 mfd. to 1.0 mfd.
TYPE 50020—50,000 v.
D.C. Work
0.1 mfd. to 0.5 mfd.
also 25,000 v. Output
(12,500 - 12,500 v.)
for Voltage-Doubler
Circuits
0.25-0.25 mfd. to
0.5-0.5 mfd.

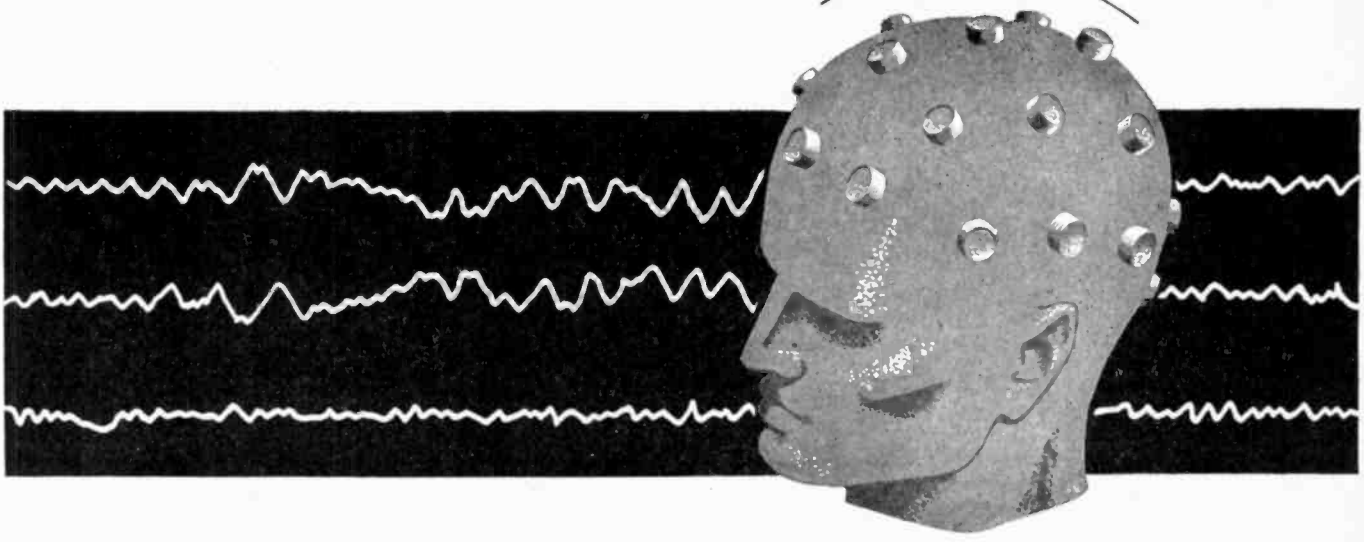
● Regardless whether it be giant high-voltage capacitors or a low-voltage by-pass electrolytic, send that problem to us for engineering collaboration, recommendations, quotations. Catalog on request.

AEROVOX Capacitors

INDIVIDUALLY TESTED

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

TUNING IN ON Brain Tissue



WITH IRC RESISTORS

Scientists have long known that living tissue generates minute electric potentials. But only recently have researchists been able to adapt this knowledge to clinical use on the human brain through means of the Electroencephalograph.

In its functioning, tiny electrodes are fastened to the skin by collodion at the points indicated in the illustration. The average potentials of only 50 microvolts are led to a high-gain amplifier and enlarged to a size where the waves are easily visualized. Comparative studies of the graphs obtained from various brain areas indicate and localize the presence of abnormalities, if any exist.

Quite naturally for such a sensitively adjusted instrument, measuring minute voltages, details of resistor construction are of vital importance in addition to the inherent stability, precision, low noise level and other characteristics which

ANOTHER IRC DEVELOPMENT

are fundamental requirements. IRC is proud to have collaborated in the evolution of the Electroencephalograph and to have had its resistors and specialized engineering skill play a part in its development.

If you are seeking unbiased counsel on a resistance problem, consult IRC—the company that makes resistor units of more types, in more shapes, for more applications than any other manufacturer in the world.

PREFERRED FOR PERFORMANCE • IRC • FIXED & VARIABLE RESISTORS

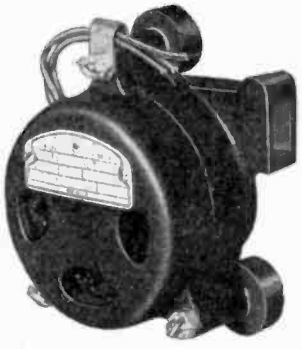
ARMY E NAVY

INTERNATIONAL RESISTANCE COMPANY

425 N. Broad Street · Philadelphia 8, Pa.

WEIGHT REDUCTION PROBLEMS?

Hipersil*, the new Westinghouse magnetic steel for transformer cores, increases flux-carrying capacity ⅓ and reduces weight 30 to 50%.



For aircraft and airborne radio, blower and motor combined for maximum air circulation in a weight-saving magnesium housing.

Inerteen capacitors deliver more microfarads per ounce.

INSULATION

Tuffernell, Glasweve and mica insulating materials permit high operating temperatures and consequent savings in weight.

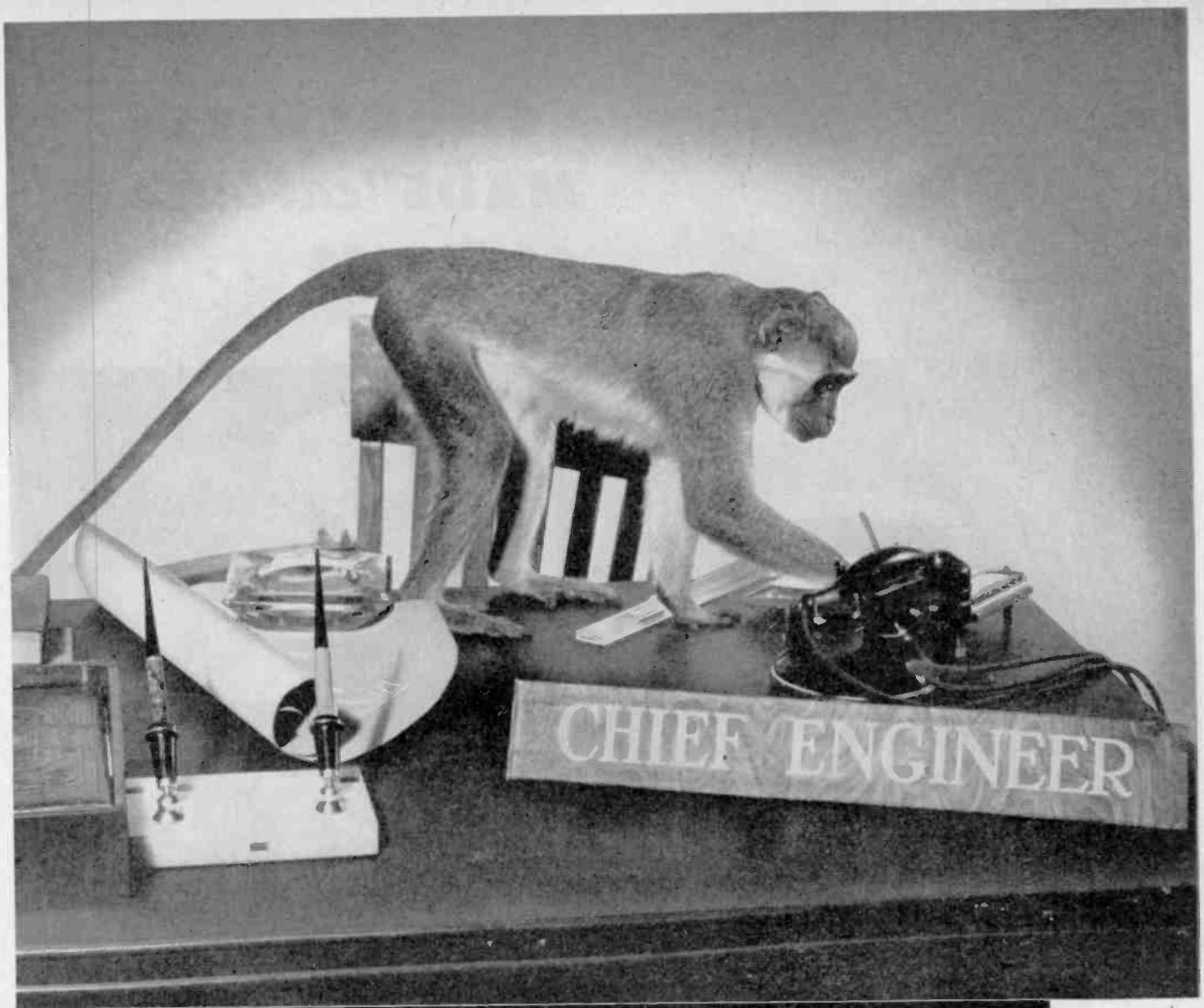
In designing radios for combat service, every ounce counts. Weight reduction is not only an engineering problem—it becomes a matter of fighting efficiency. Westinghouse engineers have co-operated with many designers to work out a variety of solutions, of which the accompanying illustrations are typical examples.

Perhaps these are directly applicable to your problem; or it may be that yours is completely different. In either case, trained and experienced Westinghouse representatives are ready to help you; call them today. Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pennsylvania. J-94565

*Registered Trade-mark Westinghouse Elec. & Mfg. Co.

Westinghouse

PLANTS IN 25 CITIES...OFFICES EVERYWHERE



he can do your work . . .

. . . *if* you are not really concerned about what happens to your designs after they leave the drafting board. And if the choice of electronic tubes and other components is left to chance, the performance of the finished product can scarcely measure up to the engineers' conception of it. Imagination is the well-spring of true progress in the field of electronics - - - but the performance of the most finely conceived design is no better than the tubes incorporated in it.

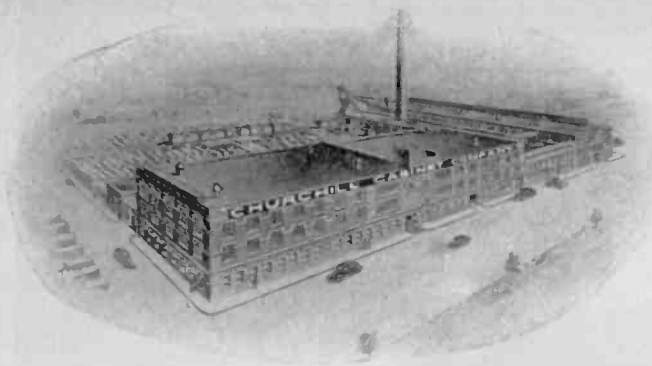
The name Raytheon is synonymous with quality and dependability wherever tubes are in use. When production can again be directed to civilian use Raytheon tubes will be built better than ever before - - - the *engineering* of Raytheon tubes will afford hitherto undreamed of new horizons for amateur, commercial and industrial radio.

FOUR "E" AWARDS FOR EXCELLENCE
Each Division of Raytheon
has been Awarded the Army and Navy "E"

RAYTHEON

RAYTHEON MANUFACTURING COMPANY
Waltham and Newton, Massachusetts

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



"CHURCHILL-MADE" *cabinets go to war . . .*

with the Hallicrafters Built SCR-299

The SCR-299 Mobile Radio Communications unit is equipped with tables and cabinets built by Churchill Cabinet Company.

This valuable new weapon is designed for the "Blitz" type of warfare and has proven its ability to fight successfully the "Battle of Communications."

Dependable equipment built by Churchill Cabinet Company is serving with this excellent transmitting unit that is giving such superb service on all fighting fronts.

Two of Our Peace-time Communication Products.

By Invitation Member

CHURCHILL CABINET COMPANY

2119 CHURCHILL ST., CHICAGO, ILLINOIS

CASH PRIZE CONTEST!

FOR RADIO MEN IN THE SERVICE!

"WRITE A LETTER"

As you know, the Hallicrafters make a wide range of Radio Communications equipment, including the SCR-299 Mobile Communications unit. We are proud of our handiwork, proud of the job you men have been doing with them on every battlefront.

RULES FOR THE CONTEST

We want letters telling of actual experiences with this equipment. We will give $100.00 for the best such letter received during each of the five months of November, December, January, February and March! (Deadline: Midnight, the last day of each month.)

We will send $1.00 for every serious letter received so even if you should not win a big prize your time will not be in vain.

Your letter will be our property, of course, and we have the right to reproduce it in a Hallicrafters advertisement.

Good luck and write as many letters as you wish. V-Mail letters will do.

W. J. Halligan

BUY MORE BONDS!

the hallicrafters co.

CHICAGO, U.S.A.

2611 INDIANA AVENUE · CHICAGO, U.S.A.

MAKERS OF THE FAMOUS SCR-299 COMMUNICATIONS TRUCK

Designed and Engineered for

DIMENSIONAL ACCURACY

PROPER DEFLECTION

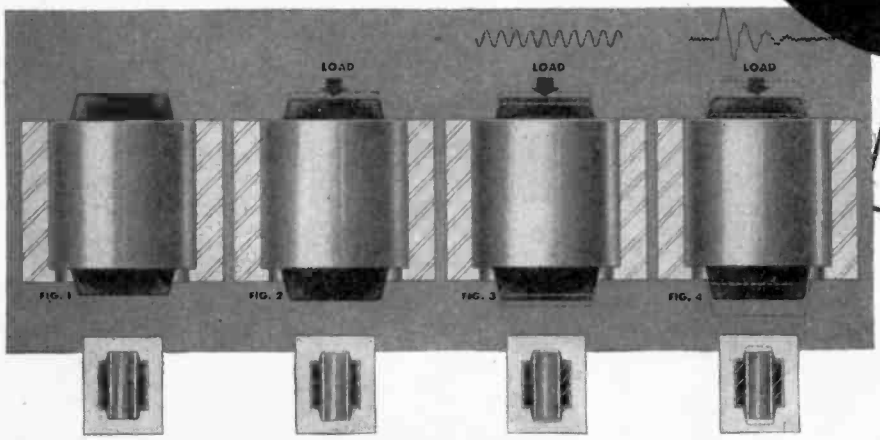
PRECISE LOAD RATINGS

SIMPLICITY OF APPLICATION

LORD
BONDED RUBBER

Shear Type MOUNTINGS

PROVIDE THE ULTIMATE IN VIBRATION CONTROL



OPERATION OF TUBE FORM MOUNTINGS

ALL Lord Mountings are designed to operate on the principle of having the rubber "stressed in shear" when load is applied in the direction of the main axis of the mounting. This design provides the required softness and deflection in the direction of the disturbing forces, and stability or resistance to movement in directions normal to the major thrusts.

Every Lord Mounting is designed to have a definite static deflection under its rated load. Load ratings for standard tube form mountings range from a few pounds to 1450 pounds, with rated deflections ranging from .065 inches to .123 inches when load is imposed.

Illustrations above show a Lord Tube Form Mounting in the various positions it assumes while static or in action.

Fig. 1—Under no load (as produced). Note position of center sleeve.

Fig. 2—Under rated load; note deflection of center sleeve.

Fig. 3—Operating in the zone of free shear action under normal vibration.

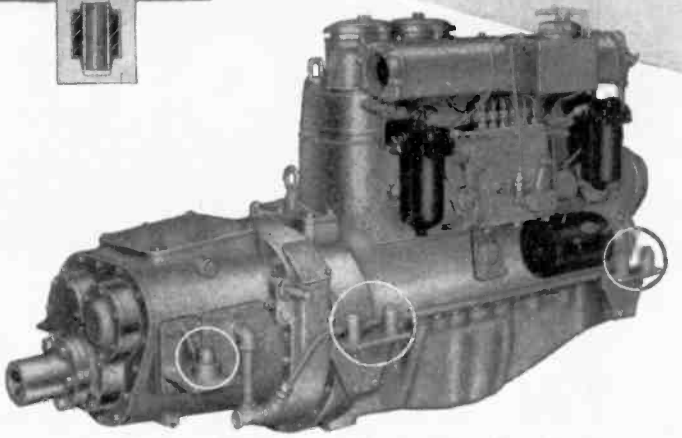
Fig. 4—Operating momentarily under sudden shock load or in zone of resonance.

Load ratings of Tube Form Mountings may be changed by:

1—Utilizing rubber compounds of varying degrees of stiffness.

2—Increasing length and/or cross-section of rubber element and metal parts.

3—Increasing or decreasing diameter of center metal sleeve.



Kermath Marine Engine suspended on Lord Tube Form Mountings

These design features, plus the unified control of manufacture from raw material to finished product, account for the remarkable efficiency and dependability of Lord Mountings.

Lord Tube Form Mountings are sturdy, compact, light weight units, and are designed to cover a wide range of applications in every field of industry. They are made in various styles and many sizes with flanged or straight outer metal members, and with snubbing or non-snubbing features.

Through proper mounting selection, isolation efficiencies ranging from 75% to 85% reduction of disturbing forces may be expected, although reductions up to 97% are not unusual on equipment operating at very high frequency.

For complete information on Lord Mountings write for bulletins 103 and 104 or call in a Lord vibration engineer for consultation on your design problems. There is no obligation.

★ ★

Back the Attack with War Bonds

★ ★

IT TAKES RUBBER *In Shear* TO ABSORB VIBRATION

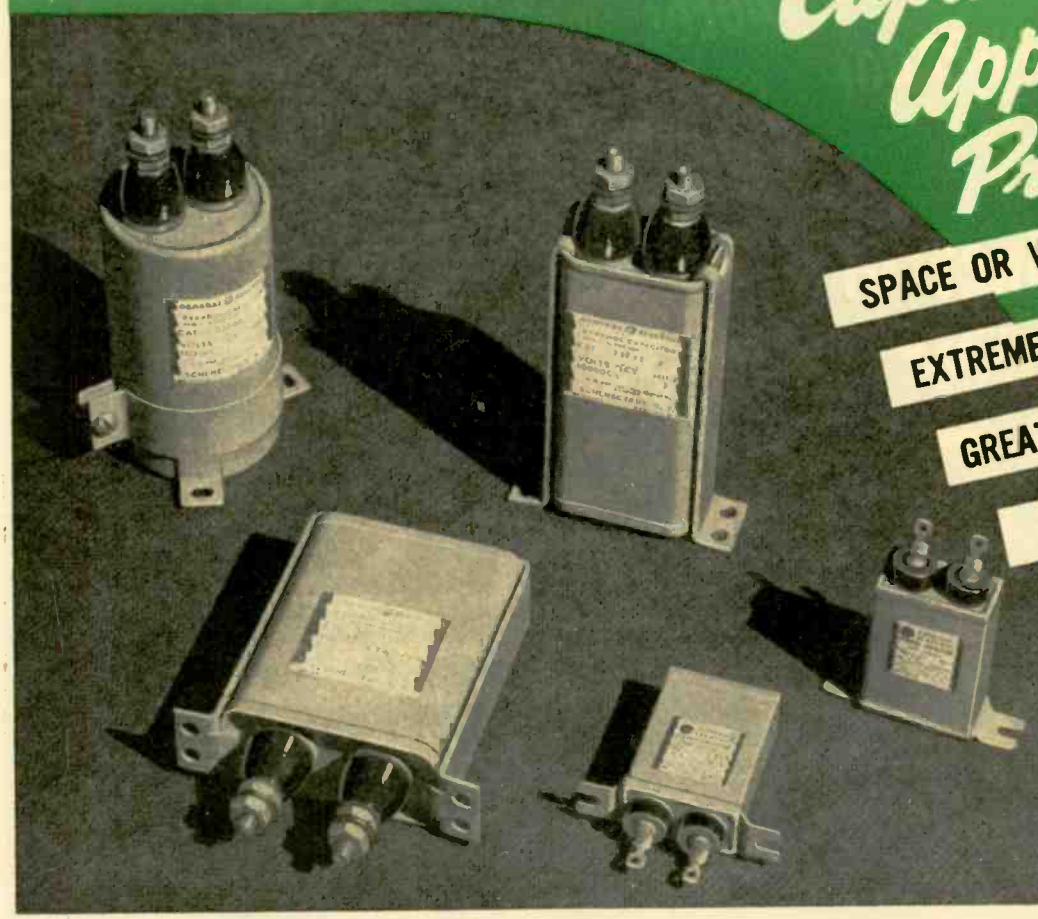
LORD MANUFACTURING COMPANY

ERIE, PENNSYLVANIA

SALES REPRESENTATIVES
NEW YORK - - 280 MADISON AVE.
CHICAGO - 520 N. MICHIGAN AVE.
DETROIT - - 7310 WOODWARD AVE.
BURBANK, CAL. - 245 E. OLIVE AVE.

Originators of Shear Type Bonded Rubber Mountings

HAVE YOU ANY OF THESE *Capacitor Application Problems?*



- SPACE OR WEIGHT LIMITATIONS
- EXTREMES OF TEMPERATURE
- GREAT STRESS OR SHOCK
- SEVERE VIBRATION
- HIGH ALTITUDE
- HUMIDITY

Whatever your specifications, we're likely to have the answer

WE are in an excellent position to provide you with hermetically-sealed capacitors for wartime applications. Our extensive engineering, research, and manufacturing facilities are at your service.

In some cases there will be no need to look further than our standard line of Pyranol* capacitors for built-in applications.

The line includes more than 350 ratings in space-saving shapes and sizes. Many of the ratings are available in three shapes—oval, cylindrical, rectangular—to make your design problems easier. And they can be mounted in any position.

BE SURE TO GET your copies of our time-saving catalogs on d-c (GEA-2621A) and a-c (GEA-2027B) types. Ask your G-E representative for them by number, or write to General Electric, Schenectady, New York.

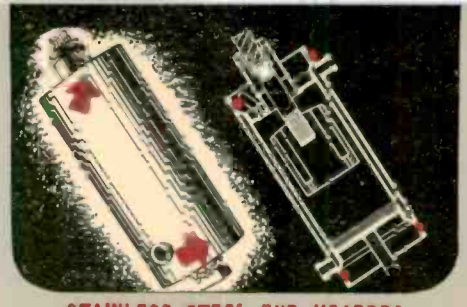
**Pyranol is the G-E trade mark for capacitors and for askarel, the synthetic, noninflammable liquid used in treating G-E capacitors.*

PYRANOL CAPACITORS

BUY WAR BONDS

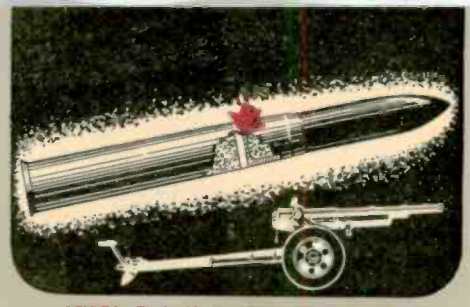
GENERAL ELECTRIC

407-80-8700



STAINLESS STEEL END HEADERS OF IGNITRON ITSELF IS SEAM WELDED VACUUM TIGHT TO WALLS.

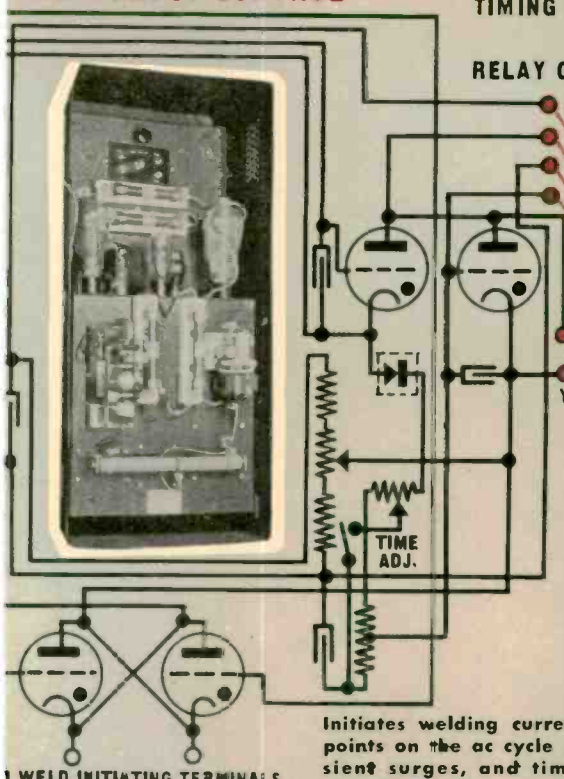
STAINLESS STEEL, ALUMINUM OR STEEL KITCHEN UTENSILS HANDLES PROJECTION WELDED.



STEEL FLASH PLATES ARE SEAM WELDED TO END OF SHELLS.

LAND MINE ASSEMBLIES OF VARIOUS TYPES SEAM WELDED.

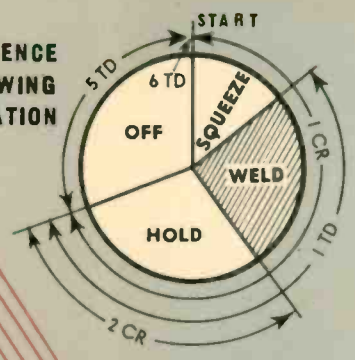
SYNCHRONOUS CONTROL



WELD INITIATING TERMINALS

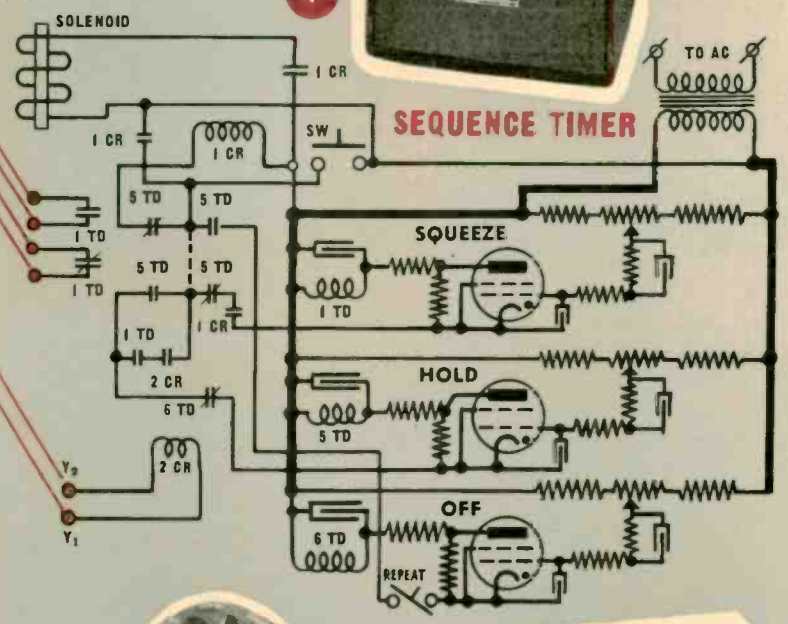
Initiates welding current at selected points on the ac cycle to avoid transient surges, and times the weld-current duration.

TIMING SEQUENCE SHOWING RELAY OPERATION

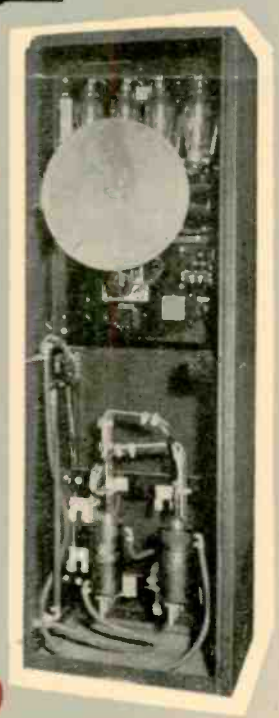


Provides fully automatic welder control when used with the synchronous timer at left ❸ for "sync." firing.

4



TIMING DISC with steel pins for timing of current, generates pulses of voltage on grid of control thyratrons by passing through permanent magnet field.

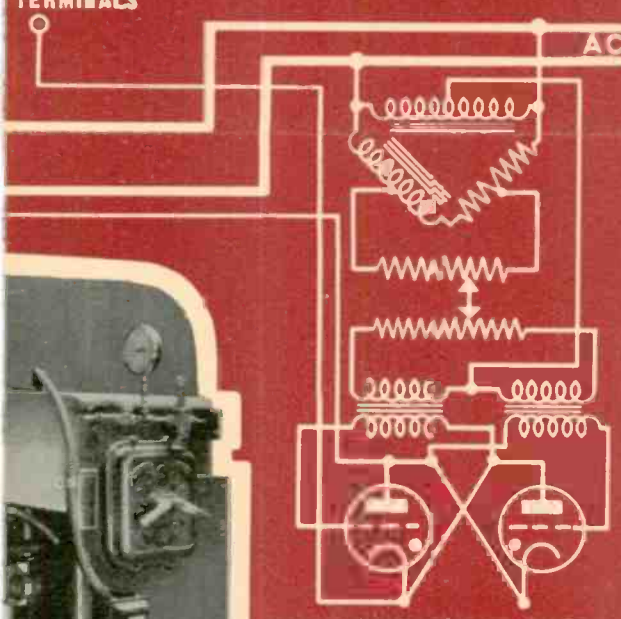


5

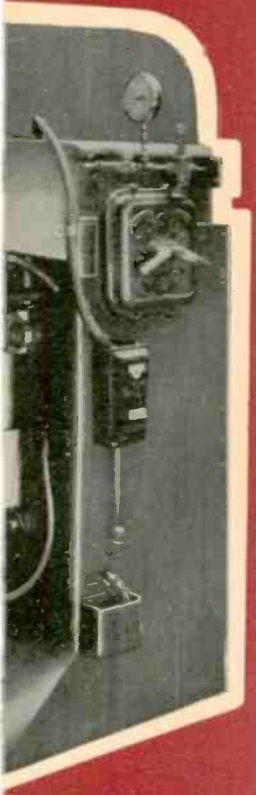
SEAM WELD TIMER

with roller electrodes uses synchronously driven disc. Provides "On" and "Off" intervals.

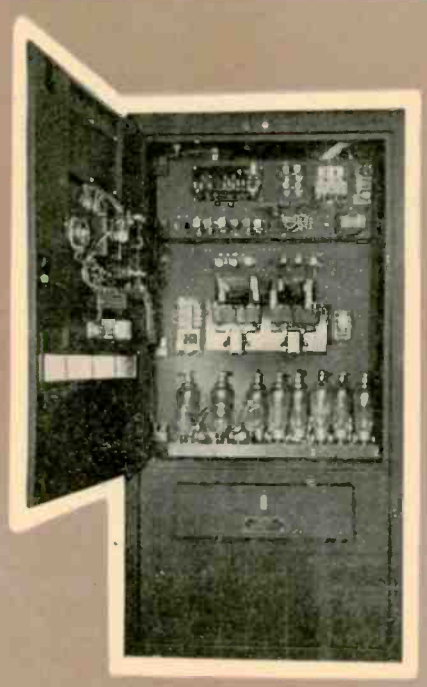
TERMINALS



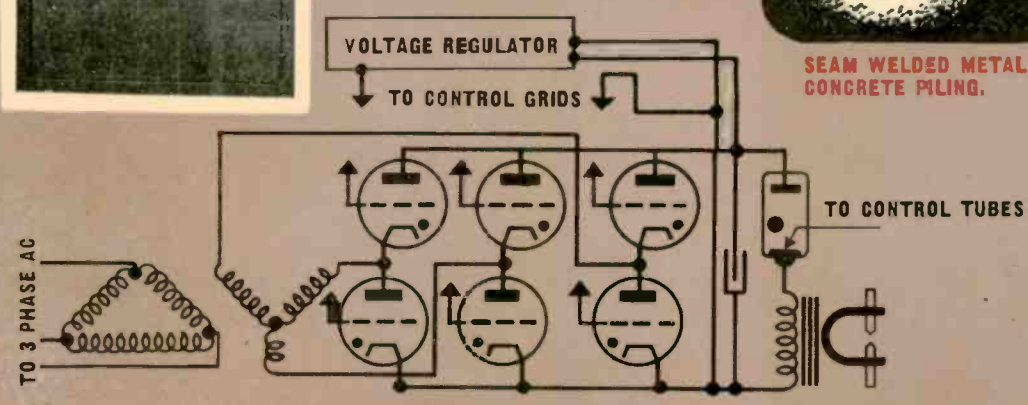
HEAT CONTROL BY PHASE SHIFT

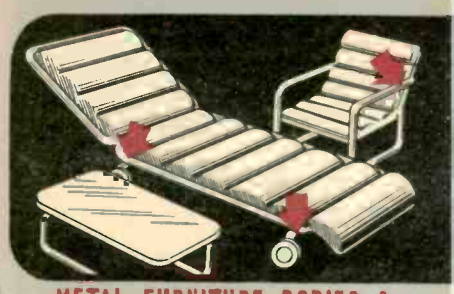


NCE WELDER



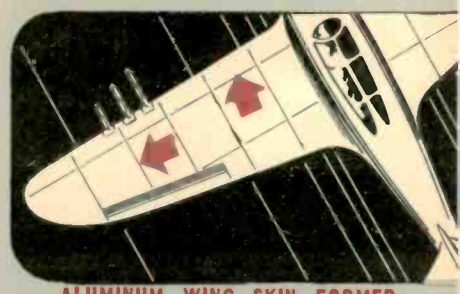
CAPACITOR TYPE STORED ENERGY WELDER



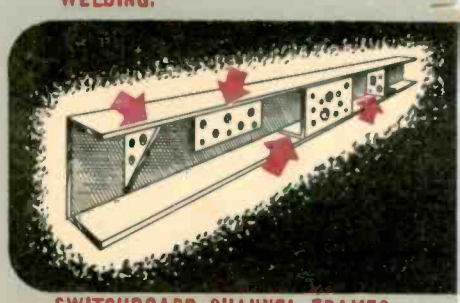


METAL FURNITURE BODIES & BRACES OF WELDED STEEL TUBING.

STEEL CONTAINERS FOR OIL AND GASOLINE ARE SEAM WELDED.

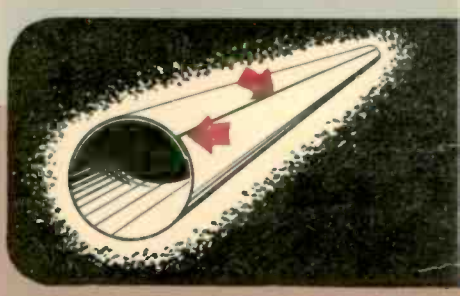


ALUMINUM WING SKIN FORMED FROM NARROW STRIP BY SPOT WELDING.



SWITCHBOARD CHANNEL FRAMES HAVE BRACKETS ATTACHED BY WELDING.

STEEL DROP TANKS FOR AIRCRAFT SEAM WELDED TO BE LIQUID TIGHT.



SEAM WELDED METAL FORM FOR CONCRETE PILING.

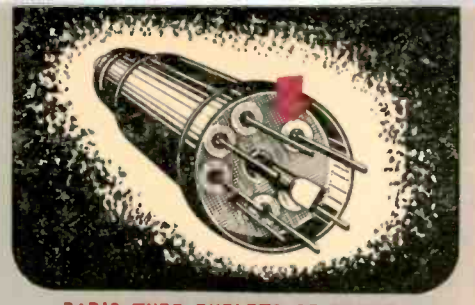
TH ELECTRONIC CONTROL

djustment • High-Operating Speeds
ss Rejections • Greater Output
LABORATION WITH WESTINGHOUSE ENGINEERS

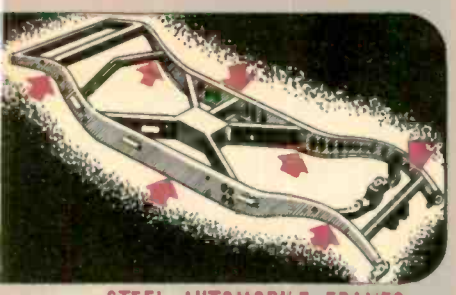
STEEL BOMB FIN ASSEMBLY GIVES ACCURACY, BALANCE, STRENGTH.

STEEL BRAKE COUPLING. TWO PRESSED PARTS WELDED TOGETHER REPLACES FORGING

TRAINS, TRUCKS & BUSES. FRAMES & SIDE PANELS SPOT & SEAM WELDED.

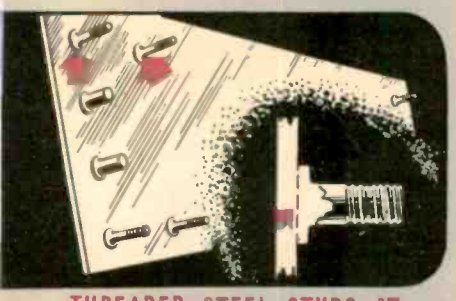


RADIO TUBE EYELETS OF KOVAR WELDED TO STEEL BASE TO BE VACUUM TIGHT.

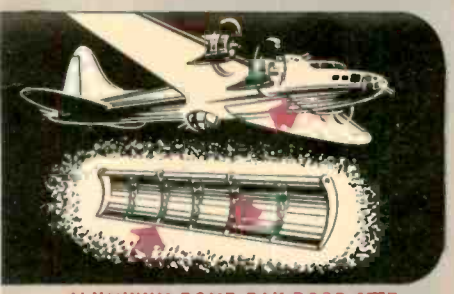


STEEL AUTOMOBILE FRAMES. WELDING REDUCES RIVETING.

STEEL TUBING BICYCLE FRAMES BUTT WELDED.

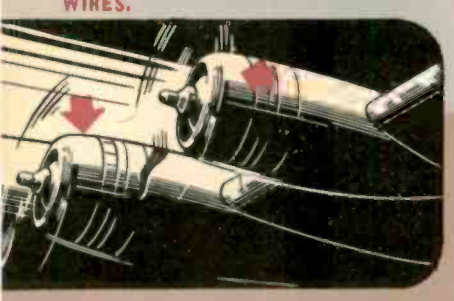


THREADED STEEL STUDS ATTACHED TO PLATES BY WELDING.

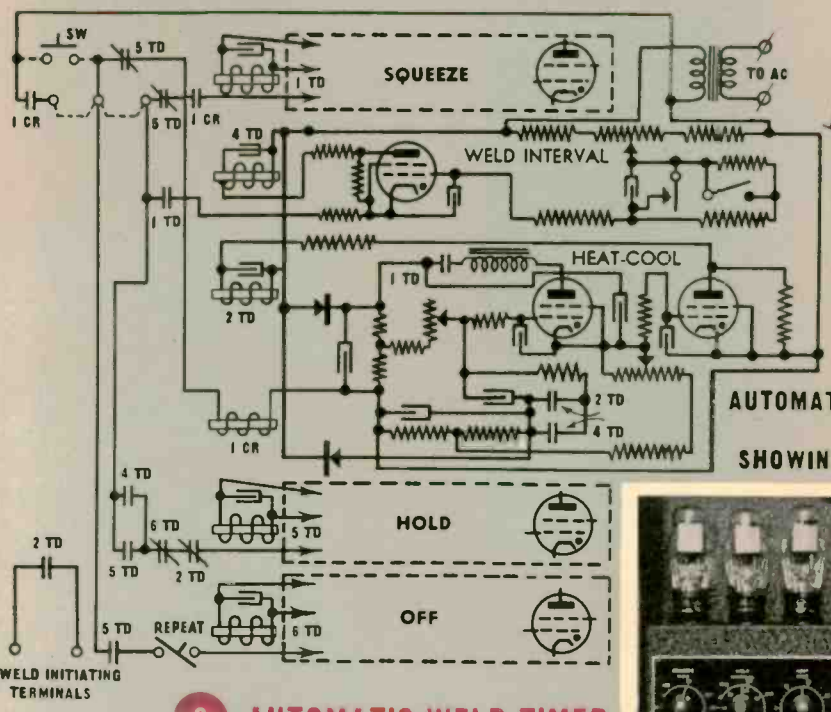


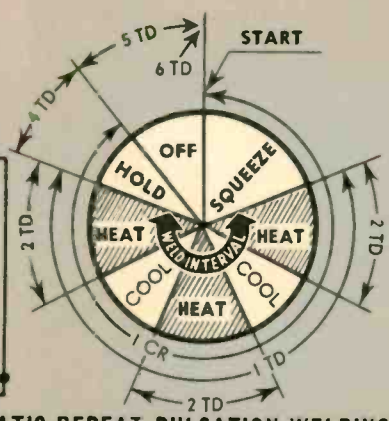
ALUMINUM BOMB BAY DOOR STIFFENING RIBS ARE SPOT WELDED.

THERMOCOUPLE JUNCTIONS REQUIRE WELDING DISSIMILAR WIRES.

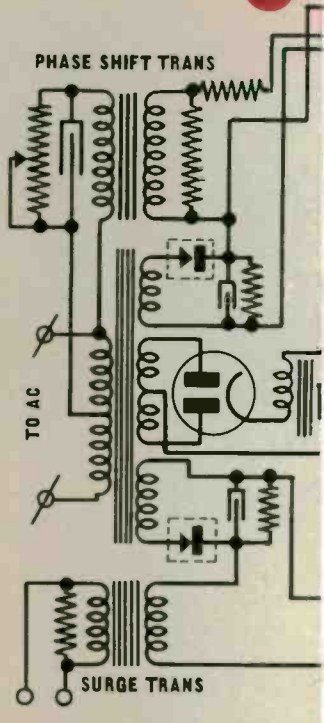


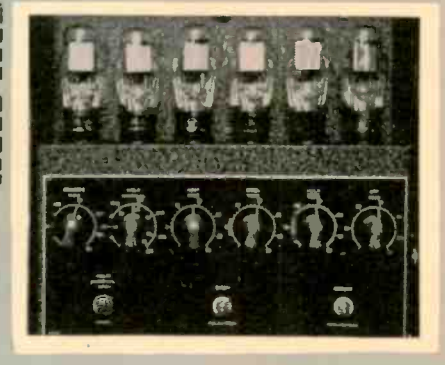
ALUMINUM COWL ASSEMBLY STIFFENERS AND MOUNTINGS ARE SPOT WELDED.





AUTOMATIC REPEAT PULSATION WELDING (NON-SYNCHRONOUS) SHOWING RELAY OPERATION SEQUENCE

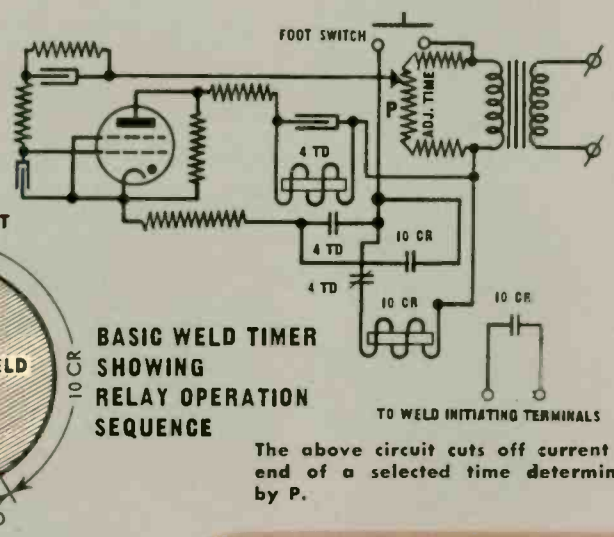


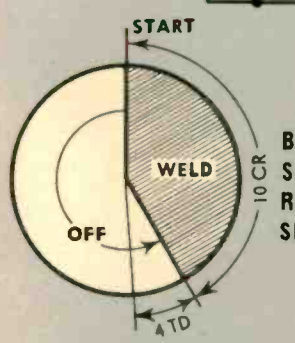


2 AUTOMATIC WELD TIMER

Six tubes control welding electrode operations and time current in single or multiple pulses.

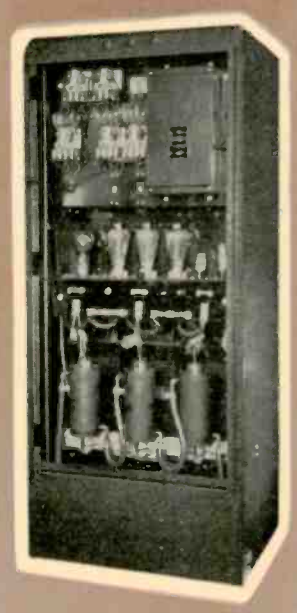
1 WELD TIMER



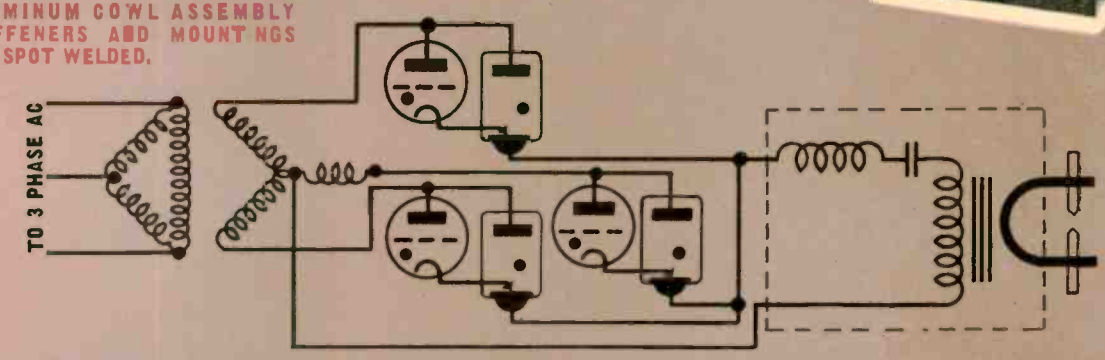


BASIC WELD TIMER SHOWING RELAY OPERATION SEQUENCE

The above circuit cuts off current at end of a selected time determined by P.

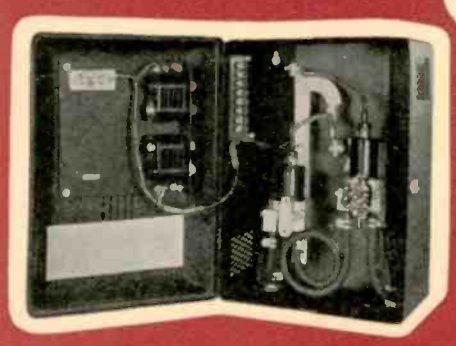


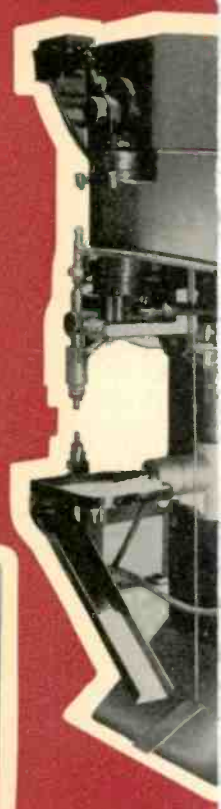
MAGNETIC TYPE STORED ENERGY WELDER



ELECTRONIC CONTACTOR

WELD INITIATING





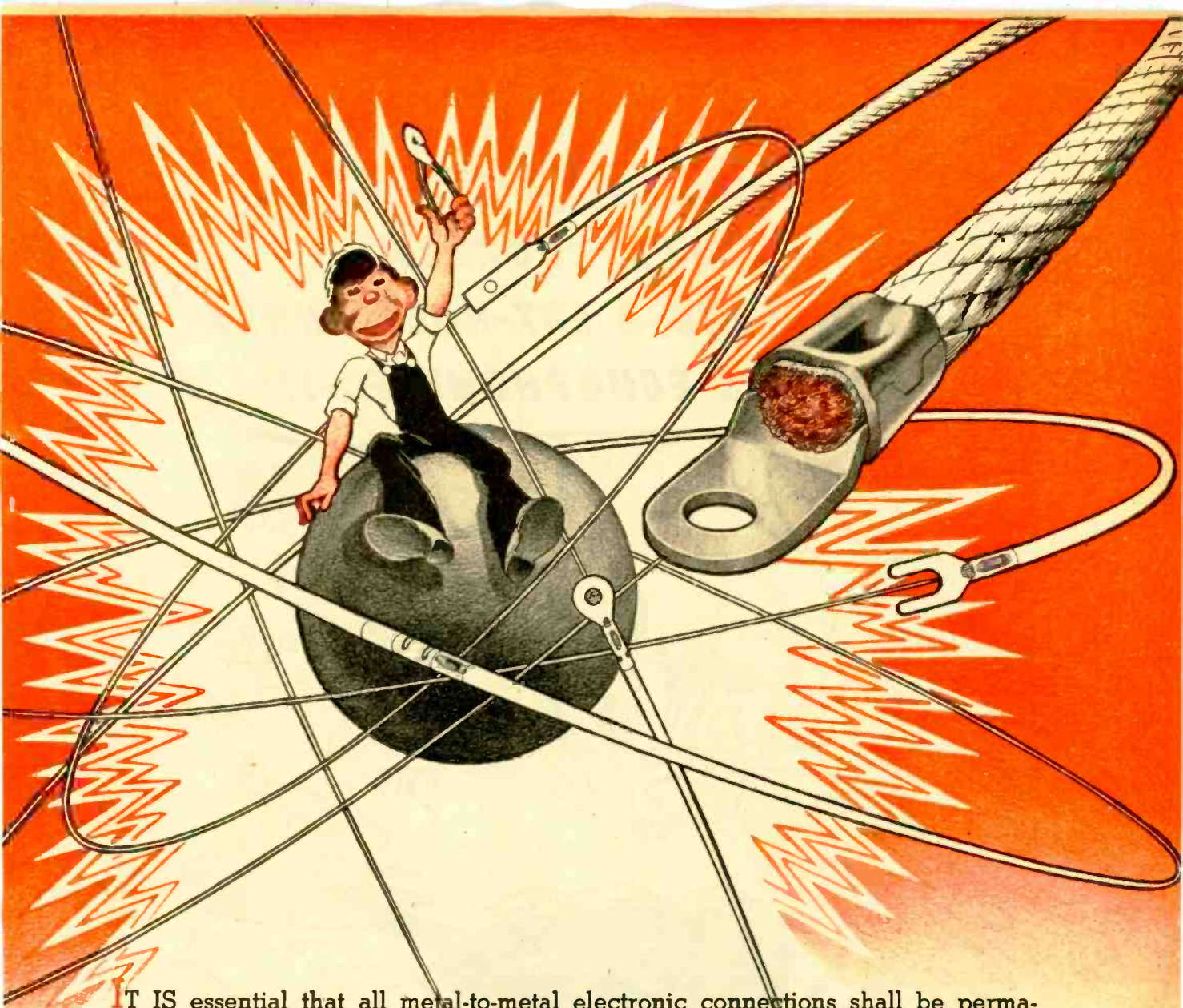
RESISTA

RESISTANCE WELDING WI

Precision Timing • Stepless Current A

Result in Less Outage Time • Le

COMPILED BY "ELECTRONIC INDUSTRIES" IN CO



IT IS essential that all metal-to-metal electronic connections shall be permanent, and resist vibration and corrosion. • T&B Pressure (Solderless) STA-KON* Wire Terminals are meeting the exacting requirements of well-known manufacturers of electronic equipment. • They are made in a wide variety of wire capacities, in scores of designs, with and without insulation grip. • Approved. • Patented. • STA-KONS* of all sizes are quickly, permanently and easily installed, even by green hands, with correctly engineered T&B Pressure Tools. • These tools are designed to operate manually or with whatever type of power you prefer—air, hydraulic, electric. • Under the T&B Plan, STA-KONS*, like all other T&B Products, 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.

WRITE US FOR FULLY ILLUSTRATED STA-KON* BULLETIN 500

*STA-KON Registered U. S. Pat. Office.

T&B

THE THOMAS & BETTS CO.

INCORPORATED

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

ELIZABETH 1, NEW JERSEY

In Canada: Thomas & Betts Ltd. Montreal

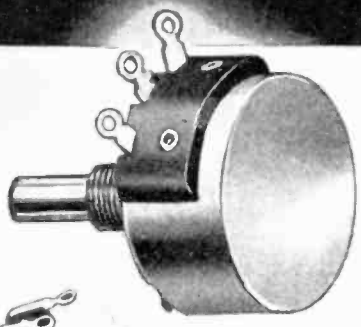
Echophone Model EC-1

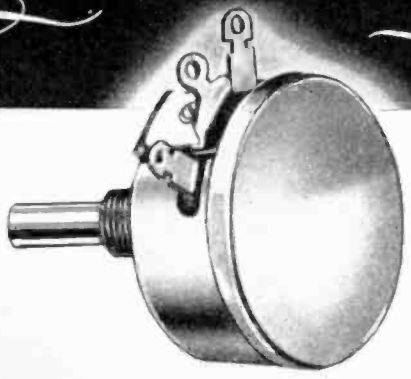
(Illustrated) a compact communications receiver with every necessary feature for good reception. Covers from 550 kc. to 30 mc. on three bands. Electrical bandspread on all bands. Six tubes. Self-contained speaker. Operates on 115-125 volts AC or DC

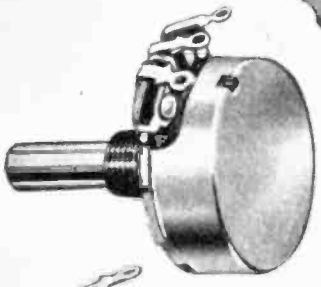
ECHOPHONE RADIO CO., 201 EAST 26th ST., CHICAGO, ILLINOIS

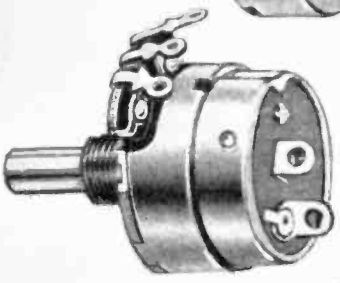
a Message to :

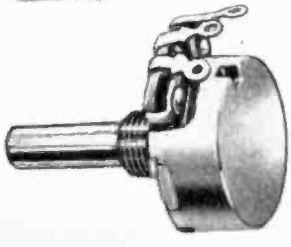
MANUFACTURERS OF ELECTRONIC EQUIPMENT











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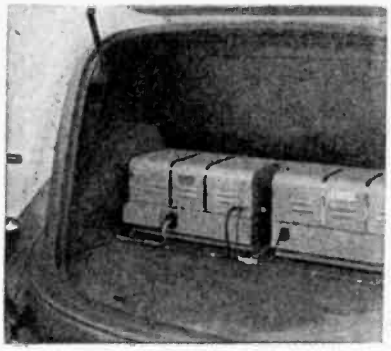

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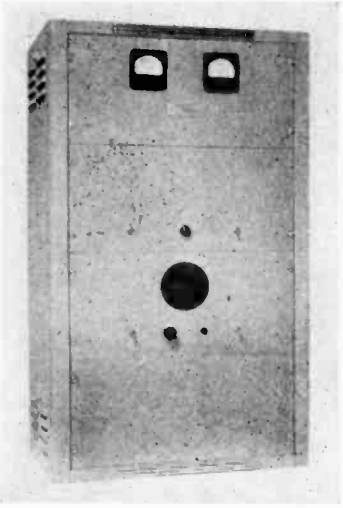

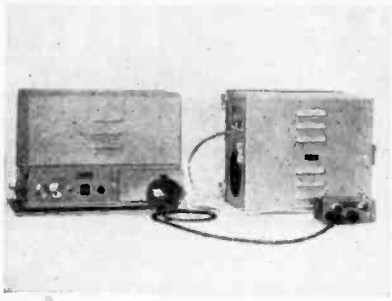

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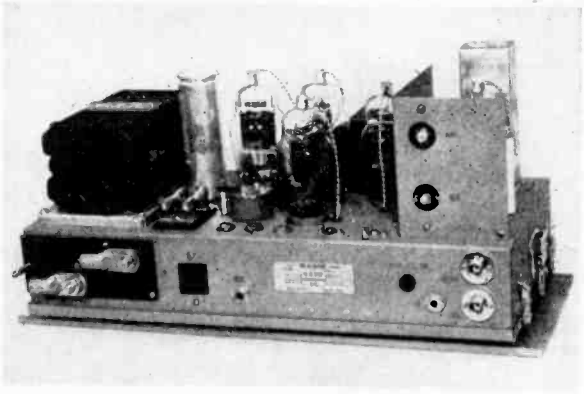

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TYPE PTL-10X	Instant Heating 10 Watt Mobile Transmitter, for frequency ranges up to 8,000 KC.
TYPE PTL-22X	Instant Heating 22 Watt Mobile Transmitter for frequency ranges up to 8,000 KC.
TYPE PTS-22X	Instant Heating 22 Watt Mobile Transmitter, range 30-40 MC.
TYPE PR-9X	Crystal Controlled Mobile Receiver, range 30-40 MC.
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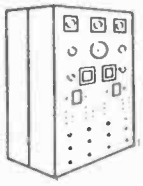

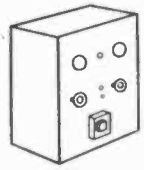

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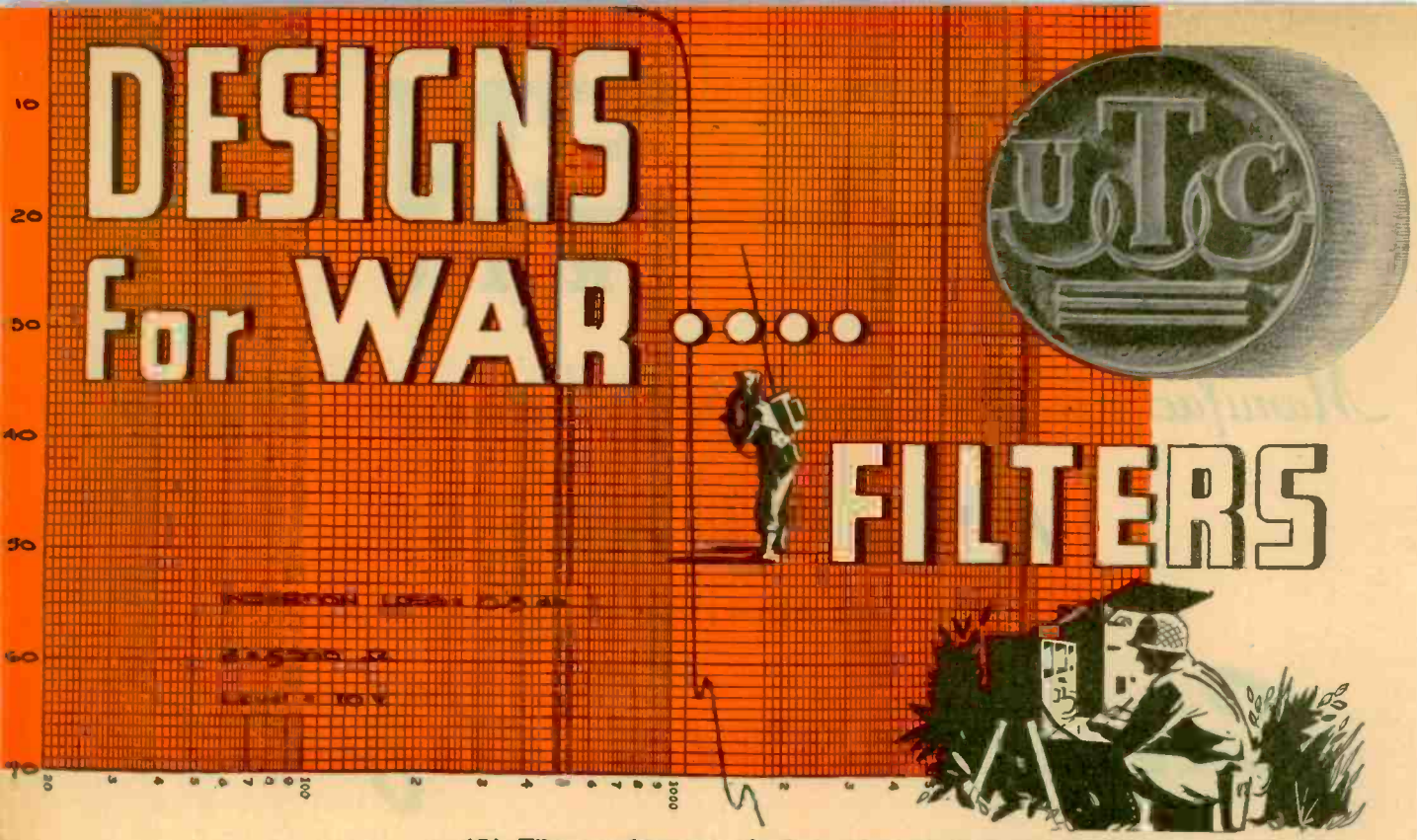
RECTIFIER ENGINEERS

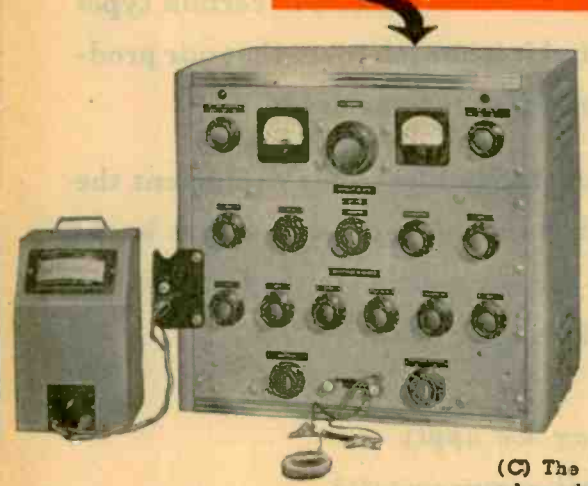
EST. 1892

DESIGNS For WAR .... FILTERS



(A) Filter performance is dependent upon three major factors, basic design... Q of coil and capacitor elements... and precision of adjustment. The superiority of UTC products in this field has been effected through many years of research and development on core materials and measuring apparatus. We illustrate below a typical filter formula and some of the UTC apparatus used to determine quantitative and qualitative values:

$$\left(\pi C f_\infty - \frac{1}{\pi L f_\infty}\right)\left(\frac{1}{Q^2} + 1 - \left(\frac{f_\infty}{f}\right)^2\right) = \text{Im (ATTENUATION CONSTANT)}$$



(B) The UTC inductance bridge is capable of four digit accuracy and covers a range from extremely low values to over 100 Hys. The effective resistance and inductance values are direct reading, eliminating the possibility of error in conversion.

(C) The UTC oscillator is direct reading, where the frequency desired is set as in a four digit decade box, and is accurate within 1 cycle at 1,000 cycles. The range is 10 cycles to 100 kc. Accuracy of this type is essential with filters having sharp attenuation characteristics. This instrument is augmented by a UTC harmonic analyzer for the output measuring device.

(D) The UTC Q meter is a unique device which has helped considerably in the development of the special core materials used in our filters. It is also of importance in maintaining uniform quality in our production coils. The Q is read directly and covers the entire range of possible Q factors over the entire audio frequency band.

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ELECTRONIC INDUSTRIES

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

Reason vs. Excuse

More than one engineer allied with an industry quite remote from this one has cast a wishful eye on the great field of electronic development and wondered whether his vision may not have been too closely focused on his own immediate problems. The wish to use an electronic application may easily be an excuse for doing so rather than a sound reason. The test is, of course, whether the job to be done can be better done electronically than it can any other way, whether it will save time, money or man power. Quite often it will, when intelligently applied.

"Factor of Ignorance"

The factor of safety in design of current military communication equipment differs essentially from that formerly used in commercial designs, where obsolescence was considered and the hazards of transportation and use were not. An item of equipment can operate only as long as each component remains operative.

However, it is just as important in these days of material scarcity, not to over-design some of the parts as it is to provide adequate safety. In either case, a lesser amount of usable equipment is produced from a certain amount of materials. To keep on the middle road requires continuous measurement and control of processes. Four groups are charged with the responsibility for the most effective utilization of material: (1) the design engineer, who sees to the job of providing strength where it is needed and not elsewhere; (2) the metallurgist or chemist who determines the type of material best suited for the job; (3) the parts inspector, who prevents defective parts from getting into assembly; and (4) the final inspector of the procurement organization, who in most cases has been given far too little latitude in the determination of what is acceptable.

In this age when everything can be measured for reliability it must be kept in mind that a large "factor of safety" which the designer employed to make up for those effects and conditions that he could not measure accurately or subsequently test, now is in reality nothing but a "factor of ignorance." Consistent use of modern testing procedure results in a marked reduction in the weight of many parts.

Current Confusion

Students of radio and electronic theory are still struggling with the old question of the direction of current flow. Is it + to —, or — to + ?

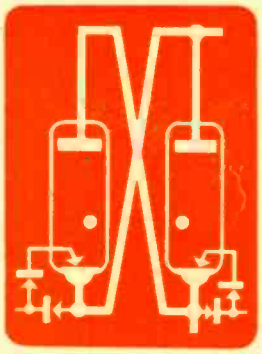
Most of the school texts, including the newest ones, define current in terms of a flow of electrons, only to state that current is assumed to flow from + to — "by convention." When the authors get to electron tubes, they introduce the amazing paradox of electron current flow out of the plate of the tube, and "conventional current flow" into the plate—and usually attempt to maintain this illusion throughout the section on vacuum tubes. Many universities foster this confusion with the apology that "the books are all written that way."

With thousands of new radio and electronic men entering the field, this is the psychological time to drop the outmoded concept of "conventional current flow."

Supplement to this Issue — Large Chart in Colors

RESISTANCE WELDING WITH ELECTRONIC CONTROL

presenting a resume of the advances in welding processes made possible by the application of the precise control of electronic devices. This chart further illustrates the important article on electronic welding methods on page 105.



Flip-Flop

by S. E. M. SUSSKIND
Engineer, Radio Television Institute

Square wave generators

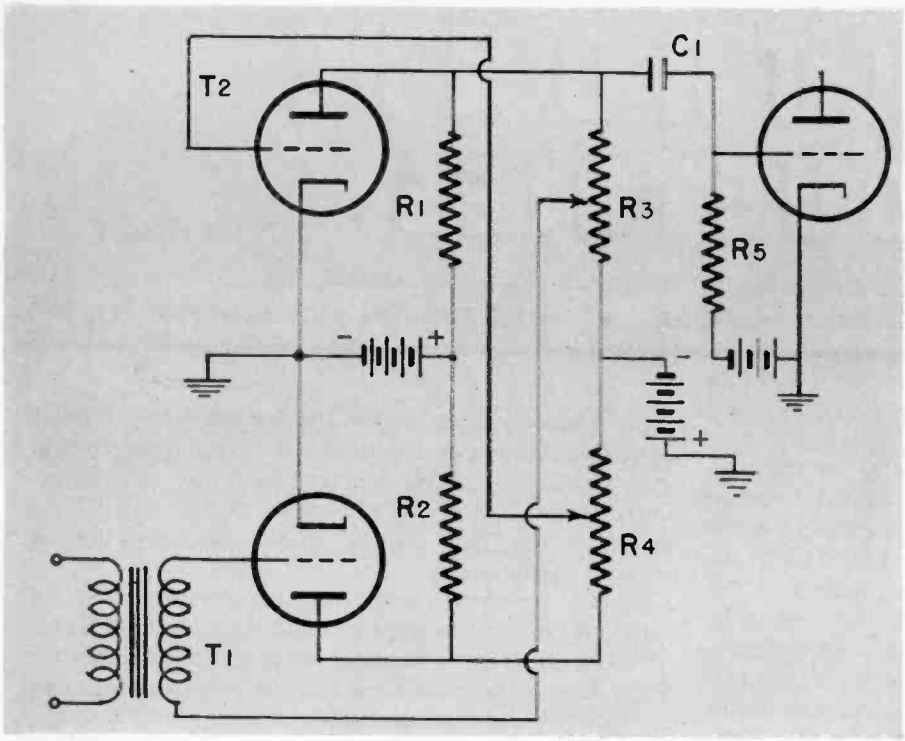


Fig. 1—Sine wave input to T_1 unbalances resistance bridge and produces square-wave output voltage of same frequency

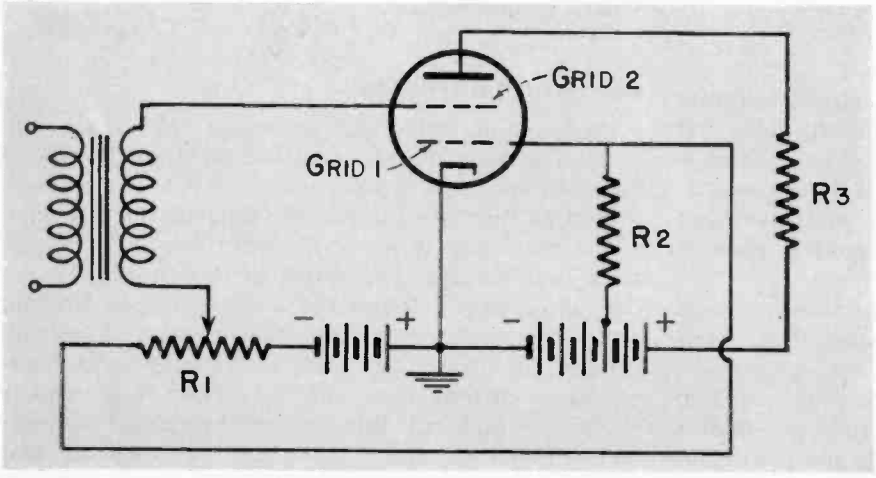
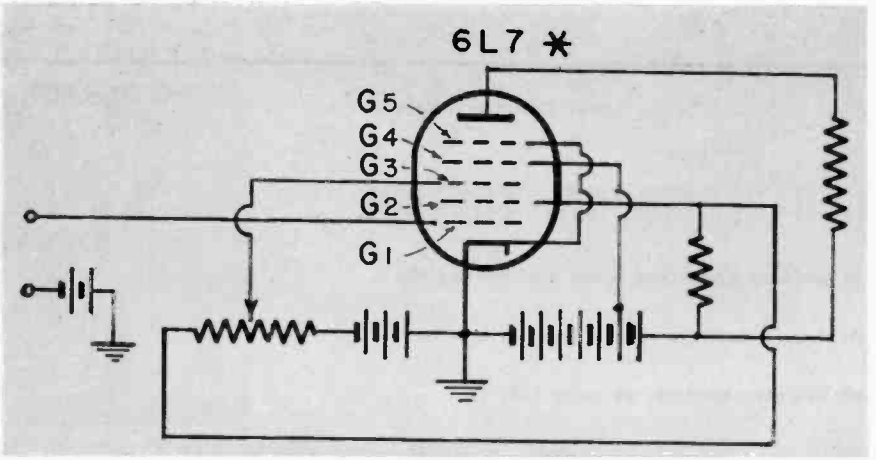


Fig. 2—Single tube version of the flip-flop circuit shown in Fig. 1

Fig. 3—A special 6L7 with two leads brought out from screen grids permits flip-flop action with isolation of input and output circuits. (Editor's note: A standard 7A8 may prove useful in place of special 6L7.)



• Most impulse generators used in television and allied work are relaxation oscillators of suitable wave shape for use in cathode ray deflection circuits, blank-out and synchronizing impulse generators, and similar applications. Relaxation oscillators will normally oscillate at a frequency determined only by the circuit constants. However this free frequency can be changed to coincide with a harmonic or the fundamental frequency of synchronizing impulses injected into the circuit. The disadvantage of such an arrangement is the fact that too little synchronizing voltage may cause the relaxation oscillator to resume its free frequency and thereby fall out of step with the control voltage whereas on the other hand too much synchronizing voltage may seriously affect the output wave shape.

In the following, so-called flip-flop impulse generators will be described which operate on a discontinuity principle in which the whole circuit remains electrically inoperative between initiating impulses. Since these circuits do not oscillate, they obviously have no free frequency and therefore can not fall out of synchronism with the control voltage. Also reasonable changes in the amplitude of the control voltage do not appreciably affect the output wave shape of the impulse generator. These inherent advantages of the flip-flop circuits* should make them preferable to relaxation oscillators in certain applications.

Fig. 1 shows a fundamental two tube flip-flop circuit. In order to understand the operation of this circuit let us assume that there is no signal voltage on the grid of tube 1. In this case the grids of both tube 1 and tube 2 will be at cathode potential. This is accomplished by the bridge circuit formed by the resistors R1, R2, R3 and R4 and the two batteries. By proper choice of the components a point can be found on both resistors R3 and R4, which is at cathode potential. If now a negative potential is applied on the control grid of tube 1 the plate current of this tube will decrease, which in turn decreases the voltage drop across R2 and thereby raises the plate voltage of tube 1.

*U. S. Patents No. 2,266,668 and No. 2,231,971. Natl. Television & Mfg. Corp.

Circuits

for test and sweep work

Since the control grid of tube 2 is connected to the plate of tube 1 over the resistor R4 the increase in plate voltage of tube 1 will cause the grid of tube 2 to become more positive. This increases the plate current of tube 2, thereby increasing the voltage drop across R1, causing the plate voltage of tube 2 to decrease. However, since the grid of tube 1 is connected to the plate of tube 2 through the resistor R3, the decrease in plate voltage of tube 2 causes the grid of tube 1 to become more negative which again reduces the plate current of that tube so that the whole action described repeats itself.

Square-wave output

Thus it will be seen that there is a cumulative effect which causes the grid of tube 1 to become so negative that the current through this tube becomes a minimum. The grid of tube 2 on the other hand becomes very positive, so that the current through this tube is at a maximum. Analyzing this circuit with the assumption that a positive initiating voltage is applied on the grid of tube 1 it can be easily seen that in this case, the cumulative action will work in the opposite direction, i. e., the plate current of tube 1 becomes maximum and that of tube 2 minimum.

Although the action of this circuit is of necessity rather lengthy in its description, its actual operation is almost instantaneous. A predetermined negative potential on the control grid of tube 1 will immediately cause the lowest possible potential to appear on its plate and hignest possible potential on the plate of tube 2. On the other hand a predetermined positive grid potential will cause the highest possible potential on the plate of tube 1 and lowest on the plate of tube 2. Therefore by impressing an alternating voltage on grid of tube 1 the wave shape of the output voltage will be a square wave. There are many uses for square waves. For example by passing this square wave voltage through a differentiating circuit such as indicated in Fig. 1 by the condenser C1 and the resistor R6, sharp impulses may be obtained.

The flip-flop action just described can be obtained by using a single tube circuit such as that of Fig. 2. The tube in this case is a tetrode with the control and screen grids connected as shown. Grid 2 is normally connected to a point at ground potential on the resistor R1. Assuming a negative initiating voltage impressed on grid 2 from the transformer, electrons flowing toward the plate will be repelled toward grid 1 which is at a positive potential. This will therefore cause the plate current to decrease and the current of grid 1 to increase.

An increase of the current of grid 1 means less voltage on it due to the potential drop across the resistor R2. Since grid 2 is directly connected to grid 1 through part of the resistor R1, the drop in the voltage of grid 1 will cause grid 2 to become more negative. Again there is a cumulative effect which will cause the plate current of the tube to lock at a minimum almost instantaneously. An initial positive voltage on grid 2 would have caused an almost instantaneous maximum plate current.

(*Continued on page 236*)

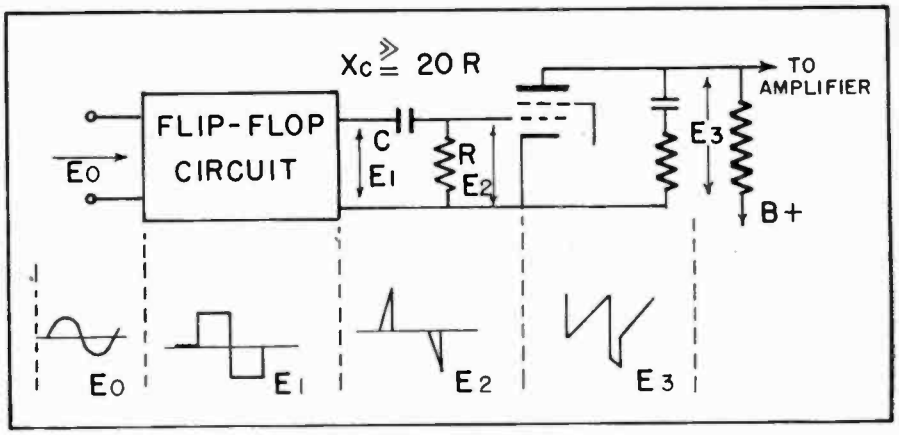
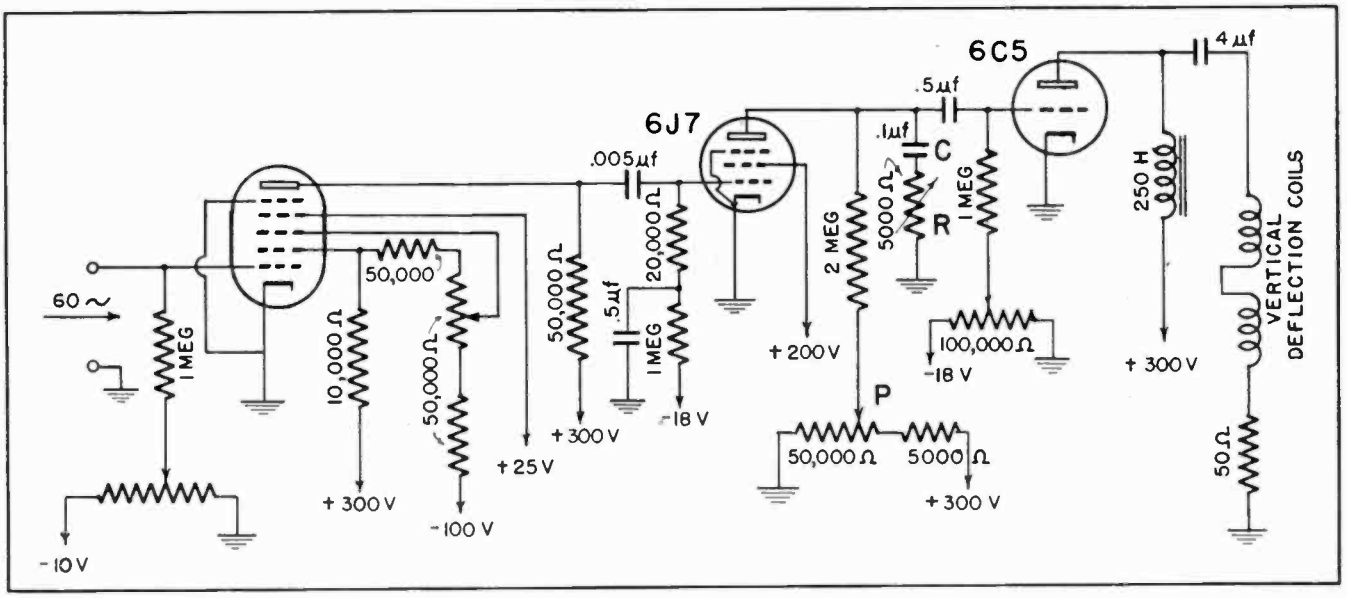
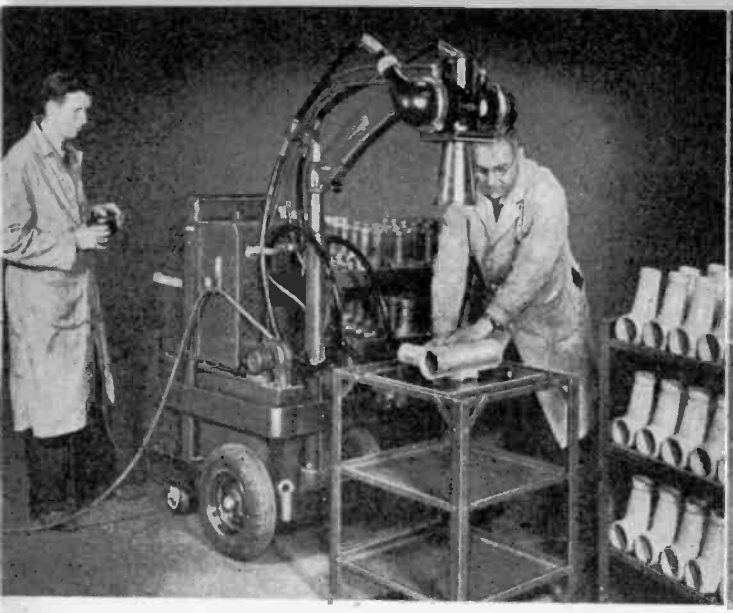


Fig. 5—Diagram to show basic actions obtained with circuit shown in detail in Fig. 4 below

Fig. 4—Flip-flop and wave shaping amplifiers for magnetic deflection of cathode ray tube





Mobile 150 kv industrial X-ray unit manufactured by Picker X-ray Corp., Cleveland

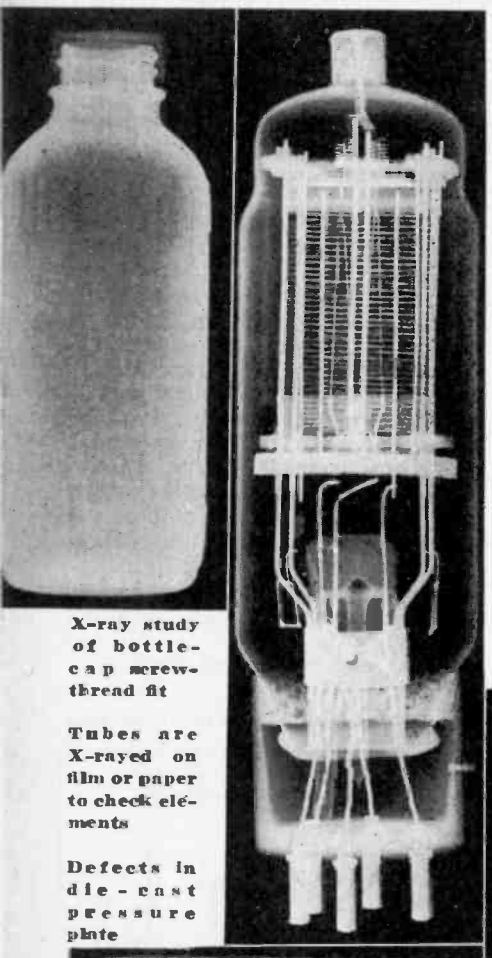
Typical fluoroscope set-up on conveyor belt. Operator rejects defective parts or goods by convenient levers

X-RAY Tubes in

Detection of invisible flaws saves time, money, and lives

● It has been said that the X-ray tube was a by-product of the study of cathode ray effects. Electrons emitted from a hot cathode or filament are accelerated to high velocities by a positively charged anode and produce X-radiation upon striking the anode. The wavelength of the radiation ranges roughly from 1100 to 0.004 Angstrom units, and is a function both of the material of the anode and of the velocity of the impinging electrons.

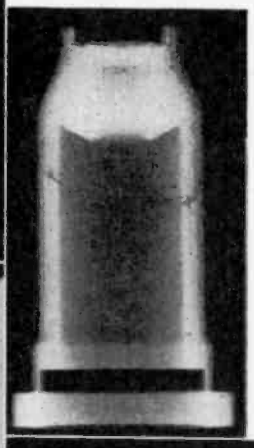
Discovered by Wilhelm Konrad Roentgen in 1895, X-rays early found widespread application in medical and surgical fields. Application of the several forms of X-radiation and technics to industrial problems is a comparatively recent development.



X-ray study of bottle-cap screw-thread fit

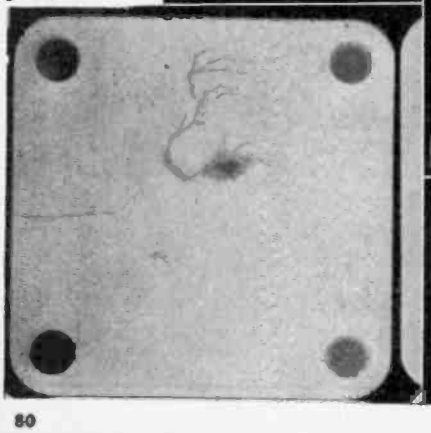
Tubes are X-rayed on film or paper to check elements

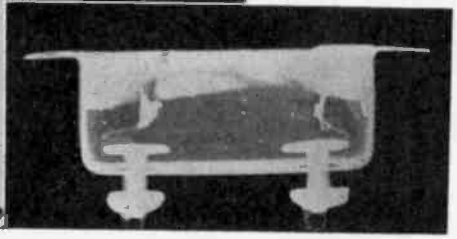
Defects in die-cast pressure plate



High voltage pressure-molded insulator rejected for defect which might carbonize in service

By-pass condenser as seen on fluoroscope screen. (X-rays courtesy Philips Metalix Corp., N. Y. C.)





X-ray characteristics

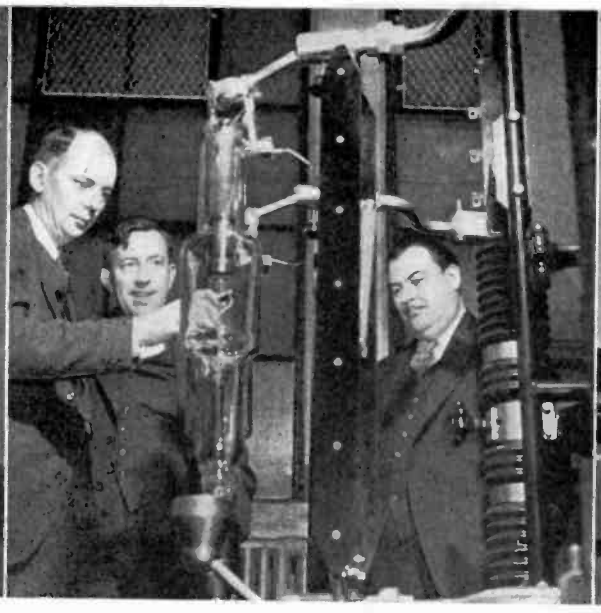
The chief property of X-radiation is its ability to penetrate objects and materials opaque to visible light, and its ability to produce a chemical change on photographic film or to cause visible excitation of a fluorescent screen consisting of finely divided calcium tungstate or other fluorescent material.

Production of a visible shadow-image on the fluoroscope screen is a function of the intensity and wavelength of the X-radiation and of the thickness and density of the material being penetrated. When film is used, the exposure-time element is added.

Hence, shadow pictures of almost any class of object reveal by the lightness or darkness of the image on the screen or developed photographic film, the internal structure of the object.

Industrial X-ray equipment and technic differ in several respects from established medical practice. In general, industrial equipment is not built to be flexible. Single-cabinet X-ray units usually involve a fixed position of the X-ray tube, and the platform or fluorescent screen upon which the objects to be X-rayed are placed. If a screen, it is convenient to view it from the

150 kv North American Philips Co. "Searchray industrial X-ray unit



Millionth-second Westinghouse tube can X-ray in-thick armor plate as projectile tears through

Automatic check on grenade fuses. Phototube behind fluoroscope screen sounds alarm if powder charge is incorrect, in this G-E set-up

Industry

by GILBERT SONBERGH

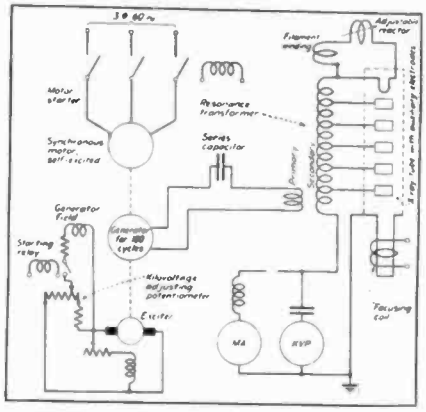
underside by means of a mirror set at an angle. The fixed relationship enables exposure technics to be standardized.

Such industrial X-ray equipment is always provided with suitable shielding against unwanted radiation, which, over a period of time, may be harmful to an operator. In fluoroscopy, the mirror-method of viewing the fluorescent screen is a valuable safety feature. Mobile and portable field X-ray equipment for larger work generally permits adjustment of tube radiation angles, heights, etc., and consequently requires somewhat greater skill in its manipulation. The more or less specialized units working on potentials from one million to ten million volts involve more elaborate installations.

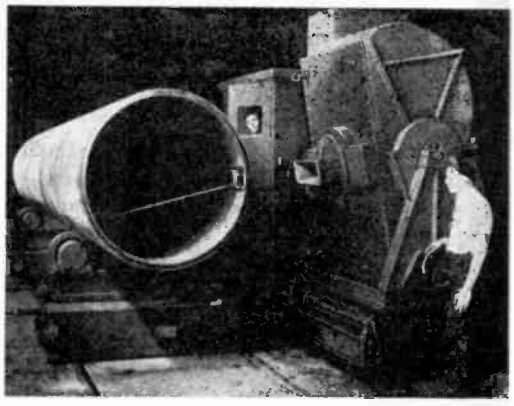
General purpose tubes

Unlike other electron tubes, the X-ray tube, by careful selection of the cathode temperature-anode potential ratio is always operated in the region of plate current saturation. Thus, the adjustment of cathode temperature, by variation of filament voltage or current, controls the quantity of electrons emitted and hence, the quantity of X-radiation produced. Adjustment of anode voltage above the saturation point controls only the velocity of the electron stream and the wavelength of the X-radiation, having little if any effect on the anode current.

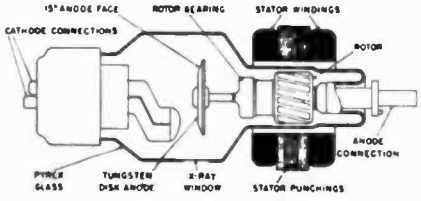
(*Continued on page 230*)



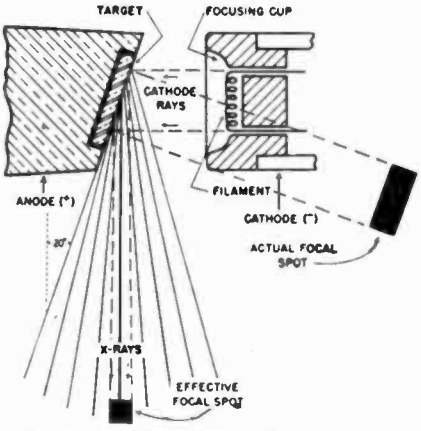
Million volt G-E unit in simplified schematic representation



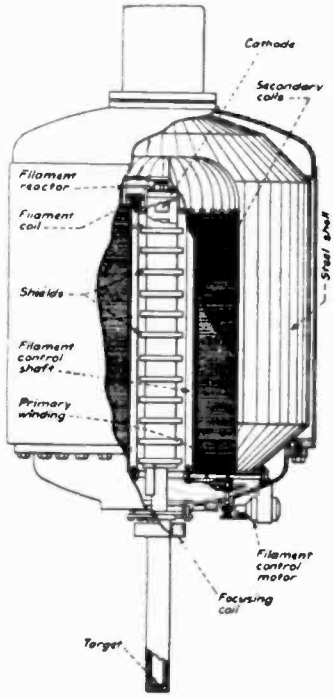
Track-mounted 400 kv Keleket unit with electrically operated adjustments



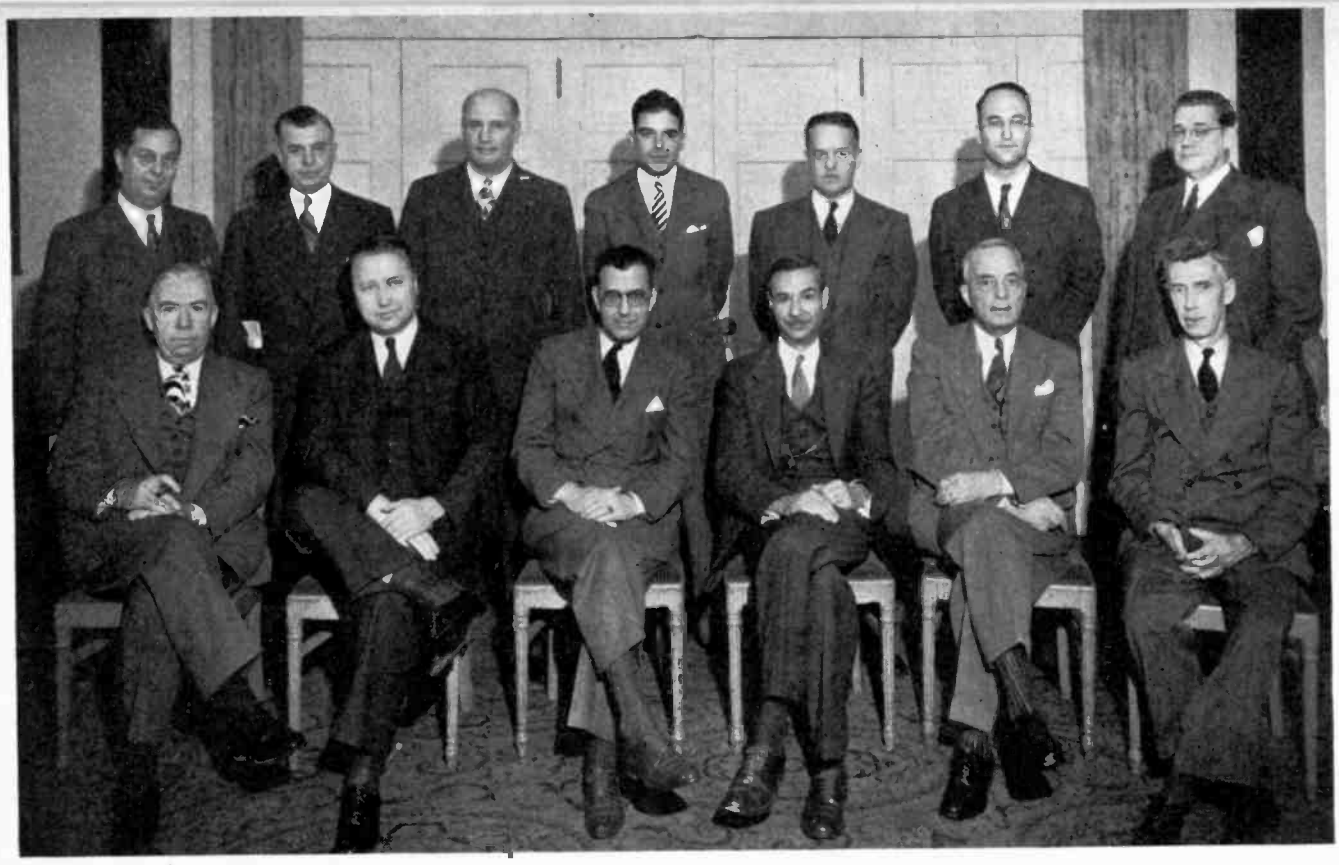
Rotating anode tube manufactured by Westinghouse



Line-focus principle. (From Eastman Kodak Co.)



Tube in "Million Volt" unit is mounted inside high-voltage transformer



Radio Technical Planning Board Members at New York, October 13.

First Row—Paul V. Galvin, president RMA; Howard Frazier, representing NAB; Dr. W. R. G. Baker, chairman RTPB; Haraden Pratt, representing IRE; Bond Geddes, treasurer RTPB; K. B. Warner, representing ARRL. Second Row—E. J. Content, representing FM Broadcasters, Inc.; Fred D. Williams, alternate RMA; A. S. Wells, representing RMA; B. J. Thompson, alternate IRE; H. W. Holt, representing Independent Broadcasters, Inc.; Dr. G. T. Harness, representing AIEE; Frank J. Martin, observer for NEMA.

PLANNING BOARD SET-UP

Dr. Baker, chairman of new RTPB. Procedure and staff outlined. Will study postwar radio problems

● The new Radio Technical Planning Board, sponsored by the Radio Manufacturers Association and the Institute of Radio Engineers, at its first meetings in New York, Sept. 29 and Oct. 13, elected Dr. W. R. G. Baker, vice-president of General Electric Co. in charge of radio and television, as RTPB chairman for a term of one year, and established a new plan of organization and procedure under which the Board will function. This plan was considerably different from the original program of procedure.

Haraden Pratt, vice-president and chief engineer of Mackay Radio, and past-president of IRE, has been mentioned as vice-chairman of RTPB, but no definite appointment was made at the Oct. 13 session. Elected treasurer was Bond Geddes, executive vice-president of RMA, and elected secretary was William B. Cowilich, assistant secretary IRE. Two other RTPB officials to be appointed later, as the work develops, will be a "coordinator" (L. C. F. Horle, nominee) and a "recorder" (Donald G. Fink, nominee).

Board objectives

Objectives of the RTPB will be the formulation of plans for the technical future of the radio industry and radio services, including frequency allocations and systems standardization, in accordance with the public interest and the technical facts, and the advisement of the Government, industry and the public of its recommendations, with such planning restricted to engineering considerations. Haraden Pratt of Mackay Radio headed the IRE Committee which formulated the plan, other members being Prof. H. M. Turner, Yale University; Dr. Alfred N. Goldsmith, consulting engineer, New York; and B. J. Thompson, RCA Laboratories, Princeton, N. J.

The new Radio Technical Planning Board, made up of representatives of principal industry associations, will develop studies, investigations, recommendations and standards, and will call upon technical experts from all branches to assist in its work. The Board will also consider and act upon suggestions or requests for recommendations from branches of the government or other important groups in the radio field, both broadcasting and communications.

Eligible for membership as sponsors of the RTPB are the non-profit technical and trade associations and societies which have an important interest in radio and which indicate willingness to cooperate in achieving the Board's objectives. The Board will be composed of one person or his alternate selected by each sponsor, and each member,

except the RTPB chairman, will have one vote. Sponsors who agree to contribute in the first year of operation $1,000 or more to the RTPB, will be designated "contributing sponsors," from whom an Administrative Committee will be drawn, with the chairman of the RTPB serving as chairman of the Administrative Committee, without vote.

Changes from original set-up

The procedure was vastly different from the original plan. When the RTPB had been originally suggested, the FCC and its chairman, James Lawrence Fly, would have had a "behind-the-scenes" voice in its policies, it was felt. Mr. Fly and the heads of RMA and IRE were to have chosen the RTPB chairman. In addition, the RTPB chairman would have had sole power to designate the members of the Board. Now the procedure is to have the sponsoring organizations name their Board members and the RTPB chairman will not have any plenary power—in fact not having a vote on the Board or on the Administrative Committee.

The Administrative Committee will govern the budget and control all expenditures of the RTPB, and with the advice of the chairman, appoint the vice-chairman, secretary and treasurer, and other personnel to insure proper functioning of the Board.

The Board itself will appoint various Panels, assigning each to a special task, and will receive the findings of each Panel. The chairman of each Panel must be a member of the RTPB, and each sponsor will be given an opportunity to express his views with respect to the report, which after approval may be released by the RTPB.

THE RADIO INDUSTRY IN WARTIME—ITS MAGNITUDE

NOVEMBER 1, 1943 — *Compiled by "Electronic Industries"*

	Total Investment	Annual Gross Revenue	Number of Employes	Annual Payroll
Radio manufacturers (1200)	$350,000,000	$3,500,000,000	350,000	$800,000,000
Radio distributors, dealers, etc.	280,000,000	200,000,000	100,000	150,000,000
Broadcasting stations (947)	90,000,000	215,000,000	*20,000	55,000,000
Commercial communication stations	60,000,000	———	15,000	7,000,000
Listeners' sets (57,000,000)	3,600,000,000	———	———	†320,000,000

**Regular staff—not including part-time employes, artists, etc., who number at least 25,000 more, and earn in talent fees $45,000,000.*
†Annual operating expense for listeners' sets, for tube replacements, electricity, servicing, etc.

Chairmen for some of the Panels have already been nominated. Dr. C. F. Jolliffe, RCA-Victor, has been proposed to head the Panel on Frequency Allocation. Dr. Alfred N. Goldsmith, consulting engineer, has been named as chairman of the Panel on Spectrum Utilization.

Present sponsors of the RTPB, besides the RMA and the IRE, include the American Institute of Electrical Engineers; the American Radio Relay League; FM Broadcasters, Inc.; the International Association of Chiefs of Police; the National Association of Broadcasters; the National Independent Broadcasters; and Aeronautical Radio, Inc. A representative of the National Electrical Manufacturers Assn. attended the Oct. 13 session as an observer, to consider the desirability of joining the group.

The Radio Technical Planning Board may be dissolved on affirmative vote of the Administrative Committee.

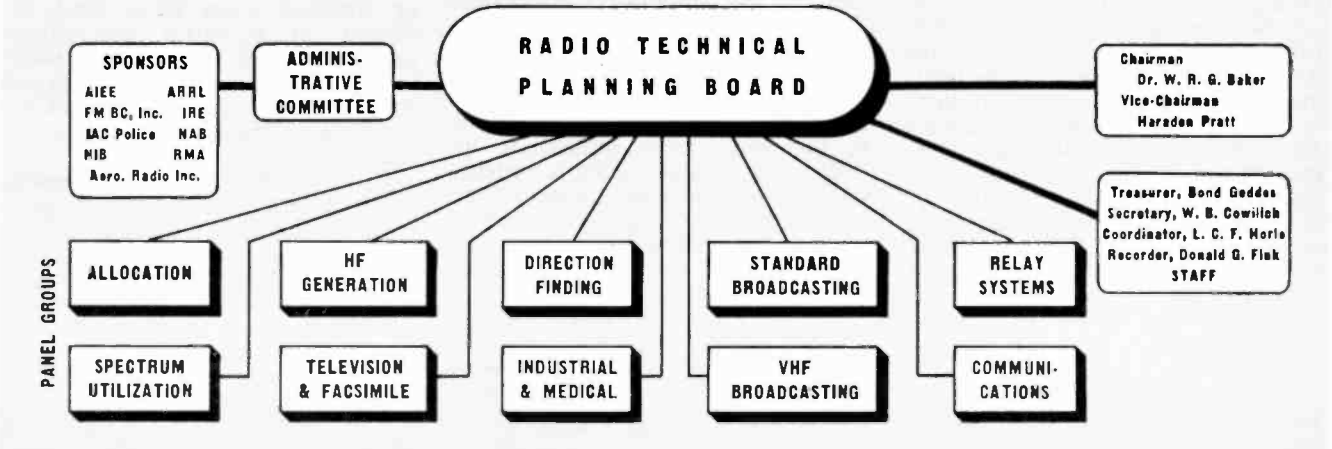
On the general problems facing the Radio Technical Planning Board, a man thoroughly well-informed on the existing and prospective radio situation has these comments to make:

"The most important postwar subject now being discussed in government and industry circles is frequency allocation. We all have a right to be concerned with this problem because all of us know that the present allocation structure lacks the essential elements for carrying on an orderly and efficient peacetime system of domestic and international communications.

"We know, too, that the war has brought out many new developments which must be considered and incorporated in our present-day standards of good engineering practice. We are also conscious of the tremendous expansion which has taken place—and the expansion yet to come for both military and civilian purposes. Coupled with this are problems relating to the so-called by-product devices; for example, electronic heating and diathermy equipment which will

(*Continued on page* 228)

Eventual organization of RTPB, including some appointments not yet completed



Iron Core

by W J POLYDOROFF

Consulting Engineer

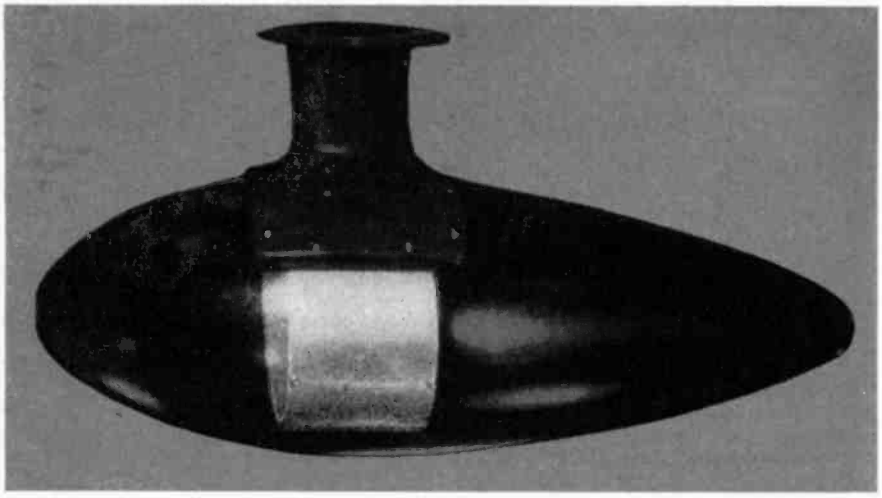


Fig. 1—Relative dimensions of streamlined housing for typical loop antenna as used in modern aircraft design. Housings for iron core loops may be considerably smaller

• Radio direction finders come into a greater prominence with the development of long distance aircraft and extended operations, particularly over long stretches of water. For years it has been known that the longer the wave length is, the more reliable become radio bearings taken by a craft from a fixed shore station. For this reason particularly, commercial aviation has reserved for its use in America a frequency range from 200 to 400 kc at which frequencies bearings can be taken with certainty. It appears that still lower frequencies will provide better aid for navigation purposes.

The frequencies as high as highest broadcast frequencies have been used to take bearings on a conveniently located broadcast station, but at the frequencies higher than one megacycle the bearings cannot be relied upon, especially when ionization of the upper atmosphere causes reflected sky waves which may produce erratic deviations of the bearing. A similar effect has been noted in television technic, causing a distortion of the images and consequently television reception is usually restricted to the optical path. This effect of distortion of the direction of wave front is often called "night effect" or "sky effect" and has been particularly studied in long distance radio navigation. Thus it appears that with the advancement of high frequencies the direction finding of the future will be still limited by the mentioned phenomenon to the frequencies below one megacycle, when simple and compact radiation collectors are considered.

Using the loop

While wave propagation across salt water is fairly regular, numerous references from the past indicate that the path chosen by the wave is not always a great circle route. For all practical purposes navigation can be successfully maintained by the use of the direction finding radio equipment, especially designed for this purpose. A most essential part of this equipment is the loop antenna which for many years has been successfully used on board ships and relatively recently universally adapted for aircraft.

Directional characteristics

The loop, as has been known ever since its introduction, possesses desirable directional characteristics, substantially approaching a figure "8" and numerous workers have dealt with these characteristics showing in detail influences of various factors affecting loop polar characteristics. The most important is the position of a loop with its axis parallel to the direction of propagation, at which position very little signal voltage is induced in the loop antenna. This position is utilized for direction finding. Two such positions are at 180 deg. to each other and therefore an ambiguity of the same order is present.

Because zero position serves for the determination of direction, the minimum of the signal may be confused with the absence of the signal and several systems are known to overcome these difficulties by additional signal pickups, which when combined with the figure "8" pattern produce either true or "apparent" cardioid pattern.

The "ideal" loop characteristic which still remains the base for direction finding is only attained when a pure electro-magnetic component is received by the loop. However, the loop itself must be considered as a vertical antenna capable of receiving an electrostatic component which component usually reduces the sharpness of zero indication. It must be remembered that the effective height of a loop antenna proper ($h_{eff} = \frac{2\pi AN}{\lambda}$) is very small indeed and a minute electro-static pickup may entirely upset its true function. To eliminate the electro-static pickup, two methods separately or combined are used:

1. Balancing of the loop to the ground by means of a center tap, and by the use of split condenser or split inductance termination.
2. By effectively shielding the entire loop winding.

Several methods of electro-static shielding have been used, one of which is to enclose the loop in a grounded metal tube which is split on top. When such loops were used on an aircraft it has been noticed that another unpleasant effect has been greatly reduced, the effect known as precipitation static, at times very bothersome.

Fig. 2—Iron core loop antenna of this design may have Q of 500 to 600

Precipitation static

These open type shielded loops have been used on all the ship installations (in the latter case mostly in the form of two stationery crossed loops for Bellini-Tosi installations) and with medium success on slow aircraft. As the speed of aircraft increased, the same type of shielded loops have been installed in teardrop streamlined housings made of various plastics in which construction precipitation static reappeared again notwithstanding perfect electro-static shielding.

It is possible that the streamlined housing by itself may generate precipitation static in the flight as the outside wall of the housing is usually made of nonconductive material. New solutions are being found today which may exclude this difficulty while retaining streamline characteristics.

While in marine installations the size and weight of the loop are of no importance, the main considera-

Loop ANTENNAS

Reduced drag and power consumption in aircraft from use of ferromagnetic core construction

tion being to pick up sufficient signal on aircraft, the size becomes a paramount factor on account of air resistance or drag introduced at high speeds.

As a compromise for adequate reception with permissible drag, a loop of an outside diameter of approximately 8 in. usually is placed in a streamlined housing of 9 in. maximum diameter. This installation has been proven to be satisfactory for large airships where at relatively slow speeds up to 250 mph a drag of 6 to 8 lb. is observed which is small compared to the drag of a large ship. Nevertheless, the loss of power or speed represents an unjustifiable expenditure of gasoline and shortening of the cruising radius. As the speed of modern aircraft considerably exceeds this figure and noting that the drag increases as the square of the velocity the figure given above would become intolerable at a speed of 400 mph when the drag will amount to 24-32 lb.

Use of iron cores

Attempts were made to go back to "open type" shielded loops, but drag characteristics were found to be considerably worse than the figures just quoted. Besides, at high speeds this type of loop vibrates sufficiently to blur the zero position and render the radio compass inoperative.

With the increased demand on performance, requiring reduction of size and drag of aircraft loop installations, great efforts were made to improve loop antennas by employment of powdered iron cores.

The iron core loop antenna operates on the principle that when a core is placed in a coil exposed to radiation fields, the presence of the iron coil "attracts" or increases the linking magnetic lines so that a higher voltage is generated in the antenna. It was ascertained that the degree of such "attraction" is numerically equal to the effective permeability of the core in a given coil antenna. Thus the formula of the effective heights of an antenna with the iron core becomes

$$h_{eff} = \frac{2\pi\ AN\mu_{eff}}{\lambda}$$

It was also observed that for increased effective height of an antenna "open" type cores should be used. High frequency magnetic materials suitable for this application may have permeability of the order of 40 but in the actual utilization of such core materials in the antenna the effective permeability represents a small fraction of the above figure. This is due to a relatively small length of the coil and to the above stated "open" construction.

Further on, with the insertion of iron the number of turns must be reduced to preserve the same inductance so that the net gain of effective height in the present construction rarely exceeds order of 3 as compared with an air core loop of the same dimension. Since the effective height is approximately proportional to the loop's diameter it means that the loop can be reduced 3 times in its cross-sectional dimension.

It is also interesting to note that due to the localization of fields in the coil with iron, the loop antenna can be placed closer to the skin of the aircraft.

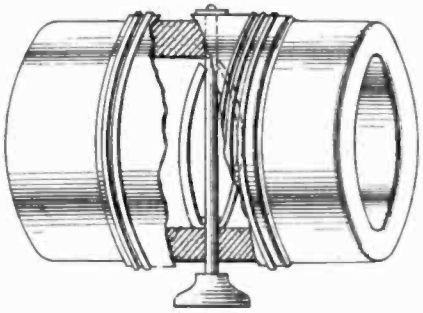


Fig. 3—An elongated design permits high utilization of iron

Reduced size and drag

The reduction of frontal area for the drag consideration is still greater since the area is proportional to the square of the diameter. Both of these factors radically change the design and the shape of a streamlined housing making it smaller and lower from the plane surface so that the drag is reduced to a small fraction of previously quoted figures and for

(*Continued on page* 240)

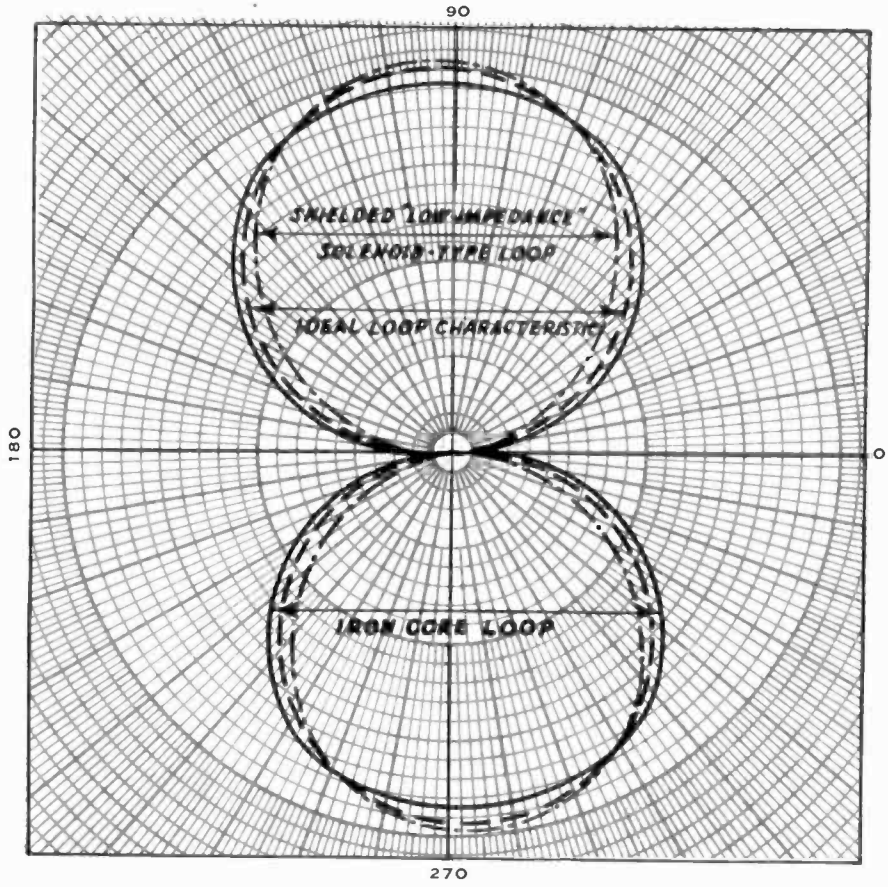
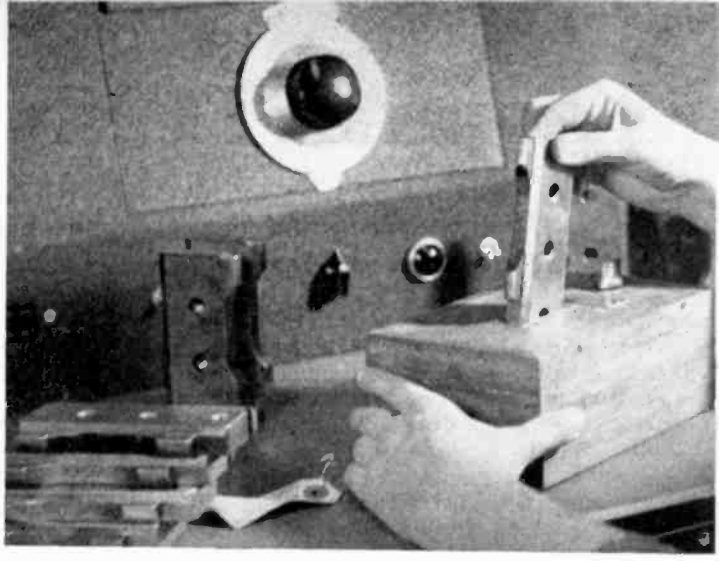


Fig. 4—Typical polar diagram showing departures from the ideal due to air cored and iron cored loops

Using the Cyclograph to check the case-hardening depth of roller bearings



Testing case-hardening of gun breech blocks

METALLURGICAL Analysis

Allen B. Du Mont Laboratories apply loss-factor checks to provide non-destructive tests for metal products

● The term Factor of Safety has been used for many years to take care of quality variations in the production of industrial items and in the design of all public construction projects where reliability and safety are involved. For example, for centuries metal castings have been made with ample proportions so that their ultimate strength would be, say 10 times that necessary, because of the possibility of hidden flaws. If every part were perfect in regards to its alloying, heat treatment, and without hidden checks or voids the material used could be reduced by using a lower factor of safety.

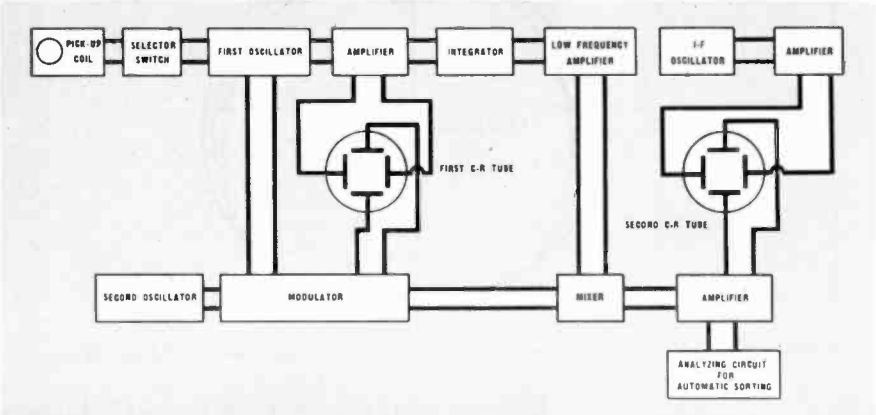
A little thought will show that less weight in a few parts usually will permit the lightening of associated parts on account of the reduced load on them which results. The actual saving is dependent on the surety with which parts can be inspected. In following out this plan, it is necessary to test every piece; a sampling test of a few in every lot will not suffice. This rules out all kinds of destructive tests where samples are operated to their ultimate breakdown.

The development of non-destructive tests that were rapid enough to permit a 100 per cent check on production has been conducted by many groups during the last few years. The use of magnetic comparison systems with oscillographic indicators has been popular in a few products, especially those which are not likely to have many things wrong with them at the same time. If alloy content, tempering changes and hidden flaws are all present, the problem is more difficult and multiple tests are necessary — involving the use of fluorescent crevice-seeking oils, or radiographic tests with an X-ray in conjunction with the magnetic comparison system.

In view of the weight reduction program of aircraft and the material shortages in all kinds of products, even with those complications 100 per cent checks of redesigned parts are worthwhile. With non-magnetic materials, the use of audible or ultrasonic tests has proved of value in a few special cases, but there has been no general type of test that could be considered useful in making as complete a test as the design demanded.

To fill this gap the recently demonstrated Cyclograph, designed by the Allen B. Du Mont Laboratories, performs both qualitative and quantitative metallurgical tests on both ferrous and non-ferrous metals. It is a practical production test adapted to facilitate the checking, evaluating and sorting of these materials according to their metallurgical properties without requiring laboratory facilities. It is, of course, a non-destructive test for variations in the metallurgical properties of either metal parts or stock, such as the measurement of case depth, core hardness, plating thickness, carbon content, brittleness and variations in heat treat-

Fig. 4—Block diagram of circuits associated with C-R tubes



ment. To take care of the requirement usually found in such tests, that all properties except the one under observation remain reasonably constant from sample to sample, the system makes use of multiple frequencies and permits preliminary grouping which insures that all properties of each item in a given lot remain reasonably constant except for the property being investigated.

Checks field losses

The Cyclograph compares the variations of the core loss in a tuned pickup coil which surrounds the piece under test, by noting the shape of a visible pattern on a cathode-ray tube indicator screen. From the results of this comparison, an automatic acceptance—rejection relay circuit can be adjusted to take care of the actual inspection control automatically, as fast as five per second.

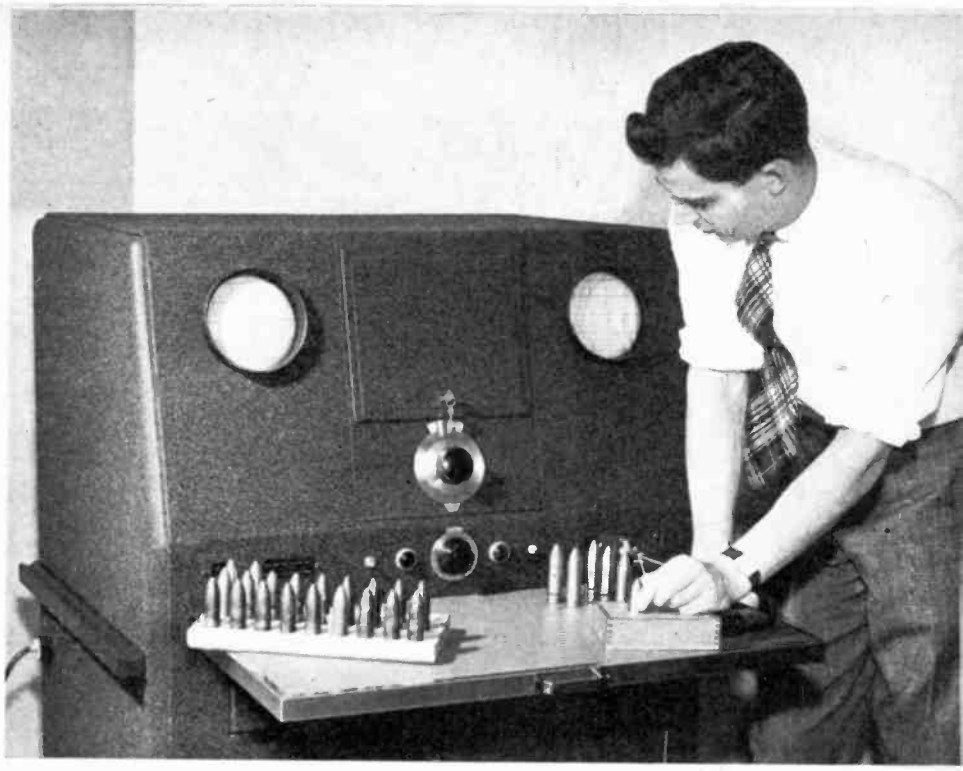
Most sorting problems are not simple, since no one can positively predict that the pieces in a given lot have uniformity in all properties other than the single characteristic under investigation. In these cases, the Cyclograph is successful because it uses a special feature multiple frequency operation, discovered during the development. The core loss characteristics of a metal having a variation in one property usually follows a different law with respect to test frequency variations than if a different property were at fault. Sending the parts through a test at a series of selected frequencies points out those which have reasonably constant metallurgical properties for a single classification which can then be sent through together as a group for further study of some other property. As shown in a photograph, two tubes are provided in the circuit connected to facilitate setting up and adjusting the system for sharpest differentiation of the inherent characteristics for a particular series of samples.

The block diagram Fig. 4 shows roughly how the component sections of the equipment are grouped together. The first calibrated cathode ray tube is used to set the preliminary adjustments, while a second calibrated tube delineates the oscillogram which indicates the comparisons.

Automatic classification

It might seem that this multiple testing would prove tedious, but this is not true, for two reasons: (1) the test is rapid and with many classes of items can be made fully automatic, (2) the classification and grouping according to characteristics is a necessary production step, since materials which have been heat treated wrongly need different handling processes than those which are unsound, are checked or otherwise defective. Both ferrous and non-ferrous metals may be inspected with the Cyclograph. For example, the extent of age hardening in aluminum alloys; or again, the decarburization of ferrous materials, may be evaluated.

Fig. 2 illustrates the basic principle that permits single property grouping of samples. Suppose identical-appearing items made from two types of steel, were mixed, and further that each type represented several stages of heat treatment. Six curves could be plotted using standard loss-methods with variable frequency bridges. An oscillograph could, of course, be connected to give such curves, one at a time.



Closeup of the Du Mont Cyclograph, and the work shelf

It is at once evident from Fig. 2 that at one frequency (say 5,000 cycles) items 1, 3 and 6 would group themselves in the same class, with some doubt as to item 2. Items 4 and 5 would clearly become separate classes, however. At 25,000 cycles item 6 detaches itself as does item 3. Items 5 and 6 are still distinct, if they had not been removed from the group at the first check. At very low or very high frequencies items 1 and 2 become distinctly separated.

Now comes the Cyclograph using the automatic and instantaneous

(*Continued on page 238*)

Fig. 2—Metallurgical characteristics of two types of steels shown by the loss factor measurements over a range of frequencies. Curves 1, 2, temper drawn; curves 3, 6, quenched; curves 4, 5, as rolled. Curves 1, 3, 4 for SAE 1095 and curves 2, 5, 6 for SAE 1315 steel

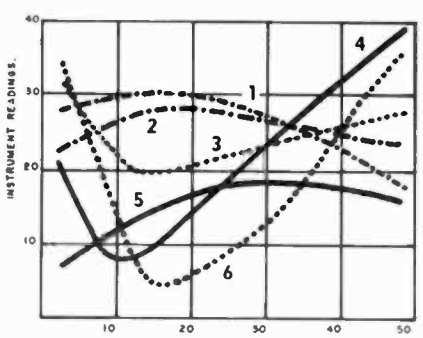
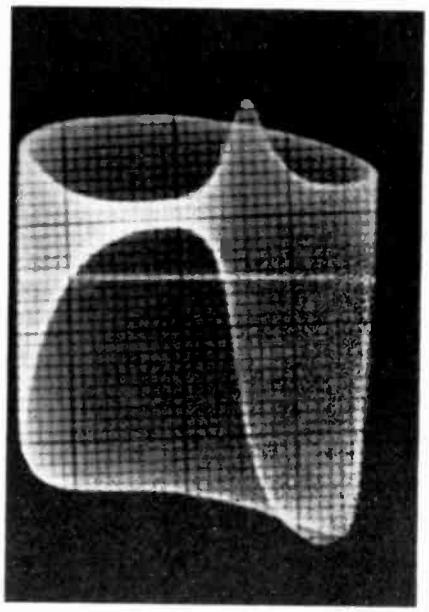


Fig. 3—Typical oscillogram seen on second tube. Length of ordinates between upper and lower curves evaluates the characteristics



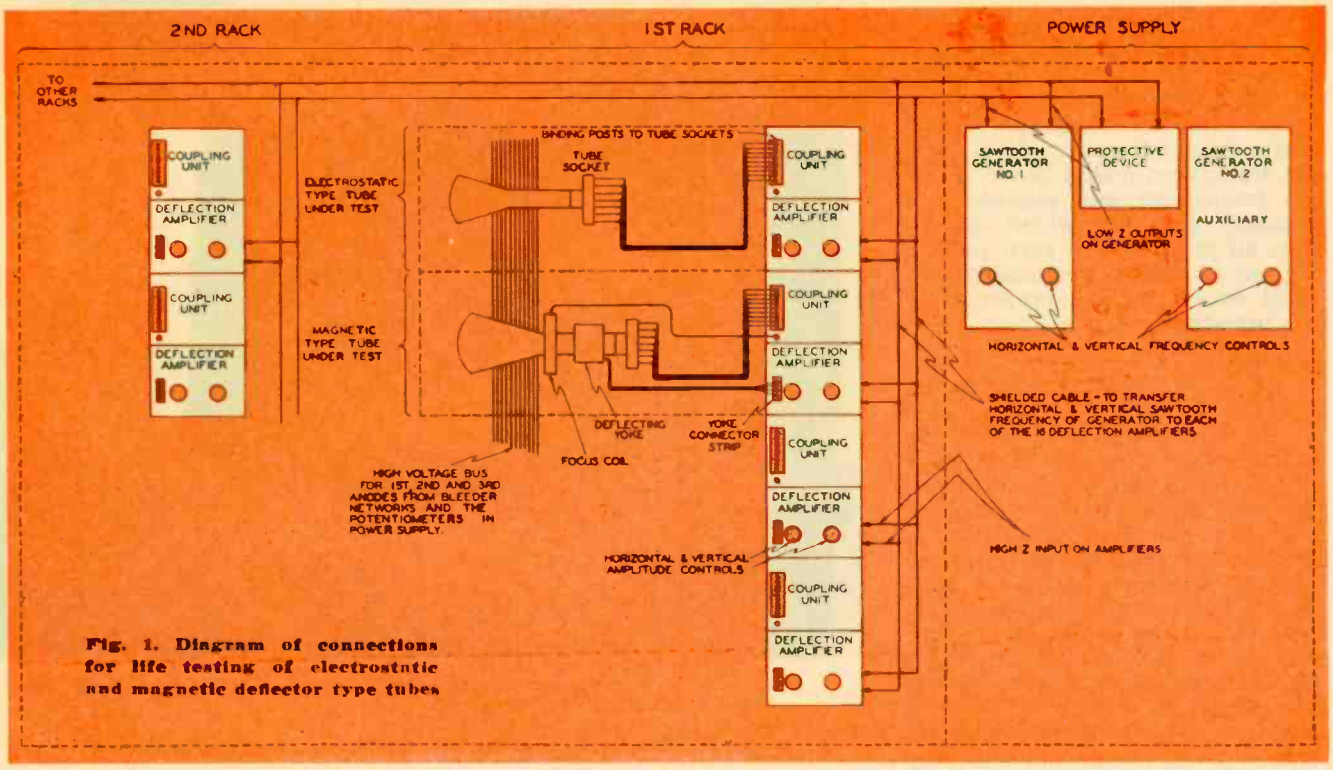


Fig. 1. Diagram of connections for life testing of electrostatic and magnetic deflector type tubes

C-R TUBE LIFE TESTING

by EMIL A. RUDAT
Project Engineer, Transmitter Equipment Mfg. Co.

Production equipment designed to handle 16 to 48 tubes of various sizes and types simultaneously

• In the past few years many and important uses for the cathode ray tube have been discovered. It is presently adapted to a variety of special functions in laboratory, mechanical, electrical and medical centers. Certain shapes, sizes, colors, screen persistence and the like, must be met in these various fields. This will account for the many different types of cathode ray tubes available today. The tubes are put through many tests before they are released to the market to be sold into the various branches of service. Among these tests are, of course, heater current and voltage, focusing voltage, grid voltage in connection with brilliance, voltage tests between elements, fluorescent screen input power per square centimeter, deflection sensitivity, spot centering, screen persistence and others too numerous to mention. The tube will pass only if it checks within predetermined limits.

The units shown in Figs. 2, 5 and 6 incorporate versatile power supplies, sawtooth generators, sine wave generators and intricate amplifiers to accomplish certain of these tests. The units will check spot centering, deflection sensitivity, focusing and screen brilliance. However, their main function is to life test the tubes. The units will operate 24 hours a day; consequently the equipment used on the units is for continuous duty, and has been placed and constructed for easy servicing in the least amount of time. It can be realized how important this is, since time of operation was the emphasis in the design of these life test units.

Fig. 2 shows a complete unit for testing sixteen 15-in. tubes at a time. The complete unit consists of five sections, one power supply and four racks. Each rack contains four deflector units and four coupler units.

Variable power supplies

The power supply section of Fig. 2 contains four high voltage continuously variable power supplies ranging from 0-10,000 volts dc. These supplies are used to supply the first, second and third anode voltages to the tubes under test. A bleeder network is associated with the three high voltage supplies: 10,000, 6,000, and 2,500 volts. Potentiometers may be inserted in any section of the bleeder network to supply a precise voltage to any of the tubes under test. The voltages from the bleeder and potentiometer network are injected, by means of copper bus, into the four test racks. The spacing of the high voltage bus is at least 2 in. from any metal ground.

The voltages at the bus are indicated by two electrostatic voltmeters either of which can be switched to the bus in question. The small meter has a range of 0-3,000 volts while the large meter has a range of 0-12,000 volts in order that voltages may be read quite accurately. These voltages are finally injected into each individual tube by means of convenient plugs and jacks. The high voltages present in the unit are dangerous and hazardous insofar as inexperienced operating personnel and inflammable equipment are concerned, but proper steps were taken in design for absolute safety in the operation and maintenance of the unit.

A 1,000 volt supply is built into the power supply cabinet to supply the tubes under test with a focusing voltage. The voltage is transferred into the racks and is placed across a bleeder network, which network appears on each of the sixteen coupling units (Fig. 3). A potentiometer shown as EB1 may be

inserted in any section of this bleeder by means of the plug 1. It can be seen therefore that the proper voltage for electrical focusing of any tube can in this manner be obtained.

Magnetic focusing is done by connecting the leads of a focus coil into a plug provided on the same coupling unit. A 150 volt dc supply which is housed in the power supply cabinet is used to supply voltage across the EC1 potentiometers in the racks. This voltage is used to control the brilliance of each of the sixteen tubes under test, and the voltage may be checked by inserting a meter in the EC1 jack located on each coupling unit panel. Safety switches are located on the wall of the power supply cabinet (Fig. 2). The 115 volt ac switch supplies filament and plate or anode power for the entire rack. The filament voltage to the tube under test is controlled by means of a Variac located on the coupling unit panel. The filament voltage can be adjusted to meet filament requirements of any tube manufactured today. This filament voltage can be read by inserting a meter in the EF jack. The 300 volt dc switch is used to supply plate voltage to the sawtooth generator in the power supply cabinet. This voltage is also existent across the EC2 potentiometers of the 16 coupling units (Fig. 3). The acceleration grid voltage can also be measured and controlled from the front panel of the coupling unit. The 500 volt dc line supplies plate voltage to the amplifiers of the sawtooth wave generators and to the deflection amplifiers in each of the 16 deflector units. The power supply cabinet contains two sawtooth voltage generators. The outline diagram of these generators is shown in Fig. 8.

One of these generators is always in use. The other is an auxiliary in the event that the first should fail to enable the entire life test unit to continue to operate while the first is in repair. The generator supplies horizontal and vertical sawtooth frequencies to each of the 16 deflector units in the racks.

A protective device is built into the power supply and functions in connection with the sawtooth generators. The purpose of this device is to protect the screen of each tube under test under the condition that the high or the low frequency scanning generators used for horizontal and vertical deflection fail. Under normal conditions, these sawtooth frequencies, when applied to the deflecting plates through the amplifiers, will produce a square-cornered scanning raster on the fluorescent viewing screen. Should either fre-

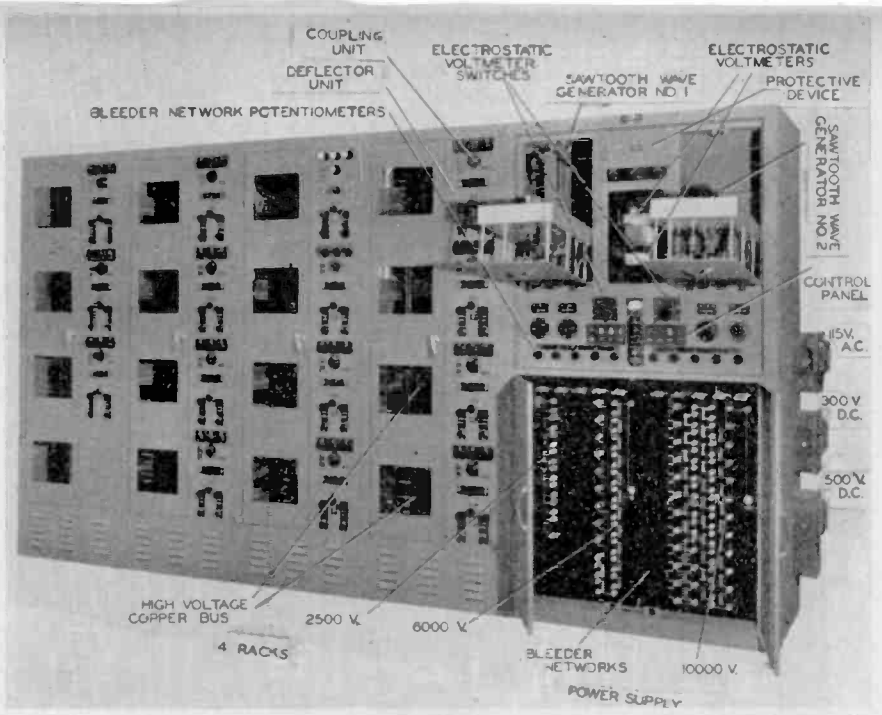


Fig. 2—Sixteen-position cathode ray tube life test equipment

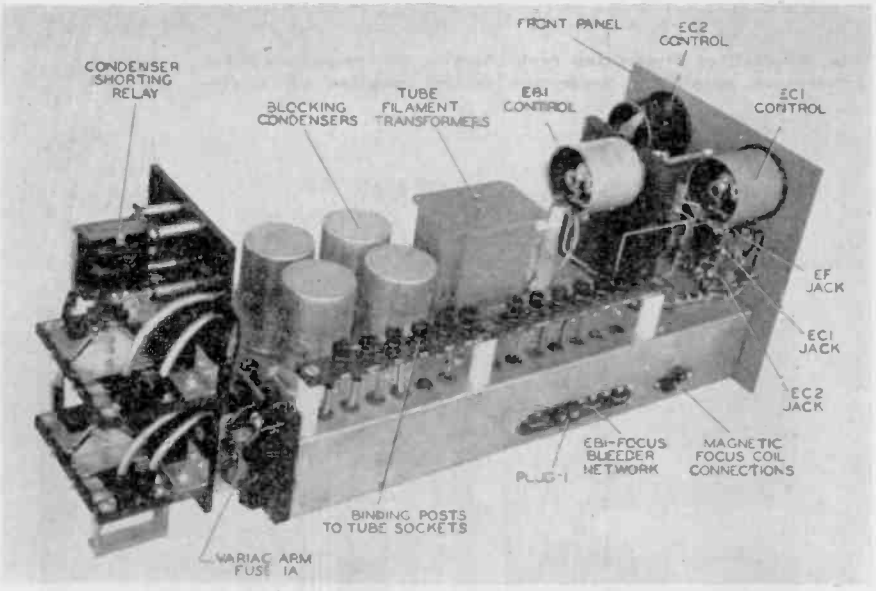


Fig. 3—Coupling unit used in sixteen-position life test rack

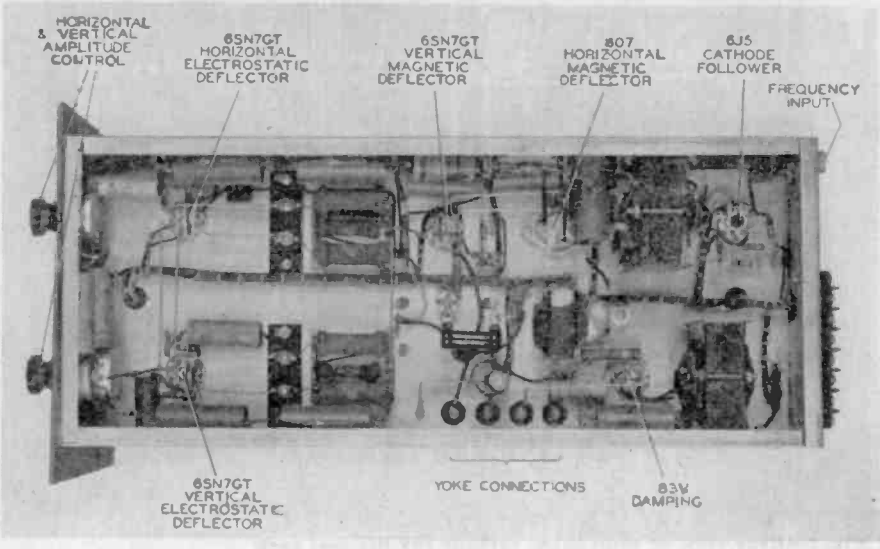


Fig. 4—Deflector chassis of sixteen-position rack

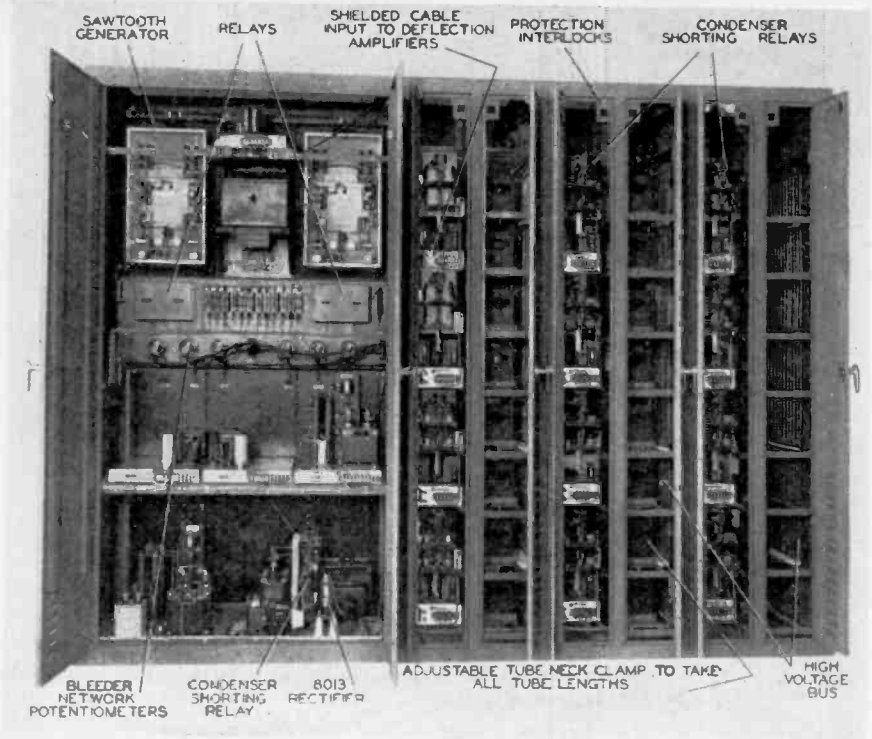


Fig. 5—Back of 24-position rack showing power packs, pulse generators, amplifiers, protective device, coupling units, etc.

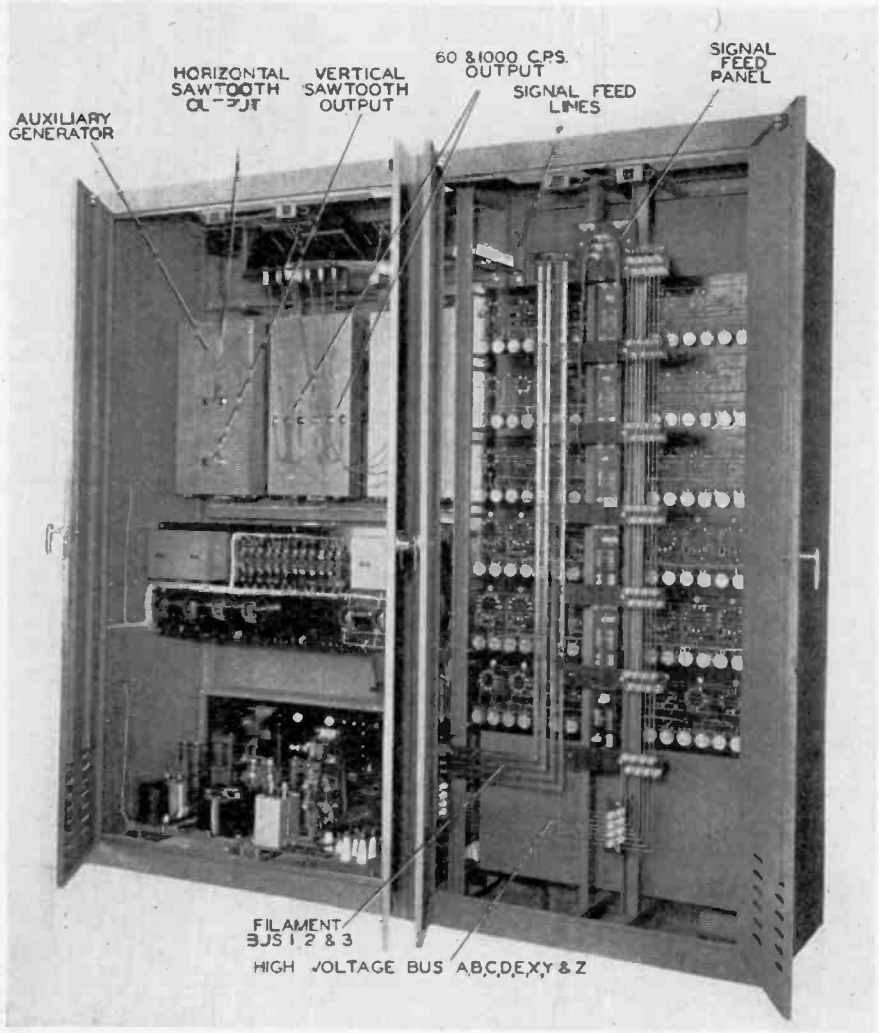


Fig. 7—Rear view of 48-position cathode ray life test rack illustrating interior wiring details and bus connections

quency fail, the brilliance usually spread over the normal area of the raster is concentrated in a line, and may burn the screens of the tubes under test.

In this event, the protective device will automatically shut down all dc voltages generated within the power supply and dc voltages supplied through the switches external to the power supply, such as the 300 and 500 volt lines. Output of the sawtooth generator is low impedance but at high level, obtained by using parallel tubes in the amplifying circuit. Need for this type of output is obvious when it is realized how far the sawtooth wave form must travel and to how many amplifiers it must be connected (Fig. 1).

The unit of Fig. 2 consists of four racks, each capable of testing four 15-in. tubes. The tubes can be deflected magnetically or electrostatically or a combination of both. Figs. 4 and 9 show a bottom view and outline diagram respectively of these units. The horizontal deflection wave from the sawtooth generator is fed into a 6J5, connected as a cathode follower, whose output drives a 6SN7GT. The latter, as a phase inverter, can deliver approximately a 175 volt sawtooth wave to a pair of horizontal deflecting plates. The output of the 6J5 also drives an 807 tube, whose output is fed into the horizontal windings of a yoke for magnetic deflection. The vertical sawtooth from the sawtooth generator is fed into two 6SN7GT tubes. The first 6SN7GT phase inverter can deliver approximately 175 volts to the vertical deflecting plates. The second 6SN7GT parallel triode arrangement is connected to drive the vertical coil of a yoke.

Tests electrostatic tubes

The unit for testing twenty-four 7-in. tubes at a time consists of four sections, a large power supply similar to that shown in Fig. 2, and three racks, each of which contains four deflector units and four coupler units. Each deflection amplifier in these racks is designed to deflect the beam of two cathode ray tubes so that the coupler is arranged to hold two sets of binding posts for connections to the two tube sockets. This rack will test only the electrostatic type of tube. Fig. 10 shows the outline of tubes and controls used in the deflection amplifiers. A rear view of this life test rack is shown in Fig. 5.

Tubes normally rest in a V-block which can be raised or lowered as needed. The adjustment for length of the tube can be made by setting the clamp (to be seen in Fig. 5)

which holds the neck of the tube in the desired position in the track. Fig. 5 is a rear view of this life test unit, with all doors open. We can see the sawtooth generators and their exposed wiring, and the relays. These relays are enclosed, since the primary contacts of them are at harmful potentials.

The door interlock protection will shut down all dc voltages generated within the power supply cabinet and those supplied through the switches external of the power supply. One other protection is incorporated in these units. All condensers charged to a high potential in operation of the unit, such as the filter in the power supply and blocking condenser in the coupling unit, are immediately shorted when this potential across them has been removed. It is known that voltages of 500 volts across a charged capacitor have been fatal. Since the voltages used here are 20 times this value, the construction and placement of the various parts and controls had to be well planned and executed.

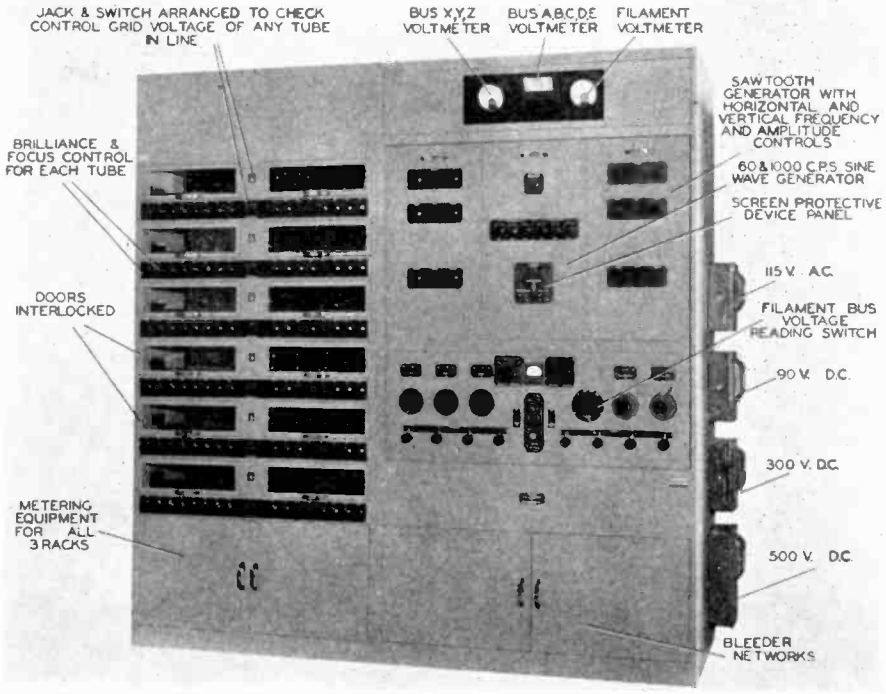


Fig. 6—48-position life test rack for electrostatic type tubes up to and including four-inch diameter

Safety precautions

For instance the bleeder network potentiometers, in Fig. 5, which operate at potentials of 6,000 and 10,000 volts are set 10 in. back from the control panel. The shafts to these potentiometers are coupled by flexible insulating couplings to the control panel of the power supply. The arms of the potentiometers are brought out to the high voltage bus runs within the racks by means of wire insulated for more than 20,000 volts. It can be seen, as a further precaution, that the wire is carried to its terminal through holes in bakelite.

Another cathode ray life test unit is shown in Fig. 6. This unit can test 48 tubes at a time. Electrostatic type tubes up to 4 in. in diameter may be checked in this rack. The power supplies with their bleeder network and associated potentiometers are incorporated in this unit to perform the same functions as those of the 16 and 24 position units. Two sawtooth generators (one for standby use), using low resistance in the plate circuits of push-pull 807 tubes are built into the power supply cabinet. The center panel contains a sine wave generator capable of 60 cps and 1,000 cps output. The output voltage of all sweep generators, controlled by potentiometers located on the immediate generator panel, are fed from the amplifiers over open lines to the tubes in the rack. A screen protection device is also contained on the center panel, which shuts down all anode voltages to the tubes under test if the output of the sine wave or the sawtooth wave generators fails or is abnormally low.

The tube rack of this unit has 96 controls and six eight-position switches. Each of the tubes has an individual focus and brilliance control. The control grid voltage to give proper brilliance can be read by inserting a meter in the jack provided for that group of tubes and switching to the proper tube in the line.

Fig. 7 is a rear view of this life test unit. The signal feed lines can be seen coming from the sine and sawtooth wave generators into the rack and finally terminate on the signal feed panel. These lines are then connected to the tube panels as required. The filament and high voltage bus are also seen coming

(*Continued on page 210*)

Fig. 8—Sawtooth generator diagram, 16 and 24-position rack

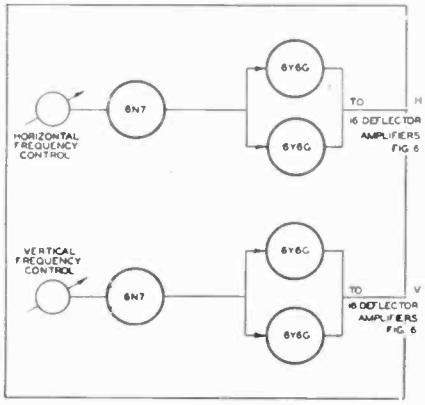


Fig. 9—Deflection amplifier and control diagram, 16-position rack

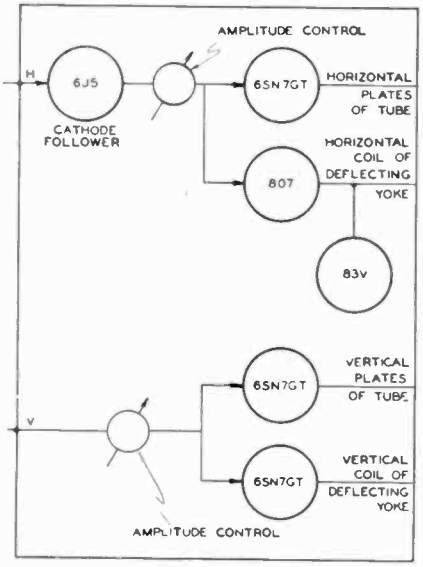
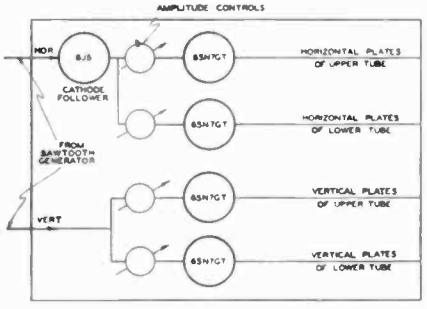


Fig. 10—Deflection amplifier and control diagram, 24-position rack



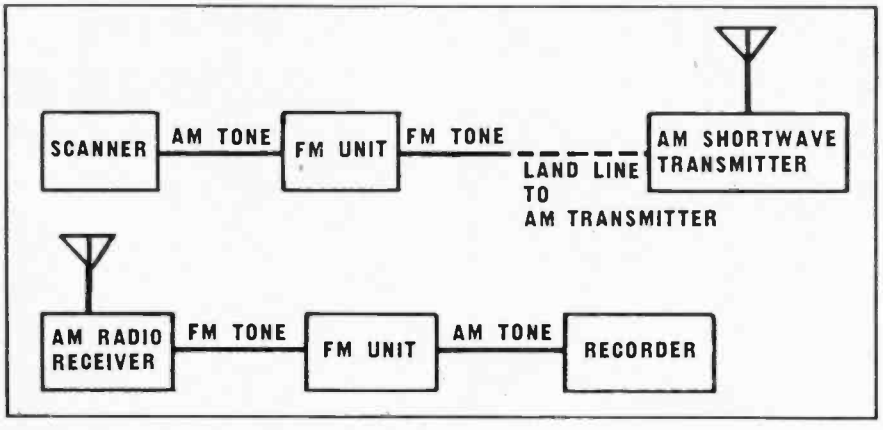
The radio picture equipment used by OWI in various foreign outposts, and here shown in complete form as used at New York headquarters, is compact, easily portable and ready for operation, weighs 45 lbs.

Radio Picture Transceiver

Frequency modulated sub-carrier tone used for blind broadcasting over OWI's worldwide short-wave system

• For some time the Office of War Information has been blind broadcasting photographs using a recently developed transceiver and a method by which a sub-carrier tone is frequency modulated and in turn used to amplitude modulate any of the many short-wave transmitters used by "The Voice of America" to reach the four quarters of the earth. The transceiver weighs but 45 lbs., thus is readily portable. A considerable number of the units, operated by OWI trained technicians, are now in use for the reception of pictures beamed on great circle routes to Northern Europe, covering such places as Russia, and carrying on to Bombay, to Central Europe, covering London, Istanbul, Beirut and Cairo, to North Africa. Many of these outpost stations are equipped to send pictures back to the United States.

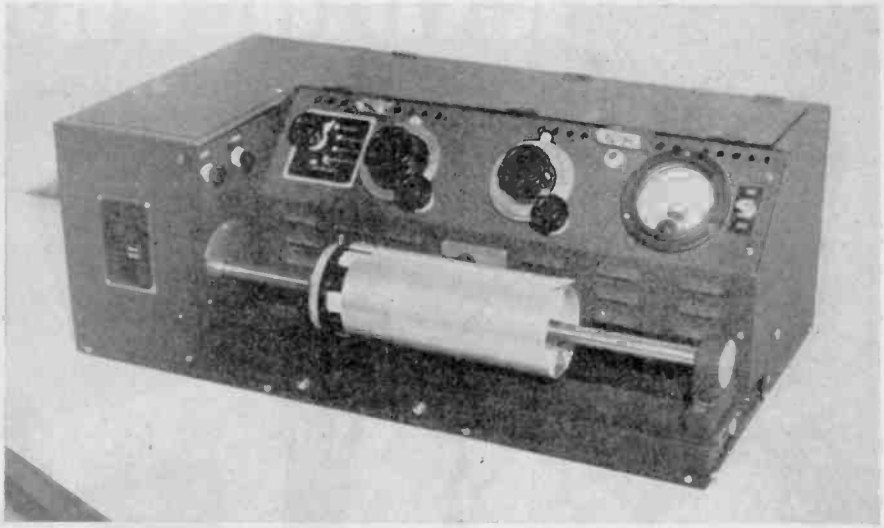
Block diagram showing relationship of the various units in the FM sub-carrier tone picture transmission and reception system



Although the principle of sub-carrier frequency modulation is neither brand new nor novel, having been introduced to commercial use by RCA in 1939 with the opening of a circuit between London and New York, there is considerable element of newness in the lightweight compact equipment developed by OWI engineers and in the method of using it.

In its simplest aspect, the equipment consists of three separate units—the regulated power supply,

the frequency modulation unit and the transceiver itself. Standard 115 volt 60 cycle supply is used. Variation in supply voltage is smoothed out by the customary regulatory means. The frequency modulation unit functions for both reception and transmission. The transceiver is small enough for desk mounting and has its constant speed motor controlled by a fork oscillator thus insuring synchronization at the transmitting and receiving ends. Pictures are scanned 96 lines to the inch, which is ample for even fine detail, which fact is indicated by the unretouched photograph reproduced herewith.



Transceiver unit of the FM sub-carrier radio photo equipment scans pictures 96 lines per inch, is synchronized by means of a fork oscillator

Greater picture detail

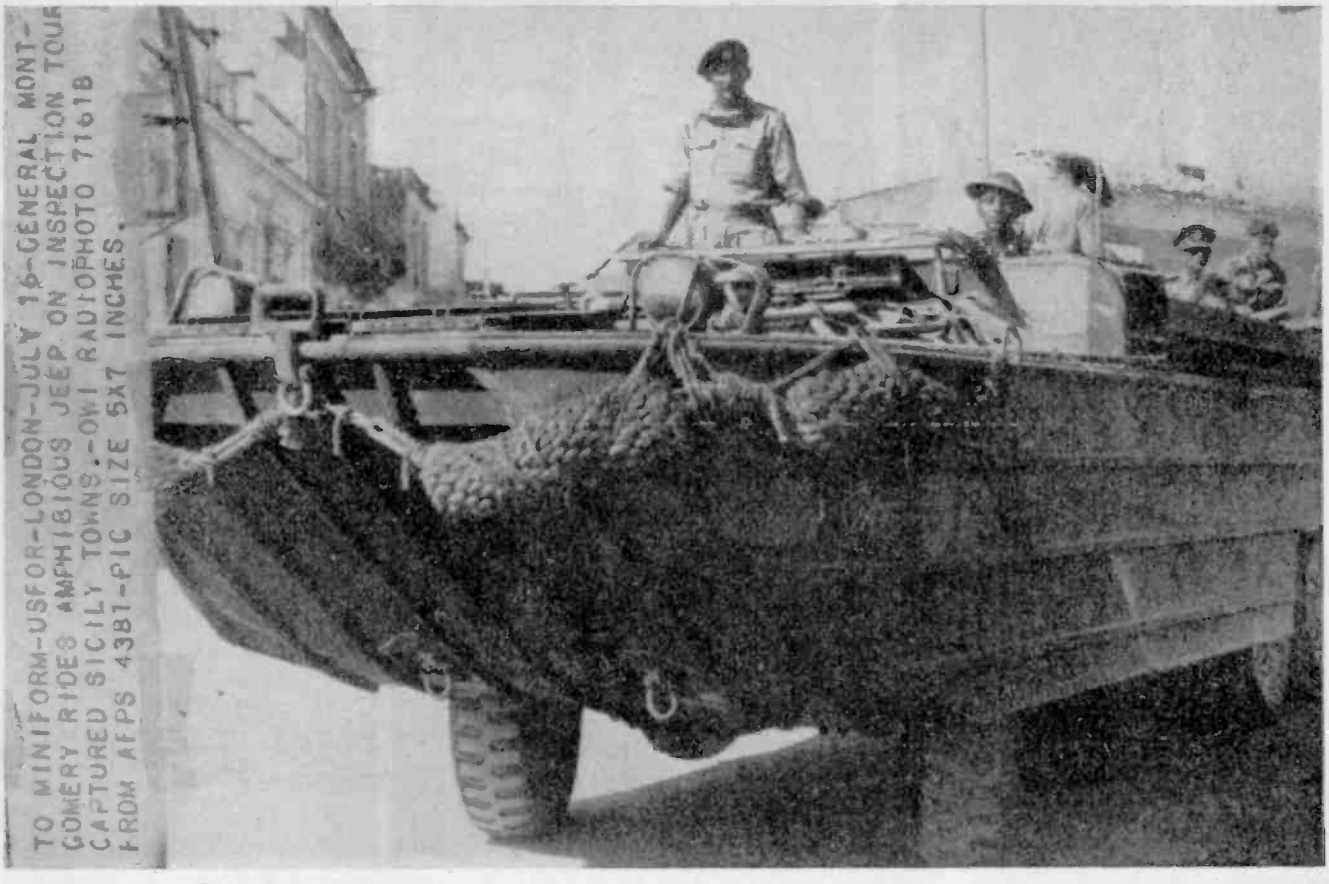
The frequency modulated sub-carrier system results in a number of important advantages which places the method well ahead of all others now generally available. Because linear amplitude recording is obtained, much greater picture detail is possible and half tones are recorded with better tonal value. Also there is complete elimination of streaks due to fading. Another important aspect is that the system makes possible the use of standard amplitude modulated broadcast equipment and introduces no new technic that requires long training or special knowledge on the part of broadcast engineers and technicians.

The new method, it is explained by George J. Hummel, chief of the technical equipment division of the Overseas Branch OWI, is not intended to take the place of regularly scheduled picture transmission over the usual commercial channels, nor does it compete with such service. It is a supplementary service. Existing channels have long been overtaxed and for some time have been inadequate to handle the volume of pictures OWI experts considered necessary and desirable.

As a result the blind broadcasting of pictures was begun. It was found that experienced operators could receive as many as eight pictures in an hour's facsimile broad-

(*Continued on page* 220)

Unretouched photograph, transmitted from somewhere abroad and here reproduced full size, shows great fidelity obtainable; the system gives excellent halftone detail and reception is practically immune from fading

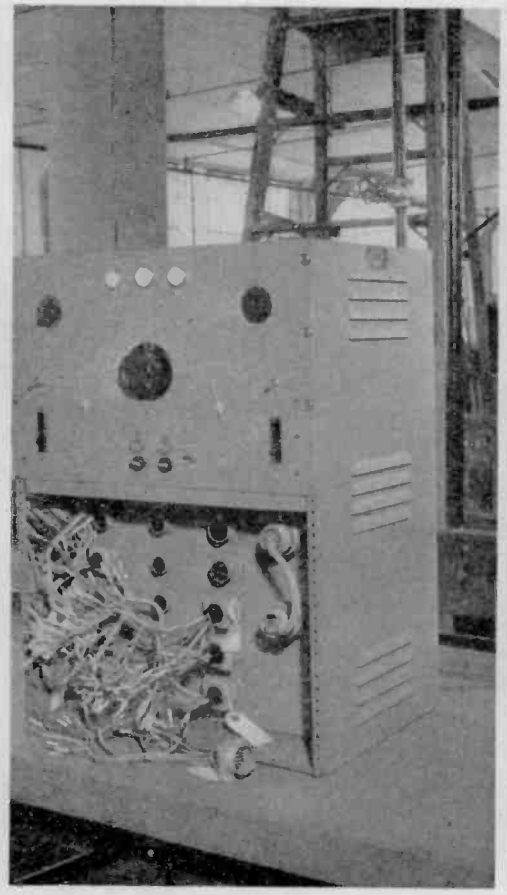


RADIO PRODUCTION

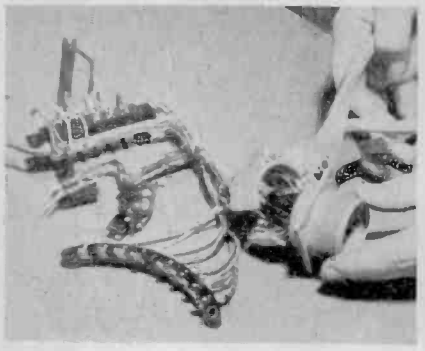
1. CHINESE RADIO TRAINEES receiving instruction with help of cabling and lacing demonstration board at Federal Telephone and Radio Corp., Newark, N. J. Federal has employed 225 Chinese and found they work with a vengeance

2. ROTARY AGING RACK used in a Western Electric plant. Drum holding tubes revolves slowly, completing operation when tubes return to starting point

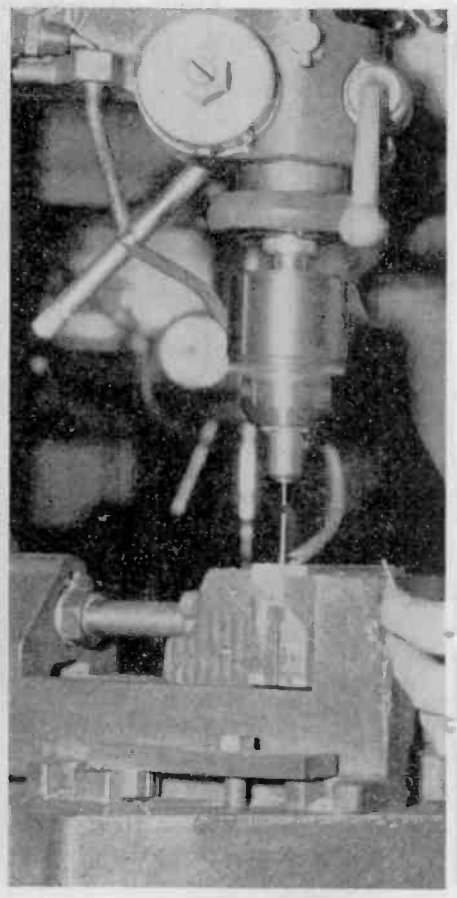
3. HIPOT TEST UNIT automatically stops when breakdown occurs in any one of fifteen cable assemblies or cannon plugs under test in plant of A-C Spark-Plug Co., Flint, Mich.



4. SPECIAL TOOL to assemble spring in cannon plug receptacle saves 50 per cent of time



5. AIR-OPERATED VISE at Northam Warren Corp., Stamford, Conn., uses compressed air in four ways; holding, ejecting work, blowing away chips, cooling drill



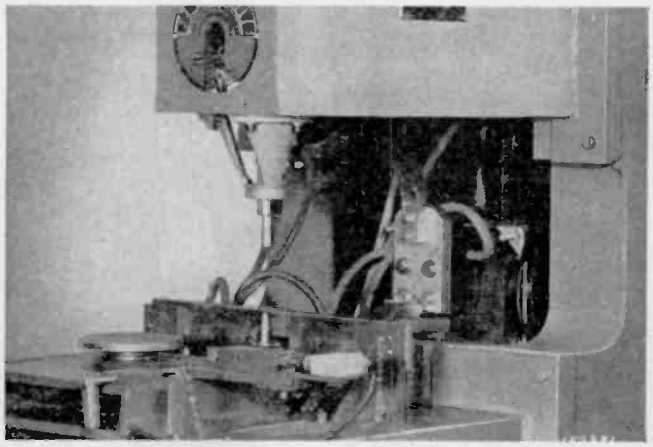
SHORT CUTS

6. JEWELER'S EYE LOOP facilitates delicate assembly and adjustment of meter movements in Western Electric's Chicago plant. Eye loops cost from fifty cents to a dollar or two per operator

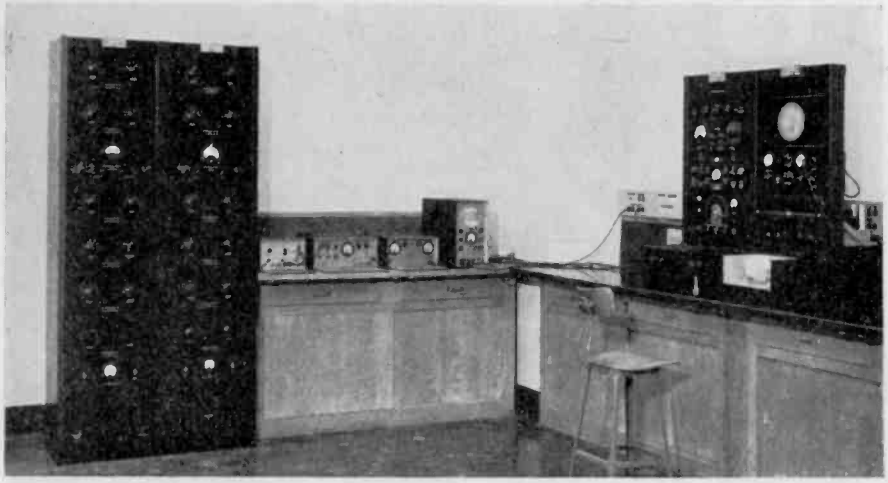
7. TUBE PRODUCTION boosted by collar-like device which holds tube mount while bulb is sealed. Ball bearings and three metal jaws make for easy removal after operation

8. INTERNAL CLAMP holds three forms together in coil winder, speeding production 30 per cent at Federal Telephone and Radio Corp., by replacing chucks formerly used

9. HOT RIVETER from a standard Progressive resistance welder with electronic controls heats and upsets rivets



SOUND



Measuring equipment for use with free field sound room is located in an adjoining laboratory; this view shows only one corner

● One serious problem in the development of every sort of sound equipment and in checking results under normal operating conditions, is the need for test facilities under which there may be close control of all variables. It is essential that results obtained under controlled conditions be reproducible. As a means to such ends, RCA Laboratories, Princeton, N. J., has developed one of the most elaborate acoustic set-ups in the country. It is in charge of Dr. Harry A. Olson.

Included in these extensive laboratories is a free field room which has been so designed, isolated and insulated that it is almost possible for a person standing in the room to hear his own blood circulating! Reason for this carefully engineered room is that many measurements must be made under what are known as free field conditions, in the development of most electro-acoustic transducers. An obvious method of approaching ideal conditions might be to conduct such tests out in the open, where it is perfectly quiet, and at a long distance from all reflecting surfaces. Inasmuch as such direct methods are impossible, a suitably constructed room is the only solution.

The objective in the design of such a sound room is to reduce to a negligible amount all reflections from the boundary surfaces of the room. This is equivalent to a very small ratio of generally reflected to direct sound. The ratio of generally reflected to the direct sound in a room is:

$$\frac{E_R}{E_D} = \frac{16\pi D^2}{aS}(1-a)$$

where E_R = energy density of reflected sound,
E_D = energy density of the direct sound,
D = distance from the source to the observation point,
S = area of absorbing material,
V = volume of room, and
a = absorption coefficient

The ratio of reflected to direct sound may be reduced by decreasing the distance between the source and observation point, by making the absorption coefficient of the walls near unity or increasing the area of the walls. In other words, free field conditions are approached by making the room large and the absorption coefficient of the wall near unity.

To satisfy the first requirement, the free field room was made as large as seemed practical. The dimensions of the room before acoustic treatment was applied were 48 ft. long, 36 ft. wide and 36 ft. high. The next objective was to obtain an absorption coefficient as near unity as possible. The high and low frequency ranges present the greatest difficulty in attaining this objective.

All-frequency absorption

It is a comparatively simple matter to attain 100 per cent absorption in the mid-frequency range. In the high frequency range the principal difficulty is reflection from grills, control boxes and test apparatus. These reflections can be eliminated by acoustical treatment of these reflecting surfaces. In the case of the low frequency range it appears to be an inexorable fact that the ideal objective can only be attained in a relatively large room with correspondingly thick absorption material. An examination of existing rooms indicates that regardless of the form of treatment it appears that absorption deviates quite rapidly from unity when the thickness of the treatment is less than ¼ wavelength.

The absorbing system employed in this room is of the baffle type, that is, strips of absorbing material are arranged normal to the walls of the room. The advantage of this treatment is the relatively simple construction and lowered cost.

One-inch Ozite is spaced 1 ft. from the walls, ceiling and floor.

Sound proof room for testing speakers at high levels

The living room laboratory is designed to be acoustical equal of average room

The sound stage is large enough to permit testing microphones under various conditions

STUDY LABORATORIES

One-inch Ozite baffles 7 ft. in length and spaced 2 ft. apart are placed normal to the walls, ceiling and floor. 4 ft. baffles of the same material are placed between the 7-ft. baffles. The total thickness of the absorbing material, measured from the outside wall, is 8 ft. This leaves the inside dimensions of the room: 32 ft. long, 20 ft. wide and 20 ft. high.

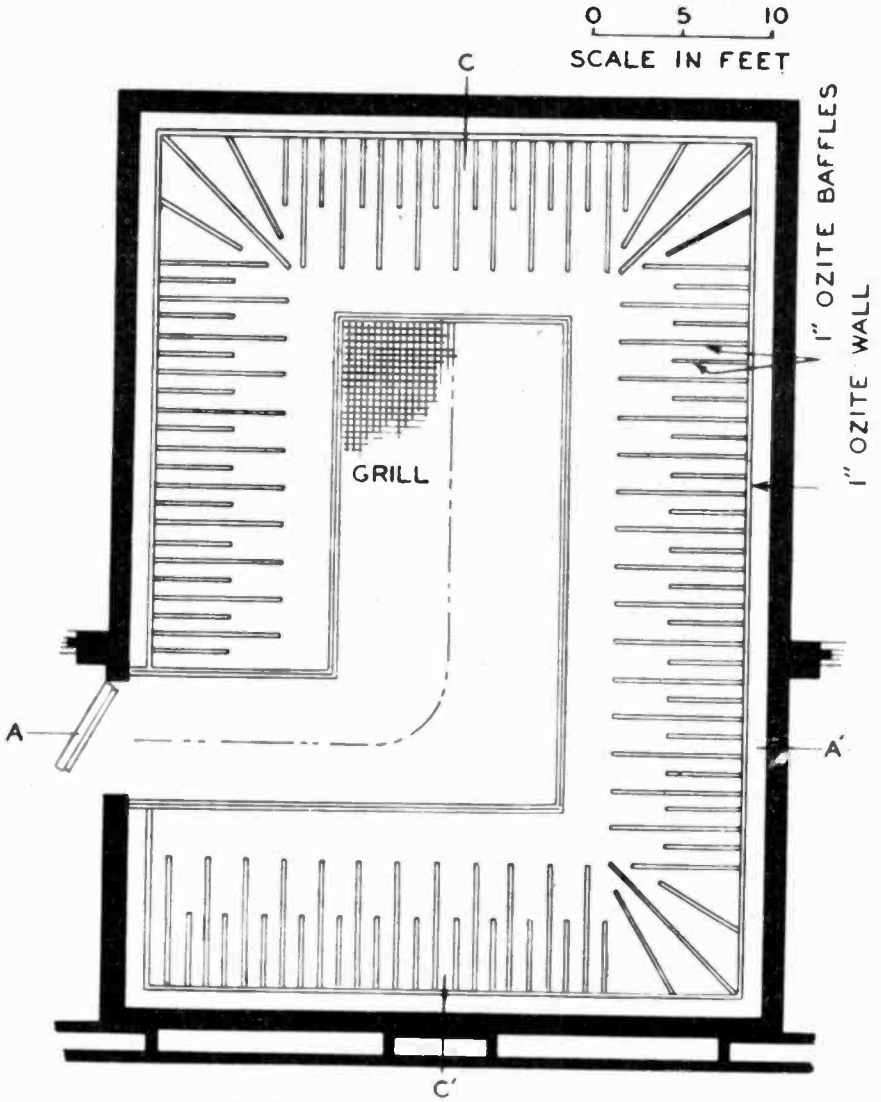
A special grill 12 ft. wide and 24 ft. long is supported on vibration-isolated feet. The ratio of open to total area in the grill is .87. This is a relatively open grill when it is considered that the grill platform will carry a load of 200 lb. per sq. ft. The floor level of the grill is located 11 ft. above the floor level of the room.

Charting acoustical merit

Measuring equipment used in conjunction with the room is in the adjoining laboratory. The apparatus includes means for measuring the response frequency, power sensitivity and directional characteristics of electro-acoustic transducers. Signal lines connect the free field sound room with the adjacent laboratory as well as all other rooms in the acoustic laboratory.

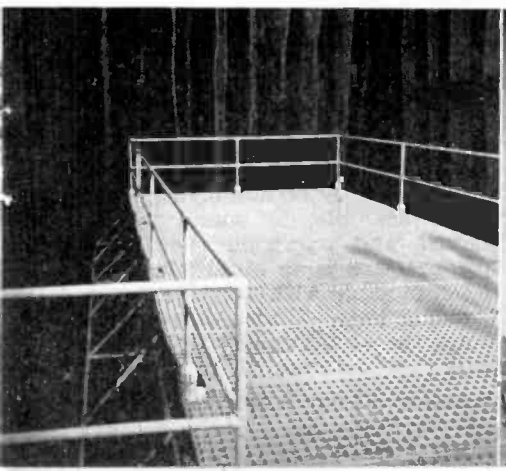
The acoustical merit of the room can be expressed by the deviation in sound pressure from an inverse distance characteristic. Pressure response frequency characteristics were obtained at various distances from a small loud speaker. A chart shows the maximum deviation in pressure from an inverse as the distance characteristic for various frequencies. The deviation in the mid-frequency ranges is negligible.

How RCA has arranged for the study of acoustics and the testing of all types of sound equipment



Plan of the free field sound room laboratory showing method of applying sound absorption material and location of platform grill

General view of free field sound room showing acoustical treatment and grill platform



The field laboratory, remote from other buildings, is designed for outdoor tests of acoustical systems

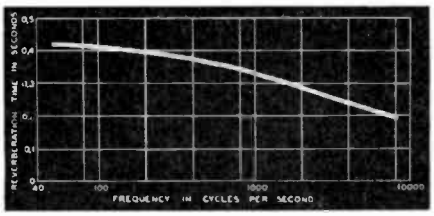
Magnetic laboratory showing part of the testing equipment

The deviation at the high frequencies is due to the grill, overhead trolley track and power and signal outlet boxes. These units will be treated which will make the deviations from an inverse characteristic practically the same as the mid-frequency range. The deviation at the low frequencies begins when the thickness of the material is approximately a wavelength. However, the deviation is only 1.7 db at 40 cycles at a distance of 8 ft. At 40 cycles the thickness of the material is .28 of the wavelength.

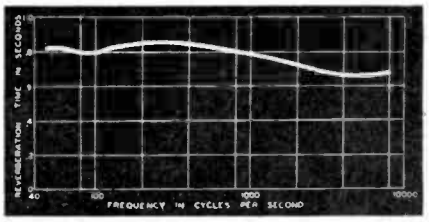
Absorption coefficient

The absorption coefficient of the walls may be determined from the ratio of direct to generally reflected sound. These two components may be determined by employing a velocity microphone. Two measurements are made: one with the normal to the plane of the ribbon passing through the source and the other with the plane of the ribbon passing through the source. The absorption coefficient frequency characteristic of the walls of the room are shown in chart form.

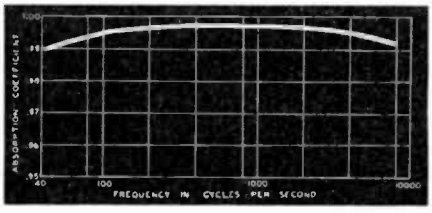
The noise level in the room, when the laboratories are in normal operation, is about 10 db. At night when the shops are closed down the noise level is 0 db. This shows that the sound treatment is also quite effective in absorbing sounds generated outside the room. The room is heated by hot air forced through 48 openings in the floor. With the blower in operation the noise level in the room is about 20 db. However, it is not necessary to operate the heater during the day because the room is very well insulated thermally as well as acoustically. For example, if the heater is operated 8 hours in every 24 hours the temperature variation from 70 deg F. is only 3 deg. F. on the coldest day. It is possible to make measurements in this room under essentially free field conditions over the frequency range above 40 cycles for distances between the source and observation up to 8 ft. This distance can be increased if either the source or the microphone or both are directional.



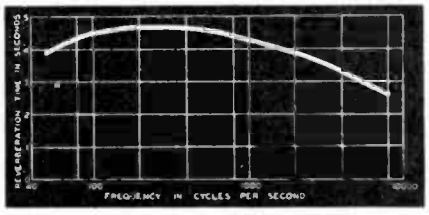
Reverberation time - frequency characteristic of the sound stage



Reverberation time - frequency characteristic of the living room



Absorption coefficient - frequency of treatment in free field room



Reverberation time - frequency characteristic of the live room

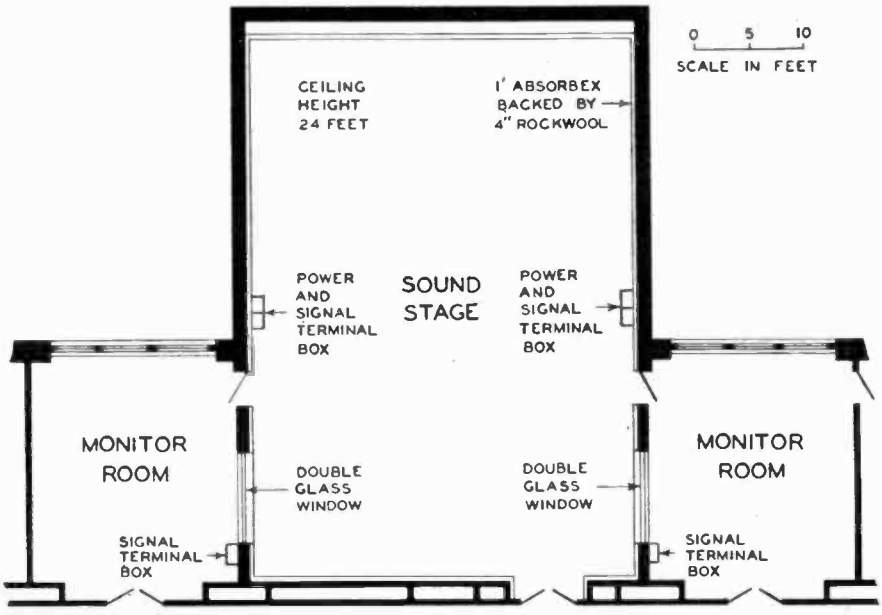
Simulated stage tests

Measurements made under free field conditions determine the physical acoustic characteristics of the microphone or loud speaker. In the collection of sound by microphones under normal operating conditions, there are many complex factors which influence the performance. The dispersion of sound by loud speakers is equally complex. Therefore, after a microphone or loud speaker, with certain physical characteristics, has been developed the next step is a test under actual operating conditions. These tests require a sound stage with flexible acoustic characteristics.

The sound stage (48 ft. long, 36 ft. wide, and 24 ft. high) is large enough to permit practical working tests of microphones under a variety of environments. Two large monitoring rooms are provided on the sides of the sound stage. Large sound proof windows permit a good view of the entire stage from the monitoring room.

The walls and ceiling of the sound stage are finished in 1 in. Absorbex backed by 4 in. of rock wool blanket. The stage floor, for practical reasons, is covered with asphalt tile with practically no absorption. An abuse-resisting wainscot extends up 4 ft. from the floor.

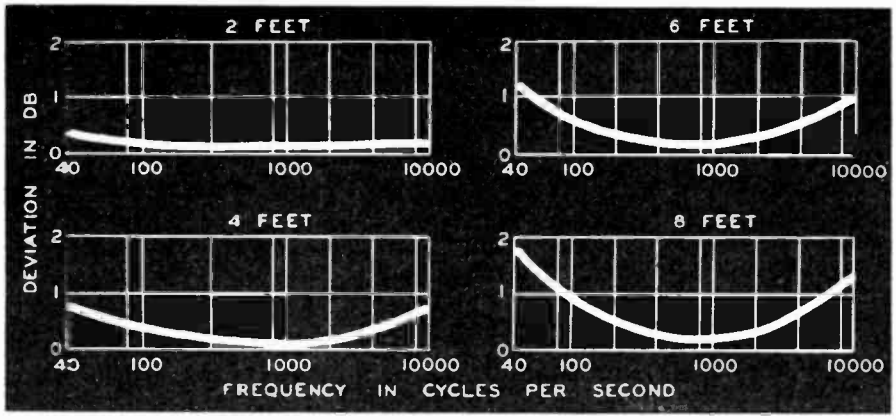
The sound stage, here shown in plan, has two adjacent monitoring rooms which are isolated from it and made completely sound proof



Reverberation time

The measured reverberation time frequency characteristic with no covering on the floor is charted. The reverberation time is quite low and is about one-half that recommended for a normal broadcast studio of this volume (40,000 cu. ft.). The reverberation time is made low so that flexible acoustic characteristics may be obtained.

For example, in sound motion picture and television the standard practice is to build sets upon a sound stage with very low reverberation time. Under these conditions, the acoustics of the collected sound is determined by the set.



Deviation of the pressure from an inverse distance characteristic for various distances from a sound source

Added realism is attained by this expedient because the acoustics of the collected sound corresponds to the picture depicted on the screen. For tests under normal broadcast acoustic conditions, the reverberation time of the sound stage may be increased to optimum values by introducing reflecting surfaces on the walls. In this case "V'ed", poly-cylindrical or other dispersing surfaces may be used. This sound stage provides a means for testing the acoustical properties of these surfaces. The noise level in the sound stage when the laboratories are in normal operation is 20 db.

The sound stage is designed so that it may be used as a small theater. For these tests, the room may be "livened" by increasing the reverberation time. This can be accomplished by introducing reflecting surfaces along the sides and in the ceiling.

There is thus a flexible acoustic laboratory for testing microphones for sound broadcasting, sound motion picture and television under typical operating conditions.

Home conditions reproduced

The radio receiver and phonograph constitute, by far, the largest number of complete sound reproducing systems. Home sound reproduction is the principal application of phonograph and radio receivers. For this reason, the performance of a sound reproducer in a relatively small room is an extremely important problem.

The living room laboratory is designed to be the acoustical equal of the average living room. The room is 24 ft. long, 20 ft. wide and 8 ft. 6 in. high. It is finished with acoustical plaster backed by 2 in. of rock wool blanket. The reverberation time characteristic frequency characteristic is illustrated. This reverberation characteristic approximates that of a typical living room in a home or apartment.

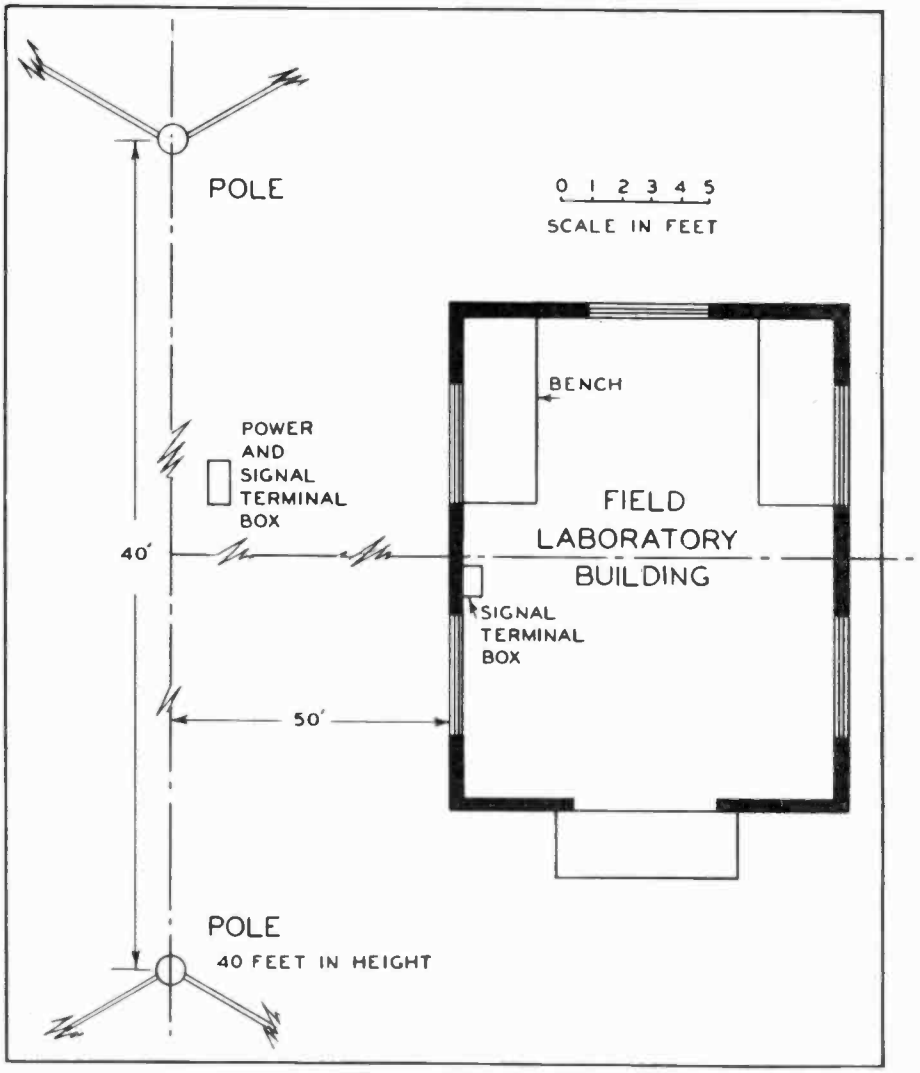
Suitable antennas are brought to the living room over transmission lines. Audio frequency signal lines are provided so that the living room may be connected to any part of the acoustic laboratory. These lines provide means for obtaining objective data, in the form of response frequency, non-linear distortion, spotial distribution, intensity level and transient characteristics, on sound reproducers operating in the room using permanently installed measuring equipment in other parts of the acoustic laboratory.

The absorption coefficient of an acoustic absorbing material may be obtained from reverberation measurements in a relatively live room. The live room for these tests is a room 24 ft. long, 18 ft. wide and 13 ft. high. The reverberation time characteristic of this room without any material is illustrated, and is about 5 seconds.

A sound proof room is used for testing loud speakers at high levels without creating annoyance in adjoining rooms. The room is built with separate double masonry walls. Two heavy sealed doors lead to the chamber. As much sound absorption as is practically possible is used to reduce the sound level in the room. A standard laboratory bench with a power outlet panel is

(*Continued on page* 210)

The field laboratory building is located at a considerable distance from all other buildings so that isolation may be effective



Technical Information, Please

Electronic Industries inaugurates a new service for readers to help in the solution of industry problems

1. If your design department is working to its limit and if you have a problem that is vital to the design or production of military equipment that you think might be solved by an electronic application, state your difficulty in a letter to *Electronic Industries*.

2. The editors will put your problem (identified only by a key number) before our readers, inviting reports of their experience in finding solutions.

3. Solutions will be printed in *Electronic Industries* for the general benefit of readers. (Correspondents so requesting will be put in touch with each other.)

• With every research laboratory in the country working at double speed, there are still a great many technical projects and production aids that must be shelved for lack of time and equipment. A great many of these problems are just the "means to an end," and not in themselves developments of prime importance in a major program. If a company can accomplish miscellaneous results by electronic means, it would generally mean more accurate tests, simplified procedure in production, or even the reduction of complexity in the product itself. It is possible that a process set up in one field of industry may be a perfect solution to some problem in an entirely different field.

It also happens that there is an enormous duplication of design effort in this country in producing some of these short cuts, since similar problems come up in widely separated industries between which there is little association of ideas. *Electronic Industries*, therefore, proposes the following plan to put technical organizations having similar problems in touch with each other, believing that this will be of advantage to everyone.

Therefore, if you have a technical or production problem that needs a solution, for which you believe some electronic device or circuit will serve, send us a full description of what it is. The query will be published with a key number, directed to our readers, among whom are doubtless a number who have worked out solutions to a similar problem for their own use. In cases where secrecy is required, two-way contacts will be established between the principals. Otherwise, in instances of developments of general interest, we hope to have permission to give all readers the benefit, with full credit, of course, to all parties.

The plan works two ways; if you have an interesting solution to a problem, let us know what it will do. Maybe it is the answer to a crying need in some widely different industry. Also it may disclose to you a postwar application for your product, so that plans can be made for its promotion. However, the department is intended primarily to help those charged with problems of executing government contracts with least delay.

It is hoped that in many cases the problems can be handled by commercial equipment items since it is always easier and cheaper to get ready-made instruments than it is to build them no matter how well organized design facilities may be—provided, of course, that a prohibitive delay in getting the required deliveries is not indicated.

The service is not intended at this time as a stockpile for concerns scouting for good ideas for postwar products, to permit them to jump into this "marvelous *new* field of electronics." Those who are after production items should so state, so that correspondents can be guided in further negotiations. For example, can you answer the first question N-1?

(N-1): "—— wants to be able to synchronize and control the speeds of two motors, say of ¼ hp each, so that the sum of the rpm of both motors will always equal 2400 rpm. In other words, when one motor is operating at 2400 rpm, the other motor will be at a standstill. When one of the motors is operating at 2150 rpm, the other one will be operating at 250 rpm, and so on, up and down the scale."

A question of pressures

(N-2): "A method is needed for showing the point during a revolution when the pressures in two compartments are equal. The maximum pressure difference may reach 200 lbs. and will reverse in direction during a cycle. The rotational speed may be as high as 2400 rpm."

Answer: While this problem is not fully described, there is enough given to point out a possible solution. No mention is made of the type of gas, its temperature or whether the introduction of tubes extending the pressure level to an external pressure converter will affect the normal operation.

A small cylinder is divided into two parts by a central diaphragm of sufficient stiffness so that the pressure levels encountered will move its center point only about one thousandth of an inch. A fixed electrode is mounted parallel with this diaphragm in one compartment a few thousandths of an inch away, forming a small condenser—that is, a capacitor microphone. The fixed electrode should be perforated with many small holes so that the path of the pressure wave is not shielded from striking the diaphragm.

The capacitor is used to "frequency modulate" (that is, alter the frequency of) a fixed oscillator. The two spaces on each side of the diaphragm are connected to the cylinders or pressure compartments being investigated. The whole unit must be gas tight at the maximum working pressure.

The frequency-modulated signal is amplified and connected through a discriminator circuit (like that found in an FM receiver) to the vertical plates of an oscillograph. The horizontal plates are connected to a linear time base which is in synchronism with the machine under test.

With no movement of the diaphragm, a definite media of fre-

(*Continued on page* 220)

HIGH FREQUENCY Welding

Reduction of weld time in capacity storage welders improves quality of welds with less storage capacity

• Welding thin sheets, such as three mil stainless steel or aluminum, to members of thicker section is but one of a number of problems that have engaged the attention of welding experts of late. In other jobs, there comes the need for welding light metals to heavier metals, as for example, magnesium to cast iron, silicon to steel, aluminum to copper, etc. Progress along these lines has been shown until it seems that there are few impossible jobs of welding when it comes to handling unusual junctions.

A particularly interesting approach to these problems has been disclosed by Alfred M. Vang, chief research engineer, Stevenson, Jordan & Harrison, New York, using a form of capacitor storage welding, (see welding chart with this issue). In any form of resistance welding, use is made of the relatively high resistance that exists at the junction when two separate pieces of metal touch. Normally the resistance of the metal on either side of the gap is so small as to be negligible in comparison. There are several schools of thought on the subject of contact resistance, and research is still carried out on the nature and values to be expected. The electrical circuit, therefore, is that of two conductors separated by a higher resistance film at the high spots, and minute air gaps at other places. As the current passes across this junction the RI^2 loss heats the contacting surfaces, and a certain amount of the material nearby, by conduction. In any case, all that is necessary is to bring the touching faces up to fusion, whereupon the pressure between them causes an intermingling of the surface molecules, so that on cooling, permanent welding has occurred.

Time element control

Since the major part of the circuit resistance is between the layer of molecules on the high spots of one surface and a similar layer on the opposite surface, the problem according to Mr. Vang, is to apply sufficient current to bring about instant fusion and then to stop, because a longer flow of current will not only do no good, but will actually increase the temperature in the surrounding metal to a point to cause crystallization or to destroy any metallurgical characteristics which were inherent in the metals.

To prove the validity of this premise, the main problem was that of getting lots of current for an exceedingly short interval of time, a matter of a fraction of a millisecond, compared with the interval equal to a substantial part of a second that is ordinarily used.

Here an electronic tube proved to be a satisfactory solution, when it was constructed along the lines shown in Fig. 1. In order to shorten the current build-up interval to a small fraction of the usual time, it was necessary to reduce substantially the inductance of the circuit, and to utilize the principle of resonance at a frequency of several kilocycles per second. A welding transformer for this purpose would have a primary wound for high voltages (the condenser is usually charged to several thousand volts), a secondary, which is generally a single turn of extremely low resistance, on a core with a minimum of iron (which must be of a low-loss type so that it will be efficient at frequencies of the order of six kilocycles). Such a transformer will give satisfactory energy transfer, and will have low primary reactance. It is in fact an inverted Tesla coil in principle.

Two direction conduction

In a resonant circuit, as mentioned above, the electronic switch must conduct in both directions, something an ignitron or thyratron will not do. This resulted in a double-ended symmetric tube, several types of which are shown in Fig. 1. A tube of this type has no polarity characteristics once it is ionized, provided the reverse current follows along quickly enough so that deionization does not occur. Several forms are possible for the discharge tube, although none is difficult or expensive to construct.

This tube must be started by the application of an ionizing voltage to an external metallic electrode near the surface of the mercury—a voltage obtained by a spark coil or ignition coil of some type. As shown, the tube rests on metallic cushions which are located to give the high electrostatic fields at the right point, to start the ionization.

A set-up for studying the principle of resonant welding circuits, wherein highly damped oscillatory

(*Continued on page 226*)

Fig. 1. Several typical mercury tubes capable of handling thousands of amperes in capacitor welding

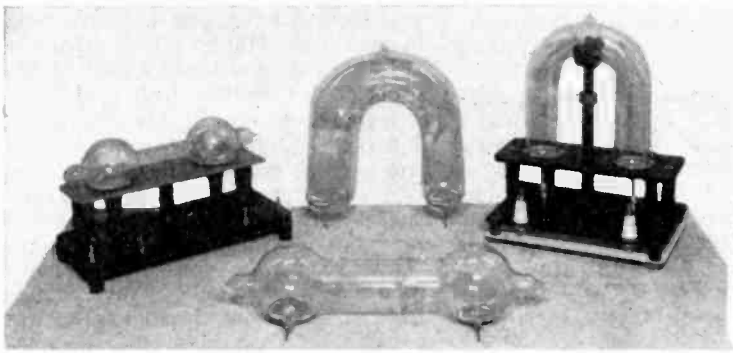
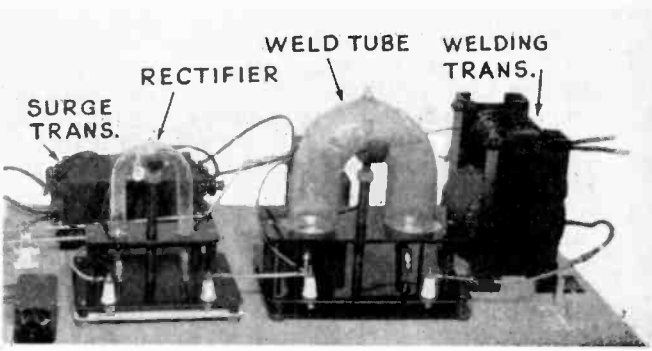
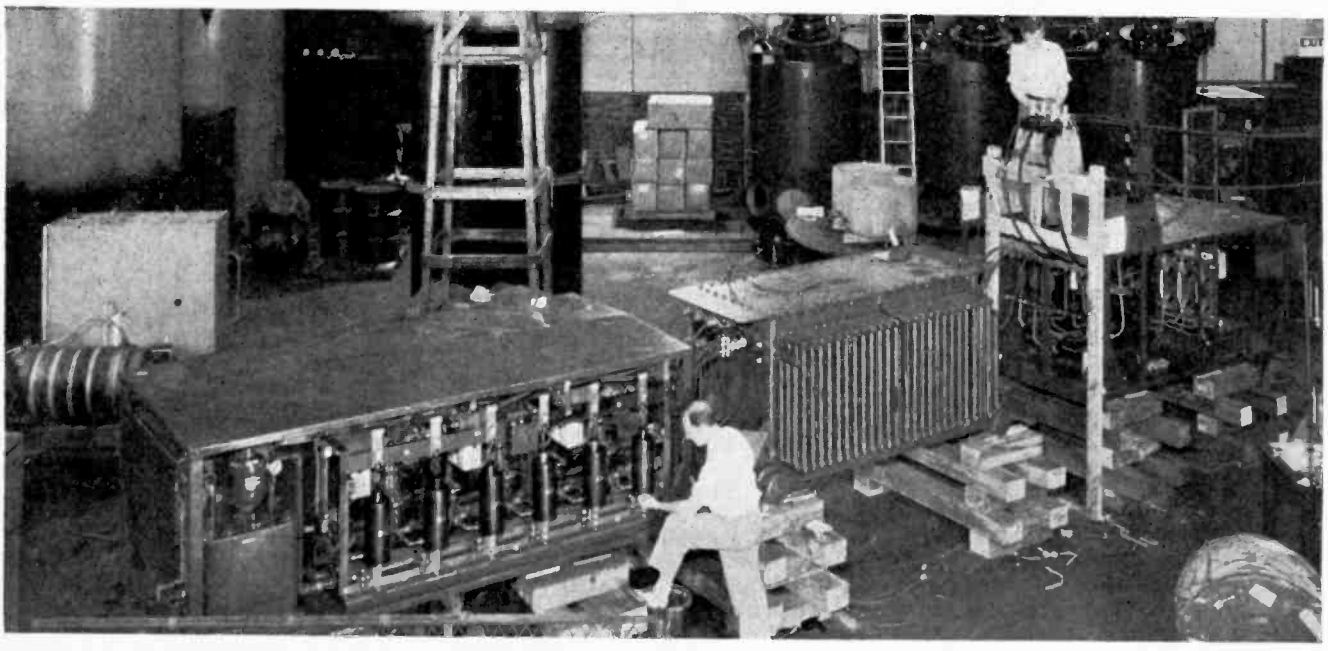


Fig. 2. Demonstration set-up showing essential parts of high frequency welding system





View of complete sealed ignitron rectifier equipment being made ready to undergo test

Ignitron Rectifier Testing

by LUMIR F. DYTRT
Switchgear Division, General Electric Co.

Using the oscillograph to determine the phase relations of anode and ignitor voltages

• Ascertaining relative phase relationships among main anode voltages, auxiliary anode voltages, and ignitor electrode voltages on power rectifiers of the ignitron type—a problem requiring solution at the time of initial testing of such rectifiers and sometimes on special occasions as those following rectifier repair, during trouble-finding operations, and prior to equipment installation—is perhaps best attacked with the aid of a cathode ray oscilloscope. Yet for many who are unaccustomed to using this instrument in any except its most commonly described applications, the problem may seem difficult. Such is not the case. It is only necessary to recognize certain facts to obtain correct results.

For example, let us consider the testing technic for a specific case. Assume that a cathode ray oscilloscope is to be used to find the phase relationships of the various voltages involved in a newly-constructed, three-phase, ignitron rectifier.

Such an apparatus, generally speaking, would have its ignitrons numbered in their firing or conducting-period order. That is, if ignitron No. 1 were considered as the first to be rendered conducting, ignitron No. 2 would succeed it in the transmission of energy 60 electrical degrees later; ignitron No. 3 would have its operation likewise deferred with respect to No. 2; and so on. Considered differently, this simply means that a 60-degree phase difference must exist between the two voltages applied respectively between each anode of consecutively numbered ignitrons and the common load, the phase of the voltage of a higher numbered ignitron lagging that of a lower number.

Ignitor phasing

Similar relations prevail among the auxiliary anode voltages considered as a group as well as among the ignitor electrode voltages. Since an auxiliary anode voltage is utilized principally for maintaining a sufficient degree of ionization in its ignitron to assure proper firing not only under full load conditions but also under light loads, the vector position of this voltage is in phase or slightly ahead of that applied to the main anode. Usually the extent of this lead is zero to 30 degrees.

On the other hand, since conduction takes place when the instantaneous supply voltage varies about its crest positive value, the preparation of the ignitron for conduction is delayed until the main anode voltage has risen somewhat. Then a sharp current impulse is passed through the ignitor-cathode circuit and an ionized state created, in an orderly way, throughout the ignitron. In other words, the ignitor-circuit pulse is made to occur sometime after the anode has had a rising, positive potential applied to it. Ordinarily, the instant at which this ignition pulse is brought into play may be shifted over a rather wide range by a phase-shifting circuit. But in rectifiers of the type being considered, the current peak is usually developed after the anode voltage has progressed about 30 degrees in its positive half cycle.

Keeping in mind this outline of the desired phase relations among the several voltages mentioned, we can consider the means whereby these voltages may be impressed upon an oscilloscope and their actual, respective phase displacements viewed. Several approaches toward this goal, incidentally, are available. That involving the cus-

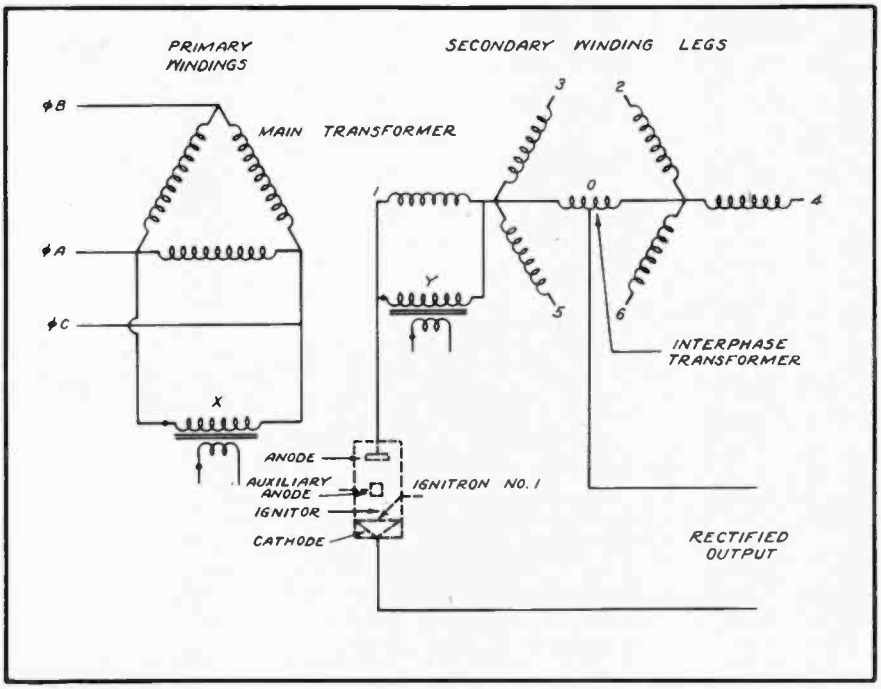
tomary procedure of applying one voltage to the vertical deflecting plates of the cathode ray tube and impressing a second voltage, which is out of phase with the first, on the horizontal deflecting plates and so producing a peculiarly inclined loop is not favored here, however, because of the difficulties inherent in the method when several quantities are to be measured. The alternate approach is not only more direct but also more satisfactory. This is dependent on successive reproductions on the fluorescent screen of each voltage wave in its true character and the noting of the lateral distances by which individual waves are removed from each other.

Viewing recurrent voltages

Hence, except for the need of presenting the successive voltage waves in their proper phase positions, it is obvious that the alternative scheme is identical with that used for viewing any recurrent voltage. Subjective voltages are applied in turn to the vertical deflecting plates of the cathode ray tube while horizontal deflections are again left up to the voltage developed by the sawtooth oscillator in the oscilloscope. To make possible the lateral wave shifts of the various voltages, however, the sawtooth oscillator must be actuated by a voltage whose phase is fixed with respect to those undergoing study. Evidently any one of the anode-load voltages may assume this control function.

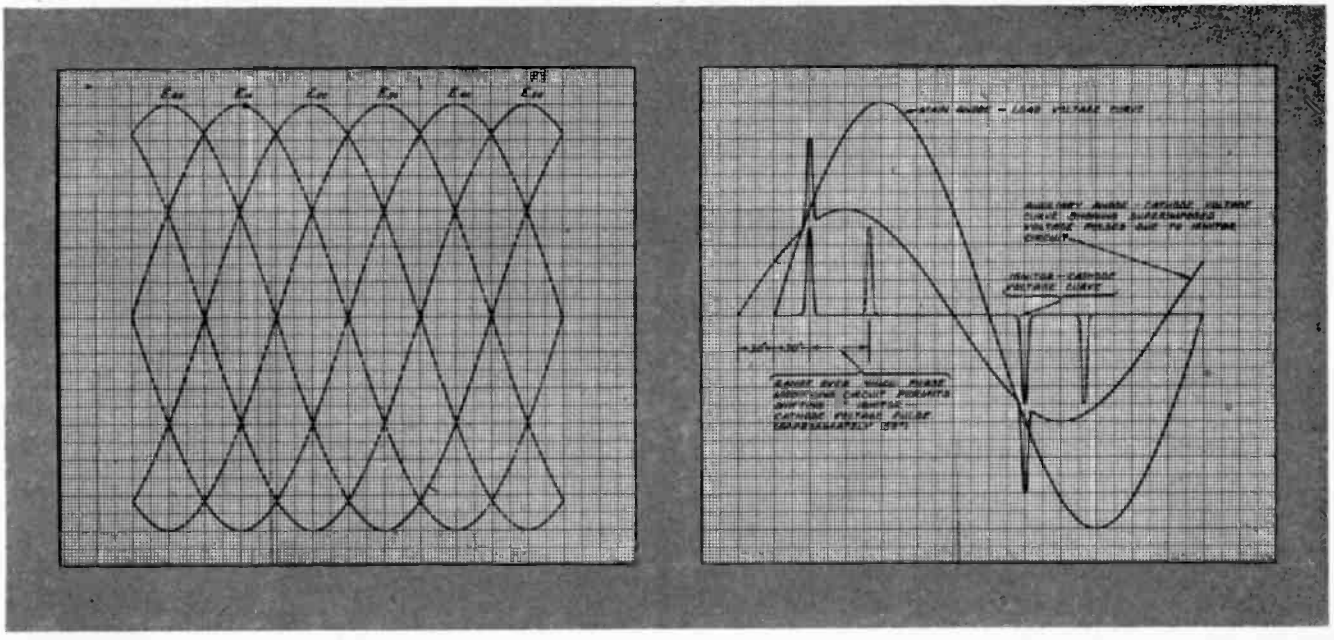
Usually there are two courses open to ascertain the phase positions of the voltages of an ignitron rectifier. The simpler of the two courses takes advantage of the fact that most large rectifier equipments are provided with service outlets, and the oscilloscope is operated from the same power source as that serving the rectifier. When such operation is possible, a potential signal voltage is introduced automatically into the oscilloscope. This voltage is fixed in terms of those under study because it is identically derived. Thus, it may be used for actuating the sawtooth oscillator merely by turning the oscilloscope's "Synchronizing Selector Switch" to the "60" or "Line Frequency" position.

The second course is only slightly more involved and should be used whenever the oscilloscope has to be operated from a power source independent of that supplying the rectifier equipment. At such times, of course, it again becomes necessary to obtain the requisite synchronizing voltage from the system connected to the ignitron rectifier. There are two ways to do this. One is by wiring a small step-down



Positions X and Y are alternative ones for the auxiliary transformer sometimes used to provide an external synchronizing voltage for the oscilloscope

Oscillographic traces recorded by successive applications to the oscilloscope of the several, 60-deg. displaced, anode-load voltages. Right—typical oscillograms obtained by successively applying to an oscilloscope the anode-load voltage, the auxiliary anode-cathode voltage, the ignitor-cathode voltage of any given ignitron tube



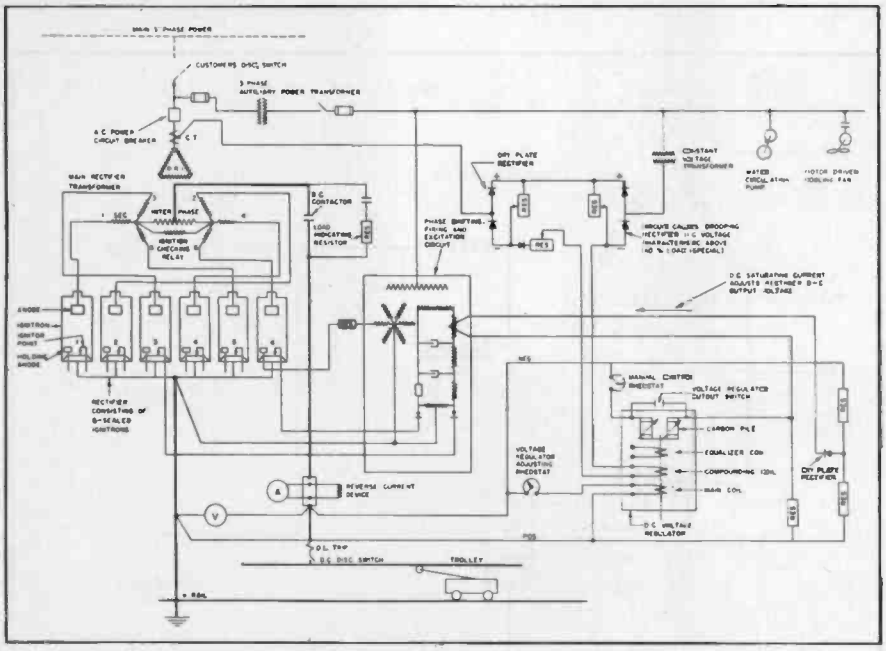
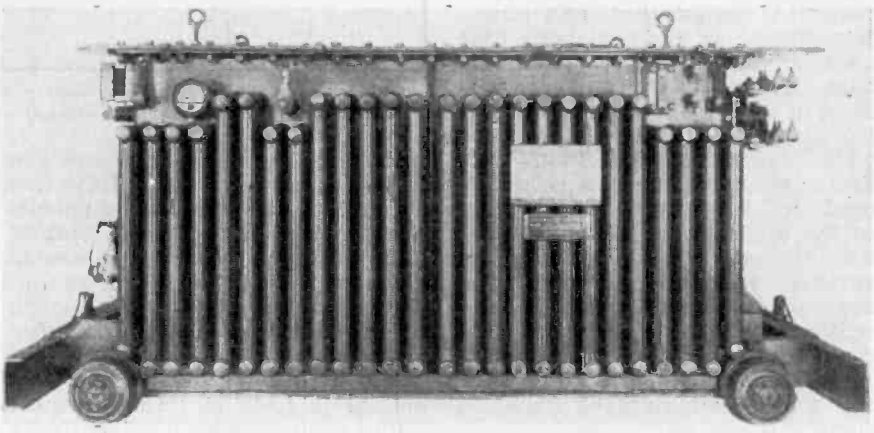


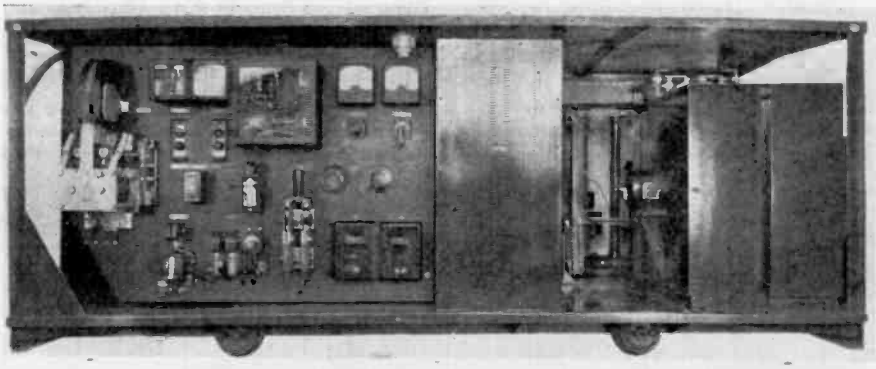
Diagram of a typical sealed ignitron rectifier adapted to mining service

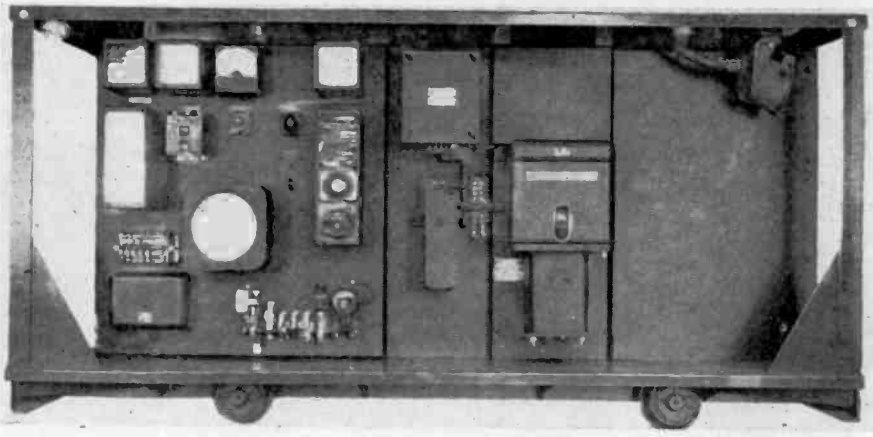
Right — rectifier transformer and its truck shown as a unit

Center—A number of the direct current devices of a sealed ignitron rectifier shown segregated aboard the dc car truck

Below—Certain of the alternating current switchgear elements of a sealed ignitron rectifier segregated aboard the ac car truck







transformer across a pair of the ac mains joined to the primary winding of one of the rectifier equipment's transformers. Any pair may be used, but for most easily interpreted results the pair having a voltage in phase with the anode-cathode voltage of No. 1 ignitron should receive preference. The second way is to place the step-down transformer across one of the secondary winding legs of the main power transformer. From the secondary of the step-down transformer a potential difference of the order of one or two volts should be derived for sawtooth oscillator actuating purposes. The synchronizing voltage obtained by either method should be applied thereafter to the "Ext. Sync." terminals of the oscilloscope and the "Synchronizing Selector Switch" then turned to the position marked: "Ext.".

Phase relationships

Following energization as well as adjustment of the oscilloscope and adaptation to it of an appropriate synchronizing voltage, it is possible to proceed to the examination of the phase relationships between the various voltages of the rectifier. First, however, all the ignitrons should be completely disconnected from the rectifier, and an artificial resistance load having a value of several ohms connected between each lead that proceeds to the ignitor of a tube and the cathode bus. Such an artificial load takes the place of that included in the normally closed circuit comprising the ignitor and the cathode mercury pool.

Then, working from the leads of ignitron No. 1, the anode-load voltage should be applied through a suitable potentiometer to the binding posts on the oscilloscope that are intended for a vertical-deflection-producing signal. A well-spread, single sine wave should now be projected on the screen of the cathode ray tube. The curve should be traced upon a light or translucent piece of rectangular coordinate paper fixed in place over the

(*Continued on page 224*)

Electronic Welding Controls

by RALPH R. BATCHER

Description of recent control methods provides guide to resistance WELDING CHART supplementing this issue

• Standard resistance welding is the familiar method by which metal parts are joined. In its simplest form the method entails pressing the two parts between copper electrodes and passing a heavy current through the work, melting the surfaces in contact. When the current is cut off, the fused metal is self-quenched by conduction of heat to adjacent areas.

In standard welding equipment the amount of current has in the past been controlled by adjusting taps on the transformer primary and the duration of current flow was estimated by the operator and controlled by a mechanical foot switch in the primary circuit. Obviously, many variations possible under such circumstances can, and do affect the quality and reliability of the welds.

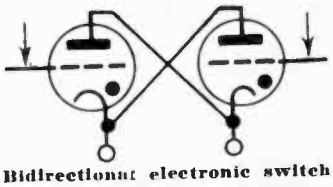
The welding chart included as a supplement with this issue shows the methods by which all of the elements that introduce these variations are handled by electronic tubes.

Typical modern resistance welders usually are equipped with air pressure sources controlled by solenoid valves for operation of the welder electrodes.

Two part problem

The whole problem can be divided into two parts. First, to apply sufficient pressure long enough ahead of the application of current to insure that the metals are tight against each other, and to see that this pressure is maintained throughout the welding time and sufficiently long thereafter to insure that the material is cool. Second, to apply the right amount of current for the correct interval of time. In order to accomplish both functions in the most effective manner, electronic devices of numerous types have been developed.

The first electronic application to welders was to replace actual metallic contacts of the contactor with the modern, sparkless type of contact provided by the ignitron tube, as in Weld-O-Trol system on chart. These tubes pass current only in



Bidirectional electronic switch

one direction, so it is customary on ac to use them in pairs connected "back-to-back." Therefore the symbol which is illustrated herewith indicates a simple electronic contactor or relay.

These tubes contain no moving parts and act as conductors only when an appropriate "firing" signal is applied to the starting electrode or ignitor, which is indicated by the arrows associated with the symbol. In the central portion of the chart, we have shown an electronic contactor of this type. It will pass welding current only when the terminals marked "weld initiating terminals" are connected together.

Before taking up the matter of welding current timing, we will first discuss the heat control circuit which is in series with the contacts referred to. The amount of heat provided at the weld, instead of being adjusted by changing the transformer turns-ratio, is controlled by the electronic method shown. The heat control circuit cuts down the current by delaying the firing of the ignitrons during each half-cycle until more or less of the cycle has passed. This delay is accomplished by a simple phase-shift network associated with the heat control circuit. The phase-angle is selected by the potentiometer, which is calibrated in per cent of full heat or weld current. This circuit, of course, has no influence on the total duration of the welding time, and is operative only while the ignitron firing circuit contacts are closed.

Welding current timing

The simplest system of automatically controlling the duration of the welding current flow is with the weld timer shown in Fig. 1 of the chart. With the work held between the electrodes, a foot switch is closed by the welding operator, starting the weld current. The current then is turned off by the timer after a selected interval. The circuit shown is a standard R-C time-constant interval control. All circuits on the chart are abridged and include only those parts essential to explain principles of operation.

Thyratron control

In each thyratron plate circuit is a relay that controls particular functions in the welding operation. The current through these relays and through the tubes is not completed until the grid circuit reaches a particular positive voltage after the cathode return is connected by other circuit elements. The latter condition is not fulfilled instantly, however. Before the cathode circuit is completed the grid condenser has been charged to a particular level depending on the manual setting of its control, blocking the tube. When the cathode circuit is completed, this condenser starts to discharge and a point ultimately is reached where the thyratron fires. The adjustment range covers an interval of from a few cycles of a 60-cycle current to several seconds.

In view of the important progress that electronic timing is making in many industrial fields, engineers not particularly interested in welding problems may want to study the circuits which provide many ingenious arrangements. Associated with Figs. 1, 2, and 4 is shown a time clock which indicates the sequence of the welding operations and the time that the thyratrons and their associated relays are operated. The latter intervals are shown by the circular arrows around the periphery of the clocks. It is, of course, possible to make any section of these time schedules shorter or longer as required by the work at hand.

In the desire to increase the reliability of the welds and to decrease the amount of time lost, further electronic controls have been devised which have been found to facilitate production es-

pecially when critical materials such as stainless steel are worked on.

In Fig. 2 a completely automatic weld and sequence system is shown which accomplishes the following additional operations: First, the "squeeze" time is definitely controlled by a squeeze timing circuit before the weld interval starts. In addition, several time intervals, following a prescribed heating and cooling sequence during the total weld time selected, are provided These are adjusted by the double timer, designated Heat-Cool. This heat-cool pulsation-producing circuit operates until the whole period allowed by the weld interval timer has been completed. Thereafter the solenoid that controls the squeeze pressure is still maintained during the hold period, until the work has cooled enough to be advanced. The pressure is then released and the work is advanced to a new position during the off time. By the closure of the repeat switch, a new cycle of operation is automatically started again, after a controlled waiting period (provided by the "off" timer setting) if the foot switch is held closed. Otherwise the operation awaits a reclosure of the foot switch to start off the next weld. Pulsation welding is useful in such jobs as welding of thick steel plate.

The next important improvement, in an effort to attain consistency in welding, is an electronic circuit which prevents transient currents from affecting the actual welding current, and, therefore, the strength of the weld. If the weld current happens to be initiated at an unfavorable instant in the cycle, a large surge results which appreciably affects the weld. This synchronizer insures that the closure for each weld current interval is made at the correct point on the cycle.

Synchronous operation

Use of such a system is called synchronous operation. A synchronizing circuit, which can be used in conjunction with the other control circuits for welder electrode timing is shown in Fig. 3. In addition the synchronizing circuits provide an extremely accurate weld time control, operating so that an exact number of half-cycles can be allowed. This is somewhat more precise than can be assured by the weld interval timer of Fig. 3, which has more magnetic relay contact circuits involved in its operation.

In each of these figures it is to be remembered that the two leads marked to weld initiating terminals control the active period. They are connected by wire to the designated terminals of the electronic contactor circuit at the center of the chart.

Two extra leads appear in the lower left part of the circuit connected to the primary of a surge transformer. These leads connect to the primary of the welding transformer and are used to trigger off the control tubes on the second halves of all cycles during the weld time interval.

Sequence timer

The combination synchronizing and weld timing circuit shown in Fig. 3 has been tied up with a typical sequence timer which controls the squeeze, hold, and off intervals and operation of the electrodes. The latter is similar to the circuit shown in Fig. 2 except that the heat-cool pulsating feature is omitted. The phantom circuits marked "squeeze," "hold," and "off" in Fig. 2 are identical to those shown in detail in Fig. 4.

For jobs such as continuous seam welding, a mechanical timer such as the type shown in Fig. 5 is of value. Here, the heat and cool timers are controlled by adjustable pegs placed on the rim of a rotating disk on a motor synchronized with the ac line wave.

Storage welders

In many locations, the heavy, intermittent current drains due to welding operations produce serious unbalance of three-phase power line systems and it has been found desirable to use a storage type of welder in which smaller amounts of energy are drawn from the line over longer intervals and stored up to provide energy to be dissipated in heat in the weld at one instant.

With storage welders, continuous operation is not possible since a small storage interval is necessary between each weld. There are two general types of such equipment available. At the lower left on the chart a magnetic type of storage welder is shown. A direct current builds up to a selected level in a high impedance winding. Upon breaking this current, the magnetic energy stored induces a heavy surge current in the single turn secondary, producing the weld. Since ignitrons will not cut off dc, this type of welding uses a mechanical circuit breaker in the welding transformer primary.

Energy storage welder

Another type of energy storage welder, shown at the lower right hand corner, uses the energy stored in the large banks of condensers. A heavy-duty six-tube three-phase full wave rectifier charges the condensers (which may be run to several thousand microfarads) to a definite voltage. They are discharged by means of an ignitron or other mercury-arc tubes into the welding transformer. In this system, tubes are used (1) to rectify the three-phase alternating current, (2) to insure that the preset voltage is attained in the condenser before it can be discharged and (3) to actually close the discharge circuit at the required time, and (4) to cut off the reverse currents due to the oscillating nature of the condenser discharge.

For further study of the circuits on the chart see article on circuit symbols, page 206.

DEFINITIONS—SEE ALSO CHART SUPPLEMENT

Squeeze Time: The time from application of pressure to the electrode actuating means until welding current starts.

Weld Time: The time that the welding current is applied to the work piece in making a single weld.

Weld Interval: The total "heat" and "cool" times (or total welding period) when using pulsation method.

Pulsation Welding: The method of making a single weld where the current is interrupted repeatedly, with continuous pressure on work.

Heat Time: The time that welding current flows between interrupted periods in pulsation welding.

Cool Time: The time that welding current is interrupted between heat times in pulsation welding.

Hold Time: The time that pressure is continued on the electrodes after the current is cut off.

Off Time: The time (in repeat welding) that the electrodes are separated from the work piece.

UHF Secondary Standard

Three crystal controlled oscillators generate family of harmonics to beyond 500 mc, accurate to 0.01 per cent

• With the frequencies on which various sorts of electronic equipment operate steadily climbing higher in the spectrum, some means of accurately checking in such realms is important. To fill this need, Ferris Instrument Corp., Boonton, N. J., has developed an rf calibrator containing a number of unusual features which permit its use on frequencies somewhat beyond 500 megacycles.

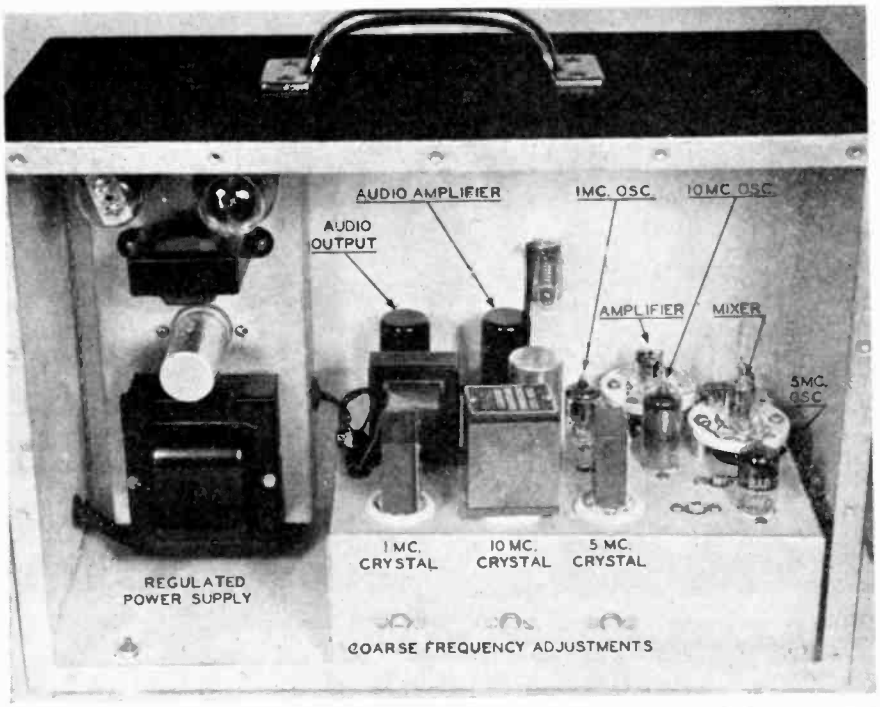
In its simplest aspect, the new instrument, styled model 34A, consists of three crystal-controlled oscillators, which may be accurately calibrated, combined with a self-contained detector and two-stage audio amplifier. There is thus, immediately available in one case, a secondary frequency standard of great accuracy capable of producing an extensive family of harmonics, and a means for detecting beat notes.

Accuracy of the three standard frequencies of 1 megacycle, 5 megacycles and 10 megacycles is within 0.01 per cent. The circuits are arranged to generate strong harmonics giving families of frequencies all having the same degree of accuracy as the fundamental. The harmonics are in general useful up to about the 30th or 40th, while under some conditions they can be used up to the 100th or even the 200th.

The strength of the harmonics at the higher frequencies is influenced to some degree by the tank circuit of the various oscillators, which may be tuned by means of the screwdriver adjustments located on top of the chassis.

At frequencies above those at which the harmonics of the 1 mc oscillator may be heard directly, they may be used to modulate on to either the 10 mc or 5 mc oscillators by turning both oscillators on. In this way the 1 mc points may be heard up to hundreds of megacycles.

The hundreds of standard frequencies thus generated appear at the terminals which are located on the panel of the calibrator, and are available either for the operation of some external device such as a receiver, or for heterodyning with any other rf voltage impressed on the terminals by an external source such as a signal generator. The beats between the external voltage and the internal standards will be audible in telephone receivers connected to the output of the audio amplifier, which is connected to a telephone jack located on the front panel. A gain control is provided for the adjustment of the audio level.



Internal arrangement of the Ferris uhf crystal controlled calibrator which provides three fundamental frequencies and harmonics beyond the 40th

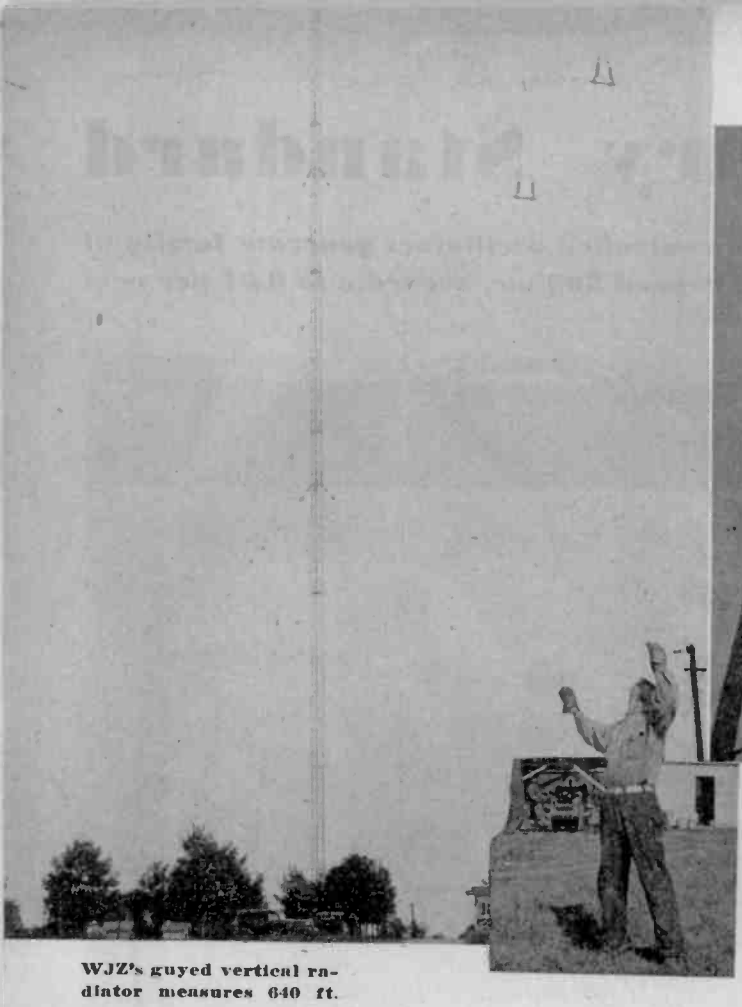
The three crystals used are of the low-drift type, ground and adjusted to their rated frequencies to within limits of 0.01 per cent, or 100 cycles per megacycle. The crystal oscillators may be tuned to exact frequency by means of coarse adjustments which may be reached with a screwdriver through holes in the back cover and fine adjustments located on the front panel. These fine adjustments consist of small 2-12 mmf condensers requiring about 10 complete turns with a screwdriver to cover this capacity range. One of the oscillators may be adjusted by beating against a radio receiver which is tuned to the Bureau of Standards, station WWV, and then the other two crystals beat with this one so that they will all be on exact frequency.

The uhf crystal calibrator is housed in a 10x13x6 case

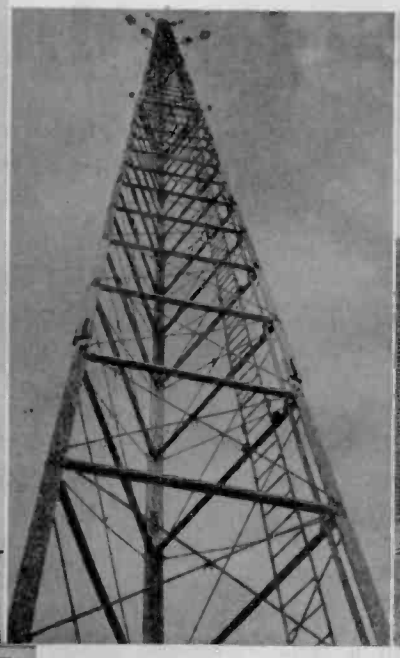
Power line operation

The calibrator is shipped complete with all necessary tubes, crystals, and a self-contained power supply unit for operation from the ac power line. The standard unit is for operation from 105- to 125-volt, 50 to 60 cycle supply. Power supply unit for any other reasonable voltage and frequency can be furnished.

The calibrator is housed in a spot-welded sheet steel case having panel dimension of 10 x 13 in., and a depth of 6 in. exclusive of knobs. A carrying handle, six-foot power cord, and pilot light are included in the standard equipment in addition to the controls already mentioned. Standard finish is fine-grained black wrinkle, with machine-engraved panel designations. Weight complete is 23-lb.



WJZ's guyed vertical radiator measures 640 ft.

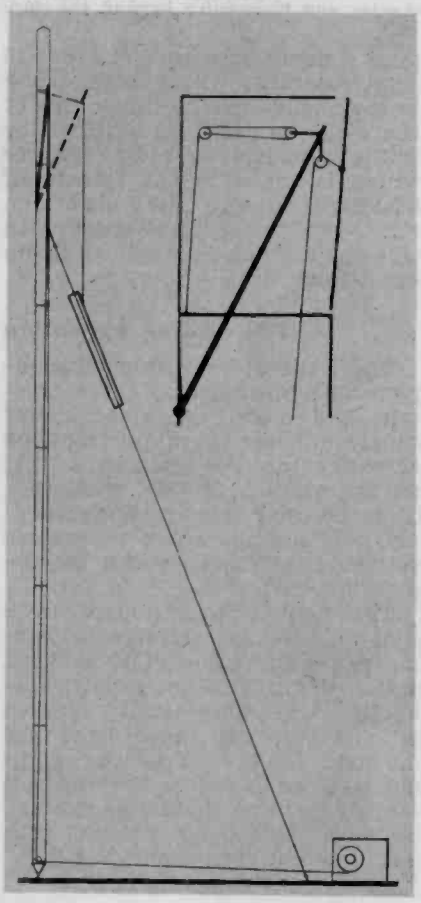


Tower is triangular, 6 ft. 10 in. on a side

Raising first section of the 43 ft. gin pole

How to Move

Dismantling operations are done from inside the tower



• If you were given the job of moving a 640-ft. guyed vertical radiator a matter of 45 miles, just how would you go about it? Assume, for the purpose of assembling your thoughts, that the radiator in question weighs in the neighborhood of 40 tons; that, by reason of the strain set up by the six sets of guys, the pressure on the base insulator runs the total effective weight up to approximately 150 tons; that the tower is a fabricated one which can be unbolted in a number of sections; that the tower must be re-erected in another location and therefore must not be damaged in any respect either during the time it is being taken down or while it is being moved to its new location.

That, in brief was the problem faced by engineers of the Blue network when the Office of War Information decided that it wanted to use the buildings and the land in Bound Brook, N. J. which for the past seven years have so well served the Blue's key station WJZ. The job was turned over to the Hartenstine-Zane Co., which put the tower up in 1936. The manner in which the work of leveling the big stick was carried out during the first three weeks of last month makes an interesting engineering story.

First, of course, a considerable quantity of gear was moved in. This included thousands of feet of steel cable, part of which was to be used for temporary guys, and a gasoline-driven hoist. Before that, workmen had been digging for a couple of weeks unearthing the extensive ground system that radiates out several hundred feet from the base of the tower.

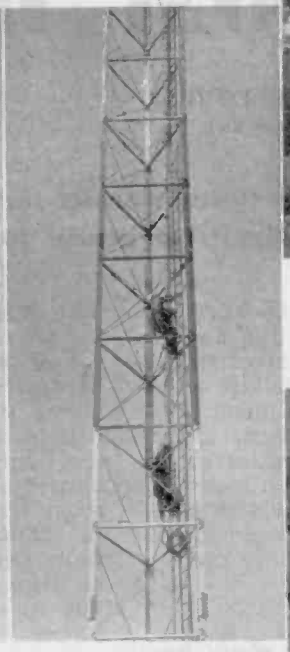
The tower itself is triangular in shape, 6 ft. 10 in. on a side, the same size all the way up to the top which is 640 ft. above ground level. There are 28 sections each 23 ft. in length, the odd footage being accounted for by the base insulator which rests on a sizeable concrete foundation.

Work from inside

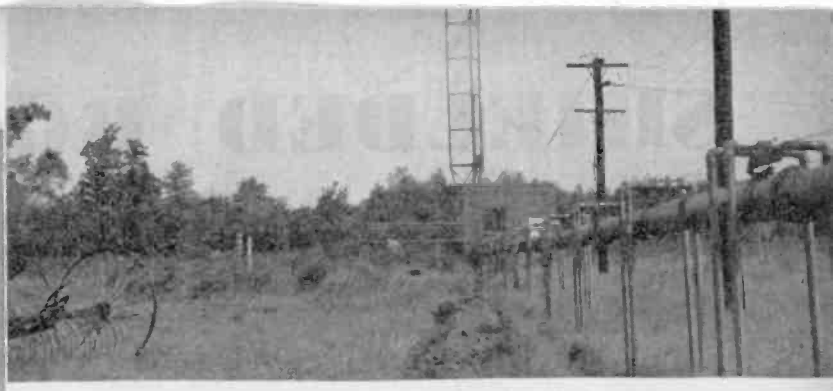
Because the tower is hollow, with the various sections bolted together instead of being partially welded, dismantling operations are relatively simple, though the operation still represents an engineering feat of no mean proportions. All the work is done from the inside of the tower.

First step is to hoist a gin pole, which is 43 ft. in length, assembled on the ground from two sections, to the top of the tower. There it is securely anchored at about the center of the second section from the top, the top section being the one that is coming off first, of course.

Gin pole is started up, remains inside tower



Lashings travel up with the gin pole



Power is fed to the tower through a feeder system extending several hundred feet to the transmitter house

The gin pole, hoisted together with its fastenings to the top of the tower, is in two sections, assembled on the ground

640 ft. Tower

Tackle is then arranged so that after one side of the triangle has been unbolted and fastened to the top of the gin pole, the whole works, gin pole and the loosened side piece can be swung out clear of the tower.

In the meantime a long slanting cable had been fastened near the top of the second section down and anchored at the ground to a "deadman" about 200 ft. from the base of the tower. The unbolted section is then maneuvered over the rundown cable, fastened to it, and slid down to the ground where it is picked up by a crane and deposited on a truck for transportation to its new resting place.

Dismantling proceeds in this sequence, until the whole tower is down, top guys being taken off just before the work reaches them and replaced by temporary guys. The bottom section, which bolts to the giant base insulator, is not dismantled. It is merely unbolted from the concrete foundation, picked up in one piece by the crane and lifted to the truck for transportation.

It requires approximately three weeks, depending on weather conditions, to completely dismantle the tower. Eventually the tower will rise in its new location at Lodi, N. J., which is about 45 miles from its recent site at Bound Brook, N. J.

Approximately 150 tons pressure is supported by the base insulator, representing weight of tower and strain on guys; this bottom section is not dismantled but is merely unbolted from the foundation and transported to the new location

SHIELDED ROOM DESIGN

by **FRANK S. McCULLOUGH**
Research Engineer, Vega Aircraft Corp.

Complete constructional details for building a laboratory effectively screened for all work

● Design, construction and maintenance of critical radio equipment has emphasized the need of adequate test facilities. One such unit required, not only by the design laboratories but also by maintenance depots, is an effective shielded room.

In a majority of cases, testing and design are carried on in locations that are electrically and acoustically noisy. These disturbances may lead to incorrect adjustment and subsequent failure of operation at some crucial moment. To circumvent this hazard, rooms shielded from these disturbances are essential. Since such rooms are costly, ranging from $400 to $3000, some details will aid those contemplating construction of such a room.

Detail of door construction and location of ventilating intake

Copper sheet best

Throughout this article the wording "shield" or "shielded" will be used rather than "screen" since the material used for isolating is copper sheet rather than copper or bronze screen.

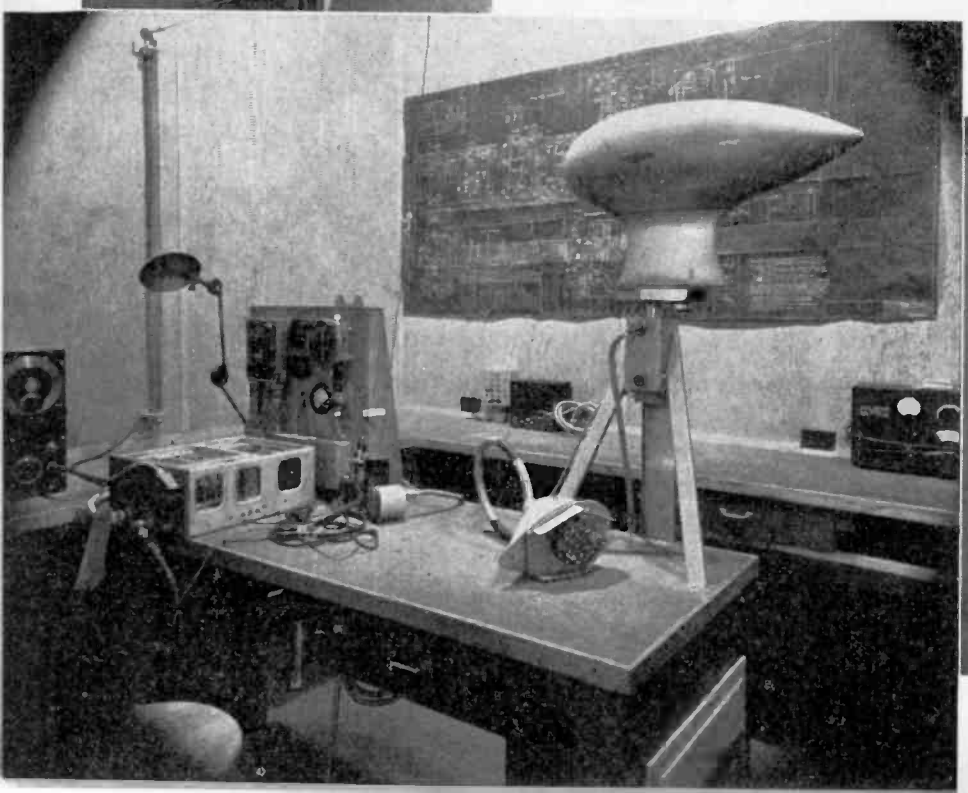
There are a number of reasons why copper sheet was used instead of copper screen. Since uhf is being used more and more extensively, it has been found that the rf penetration with sheet is less than with screen. In the manufacture of screen, lacquer is applied to aid in resisting weathering. This causes trouble. The lacquer creeps between the wire "cross overs" and allows areas of poor conductivity. Also in making soldered seams, unless the lacquer is completely burned off, the effectiveness of the room is seriously reduced. Since the rf waves impinging upon the walls penetrate only a few thousandths of an inch, copper sheet .004 in. thick is adequate. This copper is electrolytically deposited and is known as 3-oz. copper, and can be obtained in 30-in. widths, which makes it easy to apply.

Single point bond

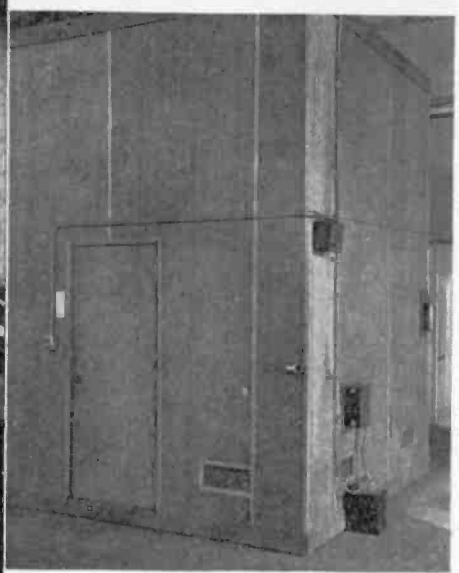
The shielding consists of two boxes, each one completely continuous; one within the other. Some shielded room users prefer to have the inner shield float, but in a majority of cases if care is taken, the method of bonding the two shields at one point is most successful. Leaving the inner shield floating will allow it to assume some charge above ground which will be a hazard if the personnel can touch both boxes at the same time.

The size of the room need not be very large since it is usually impracticable to have more than one

View inside the room showing location of various work tables



Outside of room showing isolation transformer and switches



person using it at a time because of possibility of interference. A convenient floor plan is illustrated and is 7 x 12 ft., with a ceiling height of 12 ft. This ceiling height is desirable when radio compass work is to be carried on. A lower ceiling could be used but it makes the pattern next to the loop more complex, and hence more difficult to compute. In addition, the higher ceiling aids ventilation.

Wood for the frame is kiln dried and thoroughly impregnated with raw linseed oil, prior to assembly. The linseed oil is for the purpose of retarding the dried wood from absorbing moisture. Much of the wood obtainable nowadays is usually insufficiently dried and the high moisture content impairs the effect of the two shields. In the event that kiln dried wood cannot be obtained, it might be well to face the 2 x 4 pieces with thin bakelite strips.

The frame-work is assembled exactly as one would build the room in a house. Construction will be easier if the floor frame is made first and the copper sheets fastened to it. Then the inner floor, made of tongue and groove, is laid. Now, using this as a base, the sides can be assembled. It might be best to mention now that using a width of material less than a surfaced 2 x 4 (1⅝ x 3⅝) is not recommended. To allow a space between the shields narrower than the 3⅝ in. dimension will decrease the benefit of the two shields.

Applying the copper

In order to simplify applying the copper, unroll the sheets on the floor in lengths that would go around the room and solder a number of these together. Make a fold as shown, lock the strips, and then solder. This insures a positive seam. It is far easier to solder these seams while they are on the floor than after they are on the walls. A 200- or 300-watt iron will supply enough heat to allow quite rapid soldering.

After the sections of copper sheet have been soldered, they can be applied to the framework. Hand stapling machines can be used advantageously to hold the sheet in place until all breaks and corners have been soldered and the wall covering applied. When the sheets are all in place the resistance as measured between the two shields should not be less than 200,000 ohms.

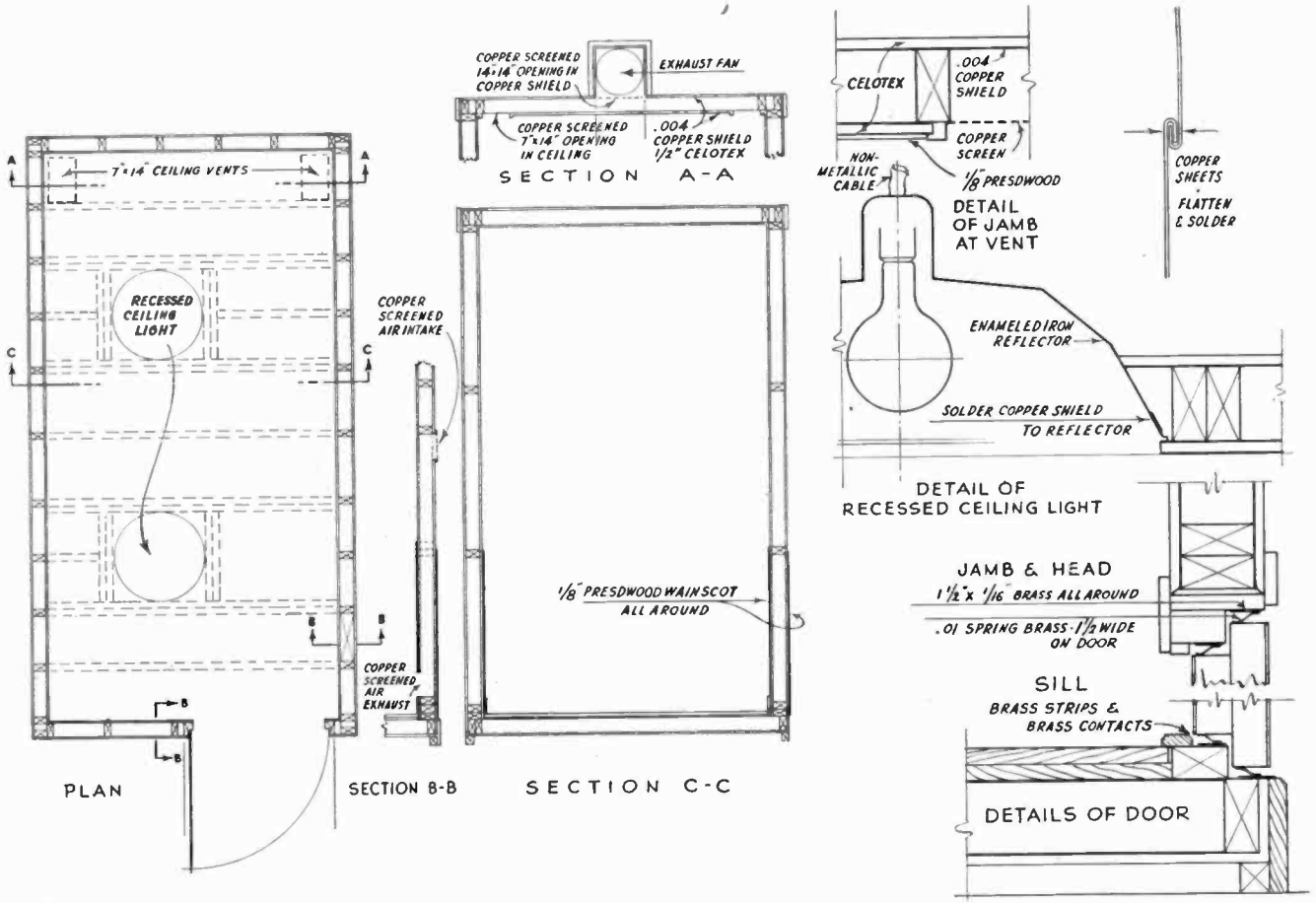
The type of wall covering will be dictated by the ambient noise level. If considerable noise is encountered, the outer and inner walls should be covered with Celotex or equivalent sound-absorbing material. Before applying the wall covering, all vents should be blocked in. In the application of the wall covering, care must be taken to insure that no nails pass from one shield to the other. This may be checked by attaching a bell and battery to the two sheets. If two nails are touching, the bell will ring and those nails can be withdrawn.

Ventilating cut-outs

Refer to Sections AA and BB in the plan for details of the ventilating cut-outs. Note carefully that the inside and outside vent holes are not opposite each other. The method shown increases the acoustic and electric paths and so decreases the losses due to cutting holes in the sheet. Due to such complete isolation a fan is required and should be of sufficient size to circulate the air every few minutes.

In calculating the size of the vents, keep in mind that wherever the sheet is cut through, copper screen (18 or 20 mesh) must be soldered completely over the hole. This is to preserve continuity of the

(*Continued on page* 216)



Plan for construction of the shielded room showing location of recessed ceiling lights and including detailed method of designing and building screened ventilating openings

CALIBRATING

Application of electronic-speeds production testing

An ingenious electronic control rotates the slotted drum to receive springs automatically measured to close tolerance

● A rather unique electronic-mechanical device for separating and sorting small instrument springs according to their stiffness or spring constant (k) has been developed by the Sperry Gyroscope Co. in cooperation with Aerotronics Products Corp., Great Neck, N. Y. The springs are small and tedious to handle.

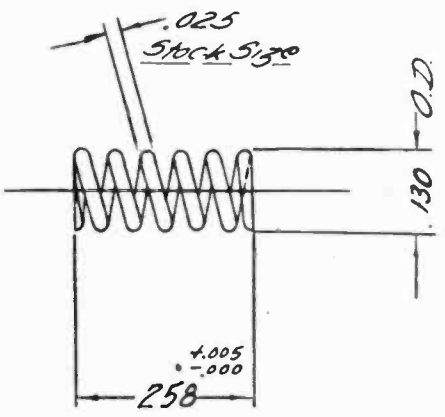
Last fall it was easy to see that with a stock backlog of almost a million unsorted springs, with deliveries from the vendors exceeding the existing sorting capacity, and with production demands rising sharply, something had to be done. Since the marketers of manual machines were at the time completely snowed-under, and the situation gave no promise of easing, the possibility of increasing the sorting rate by using more operators and machines was definitely out.

The specifications for these springs call for them to be packaged in successive ranges of stiffness. The relaxed length of all springs was held by the vendor to a very close tolerance, plus or minus .005. Therefore, if the relaxed length of all springs were to be assumed practically to be constant, then the deflection of a spring under a fixed load would be inversely proportional to the spring stiffness.

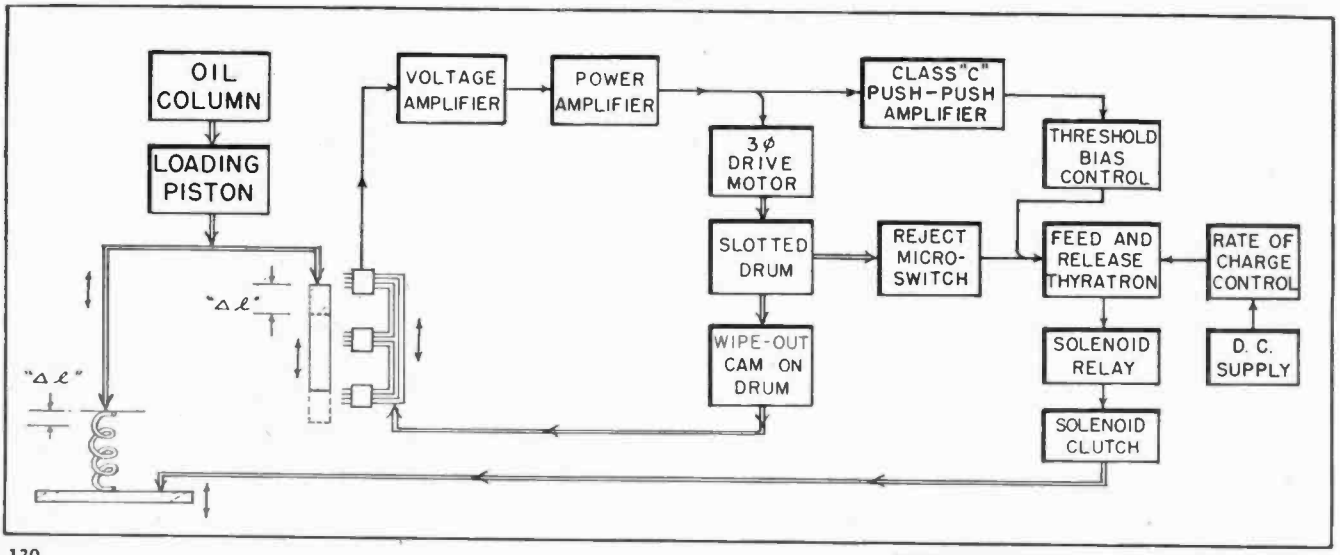
In the appended box diagram, an oil column is indicated. This oil column is fed from a reservoir which holds a constant height or hydraulic head of oil. The pressure of this column when applied to a spring through a piston serves as the fixed loading. The loading piston not only compresses any spring which is in the test chamber against an anvil, but also positions the armature of an electro-magnetic pickoff (E).

The pickoff (E) is essentially nothing more than a transformer with a single primary winding (center leg) and two secondary windings (on outer legs) connected in phase opposition. The pickoff armature, which is part of the transformer core, is movable. Varying the armature position varies the reluctance of the two magnetic paths and therefore dictates whether the upper-coil voltage or the lower-coil voltage shall dominate.

Dimensions of instrument springs to be calibrated



Block diagram showing components used in the spring calibrating equipment and the manner in which the device functions



SPRINGS

mechanical equipment and improves accuracy

Since the pickoff primary is excited with 115 volts, 400 cycles, the resultant secondary signal is a 400 cycle carrier with amplitude proportional to the armature displacement from center, and phase dependent upon the direction of displacement from center. The sorting problem resolves itself into two general functions: one, of getting the jumbled springs into and out of the test chamber in an orderly fashion, and two, of sorting each spring into the correct stiffness-range slot. If we follow the block diagram, both the problem of sorting and the elements of this particular solution are more easily understood.

A spring is automatically scooped from the hopper, slid into a chute, and fed into the test chamber. The piston compresses the relaxed spring from a length "L" to a new length of "L-prime;" the pickoff armature moves a length "delta L." A displacement signal proportional to "delta L" is fed into a phase-sensitive amplifier (push-pull 6K7's into push-pull 6L6's) which supplies power to a three-phase induction motor.

The three-phase induction motor drives a slotted drum located beneath the test chamber slowly around until a cam on the periphery of this drum has wiped out the displacement signal by moving the pickoff coil assembly to a position again even with the previously displaced armature.

As this occurs, the input signal voltage and the amplifier output voltage developed across points "1" and "2" of the three-phase motor drop to zero. It will be noted that this output transformer feeds voltage also to a Class "C" push-push amplifier stage, 117L7-GT's. When the grid signal voltage to this push-push stage drops, the average plate current is also reduced. This plate current drop results in reduced bias on the 885 feed-and-release thyratron which then fires, throwing on the relay in the 885 cathode circuit. This relay engages an electric clutch which causes a continuously-running dc motor to (1) draw back the anvil, (2) release the spring into the correct chamber of the drum, and (3) scoop up and feed another spring into the test chamber. The cycle is then ready to repeat.

(*Continued on page 220*)

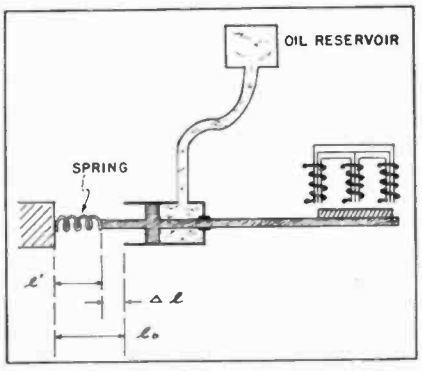
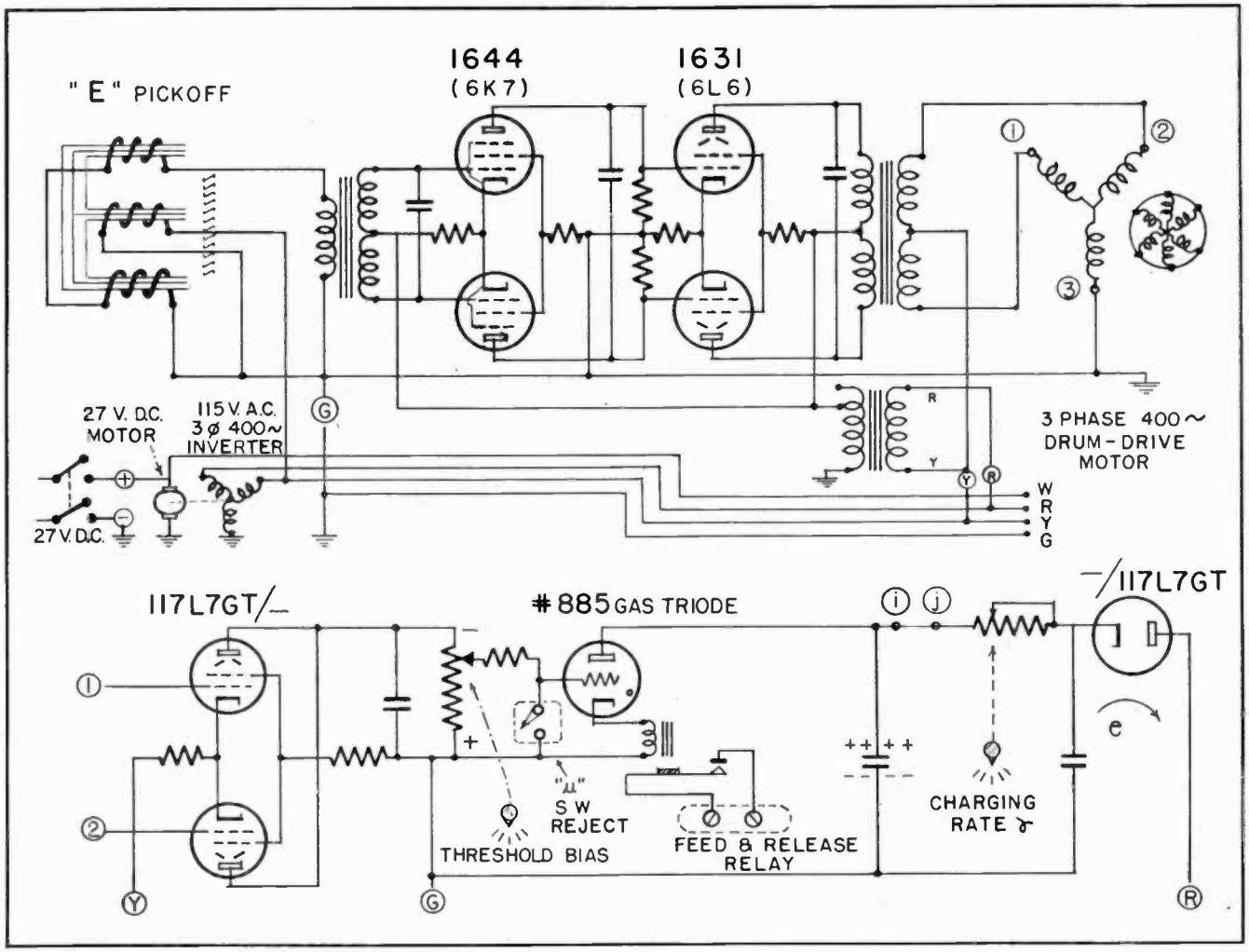


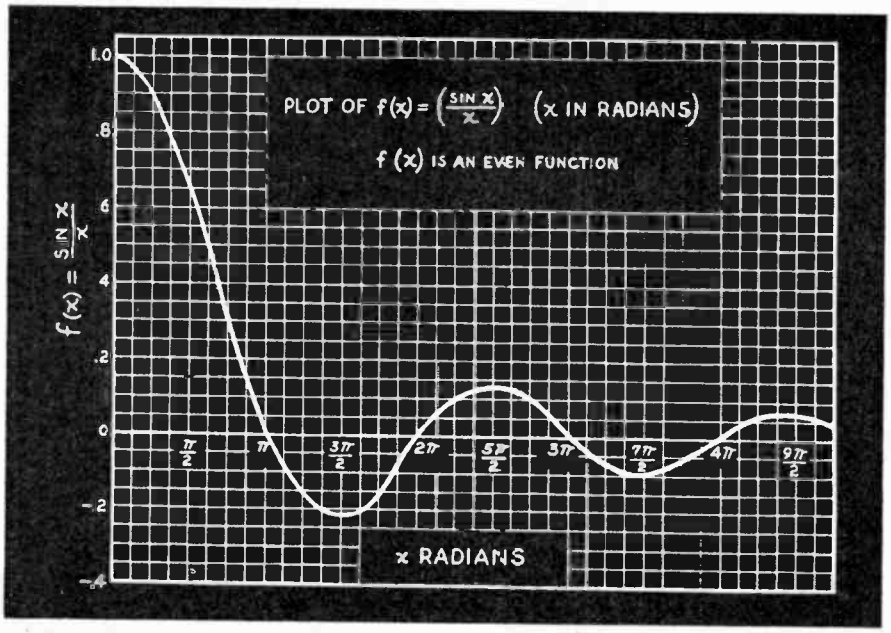
Diagram showing arrangement of calibrating equipment

Complete wiring diagram of the electronic-mechanical spring calibrating equipment



WAVEFORM ANALYSIS

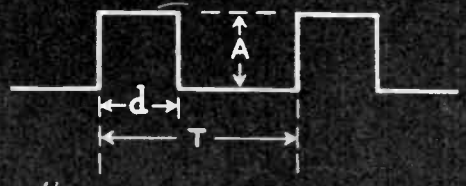
How to determine average values, RMS values, and harmonic amplitudes of common recurrent waveforms



● Recurrent pulses of many time-amplitude shapes are in use for testing and other purposes. The more common and most often used pulse shapes include the square, trapezoid, triangular, semi-sine, and sawtooth waves. While these and other recurrent non-sinusoidal waves can be analyzed by the Fourier Series, the process becomes tedious when large numbers of harmonics are present in the wave. For the common, more often used shapes, the average value, the RMS value, and the amplitude of the nth harmonic may be determined from the data presented here.

These charts are from the new handbook "Reference Data for Radio Engineers," prepared by the engineers of the Federal Telephone and Radio Corp. This new book was reviewed in the October issue of **Electronic Industries**, page 218.

1. Rectangular Wave

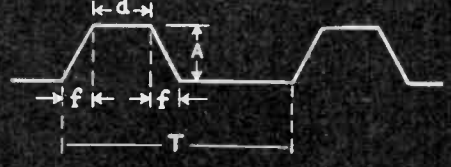


$$A_{av} = \frac{Ad}{T}$$

$$A_{rms} = A\sqrt{\frac{d}{T}}$$

$$C_n = 2A_{av}\left[\frac{\sin\frac{n\pi d}{T}}{\frac{n\pi d}{T}}\right]$$

2. Symmetrical Trapezoid Wave

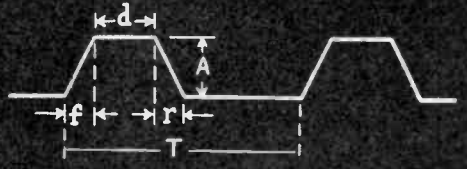


$$A_{av} = A\frac{(f+d)}{T}$$

$$A_{rms} = A\sqrt{\frac{2f+3d}{3T}}$$

$$C_n = 2A_{av}\left[\frac{\sin\frac{n\pi f}{T}}{\frac{n\pi f}{T}}\right]\left[\frac{\sin\frac{n\pi(f+d)}{T}}{\frac{n\pi(f+d)}{T}}\right]$$

3. Unsymmetrical Trapezoid Wave



$$A_{av} = \frac{A}{T}\left[\frac{f}{2}+\frac{r}{2}+d\right]$$

$$A_{rms} = A\sqrt{\frac{f+r+3d}{3T}}$$

If $f \cong r$

$$C_n = 2A_{av}\left[\frac{\sin\frac{n\pi f}{T}}{\frac{n\pi f}{T}}\right]\left[\frac{\sin\frac{n\pi(f+d)}{T}}{\frac{n\pi(f+d)}{T}}\right]\left[\frac{\sin\frac{n\pi(r-f)}{T}}{\frac{n\pi(r-f)}{T}}\right]$$

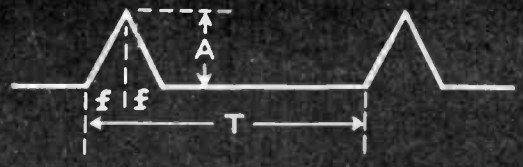
The symbols used are defined as follows:

A =	pulse amplitude	r =	pulse decay time
T =	periodicity	n =	order of harmonic
d =	pulse width	C_n =	amplitude of nth harmonic
f =	pulse build-up time	θ_n =	phase angle of nth harmonic

A_{av} = average value of function = $\frac{1}{T}\int_0^T F(t)\,dt$

A_{rms} = root-mean square value of function = $\sqrt{\frac{1}{T}\int_0^T [F(t)]^2 dt}$

4. Isosceles Triangle Wave

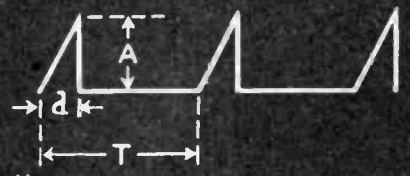


$$A_{av} = \frac{Af}{T}$$

$$A_{rms} = A\sqrt{\frac{4f}{3T}}$$

$$C_n = 2A_{av}\left[\frac{\sin\frac{n\pi f}{T}}{\frac{n\pi f}{T}}\right]^2$$

5. Clipped Sawtooth Wave



$$A_{av} = \frac{Ad}{2T}$$

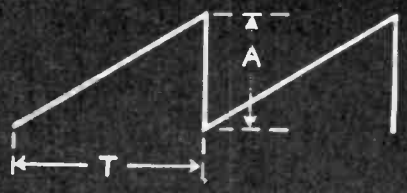
$$A_{rms} = A\sqrt{\frac{d}{3T}}$$

$$C_n = \frac{AT}{2\pi^2n^2d}\left[2\left(1-\cos\frac{2\pi nd}{T}\right)+\frac{4\pi nd}{T}\left(\frac{\pi nd}{T}-\sin\frac{2\pi nd}{T}\right)\right]^2$$

If d is small

$$C_n = \frac{2A_{av}}{\frac{\pi nd}{T}}\left[\frac{\sin\frac{\pi nd}{T}}{\frac{\pi nd}{T}}-1\right]$$

6. Sawtooth Wave

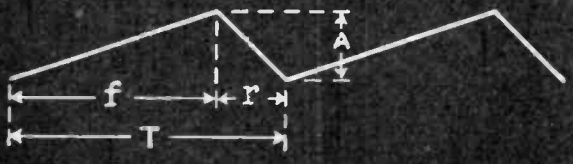


$$A_{av} = \frac{A}{2}$$

$$A_{rms} = \frac{A}{\sqrt{3}}$$

$$C_n = -\frac{2A_{av}}{n\pi}\cos(n\pi)$$

7. Sawtooth Wave

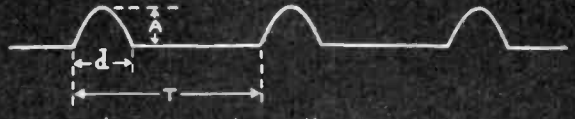


$$A_{av} = \frac{A}{2}$$

$$A_{rms} = \frac{A}{\sqrt{3}}$$

$$C_n = \frac{2A_{av}T}{\pi^2n^2f\left(1-\frac{f}{T}\right)}\sin\frac{\pi f}{T}$$

8. Fractional Sine-Wave

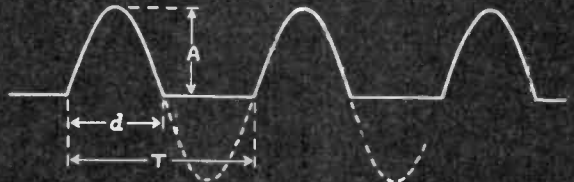


$$A_{av} = \frac{A\left(\sin\frac{\pi a}{T}-\frac{\pi d}{T}\sin\frac{\pi d}{T}\right)}{\pi\left(1-\cos\frac{\pi d}{T}\right)}$$

$$A_{rms} = \frac{A}{\left(1-\cos\frac{\pi d}{T}\right)}\left[\frac{1}{2\pi}\left(\frac{\pi d}{T}+\sin\frac{\pi d}{T}-4\cos\frac{\pi d}{T}\sin\frac{\pi d}{T}+\frac{2\pi d}{T}\cos^2\frac{\pi d}{T}\right)\right]^{\frac{1}{2}}$$

$$C_n = \frac{A_{av}\frac{\pi d}{T}}{n\left(\sin\frac{\pi d}{T}-\frac{\pi d}{T}\cos\frac{\pi d}{T}\right)}\left[\frac{\sin(n-1)\frac{\pi d}{T}}{(n-1)\frac{\pi d}{T}}-\frac{\sin(n+1)\frac{\pi d}{T}}{(n+1)\frac{\pi d}{T}}\right]$$

9. Half Sine-Wave

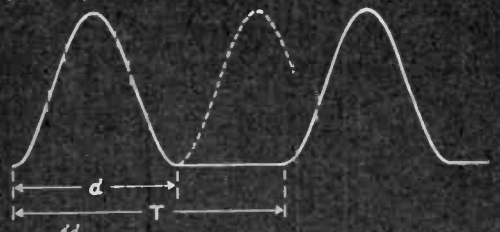


$$A_{av} = \frac{2A}{\pi}\frac{d}{T}$$

$$A_{rms} = A\sqrt{\frac{d}{2T}}$$

$$C_n = \frac{\pi}{2}A_{av}\left[\frac{\sin\frac{\pi}{2}\left(1-\frac{2nd}{T}\right)}{\frac{\pi}{2}\left(1-\frac{2nd}{T}\right)}+\frac{\sin\frac{\pi}{2}\left(1+\frac{2nd}{T}\right)}{\frac{\pi}{2}\left(1+\frac{2nd}{T}\right)}\right]$$

10. Full Sine-Wave

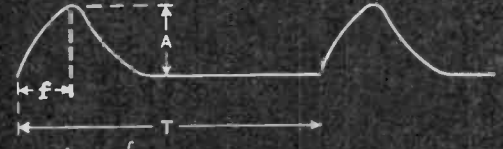


$$A_{av} = \frac{Ad}{2T}$$

$$A_{rms} = \frac{A}{2}\sqrt{\frac{3d}{T}}$$

$$C_n = A_{av}\left[\frac{\sin\left(n\pi\frac{d}{T}\right)}{n\pi\frac{d}{T}}-\frac{\sin\pi\left(1-n\frac{d}{T}\right)}{\pi\left(1-n\frac{d}{T}\right)}+\frac{\sin\pi\left(1+n\frac{d}{T}\right)}{\pi\left(1+n\frac{d}{T}\right)}\right]$$

11. Critically Damped Exponential Wave



$f(t) = \frac{Ae}{f}te^{-\frac{t}{f}}$ where $e = 2.718$

for $T > 10f$

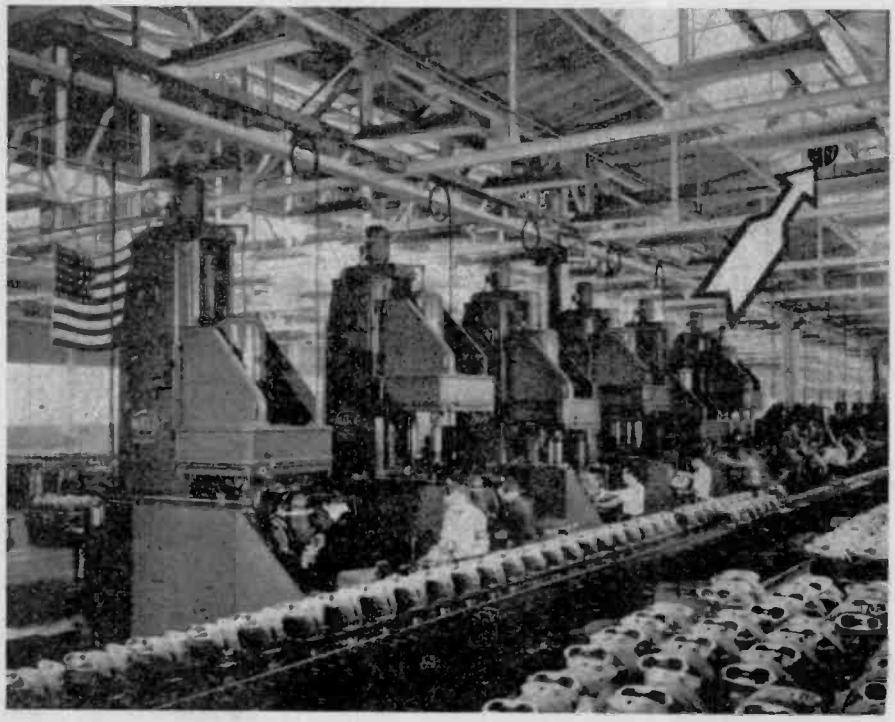
$$A_{av} = \frac{Aef}{T}$$

$$A_{rms} = \frac{Ae}{2}\sqrt{\frac{f}{T}}$$

$$C_n = 2A_{av}\left[\frac{1}{1+\left(\frac{2\pi nf}{T}\right)^2}\right] = 2A_{av}\cos^2\frac{\theta_n}{2}$$

$$\frac{\theta_n}{2} = \tan^{-1}\left(\frac{2\pi nf}{T}\right)$$

Electronic Tubes on the Job



Despite a noise level of approximately 87 db, music is being used effectively as an aid to production in the main machine shop at the Wright Aeronautical Corp., Lockland, Ohio. Arrow indicates location of the speaker, installed by Operadio Mfg. Co., St. Charles, Ill. Below: Use of germicidal ultra-violet rays in Westinghouse plant to prevent spread of foot infections

Intrusion Detection

An effective type of "intrusion detection," as it is termed by operating engineer P. C. Pray, is being used by the New England Power Co., for the protection of its property in Boston. In its simplest aspect it consists of a capacity balanced circuit. When anyone approaches within a couple of feet of insulated antenna wires surrounding the plant, the balance is upset, tripping a relay which turns on a battery of flood lighting lamps. Equipment was made by the Browning Labs., Winchester, Mass.

Car Theft Alarm

Theft from parked automobiles would be less likely if alarm equipment designed by A. Edelman, Photobell Corp., 116 Nassau Street, New York, was more widely in use. The alarm consists of high voltage generating equipment operating from the car battery which "charges" the whole car with "static" electricity. When any unauthorized person touches the car, discharge of the "static" operates to energize a relay and sound the alarm, which may be the car horn. Under one of the fenders there is a discharge button, location of which is known only to the owner. This permits the owner to unlock and enter the car without setting off the alarm.

If the Shoe Doesn't Fit

A new use for germicidal ultra-violet tubes is in the industrial shoestore of Westinghouse's East Pittsburgh, Pa., works. About 1,000 pairs of steel-capped safety shoes are sold to the workers each month. As a safeguard against the spread of foot infections, shoes tried on and found not to fit are treated to a few minutes' exposure to the 2537 Angstrom units radiation of the horseshoe-shaped tubes shown.

Hoover, Jr., Improves Oil Prospecting Process

Improvements on the "artificial earthquake" method of petroleum prospecting, which may help to replenish the nation's dwindling supply of oil, have been patented by Herbert Hoover, Jr., and his colleagues, Charles Gill Morgan and Norman J. Christie.

The patent outlines a method for continuous exploration of rock layers below the earth's surface by setting off explosives, then picking up

the man-made earthquake waves as they are reflected back to the surface from rock beds. From this pattern of sound waves it can be interpreted where oil-bearing regions are likely to be found.

Heretofore such continuous exploration in these areas has been considered unpractical, forcing engineers to depend on less reliable methods. The improved procedure is covered by patent 2,329,721, and assigned to the Consolidated Engineering Corp. of Los Angeles.

Electrical Tests Classify Mica for Capacitors

Recent work by Bell Telephone Laboratories for the War Production Board under the direction of J. R. Townsend, in the development of electrical test methods proposed by K. G. Coutlee for classifying block mica quality for use in capacitors, has opened an entirely new approach of quality control of mica based on functional requirements, reports F. J. Given in Bell Laboratories Record.

A prime requisite of capacitor mica is that it must have no veins or spots that are electrically conducting. That property is easily established by laying a specimen of block mica on a metal plate of a testing instrument and running an electrically charged test point over the surface. A spark coil supplies the high voltage and if there is electrical conduction a visible glow or sparkle takes place and the piece is discarded as unsuitable for capacitor use.

After the spark test has been passed the next question is, "How much energy is lost in the material at the high frequencies now used in radio?" A specimen of block mica is placed between two metal plates of an electronic testing instrument and a high-frequency voltage applied. A direct measurement of the electrical loss is then read on a meter. The amount of loss indicates the grade of capacitor for which the material will qualify.

Tests prove satisfactory

Samples of relatively poor quality (as judged by visual standards) from several domestic mines have been made up into condensers. Subsequent measurements in the Laboratories showed that the correlation between the electrical tests on raw material and finished capacitors were satisfactory and that the films from the poorer quality block appear suitable for many capacitor applications.

These preliminary tests on block mica samples appear to indicate fairly reliably the electrical quality of film that can be split from it. This means that it should then be possible to use the two testing instruments which are battery operated and portable, at the mine and in the processing plant, to sort out material for various end uses with the expectation of good results.

The greatest immediate promise of this proposed system is the release of stocks of mica for capacitor use which are now standing idle due to uncertainty as to exact quality by visual classification. At the request of the War Production Board, an extensive commercial manufacturing trial of capacitors made with such mica classified for electrical quality by the proposed system is now in progress under the direction of the Bell Telephone Laboratories.

Spotting Vibration Troubles

An electronic vibration-velocity meter was called in to detect the cause of vibration in grinding machines at the plant of John Bath & Co., Worcester, Mass., manufacturers of precision taps. The vibration in one machine in particular was causing a large number of rejects.

Gears caused trouble

An investigation made with the aid of the instrument revealed that a set of gears in this machine, apparently in good condition, caused the vibration. Replacing the gears eliminated the difficulty. The Bath concern also found the meter valuable for locating low-vibration areas in its plant, thus facilitating the placing of new equipment in areas where maximum operating efficiency was assured.

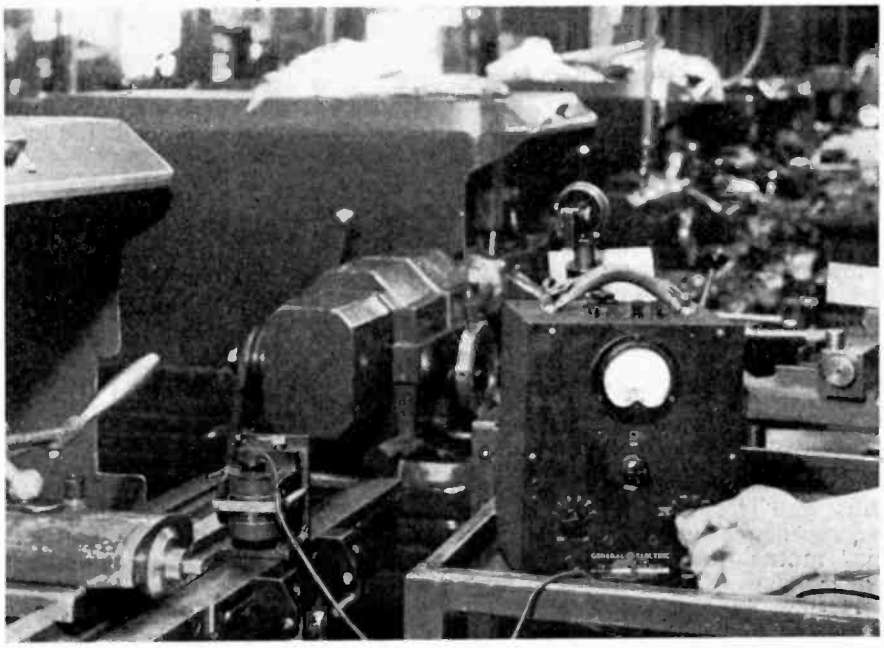
Consisting of a vibration pickup and electronic amplifier, this General Electric unit measures vibration velocity and, together with an integrating unit, vibration displacement. The vibration is analyzed graphically, if desired, by the use of an oscillograph fed by the amplifier.

Electronic Fiber Testing

In Research Paper No. 1546, U.S. Department of Commerce, National Bureau of Standards, A. M. Sookne and H. A. Rutherford describe an autographic load elongation apparatus for fibers. The instrument records the dependency of elongation of an individual fiber on the load, and vice versa.

One end of the fiber under test is attached to one beam of a balance and the other end to a movable platform. A movable chain constitutes a variable load for the other side of the balance. The fiber may be either elongated or loaded continuously by automatically moving the platform or the chain. At the same time a photoelectric control maintains the balance pointer at zero, and a recording system is operated. For constant rate of elongation the load is recorded continuously, but for constant rate of loading the elongation is only recorded at intervals.

Vibration velocity meter amplifier; pickup on bed of machine at left permits measurement of both intensity of vibration and direction of movement



SURVEY of WIDE READING

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

On V-Cut Quartz

J. E. Benson (Amalgamated Wireless of Australia Technical Review, Vol. 6, No. 2, 1943)

V-cut quartz crystals are plates having one side in the direction of the crystallographic x-axis; the normal to the plate is at an angle V to the z-axis. While a general account of modes of vibrations is given, the frequency jumps with temperature in the thickness or X_y-shear mode of V-cut crystals is particularly investigated. It is attributed to interference from other modes as indicated by the corresponding equations and a comparison of the calculated and observed frequencies. Design considerations are deduced.

Space-Current in Vacuum Tubes

B. J. Thompson (IRE Proceedings, September, 1943)

A survey of the knowledge of space charge and potential distribution in plane and cylindrical diodes is given. Effects of initial electron velocities are considered. Triode behavior is also studied.

On Electron Lenses

R. G. E. Hutter & L. Morton (Physical Review, September, 1943)

The contents of two papers is reported which were read at the Stamford Meeting of the American Physical Society on July 10, 1943. They deal with the validity of lens equations and magnification formulas of light optics for electron lenses and with optimum conditions for apertures of magnetic electron lenses of a particular field form.

On Inductance-Coupled Stages

K. R. Sturley (Wireless Engineer, London, September, 1943)

Generalized selectivity, phase shift, and trough and peak transfer impedance curves are developed for mutual-inductance coupled tuned stages of differing Q, L and C values but having a common resonant frequency. The curves are given as a function of the off-tune frequency for selected values of coupling coefficient and magnifications of primary and secondary circuits as parameters.

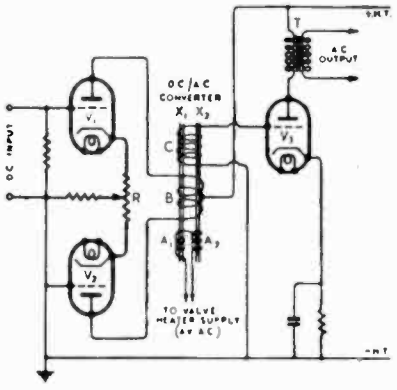
DC/AC Converter

T. A. Ledward (Wireless World, London, August, 1943)

The action of the dc/ac converter is based on the polarization of converter cores X_1, X_2. For zero dc input the currents through the two sections of winding B are balanced. Upon application of dc, this balance is upset and cores X_1, X_2 become polarized producing even harmonics in the alternating flux which is established by oppositely-connected ac exiting windings A_1, A_2. Normally no voltage is induced in winding C, but the polarization in X_1, X_2 due to winding B is in the same direction so that the even harmonic components of flux are additive and an even harmonic voltage is induced in C. This voltage is amplified and may be rectified if desired.

The two windings B and C may be replaced by an autotransformer divided into sections and coupled to two push-pull connected tubes through another transformer. Calibration curves were taken with this circuit arrangement and an output of 177 volts and 31.5 mA RMS was obtained for an input of 100 mV. The sensitivity may be increased by the use of feedback or additional amplifier stages. Details of the converter core assembly made of Stalloy are given.

DC/AC converter with high impedance tube input circuit



Magnetic Properties of Magnetites

E. F. Herroun (Proceedings of the Physical Society, London, Vol. 55, Part 4, No. 310)

Comparative measurements of permeability and coercivity of solid and powdered magnetites were carried out and the results are given in tables. The powders were either mixed with a binding material and compressed so as to form rectangular bars or were used in tubes.

The effects of powdering were found to be the following: permeability is reduced by powdering, the reduction being greater in proportion for magnetites of higher initial permeability; maximum permeability is reached at higher forces with powders than with solids; coercivity is increased in the case of magnetites of low initial coercivity, but decreased with those of high coercivity, while for some of intermediate value there is very little change.

A note is added on the remanent magnetism acquired by a bar of magnetite or self-hardening steel cooled in a magnetic field.

Camera for Stereoscopic Microradiography

G. L. Clark and R. W. Eyler (Review of Scientific Instruments, September, 1943)

An adapter has been designed which may be fastened to standard X-ray tubes to permit the taking of stereoscopic micrographs. When viewed with a stereoscope, two associated pictures give an idea of the three-dimensional distribution of the constituents of the specimen. Details of the apparatus are given.

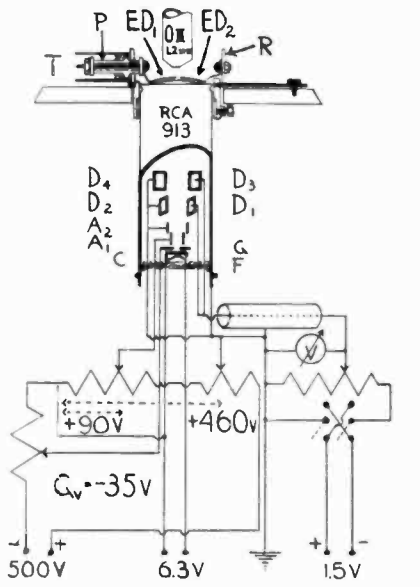
Losses in Powder-Cored Coils

V. G. Welsby (Electronic Engineering, London, September, 1943)

A suitable equivalent circuit is set up representing the inductance of the coil, the associated dc resistance of the winding, the ac losses in core and winding, the winding capacitance and dielectric losses in the insulation. Assuming some of the constants to be small as compared to others, simplifications

of the rather complicated expressions for the effective inductance and resistance of the coil are obtained.

Based on these equations, the constants of a coil as usually measured are discussed and the various effects caused by the different impedance components considered. Changes in the effective resistance and inductance of coils resulting from screens, eddy current losses in the winding and magnetic losses in the core are explained in detail. A graphical analysis based on measurements for evaluating the various core-loss coefficients is given and possible errors are indicated.



Cathode ray tube voltmeter

CR-Tube Voltmeter

Z. V. Harvalik (Review of Scientific Instruments, September, 1943)

An RCA 913 cathode-ray tube has been adapted for the determination of low radio frequency or dc potentials with a very low power input. To read the deflection, the cathode ray screen is viewed through a microscope, but the structure of the fluorescent screen does not permit an accurate reading if the magnification exceeds 30 times.

To obtain an exact reading of the beam deflection, external deflection plates ED_1, ED_2 (made of copper) are pressed against the screen of the tube in a distance of 1 mm. apart. A bright grain on the fluorescent screen is arbitrarily chosen as reference grain and the beam moved to the edge of this grain by adjustment of the potential on the internal deflection plates, D_1, D_2, D_3, D_4. The grain is still bombarded by electrons and is therefore fluorescent. Then the potential to be measured is applied to the external deflection plates causing the beam to move and the grain to stop fluorescing. A compensating potential on the internal deflecting plates is adjusted until the reference grain again becomes fluorescent; the compensating potential is measured by a millivoltmeter. The system is calibrated by applying known voltages to the external plates.

If a magnification of 900 times is used, the sensitivity is 0.01 volt, and it is stated that if specially designed tubes with excellent vacuum and low plate potentials were used, the sensitivity could be increased to at least 0.001 volt. Another advantage of this external plate system is its very high input impedance.

Fourier Analysis

M. A. S. Ross (Nature, London, September 11, 1943)

A method to evaluate the Fourier series coefficients up to the thirtieth is explained. Use is made of Bessel's solution for the coefficients involving sixty values of the function to be analyzed at successive intervals of a sixtieth of a period. The required sine and cosine terms times all values of the function from 1 to 99 had originally been developed and made available by C. A. Beevers and H. Lipson for computing Fourier synthesis. The whole process of calculating and checking a Fourier analysis can be carried through for twenty-nine harmonics in less than two hours.

Recurrent-Surge Oscillograph

E. L. White (Journal of Scientific Instruments, London, August, 1943)

A recurrent-surge oscillograph combines the functions of generating periodic voltage surges to be applied to the circuit under test, and of operating the oscillograph so that the recurrent traces are superimposed on the fluorescent screen.

The particular high-speed oscillograph designed has a time base covering a range of sweep speeds from 200 to 0.5 mm/μsec. at a recurrence frequency of 100 sweeps per sec. A single sweep is obtained by applying a positive tripping pulse to the grid of G_6 so that the latter becomes ionized. C_6 then discharges through the tube and resistor R_9, generating a positive voltage across R_9 and making the grid of G_1 positive with respect to its cathode, thereby initiating a discharge in G_1 which in turn causes G_2 to conduct. The balanced sweep circuit including G_1 and G_2 generates a time base voltage of the form $e = E^{-t/C_1R_1}$, resulting in a reduction of speed of about 25 per cent during the traverse. Since the timing scale is calibrated by a timing calibration, this change in speed is tolerable.

It is arranged that impulse waves and timing oscillations are generated by alternate pulses from R_9, so that both traces can be inspected simultaneously on the screen.

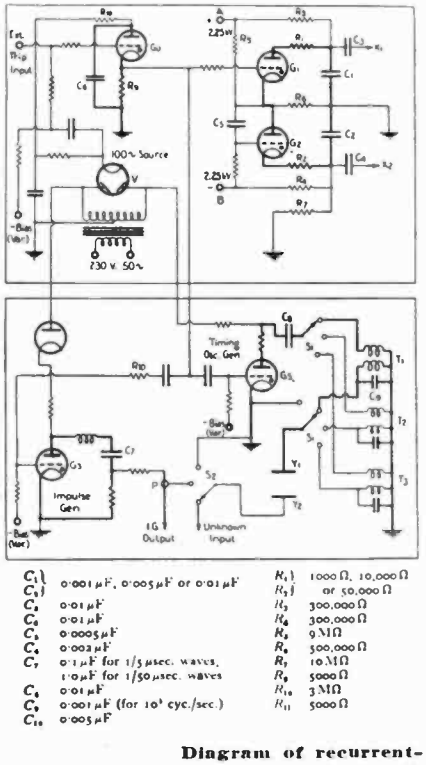


Diagram of recurrent-surge oscillograph

The impulse generator develops negative pulses of 1/50 or 1/5 μsec. If desired, a chopping circuit may be connected to the impulse generator. The three alternative transformers T_1, T_2, T_3 of the timing oscillator are tuned to 1 mc, 500 and 100 kc, respectively. The return strokes of the time base circuit form a zero voltage line. Switch S_2 permits obtaining a record of the impulse voltage applied to the circuit under test.

On Buna S Compounds

A. H. Selker, A. H. Scott and A. T. McPherson (Journal of Research of the National Bureau of Standards, September, 1943)

Tests with Buna S compounds containing gilsonite are reported. These compounds have properties that render them suitable for the insulation of communication cables, the principal objection being their

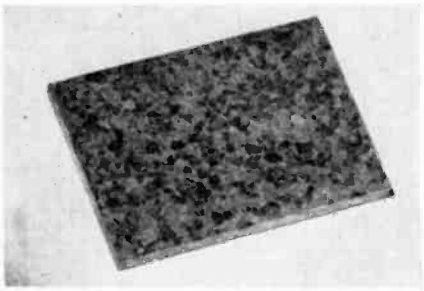
(*Continued on page 212*)

WHAT'S NEW

Devices, products and materials the manufacturers offer

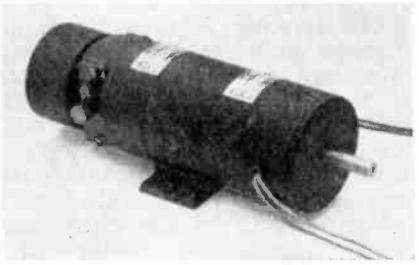
"Plasticeramic"

Printloid, Inc., 93 Mercer Street, New York, has recently developed "Plasticeramic," a plastic insulating material closely related to polystyrene, now available in sheet form. It is claimed to have better machining qualities and the ability to withstand approximately 20 deg. F. higher temperature than polystyrene with almost equal electrical characteristics at high frequencies. It can be supplied in the form of articles machined to specifications from extruded rods ranging in diameter from 3/16 in. to ¾ in.



Motor Generator

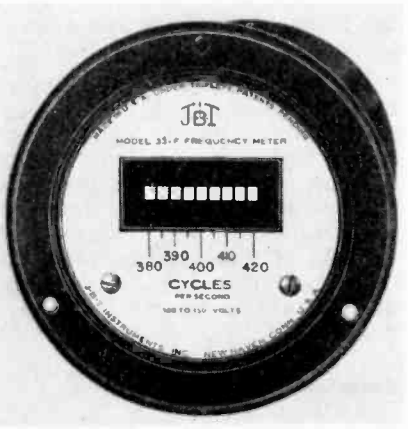
A new motor-generator has been released by the Electric Indicator Co., 110 Parker Ave., Stamford, Conn. Model L32 operates on 6-volt dc input; ac output, 1-, 2-, or 3-phase, varies with speed. Housed in black, synthetic-enameled aluminum, with speed regulator and resistance, the generator's speed is controlled within 1 per cent for 25 per cent variation in input or load, and will deliver 27 volts, 2-phase ac at 2400 rpm.



The model measures 6¼ x 2 in. diameter, weighs 32 oz. and is base mounted. It is equipped with a single 5/16 in. shaft, with 1 in. shaft extension from front of case.

High Speed Fasteners

The Camloc Fastener has been developed to meet the special demands of the airplane industry to secure cowl panels and access doors that must be operated quickly or frequently. They are flush mounted, light weight, heavy duty fasteners, fast in installation and requiring but a quarter turn to lock or unlock. They are adaptable to straight or curved sheets of metal, plastic or plywood. Manufactured by Camloc Fastener Corp., 420 Lexington Ave., New York.



Frequency Meter

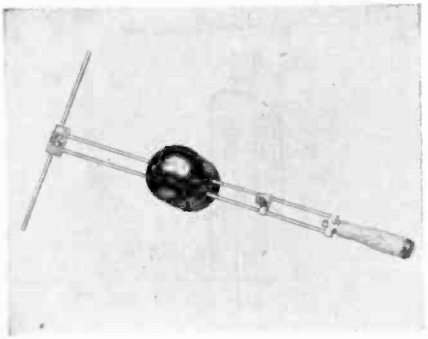
A new 400-cycle vibrating reed frequency meter, with a longer reed mount and both its driving coil and permanent magnet placed near the outer limit of the free ends of the reeds, has been developed by J-B-T Instruments, Inc., 441 Chapel St., New Haven, Conn. It is a single window type in a black metal case for flush panel mounting. Accuracy—±0.3 per cent under normal operating temperatures. Minimum voltage — 100. Power consumption—1.75 watts.

Plastic Insulating Grommets

A new line of phenolic plastic insulating grommets, available in four standardized sizes, has been developed by Creative Plastics Corp., 970 Kent Ave., Brooklyn 5, N. Y. Holes are concentric, with all corners chamfered, avoiding wire chafing. All threads are clean and lubricated. To promote easy gripping and conservation of assembly time, all parts are matte finished.

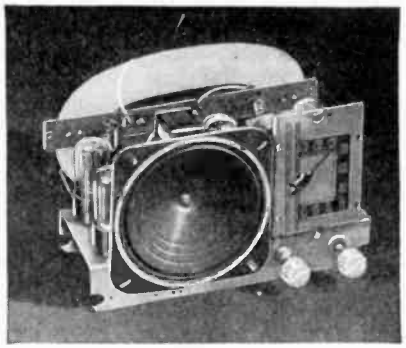
Resonance Indicator

Erco type MW-60 resonance meter is a rectifier type vacuum tube voltmeter completely self-contained in a very small water- and dust-proof plastic housing ingeniously arranged to slide along parallel rods so that optimum impedance matching can be obtained between a tuned circuit and the indicator. A sliding tuning bar permits resonating the parallel rods to any desired frequency between 130 and 600 mc. The device provides a sensitive, convenient and accurate means of determining resonance in oscillators, of detecting standing waves, etc., and as a piece of test equipment for checking uhf transmitters. The indicator depends for operation on an RCA type 957 or 958 tube energized by a single standard flashlight cell enclosed within the case. Manufacturer is Erco Radio Laboratories, Inc., Fenimore Avenue, Hempstead, N. Y.



Receiver Kit for Training

Allied Radio Corp., 833 West Jackson Blvd., Chicago, has developed a radio receiver kit for illustrating theory and practices now being covered in basic or pre-induction radio training. It is now available to all schools and colleges conducting war training programs. This 5-tube kit permits progressive study of basic receiver subjects such as rectification, filtering, detection, rf, if and af amplifications, etc. The kit consists of all necessary parts, wire, hardware, solder, tubes, and speaker for the construction of a 5-tube ac-dc superhet receiver.



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.

"It pays to have rigid specifications — eh boys?"...

HYTRON TOLERANCES ARE TIGHTER THAN CUSTOMER TOLERANCES . . . . .

When measuring aesthetic curves, or when conducting electrical and mechanical tests on vacuum tubes, the more stringent the adherence to accepted standards, the more desirable the resulting selection.

Impracticable as it is to manufacture all tubes of a given type exactly alike, it is possible to insure against slight meter inaccuracies and the human element by observing specification tolerances tighter than customers' requirements. Each Hytron tube is thus made to fit precisely the circuit constants with which it must operate. For example, strict observance of specifications for grid-to-plate capacitance makes easier the adjustment of tuned circuits to any Hytron tube of the chosen type.

Simplify your design problems for initial and replacement tubes by taking advantage of Hytron's insistence upon close tolerances. Specify Hytron.

OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

HYTRON CORPORATION ELECTRONIC AND RADIO TUBES

SALEM AND NEWBURYPORT, MASS.

HYTRON RADIO TUBES

High Vacuum Gages

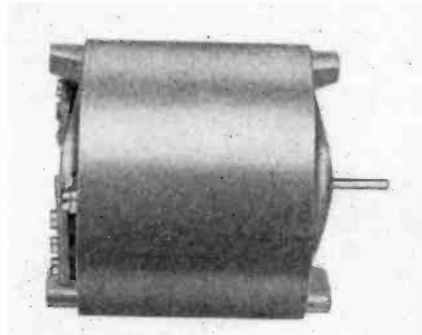
A new electronic instrument, the Televac, will measure by both thermal and ionization gages and record high vacuums during production processes. Safety devices prevent the ionization gage filament from being turned on until a pressure of 10^{-3} mm. of mercury is reached. The filament is also automatically turned off should the pressure rise above 10^{-3} mm. after the gage has been turned on. The instrument has two ranges, one from 0 to 10^{-1} mm. (0-100 microns) as measured by the thermal gage. The low range

of the instrument, when using the ionization gage, can be varied over wide limits to suit the requirements of the customer. The range of the standard ionization gage is from 0 to 4×10^{-4} mm. of mercury (0-0.4 micron). Accurate readings can be obtained down to 10^{-6} mm. (.001 micron). The ionization gages have long life and are interchangeable without calibration. The thermal gages are of the Pirani type. Complete unit, with recorder, is housed in a steel cabinet measuring 14 x 24 x 36 in. The indicating and recording scale is 10 in. long. Manufactured by George E. Fredericks, Bethayres, Pa.

Telegon Rotatable Transformer

A recent development in electronic control, particularly for aircraft, is the use of Kollsman Telegon units as rotatable transformers where only extremely low torque is available or where compactness and lightweight are important requirements.

Most applications of this sort call for feeding a high frequency alternating current into the rotor excitation winding, and taking an induced voltage from the 2-phase winding which varies roughly proportional to angular movement. This voltage is amplified and fed to a variety of devices. An application for the Telegon

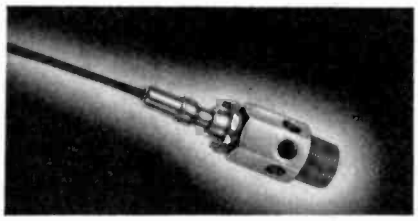


would be field control in an Amplidyne type unit. With a rotor weighing only .06 oz., jewel bearings and precision construction, the Telegon units operate with probably less torque than any other similar unit manufactured. The complete weight of the unit is only 5 oz.

Most commonly used is the Telegon, Type 315S-971, operating at 110 volts, 400 cycles, requiring an input current of .018 amp. and input power of 1.3 watts. It has six external solder terminals. Other units are available operating from 85 volt, 400 cycle or 26 volt, 400 cycle sources. Made by Kollsman Instrument Division, Square D Co., 80-08 45th Ave., Elmhurst, N. Y.

Improved Pickup

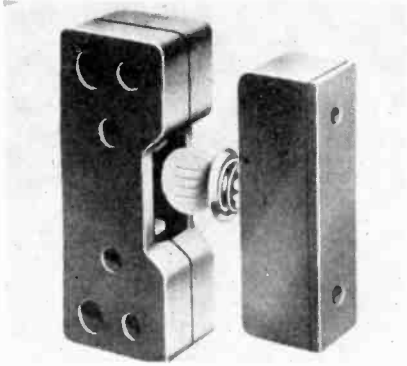
This new pickup (No. 3000 B) for detonation studies on internal combustion engines has a bayonet type socket which



provides quick, reliable contact between connection cable and pickup. Adapter adjustments are much simpler because of the use of two set-screws which replace the older type hexagonal nut. The pickup coil has special impregnation to withstand operating temperatures of 350 deg. It is engineered to provide quick replacement of either diaphragm or coil and operates at constant polarity. Manufactured by Electro Products Laboratories, 549 West Randolph St., Chicago 6, Ill.

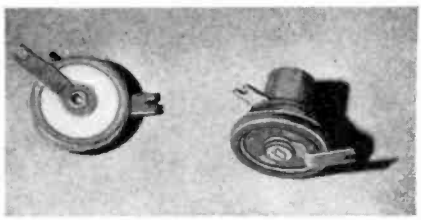
Interlock Switch

A new door interlock switch, designed as an emergency device to interrupt control circuits where access doors are opened when the power is on, has been developed by the Specialty Division of the General Electric Electronics Department at Schenectady, N. Y.



It has a carrying capacity of 10 amp, 110 or 220 volts ac or dc, and an emergency opening capacity of ac 7½ amp, 110 or 220 volts; dc on low inductive circuits, 5 amp, 125 volts; 2½ amp, 250 volts.

Application covers a wide range where doors, windows or covers must be interlocked for the protection of the equipment and safety of the personnel. For example, doors on radio transmitters, X-ray and therapeutic machines, burglar alarms, and signal controls for fire doors.



Silver Mica Capacitors

Types 830 and 831, special purpose oil-impregnated silver mica capacitors for use in high frequency applications, are manufactured by Centralab, Division of Globe-Union, Inc., Milwaukee, Wis. Capacities range from 65 mmf to a maximum of 500 mmf. Both types are made of mica disks, individually silvered for maximum stability and stacked to eliminate any "book" effect. The assembly is vacuum-impregnated with transil oil. The outside metal ring or cup connects to one plate of the capacitor, the center terminal connects to the other plate by means of a coin silver rivet. Other metal parts are silver-plated brass.

Type 830 has a metal cup holding the mica capacitor and is assembled to a threaded brass mounting stud with a terminal in the center. Stud, terminal and shell are electrically connected.

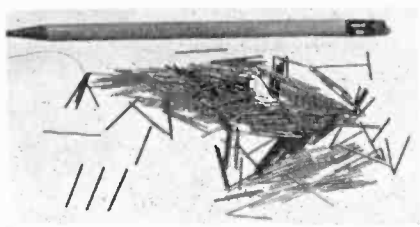
Type 831 is of "lead-through" construction. There is a center terminal on each side making contact to each other and to one plate of the capacitor by means of a coin-silver rivet. The other capacitor plate contacts the outside metal shell or ring.

General specifications of types 830 and 831 are: voltage 1300 vdc test, 500 vdc working.

Stellite Alloy Parts

An alloy of tungsten, chromium, and cobalt is being offered by Haynes Stellite Co., Kokomo, Ind., a unit of Union Carbide & Carbon Corp., in a form adaptable to instrument-bearing pivots, phonograph and recording needles, needle valves, and similar applications. This stainless metal is resistant to many corrosive media and all normal atmospheric conditions. As it is not possible to machine it in small parts, these are cast close to size and approximate shape and finished by grinding, and lapping if necessary.

The properties of this alloy, according to the manufacturer, include a tensile strength of approximately 65,000 lb. per sq. in., a hardness of Rockwell C-60 to C-62, high resistance to wear, a low coefficient of friction, the ability to take a high polish, and resistance to corrosion, whether from atmospheric conditions or chemical agents, such as water solutions of various salts, alkalies, and acids. Easily fabricated and virtually non-magnetic, the alloy can readily be brazed or welded to steel or other base metals, for use in instruments or mechanisms where non-magnetic, corrosion- and wear-resistant parts are essential. The alloy is being furnished in many cast forms, such as pins for pivots and shafts, which are centerless-ground to specified diameters.



SYNFLEX

RIGID to FLEXIBLE • RODS • TUBES • SHAPES

COMPOUNDERS AND EXTRUDERS OF SPECIFIC MATERIALS FOR SPECIFIC USES

FLEXIBLE RUBBERLIKE TUBING

TEST DATA	FT-10 Sub-Zero	FT-11 Transparent	FT-22 Versatile	FT-33 Heat
Dielectric Strength				
Dry VPM	280	1000	1200	900
Wet VPM	450	910	900	800
Low Temperature Flexibility °F. (°C.)	−85 (−65)	−63.4 (−53)	−59.8 (−51)	−22 (−30)
Impact °F. (°C.)	−70.6 (−51)	−54.4 (−48)	−41 (−40.56)	−5.8 (−21)
Elevated Temperature Continuous °F. (°C.)	150 (65.56)	188.6 (87)	194 (90)	190 (87.78)
*Soldering	Flows	Flows	Flows	Good
**Aging (Baking) at 100°C. (212°F.) good after	100 days	100 days	130 days	50 days
Tensile Strength PSI	2550	3000	3200	2900
Hardness Shore "A"	40-45	55-60	65-70	75-80
Flame Resistance		Do not support combustion		
Water Absorption %	−1.4	+0.4	+0.9	+0.75
Chemical Resistance	Good	Very Good	Very Good	Good

All tests made on Standard #8 Tubing.
*1 minute immersion in molten solder at 450°F.
**Rapid flattening between jaws of a vise to thickness of twice the wall.

USES

FT-10: Battery drain, pilot relief, window channels, mechanical rubber goods. (Lowest Temperature.)

FT-11: To facilitate circuit and wire code identification, sealing cable ends, conduit, sheath. (Transparency, Low Temperature, and Good Dielectric.)

FT-22: Sheath, sleeving insulation, communications and mechanical rubber goods. (Highly Versatile.)

FT-33: Transformer, communications and electrical manufacturing. (Baking and Soldering Temperatures.)

Sizes: From B.&S. #24 (.021" I.D.) to 2.000" I.D.—Special sizes on request.

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SYNFLEX

INDUSTRIAL SYNTHETICS CORPORATION

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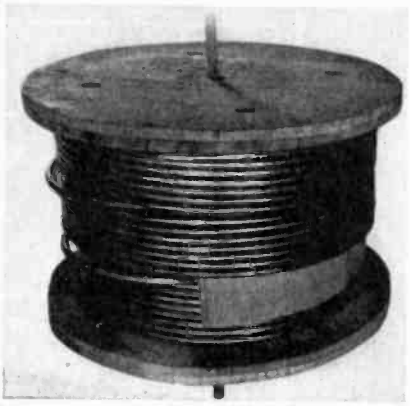
60 WOOLSEY STREET, IRVINGTON, NEW JERSEY

Copper Coaxial Cable

Soft temper copper coaxial cable (⅞ in.) may now be obtained from the Andrew Co., 363 E. 75th St., Chicago, in



continuous lengths up to several thousand feet. The cable is wound on wooden reels and is electrically identical to rigid cables of the same size. It is easily uncoiled and bent by hand to the desired contour; connectors, junction boxes and expansion fittings are not necessary. The cable may be fitted at the factory with special glass-insulated terminals and shipped under pressure.

Voltammeter

Associated Research, Inc., 231 South Green St., Chicago, has manufactured a new voltammeter, a portable combination ac voltmeter and ac ammeter in a metal carrying case with leather handle. The

cover is hinged and contains space for a doughnut type transformer which is used in the higher ampere ranges.

The instrument is designed to give with its 8-amp. ranges and 3-v. ranges complete coverage in amperes from .2 to 500 amps. ac and 0-150, 0-300, 0-600 v. ac.

Adjustable Time Relay

A combination of two hermetically sealed units, both of which are safe in explosive and corrosive atmospheres, is being produced by Durakool, Inc., Elkhart, Ind. The principle of operation is electronic, assuring freedom from trouble caused by mechanical lag or wear, and the load is carried by a mercury relay. The only moving part is the steel-encased plunger working in a hydrogen pressure atmosphere displacing the mercury.

Time settings are continuously variable within the range, covering from .05 to 0.5, 0.10 to 10, and 1 to 100.

NEW PATENTS ISSUED

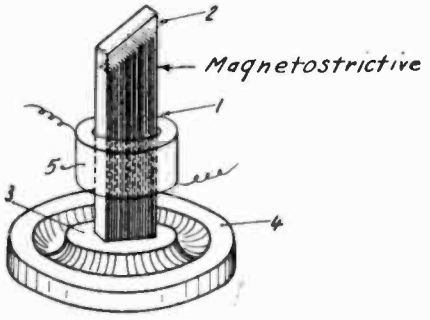
Summaries of inventions relating to electronic uses

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.

TRANSDUCERS

Magnetostriction Microphone

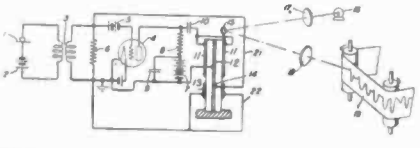
It is intended to broaden the bandwidth of the mechanical resonance characteristic of magnetostriction bars to obtain uniform response over a desired frequency range, without impairing the sensitivity by additional damping. One end of the bar or tube is cut at right angles and attached to the piston 3 of the diaphragm and the other end is cut obliquely. The bar can be made up of a plural-



ity of narrow bars of unequal lengths and may have a mass 2 soldered to it. Experience shows that the microphone using the resonance of such a bar retains its sensitivity with an increase in the width of the pass band of 50 per cent to 100 per cent, useful in listening to submarine noises. Y. Rocard, Alien Property Custodian, (F) Feb. 24, 1940, (I) Aug. 31, 1943, No. 2,328,496.

Piezo-electric Transducer

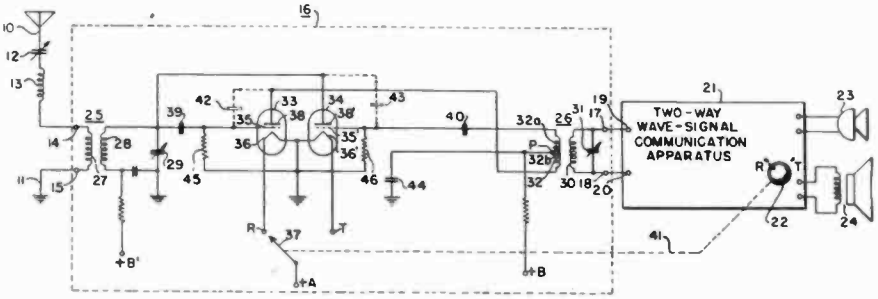
Inverse feedback is provided to compensate for the non-linearity in the operation of piezo-electric motors, whether due to hysteresis, variation in temperature, non-linear response to voltage or frequency, or other causes. In the system for the recording of speech shown in the drawing, the crystal is driven by the voltages applied to electrodes 11, 12. Feedback voltages generated by the crystal are derived from a second pair of electrodes 13, 14; these voltages are directly proportional to the bending of the crystal, and when fed back, reduce distortion. A network having a desired frequency characteristic may be inserted in the feedback path. W. P. Mason, Bell Telephone Labs., (F) March 30, 1940, (I) Aug. 31, 1943, No. 2,328,478.



INTERCOMMUNICATION SYSTEMS

Two-Way Communication

The two-way amplifier channel is designed to minimize transmission in the sending direction during reception and vice versa. During reception the oscillator of unit 21 is used as a superregenerative detector and the oscillations generated thereby are also applied to terminal circuit 26, winding 32b, inter-electrode capacitance 42 to transformer 25 and antenna 10. At the same time, the oscillations are applied to winding 32a, inter-electrode capacitance 43, transformer 25.



The two voltages neutralize one another; tap P is so chosen that they are of equal amplitude. Antenna 10 does not radiate. During transmission, cathode circuit of tube 34 is energized. Inter-electrode capacitance 43 provides feedback and tube 34 tends to oscillate. The feedback energy is applied to winding 32a, however, compensating feedback energy of the same magnitude and phase is applied through inter-electrode capacitance 42 to winding 32b. Resistor 46 is so dimensioned that the resonant frequency of circuit 30,31 is independent whether it is combined with the input circuit of tube 34 or the output circuit of tube 33. N. P. Case, Hazeltine Corp., (F) May 8, 1942, (I) Aug. 17, 1943, No. 2,327,248.

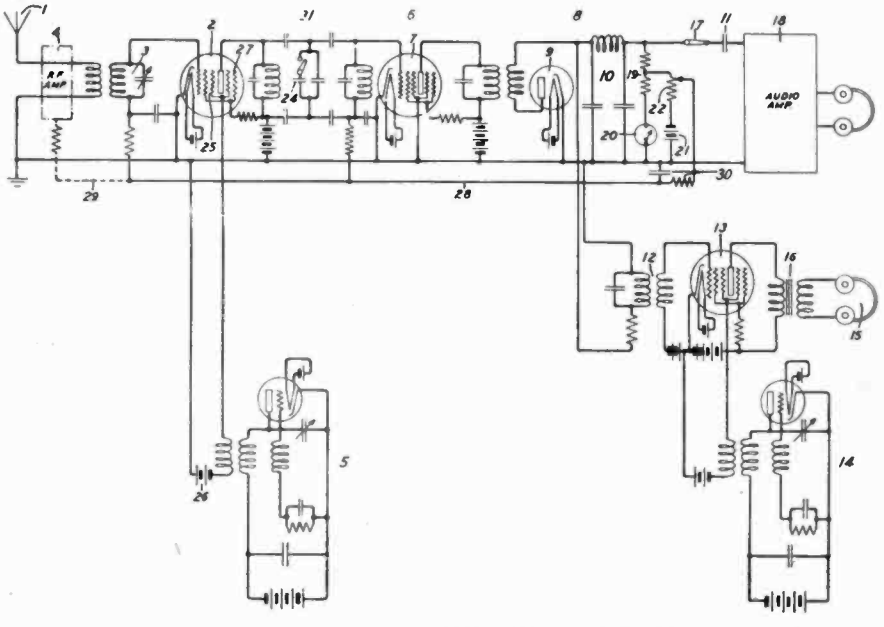
Multi-channel Transmission

One intercommunication band is based on a carrier the lower side-band of which is used for one direction of conversation while the upper side-band is employed for the other direction. Furthermore, one direction of a second conversation is transmitted over the upper side-band of an adjacent carrier while for the other direction the lower side-band of a third carrier or both side-bands thereof are used. A suitable circuit and filter arrangement is described and it is said that less filters are needed as compared with prior systems. W. Hagen, Alien Property Custodian, (F) Oct. 10, 1941, (I) Aug. 31, 1943, No. 2,328,450.

MISCELLANEOUS

Modulator and Detector

In the telephone or telegraph receiver shown tubes 2 and 13 act as heterodyne detectors; both are connected according to the invention. The signal waves are supplied between control grid and cathode, the local oscillator output between suppressor grid and cathode. A negative bias is maintained at the suppressor grid. Signal circuit and local oscillator circuit are shielded by the screen grid, preventing undesired interaction; both inputs are amplified, reducing the design requirements on the heterodyne oscillator. Auto-



When Sandino was a rebel

Henry L. Stimson had personally arranged a truce between the two factions in Nicaragua, and the Marines were asked to stay until after the 1928 election.

But one young "general" refused to be bound by the truce, and fled with his little band into the wilds of the department of Neuva Segovia. There Augustino Sandino proclaimed himself head of a republic, and might have lived unmolested to a ripe old age if he hadn't taken up the practice of ambushing small detachments of Marines.

After 400 of Sandino's men surrounded 39 Marines near Ocotal, killing one and wounding one before they were driven off, Heintz and Kaufman Ltd. received an urgent message from Washington to design and build at the earliest moment 22 special field transmitters capable of being transported along narrow jungle trails, and of being operated even after immersion in water.

This was the first time Heintz and Kaufman equipment served with the Marines. Today as thousands of Gammatron tubes pass final inspection, we like to think that some will see action with the U. S. Marine Corps . . . confident that every Gammatron will have that extra stamina, efficiency, and dependability when the odds are long that the Marines themselves possess.

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Gammatron Tubes

HK-854 . . . This general purpose Gammatron triode offers exceptional VHF performance, and has the ability to withstand high voltages. Maximum plate dissipation 450 watts.

matic volume control is provided by the dc component derived from output of rectifier 9 and fed back through network 30. For telegraph reception, the input to rectifier 9 is supplied to heterodyne detector 13 to obtain audible beat-frequencies. H. T. Budenbom, Bell Telephone Labs., Inc., (F) June 16, 1933, (I) Aug. 24, 1943, No. 2,327,866.

Filament Support

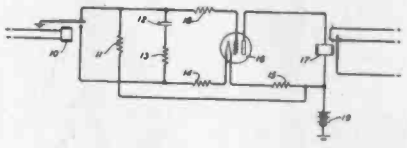
To prevent vibration of the filament in an electron tube, the filament consists of two intersecting wires which bear against one another at the intersection point. The electrical connection is in parallel. Insulating supports rigidly arranged between the two wires also improve their stability against mechanical vibration. A. Gaebel, Alien Property Custodian, (F) Feb. 8, 1941, (I) Aug. 31, 1943, No. 2,328,136.

Compensating Antenna Interaction

The interaction between antennas in close proximity to one another is compensated by arranging a phase shifter network between the feeders of the two antennas. The network is connected to the feeders at points one-half wavelength from the respective antenna and has amplitude and phase adjusting means. A. G. Kandoian, Federal Telephone and Radio Corp., (F) Oct. 23, 1941, (I) Aug. 24, 1943, No. 2,327,435.

Time-Delay Circuit

Normally, ground is connected to the upper terminal of condenser 12 and its lower terminal is charged to the potential of battery 19; a small current flows through high resistance 11. To initiate operation of the circuit, ground will be connected to the lower terminal of condenser 12 and between resistors 13 and 14. Filament of tube 16 will now be heated. At the same time, the upper terminal of condenser 12 will assume a negative potential equal to the battery voltage, as the voltage across the condenser is not changed. Condenser 12 will start to discharge through high resistance 11 to battery 19, until its upper terminal

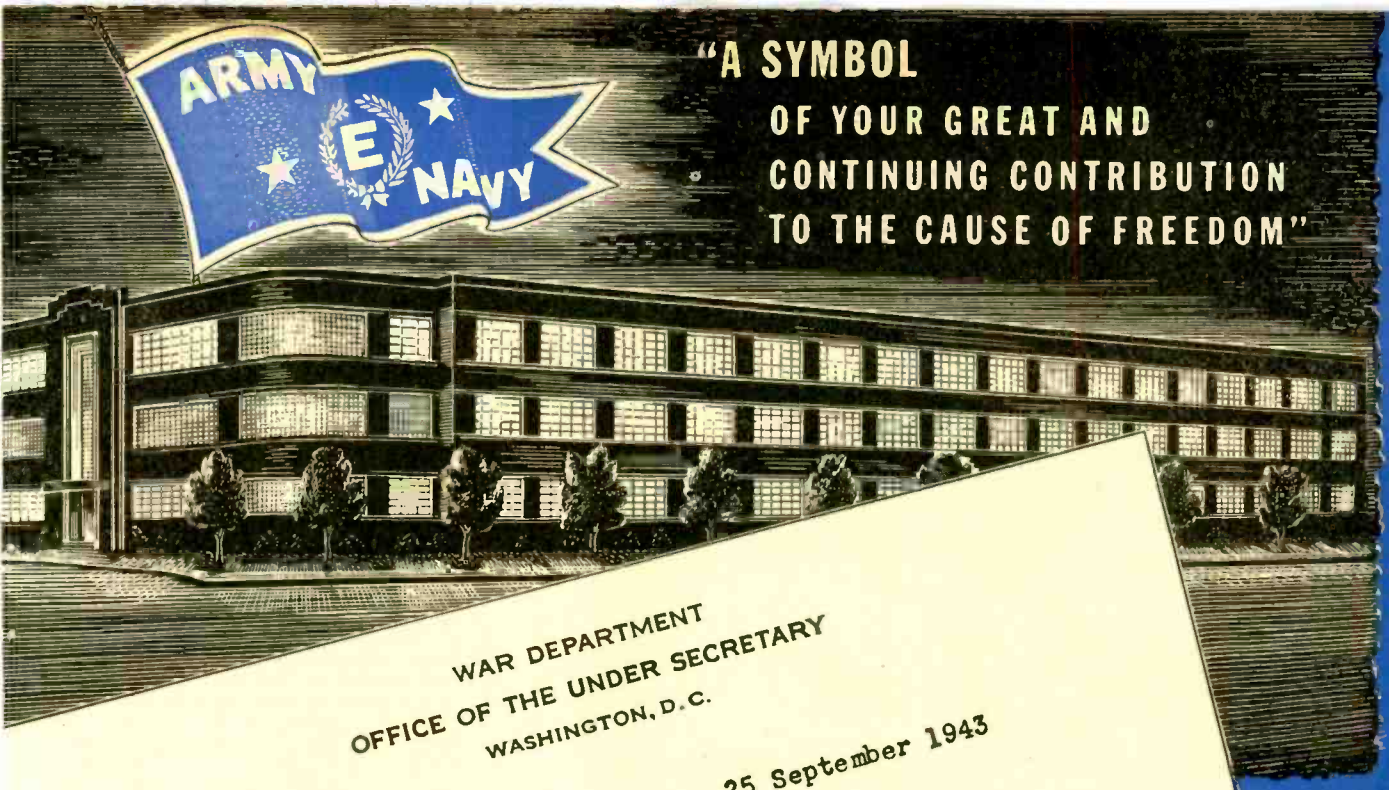


Time-delay circuit

reaches ground potential and then it will charge to the positive potential required for tube 16 to become conducting and relay 17 will operate. When ground is again connected to the upper terminal of condenser 12, plate current will cease to flow and the relay stop operation. Due to the charging of the condenser in the reverse direction, a considerable increase in time-delay is obtained. A. L. Hopper, Bell Telephone Labs., Inc., (F) Aug. 19, 1941, (I) Aug. 24, 1943, No. 2,327,791.

Distance Indicator

A device for continuous automatic indication of a distance, measured by wave propagation, is described. A motor rotates during the time interval the wave takes to travel the distance to be measured and the indicating pointer is operated by the motor. Details are described. E. Norman, (F) Dec. 23, 1940, (I) Aug. 17, 1943, No. 2,326,880.



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OF YOUR GREAT AND
CONTINUING CONTRIBUTION
TO THE CAUSE OF FREEDOM"

WAR DEPARTMENT
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D.C.

25 September 1943

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of the American Lava Company
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I am pleased to inform you that you have won for the third time the Army-Navy Production Award for high achievement in the production of war materiel.

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This second renewal adds a second White Star to your Army-Navy Production Award flag, and stands as a symbol of your great and continuing contribution to the cause of freedom.

Sincerely yours,

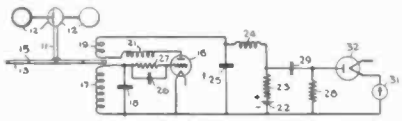
Robert P. Patterson
Under Secretary of War

Signal Selection

It is intended to select a signal of given frequency which is mixed with other signals of neighboring frequencies also containing the signal frequency. For this purpose two control circuits, an acceptor and a guarding circuit, are provided. The control voltages for these two circuits are derived from a single resonant circuit, condenser and inductance being connected either in parallel or in series, in combination with a suitably connected resistor. The invention is applicable also to a plurality of signal frequencies. B. M. Hadfield, Associated Electric Laboratories, Inc., (F) Sept. 10, 1941, (I) Aug. 10, 1943, No. 2,326,457.

Speed Indicator

To indicate the rotary speed of metal disk 13, it is provided with holes or slots. While metal is interposed between coils 19 and 17, they are effectively shielded, so no feedback takes place and oscillator 16 stops oscillation. Upon occurrence of a hole or slot between the coils, the oscillator starts oscillation. Where longitudinal speed is to be indicated, a metal tape or strip with spaced holes or notches will be moved between the two oscillator coils. During oscillation a negative charge is established on condenser 26 and this reduces the direct current component in the plate circuit as compared to the non-oscillatory state. Obviously, the oscillator frequency must be chosen much higher than the frequency generated by the speed to be measured. Resistances 23 and 28 and condenser 29 are so dimensioned that a sharp current pulse of one polarity is transmitted through the condenser when oscillation starts and a sharp pulse of opposite polarity when oscillation ceases. Rectifier 32 and meter 31 provide average indication of the number of pulses over equal time intervals and the meter can be calibrated in speed units. The indicator produces negligible reaction on driving shaft 11 because no oscillation takes place while the metal part of the disk is interposed



between the coils, and no appreciable reaction is produced while the holes are interposed. Another embodiment is shown including a network to make the meter characteristic of a desired shape to compensate for non-linearity in the mechanical part of the device. Also, the number of pulses applied to the meter can be doubled to extend the speed range covered by the meter. D. A. Wilbur, W. & L. E. Gurley, (F) Oct. 3, 1940, (I) Aug. 3, 1943, No. 2,325,927.

TELEVISION

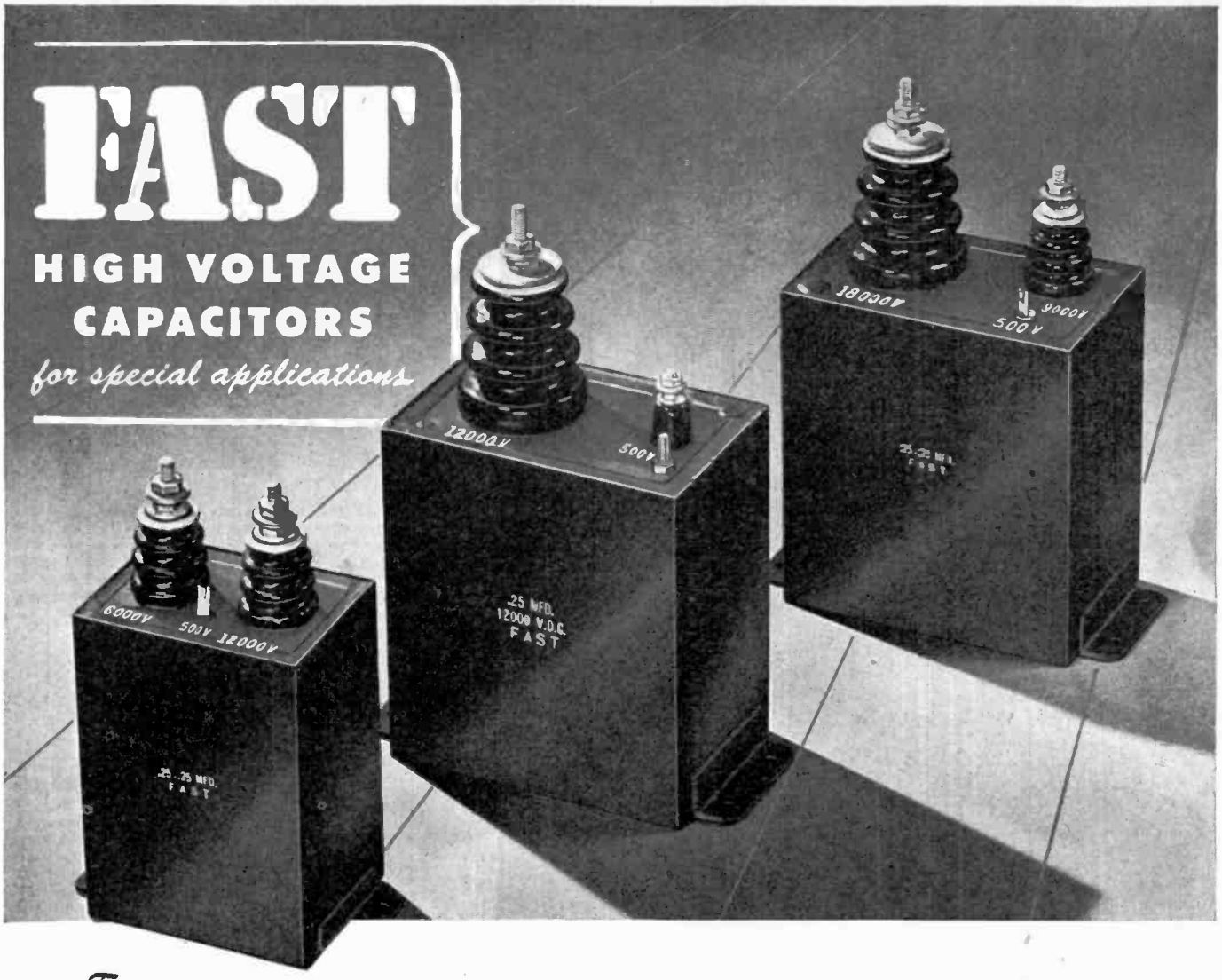
Television Amplifier

To reinsert the dc component of a video signal a reference voltage which represents blacker than black and a clipping circuit to clip the signal uniformly at a voltage representing a substantially black picture are provided. The invention is concerned with the clipping circuit. A clipper tube and a diode in series with the plate current of the clipper tube are used. It is the function of the diode to cut off the current in the output circuit when the clipper tube operates in the curved part of its characteristic. Only the straight portion of the response curve is utilized whereby all signals within the desired range are passed uniformly and the uniformity may be controlled in order to produce gamma correction. K. R.

FAST

HIGH VOLTAGE CAPACITORS

for special applications



These rugged high-voltage capacitors, specially designed for vital war use, are but another example of FAST *years-ahead planning.* Day-in and day-out... FAST Capacitors serve silently but faithfully... under the most varied and severe conditions. On burning deserts. In humid tropics. In frigid artics. On the seas... beneath the waves... and above the clouds. In their line of duty, FAST Capacitors daily meet and withstand drastic atmospheric changes *in the span of a few minutes* ... from sub-zero to high operating temperature... from extremely low pressure to sea level. Because of their stability, FAST Capacitors are in wide use in the various branches of the Armed Forces ... and in every type of industry.

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FAST Condensers and Capacitors are produced in many types and sizes, in standard and special designs, for a great variety of electronic and electrical applications in war and industry. Paper Capacitors — Oil or Wax impregnated — Rectangular or Tubular — in sizes from the smallest to the largest. Units specially engineered or built to government specifications including thermal cycle and salt water immersion tests.

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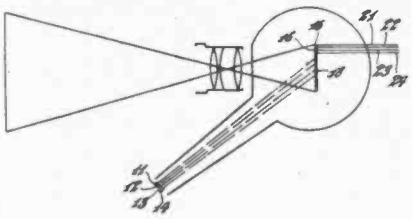
Canadian Representatives: Beaupre Engineering Works Reg'd.
2101 Bennett Avenue, Montreal, for Power Factor Correction
J. R. Longstaffe, Ltd., 143 Berkeley Street, Toronto, for Special Applications

Wendt, RCA, (F) Nov. 27, 1940, (I) Aug. 17, 1943, No. 2,326,907.

Color Television

The color television system claimed uses separate scanning beams 11, 12, 13, 14 for each color at receiver and transmitter. Over the usual image plate of the transmitter is disposed a four-color line screen which consists of a transparent plate 15, a mica plate 16 and a multi-color mosaic line screen acting as a color filter between the transparent plate

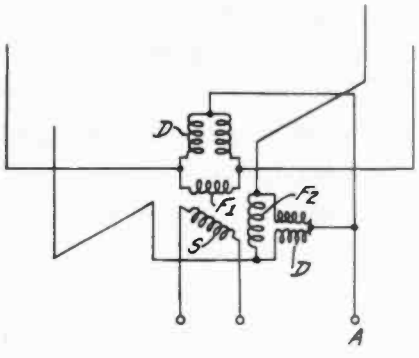


and the mica plate. The lines of four-line plate 18 are correlated with the lines of the mosaic color line screen and are fed to separate amplifiers through leads 21, 22, 23, 24. A similar arrangement is used for the receiver. B. T. Hewson, (F) Aug. 20, 1941, (I) Aug. 31, 1943, No. 2,328,145.

RADIO BEACON

Direction Finder

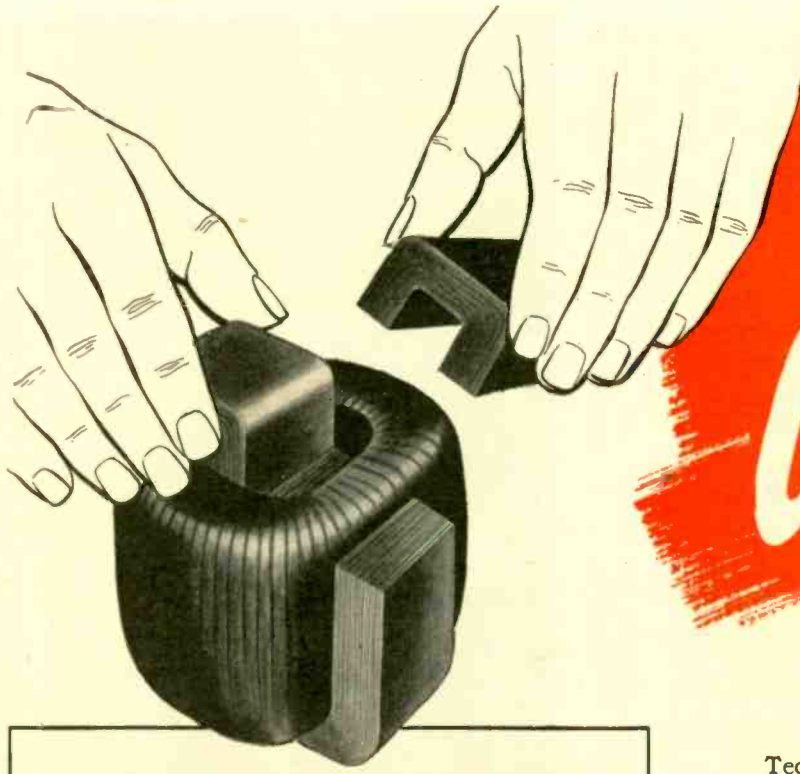
To derive the non-directional voltage for a goniometer the field coils F_1, F_2, or the coupling coils of the loop antennas, have each a double-wound choke D connected in parallel and joined at its center point to the non-directional antenna terminal A. Chokes D are each composed of two coiled wires so wound and connected that they have a very large inductance therethrough between the ends thereof which are not joined, while



they have a very small inductance from the unjoined ends to the joined ends over the path provided for transmission of the non-directional antenna voltage. The inductance of chokes D is made to be high compared with that of coils F_1, F_2. K. G. Holsten, Alien Property Custodian, (F) July 5, 1941, (I) Aug. 17, 1943, No. 2,326,945.

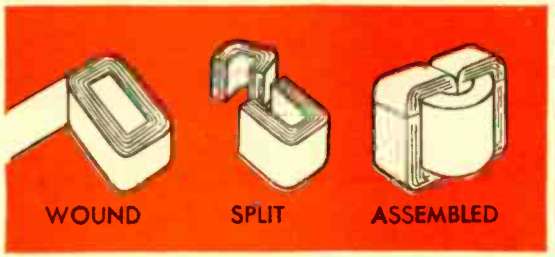
Radio Compass

A directional receiver is connected to a balanced modulator also receiving audio frequencies from a local oscillator. The modulated wave is combined with the output of a non-directive antenna to obtain a voltage which eventually controls the indicating pointer movement. Special features of the device are described and claimed. F. J. Hooven, RCA, (F) Feb. 12, 1936, (I) Aug. 24, 1943, No. 2,327,641.



SPEED UP UHF coil assembly

...two-piece cores of HIPERSIL* save "stacking"



HIPERSIL Type C Cores are *preassembled*. A single strip is wound to form, bonded, then cut in two for easy assembly around windings.

Tedious "stacking" of tissue-thin laminations by hand is no longer necessary in the assembly of Ultra-High-Frequency apparatus.

Split-type cores of HIPERSIL — the new electrical steel with one-third greater flux-carrying capacity — eliminate this time-consuming operation. Instead of hundreds of delicate laminations, Type C HIPERSIL Cores require assembly of just TWO pieces per loop. Man-hours are saved in production — faults in assembly prevented.

Other important HIPERSIL advantages are 30 to 50% weight reduction...smaller size core cross sections . . . and a wide range of linear response. ★ J-70419

Get all the facts about HIPERSIL

Get full information on Type C HIPERSIL Cores. Write for copy of HIPERSIL booklet B-3223-A. It contains full details as well as helpful application data. Address Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., Dept. 7-N.

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PLANTS IN 25 CITIES... OFFICES EVERYWHERE

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

ASSOCIATION NEWS

IRE-RMA Rochester Technical Meeting

Two days of technical sessions and an extensive exhibit of U. S. Army Signal Corps equipment will feature the Rochester (N. Y.) Fall meeting of the Institute of Radio Engineers and the Engineering Department of the Radio Manufacturers Association. The gathering will be held in the Sagamore Hotel. The complete program follows:

Monday, Nov. 8

Demountable Versus Sealed-off Tubes, I. E. Mouromtseff, Westinghouse Electric & Mfg. Co.

Recent Advances in Klystron Theory, W. W. Hansen, Sperry Gyroscope Co.

The Design of IF Transformers for Frequency Modulation Receivers, William H. Parker, Jr., Stromberg-Carlson Co.

Twenty-eight Volt Operation of Electron Tubes, Walter R. Jones, Sylvania Electric Products, Inc.

Vacuum Capacitors, George H. Floyd, General Electric Co.

The Signal Corps Looks to the Engineer, Major James I. Heinz, U. S. Army Signal Corps.

Tuesday, Nov. 9

Message of RMA Director of Engineering, Dr. W. R. G. Baker.

Operating Characteristics of Ceramic Dielectrics with Constants over 1000, R. B. Gray, Erie Resistor Corp.

A Chamber of Commerce War Research Committee, K. C. D. Hickman, Distillation Products, Inc.

Report of RMA Data Bureau, L. C. F. Horle.

New Low Loss Ceramic Insulation, Ralston Russell, Jr. and L. J. Berberich, Westinghouse.

Aids in the Design of IF Systems, J. E. Maynard, General Electric.

Stag Banquet. Toastmaster—R. M. Wise.

Chicago Contractors Welcome Ingles

It was a notable gathering of Signal Corps contractors who welcomed Major General Harry C. Ingles upon the occasion of his recent and first visit to Chicago since his appointment as Chief Signal Officer. In attendance at a dinner at Chicago's Lake Shore Club were: W. J. Halligan, R. E. Samuelson and R. C. Russell representing the Hallicrafters Co.; E. N. Rauland; Major Edward W. Medbery; E. A. Tracey; Major Edward W. Pride; C. D. Manning; Lieutenant Commander George C. Norwood; J. H. Clippinger; Colonel George P. Bush; Harry E. LaPlante; Colonel Charles N. Sawyer; Lieutenant Colonel John M. Niehaus; Brigadier General Edgar L. Clewell; Paul Galvin; Colonel Lester J. Harris; Lieutenant Colonel Samuel R. Todd; Major Henry S. Billington; Major George E. Phelps; William Whiteman; Henry Forster; D. Moore; J. J. O'Callaghan; Charles Beck; D. E. Foster; Maurice K. McGrath; D. Levinger; E. W. Shepherd; S. I. Neiman; E. E. Schultz; G. M. Gardner; M. H. Cook; Elmer Wavering; L. C. Park; Jules E. Gonseth; Oliver Read; Phillip O. Krumm; W. J. Schnell.

RMA Parts Group Chairmen

For consideration and action on problems of each of the major groups of RMA parts manufacturers, sectional organization of ten parts groups has been completed by Chairman Ray F. Sparrow of the Association's Parts Division, for work during the ensuing year.

The ten RMA Parts Sections and their respective Chairmen are:

Capacitor Section—S. I. Cole (Aerovox Corp., New Bedford, Mass.)

Coil Section—Monte Cohen (F. W. Sickles Co., Springfield, Mass.)

Fixed Resistor Section—D. S. W. Kelly (Allen-Bradley Co., Milwaukee)

Instrument Section—R. L. Triplett (Readrite Meter Works, Bluffton, Ohio)

Socket Section—Hugh H. Eby (Hugh H. Eby, Inc., Philadelphia)

Switch Section—H. E. Osmun (Centralab, Milwaukee)

Transformer Section — George Blackburn (Chicago Transformer Corp., Chicago)

Variable Condenser Section—Wm. J. May (Radio Condenser Co., Camden, N. J.)

Variable Resistor Section—J. H. Stackpole (Stackpole Carbon Co., St. Marys, Pa.)

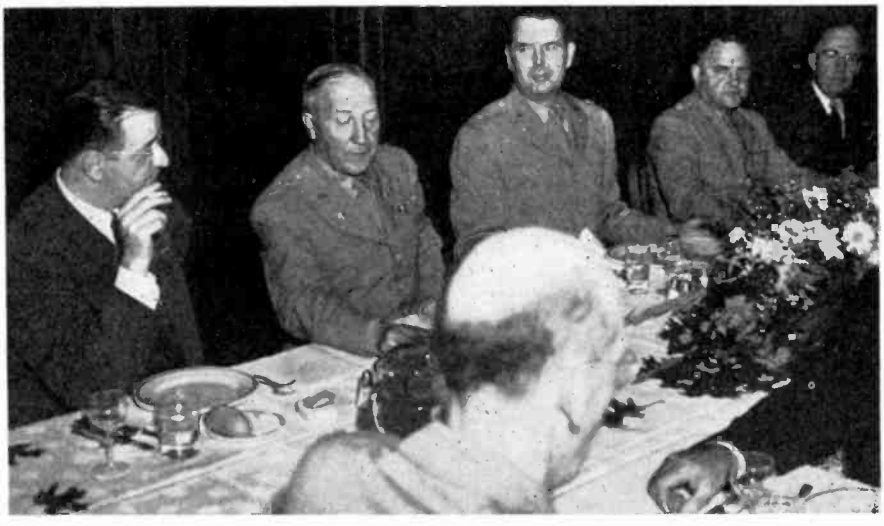
Wire Section—R. G. Zender (Lenz Electric Mfg. Co., Chicago)

Fly Addresses Executives

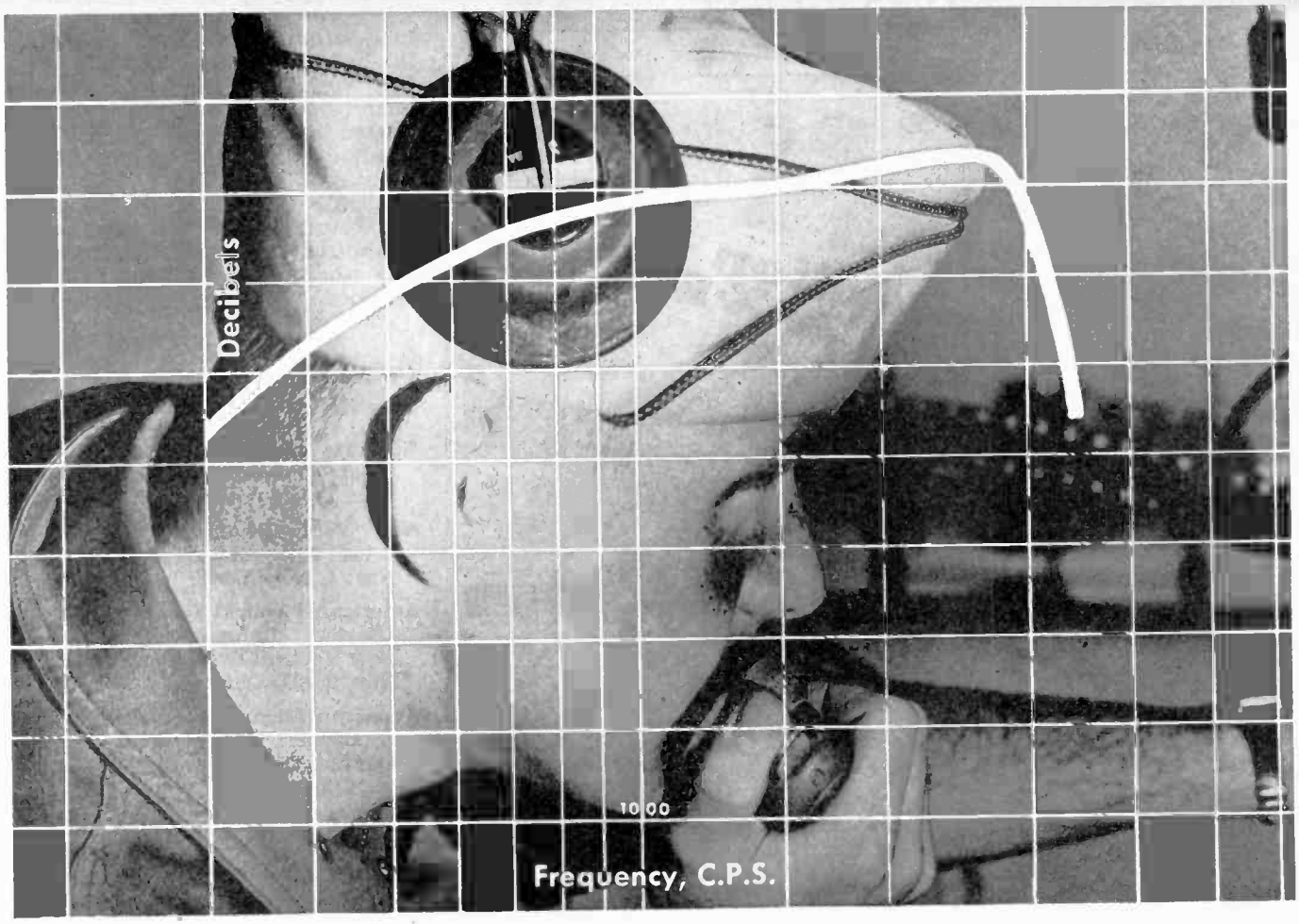
FCC's James Lawrence Fly was the speaker at the first meeting of the fifth year of the Radio Executives Club, held in New York on Oct. 7, a gathering that crowded facilities beyond capacity. Mr. Fly made an eloquent plea for better balance in broadcast programs, urging the need, from a free speech point of view, of the inclusion of controversial subjects, the elimination of the ban on membership solicitation and a broadening of the latitude given commentators. But, he pointed out, it is as essential for radio stations clearly to identify news, advertising, comment and propaganda, as it is for the public prints to do so in order that each may be properly evaluated in the light of its source.

American Institute of Physics Acquires Building

The American Institute of Physics which has been occupying rented space since its founding in



W. J. Halligan (Hallicrafters Co.); Major General Harry C. Ingles; Lt.-Col. John M. Niehaus; Brigadier General Edgar L. Clewell; Paul Galvin (Galvin Mfg. Co)



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designed to bring the message through . .

Microphone performance begins with design. Orders, instructions, information must come through—*audibly.* It is the designing engineer's job to bring the human voice through clearly—to eliminate as much as possible the engine noises and tumult that might garble a vital message.

The proven ability to design and manufacture microphones that serve under such conditions—as well as under other severe conditions that attend combat duty—has made Shure Brothers America's foremost manufacturer of microphones.

ARMY E NAVY

SHURE MICROPHONES

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Designers and Manufacturers of Microphones and Acoustic Devices

1931, acquired on September 22, the building at 57-59 East 55th St., New York, for national headquarters of the organization and its affiliated scientific societies. The expanding space requirements of the Institute's publishing and general cooperative activities will be met and several rooms for board and committee meetings, conferences and other small gatherings will be provided.

Conventions and Meetings Ahead

Institute of Radio Engineers (330 West 42nd Street, New York), Nov. 3, New York.

New York Electrical Society (29 West 39th Street, New York), Nov. 4, New York.

American Physical Society (Karl K. Darrow, Columbia University, New York), Nov. 6, Ithaca, N. Y.; Nov. 26-27, Chicago.

American Electroplaters Society (E. L. Luaces, 308 W. First Street, Dayton, Ohio), Nov. 6, Miami Hotel, Dayton.

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

American Institute of Chemical Engineers (50 East 41st Street, New York), Nov. 14-16, Pittsburgh.

Society for Measurement and Control (New York Section Meeting), Nov. 30, New York.

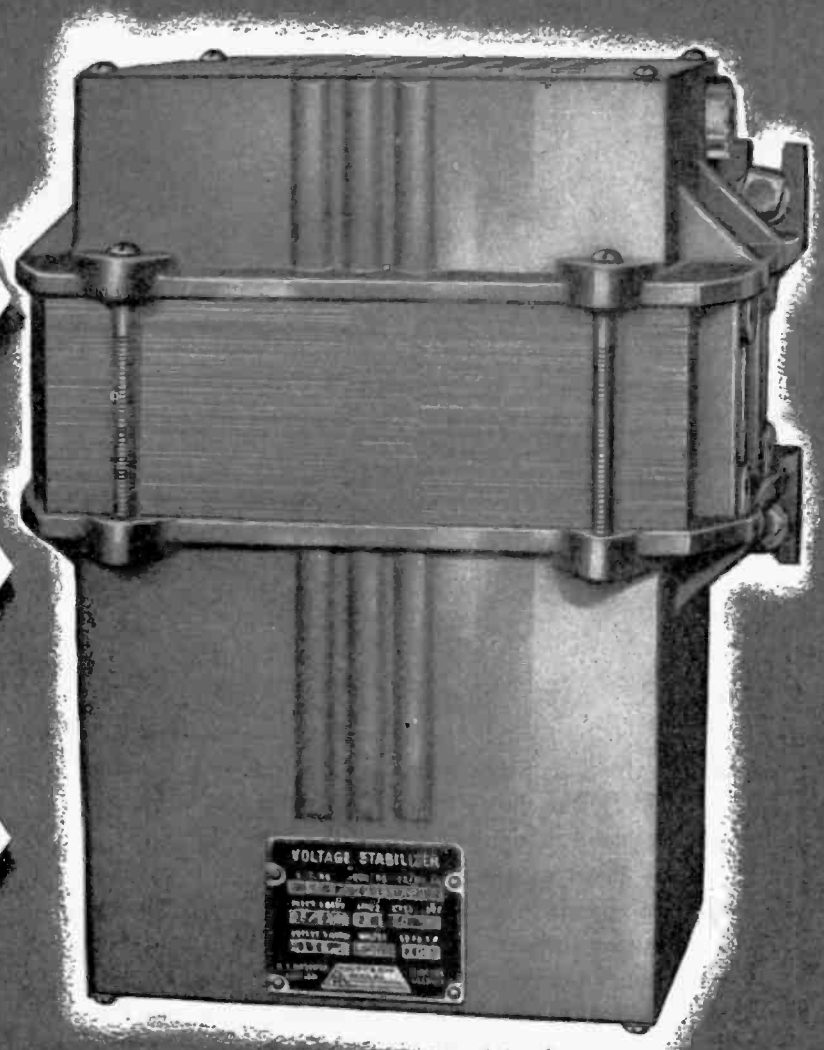
National Association of Manufacturers (G. G. Geddis, 14 West 49th Street, New York), Dec. 8-10, Waldorf-Astoria Hotel, New York.

American Institute of Electrical Engineers (H. H. Henline, 29 West 39th Street, New York City), Southern District Meeting, Nov. 16-18, Roanoke, Va.; National Technical Meeting, Jan. 24-28, New York.

Heat Flow Problems

First Fall Meeting of the New York Society for Measurement and Control was held September 28 at Columbia University. Prof. Carl F. Kayan and Dr. Victor Paschkis, both of Columbia University, disclosed the details of their contribution to the subject of heat flow in the talk: "The Application of Electrical Analogy to Temperature Control Problems." Their analogy between thermal flow and electrical current flow permits complicated three dimensional heat transfer problems to be solved by means of the heat flow analyzer which solves such problems using a series of lumped R-C sections similar to the familiar miles of cable boxes of the

RAYTHEON VOLTAGE STABILIZERS



ENDBELL MODEL

VARYING LINE VOLTAGES STABILIZED TO ± ONE HALF PERCENT

With today's heavy demands for power, line voltages are constantly fluctuating thus impairing the performance of much precision and manufacturing equipment. A Raytheon Voltage Stabilizer incorporated into such equipment will control output voltage to plus or minus ½% over wide fluctuating voltage limits. Here's what Raytheon will do for you.

Stabilize varying AC input voltage to ±½%... Quickly stabilize any load within their ratings... Input voltage is stabilized within 2 cycles, variations cannot be observed on an ordinary volt meter .. Stabilizes over wide AC voltage limits, 95 to 135 volts... Entirely automatic operation, connect it and forget it.

New Bulletin DL48-537 is free. Write for your copy.

The coveted Army-Navy 'E', for Excellence in the manufacture of war equipment and tubes flies over all four Raytheon plants where 12,000 men and women are producing for VICTORY.

RAYTHEON MANUFACTURING Company

190 WILLOW ST., WALTHAM, MASS.

telephone engineers. In this way solutions which would be exceedingly difficult to obtain experimentally are read directly from electrical instruments.

The great advances which have been made in electrical circuit analysis are enabling engineers in other fields to use the electrical concepts in the solution of their own problems.

Determining transient state heat transfer and mass flow ordinarily requires a mathematical approach, calling for a solution of differential equations, which may be solved in only a few simple cases. It seems that most problems of industrial importance cannot be handled this way. The experimental method demonstrated during the meeting is based on the identity of form of the fundamental equations between thermal and electrical set-ups.

Demonstration model

The method was developed and the model built by Dr. Victor Paschkis working together with H. D. Baker (instructor in Mechanical Engineering) at Columbia University under a grant from the Research Corp. It consists of banks of trays of electrical condensers and resistors with patching jacks and cords for making cross connections. The analogies on which the system is based are:

Temperature = Voltage
Heat flow = Electric current
Thermal capacity = Electric capacity
Thermal conductivity = Electric conductivity

The main feature of the system is that a variable time scale may be used. Thus a heat process taking hours or days may be condensed to a few minutes in the experiments. Conversely, short processes requiring only fractions of a second may be stretched in the model so as to last as many minutes as is conveniently needed to make the test.

One dimensional heat flow which amounts to conduction across an infinite slab or along a rod insulated at the sides, corresponds to electrical current flow along an ideal "R-C cable," i.e., a linear conductor, insulated at the sides with resistance and capacity uniformly distributed along its length. As is common in communication practice, the cable with distributed constants is replaced by one with lumped parameters each a series resistor and a parallel lumped capacitor. The smaller the elements taken the more perfect is the representation of the actual cable. Enough of these units are available to give the desired accuracy. Any three-dimensional heat conduction problem may be set up on the electrical model by simple con-

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Lafayette also offers: Latest developments in inter-communications equipment . . . Advance listing of 1944 Radio and Electronic books . . . Expanded list of tools, particularly suited for assembly and factory use . . . Complete list of Victory lines for repair and replacement . . . Bargain Section of Special Values.

New!

Just off the press! The new Lafayette Radio Corporation Catalog 94 is now ready for you! It presents hundreds of new listings of radio and electronic parts and equipment. Many items shown were merely designs on the drafting board a short while ago.

Lafayette Radio Catalog 94 lists the most complete stock of radio and electronic products available today for industrials, the armed forces, government agencies, schools, etc., on priority. *For civilian maintenance and repair items,* your order will bring quick delivery *without priority.*

This catalog is a *must* for all procurement men and expediters – for industrial, civilian and military needs. Write *today* for *your* FREE copy of this complete, up-to-the-minute Lafayette Radio Catalog 94.

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version rules, although a practical difficulty lies in the vastly increased number of cable elements required and the manipulation difficulties.

Equipment used

The condensers range in size from 0.1 mfd to 20 mfd with a total capacitance available of more than 2400 mfd. Flexible plugs allow interconnections. The resistor boards contain four decade resistors each, which together yield any resistance value from 100 ohms to 1,111,000 ohms in steps of 100 ohms.

A central instrument panel contains the power controls and all the instruments. All equipment is in an air-conditioned humidity-stabilized room to prevent electrical leakage across the capacitor elements. Two regulated power supplies are available with adjustable output voltage to correspond to changing temperatures in the thermal circuit. An electronic constant current regulator is also provided for any current value from 0.1 to 30 ma. Four two-stage amplifiers operate two double-point recording millivoltmeters which give permanent records of the current draft rate. For determining total heat input, the total charge in coulombs is measured by means of a special amplifier in conjunction with an accumulating ampere-minute integrating instrument.

This analyzer has become a standard tool of industry and complex heat problems have been solved in many fields. Solutions of important problems with this equipment are available to interested industrial concerns upon arrangements with Prof. Kayan.

G-E Advances Priest

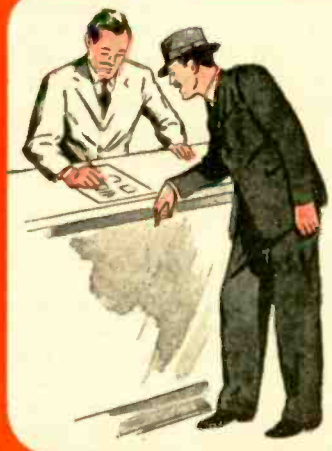
C. A. Priest has been appointed manager of the transmitter division of the electronics department of the General Electric Co. He will make his headquarters at the Syracuse plant.

Philips Centralizes Offices

North American Philips Co., Inc., Dobbs Ferry, N. Y., will move its commercial and administrative departments, late in November, to the Pershing Square Building, Park Ave. at 42nd St., New York, under a long-term lease. This will provide space for increased production at the factory on important war work.

The company will occupy the entire fourth floor, together with two other Philips companies, Philips Metalix Corp., 419 Fourth Ave., New York, and Philips Export Corp., which now has offices in the Hotel Roosevelt Building, New York. The Industrial Electronics Equipment Division of North American Philips

4 WARTIME SERVICES YOUR LOCAL RCA TUBE DISTRIBUTOR OFFERS YOU TODAY



1. Technical "Know how"

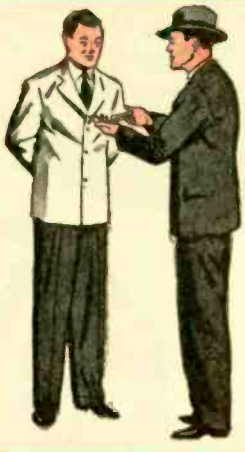
He started in Electronics on the ground floor . . . with *radio*. His advice and recommendations about circuits, tubes, and other electronic components are valuable to you.

2. Supply of Stocks

He's right around the corner; check with him first for items you need to fill on a rush priority basis.

3. Fast Delivery

If his normally adequate and varied stock should *not* include what you want, he's your one best bet today for locating it *fast!*



4. Intelligent Expediting

He's an old hand at tackling tough jobs. That's his business.
When you're in a jam, you'll find him well qualified to act as your expediting specialist.

Get to know this man. He's eager to help you. He's your EMERGENCY ELECTRONIC EXPEDITER! If you don't know where to find him, write us for the list showing your nearest RCA Tube & Equipment Distributor. RCA Victor Division, RADIO CORPORATION OF AMERICA, Camden, N. J.

TUNE IN "WHAT'S NEW?" RCA's great new show, Saturday nights, 7 to 8, E. W. T., Blue Network.

The Magic Brain of All Electronic Equipment Is a Tube and the Fountain-Head of Modern Tube Development Is RCA.

RCA

RCA ELECTRON TUBES

Co., Inc., which markets Norelco electronic products, will also move from 419 Fourth Ave., New York, to the Pershing Square Building.

The change will not affect production personnel at the three plants in Dobbs Ferry, Mount Vernon, N. Y., and Lewiston, Maine, all now engaged entirely on war production. Purchasing department of North American Philips Co., Inc., will remain at Dobbs Ferry.

Half Century for Hopp

Exemplifying the extent to which modern plastics have come to be a part of industries primarily identified with electronic products, Hopp Press, Inc., which started some 50 years ago this month in a tiny shop with a single foot treadle press, celebrates half a century of service this year. At present the company has grown to occupy a plant of 45,000 sq. ft. at 460 West 34th St., New York, employing 150 people, mostly employed in the production of dial faces, scales, instrument boards and name plates of printed and laminated plastics.

Walker Heads Police

Frank W. Walker, chief engineer of the Michigan state police network, was elected president of the Associated Police Communications Officers, Inc., at the close of that organization's tenth annual convention in Madison, Wis., in September. Other officers elected were: first vice-president, Ray Gronier; second vice-president, R. M. Jones; sergeant-at-arms, Wm. E. Taylor; secretary-treasurer, Ero Erickson, supervisor of the Illinois state police system. G. M. Wherritt, Communication Officer of the Missouri State Highway Patrol, was re-elected to fill the post of bulletin editor.

Frank M. Walker, newly elected president of Associated Police Communications Officers, Inc.

A TYPE FOR IMPORTANT NEEDS

STYLE "K" RESISTORS: Power Wire Wound Resistors 5, 10, 25, 50, and 120 watts.

Wire leod or lug terminols on styles 5K and 10K.

Lug terminols only on styles 25K, 50K, 120K.

Non-Inductive windings avoilable.

Various types of mounting, shown in catalog.

STYLES A, B, C, D, E, F: 120, 90, 50, 35, 20, 10 watts.

Hermetically sealed power wire wound resistors. Designed to withstond solt water immersion tests.

Ferrule Terminals for fuse clip mounting.

Non-Inductive windings ovailable.

STYLE V. D.: 10 watt and 15 watt wire wound. Resistors designed to make voltage divider sections when mounted end to end on through bolt.

STYLES MFA, MFB and MFC: Precision Meter Multiplier Resistors. Hermefically sealed. Salt water immersion proof.

Type MFA—7.5 megohms max.
Type MFB—4 megohms max.
Type MFC—1 megohm max.

STYLE SP: Wire wound bobbin type resistors. Style SP-1, single section. Style SP-2, duol section.

2.5 watts, continuous roting, per section.

250,000 ohms max. per section.

MEGOMAX: High voltage, high temperature, composition resistor. Hermetically seoled.

Type 1—3400 ohms to 100 megohms
Type 2—6800 ohms to 100 megohms

Voltage and power ratings depend on resistance value.

SPRAGUE SPECIALTIES CO., Resistor Division, NORTH ADAMS, MASS.

SPRAGUE KOOLOHM RESISTORS

REGISTERED TRADEMARK

Signal Corps' New FM "Walkie-Talkie"

Adapting FM to another use for the armed forces, the US Signal Corps has developed a new type of "Walkie-Talkie (SCR-300) which has approximately three times the range of older AM types, yet is neither larger nor heavier. Instead of the old type super-regenerative receiver, the new "Walkie-Talkie" has an improved superheterodyne. This facilitates "netting," or use of two or more sets on the same frequency for intercommunication. Two antennas are provided instead of one. In addition to the standard vertical antenna, a goose-neck type is included. This permits the soldier using the set to operate it while he is prone on the ground or in a slit trench.

A headset is included with the new model, enabling the operator to listen in for a call, while a handset is available for use by the officer in command. Minature radio tubes are used, with a resultant increase in the life of batteries and in compactness. Carrying qualities are improved through an extra strap that goes around the abdomen of the soldier, thus distributing the set's weight more evenly. The entire set is carried like a haversack, weighs about 35 lb.

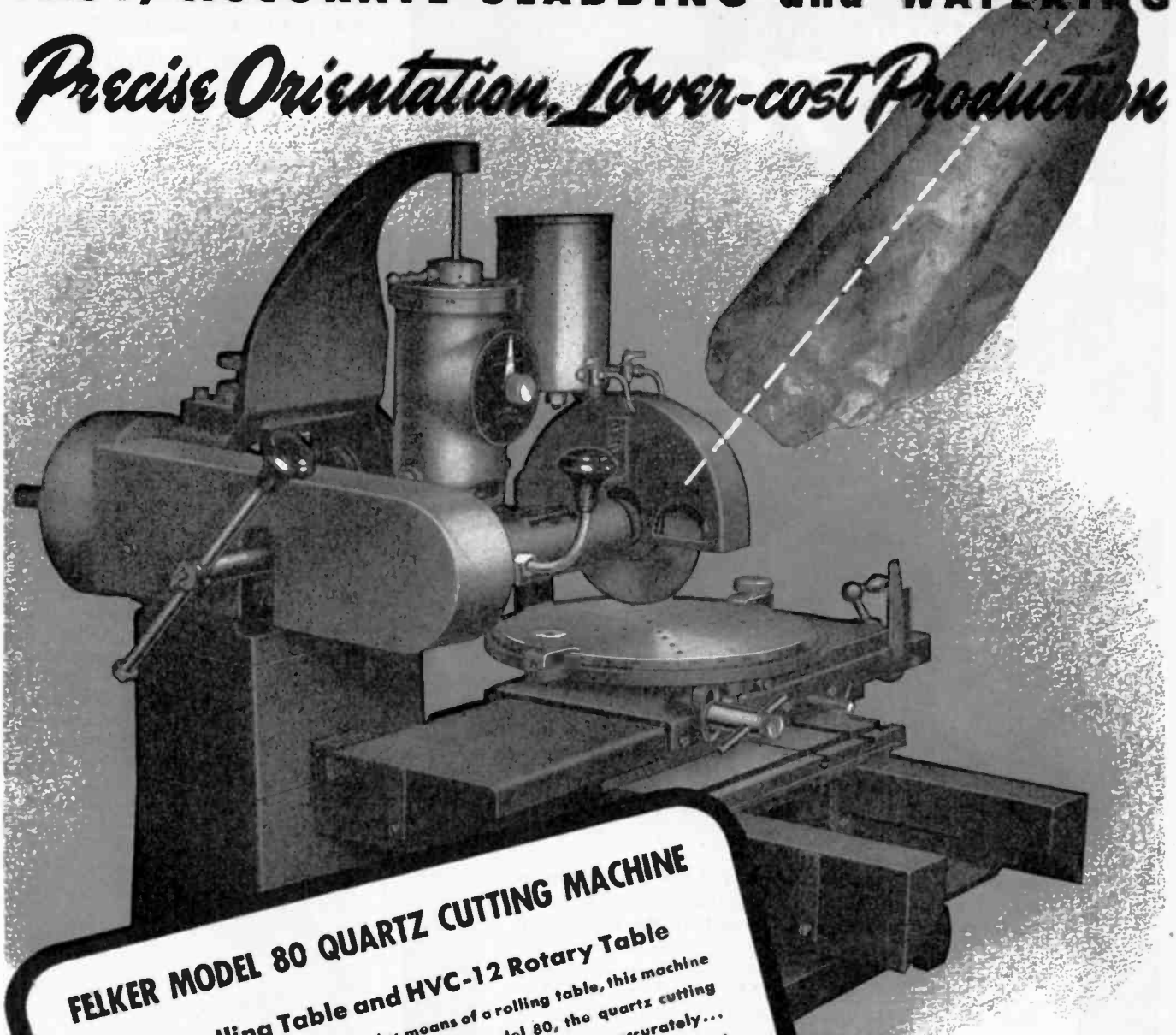
Signal Corps' new FM Walkie-Talkie, carried like a pack

Kelley-Koett Addition

The Kelley-Koett Mfg. Co., Covington, Ky., soon will occupy a new one-story addition to its plant. The concern manufactures X-ray equipment; will move into the new structure early in January.

FAST, ACCURATE SLABBING and WAFERING

Precise Orientation, Lower-cost Production



FELKER MODEL 80 QUARTZ CUTTING MACHINE

With Rolling Table and HVC-12 Rotary Table

Designed for rapid through-feeds by means of a rolling table, this machine is another variation of the versatile DI-MET Model 80, the quartz cutting machine that's increasing crystal production...cutting more accurately... saving valuable quartz...paying for itself out of increased production!

The Rolling Table glides smoothly on hardened rollers and carries an HVC-12 Rotary Table for precise orientation of the mother quartz. The 12" circular rotary table tilts vertically to ± 10°, swivels horizontally, and is equipped with a vernier for accurate horizontal adjustment to one minute of arc. Vertical positions are direct reading to 10 minute intervals. Width of slabs are easily measured to thousandths by means of an easily read, graduated dial on the screw-controlled cross-feed.

If you're tooling up for more production or replacing obsolete equipment, ask our distributors or write direct for our free catalog illustrating and describing the sturdy, accurate, DI-MET machines especially designed for quartz cutting!

FELKER MANUFACTURING COMPANY
1114 BORDER AVENUE • TORRANCE, CALIFORNIA

The DI-MET Model 80 (8" maximum blade size) is available as (1) a basic unit, (2) with the HVCT-12 Rotary Table, (3) with the Rolling Table, and (4) with Rolling Table and HVC-12 Rotary Table (illustrated herewith). The larger Model T20 is comparable in design and characteristics but takes a 14" blade, maximum. All variations of these two models contain the Felker Hydraulic Retardant. Other DI-MET machines are available for specialized applications.

FELKER DI-MET ARMY E NAVY

MANUFACTURERS OF DIAMOND ABRASIVE WHEELS

Grenby Now Maker of Variable Capacitors

"The Grenby Manufacturing Co., Plainville, Conn., maker of precision machine tools for almost every important war producer, has entered the radionics field both for the war and more particularly for the postwar period," reports McMurdo Silver, widely known radio inventor, adding, "The writer is vice-president in charge of radionics activities, and I believe that we here combine a very unusual diversity of skills in that not only are we precision machinists, as evidenced by Norden and Sperry being our best customers, not to mention such outstanding companies as Pratt & Whitney, Boeing, Wright Aeronautical, etc., but we also combine a fair electronic knowledge.

"The new Grenby variable capacitor which will cut man-hours and cost of air trimmer capacitors in half, is already being offered to the large producers of military radionic equipment, this trimmer bringing as it does a new concept of precision mechanics combined with outstanding radio engineering to the capacitor field. It is but the forerunner of many more component parts and precision laboratory instruments and test equipment which Grenby will shortly offer to the trade."

McMurdo Silver, vice-president in charge of radionics for Grenby Mfg. Co. scrutinizes design details perfected by mechanical-genius Ralph H. Soby, senior vice-president. Carl A. Gray, creator of famous Connecticut Job-training Plan, is president of Grenby.

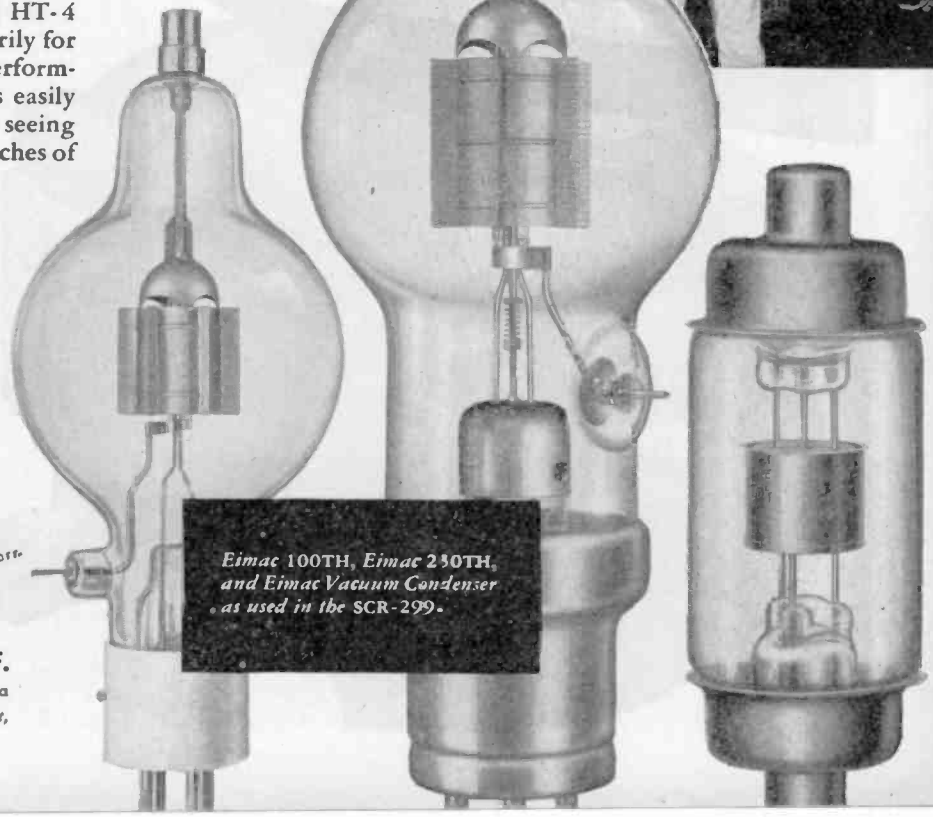
Complete High Power Radio Transmitter and receivers mounted in light army truck. These transmitters are in service in all theatres of war and in most all branches of the army.

The radio amateur is fighting this war, too

The radio amateur is off the air as an amateur but he's still in radio. He's there in person and he's everywhere in the products created to satisfy his progressive demands. Many of the world's leading electronic engineers are radio amateurs and much of the equipment in use today by the armed services is a product of the great amateur testing grounds. Two outstanding examples are: the SCR-299 Transmitter and Eimac tubes.

The SCR-299 transmitter, designed by Hallicrafters, is an adaptation of the model HT-4 which is a 450 watt rig designed primarily for amateur use. Its characteristics and performance capabilities were such that it was easily adapted to military use and it is today seeing service throughout the world in all branches of the army. It is significant to note that Eimac tubes... created to satisfy the demands of the amateur...occupy the key sockets of the SCR-299. Yes, and Eimac Vacuum Tank Condensers, too, are in this now famous transmitter.

The SCR-299 offers a striking confirmation of the fact that Eimac tubes are first in the important new developments in radio...first choice of the leading engineers throughout the world.



Eimac 100TH, *Eimac* 250TH, *and Eimac Vacuum Condenser as used in the* SCR-299.

Follow the leaders to

Eimac TUBES

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

Plants at: Salt Lake City, Utah and San Bruno, California

Export Agents: FRAZAR & HANSEN, 301 Clay Street, San Francisco, California, U. S. A.

Advancements at Crystal

Advancement of six employes of the Crystal Research Laboratories, Inc., 15 Lewis St., Hartford, Conn., was announced by S. I. Ward, president. Henry F. Jochim has been named vice-president; Richard K. Blackburn, chief of radio engineering and research; Ernest B. Lewis, general production manager and crystallographer; Norman Chalfin, radio and X-ray engineer; Richard B. Wolcott, chief mechanical engineer, and Frederick T. Wells, production manager. The company is enlarging its research facilities, to increase use of crystals in electronic devices for government services.

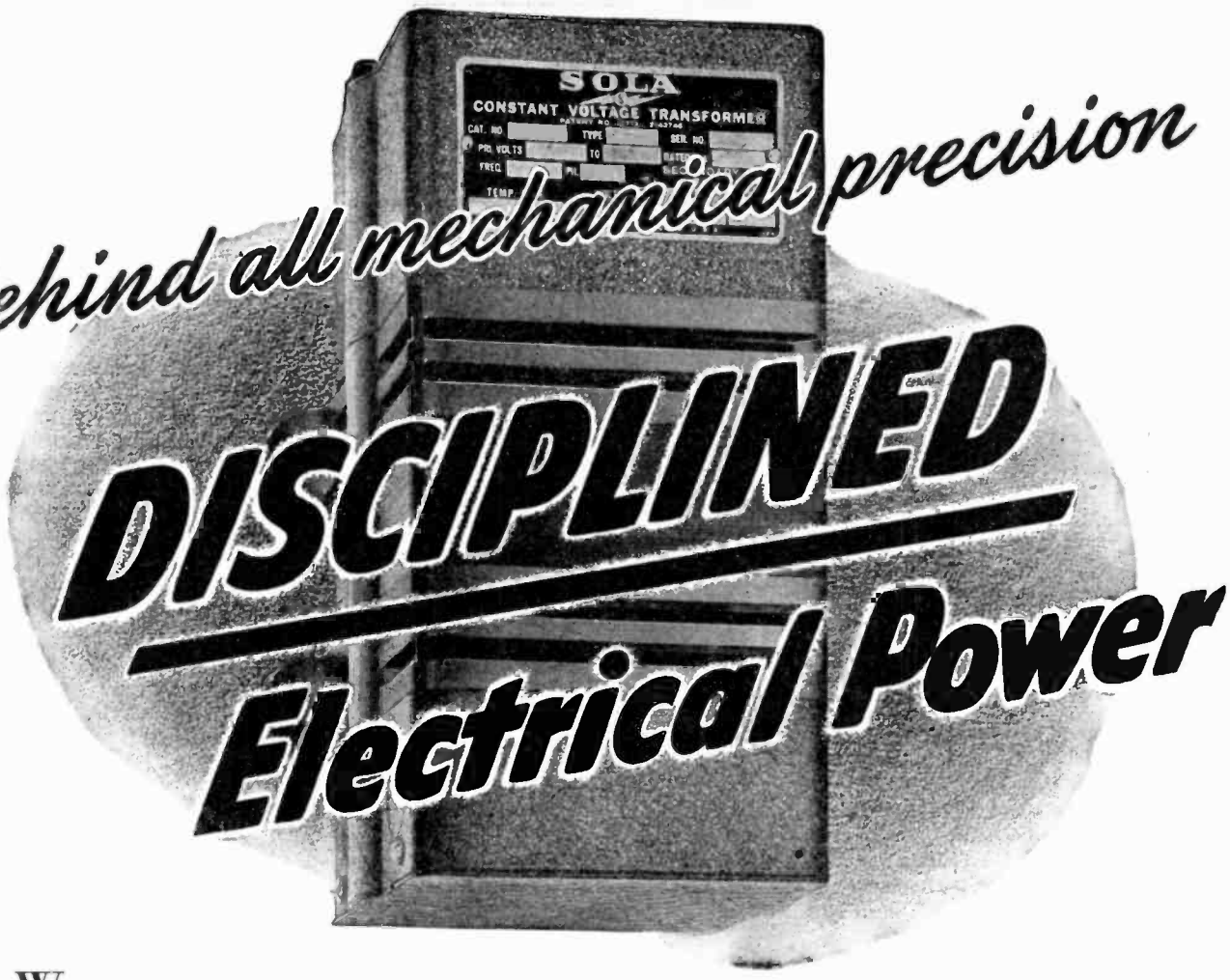
Shea Joins Electronic Corp.

H. Gregory Shea has been appointed production manager for the Electronic Corp. of America, New York. Latterly he has been assistant superintendent of methods and planning, chief industrial engineer and special assistant to the works manager at the Utah Ordnance Plant of the Remington Arms Co.

Magnavox Advances Quinnell

LaVerne E. Quinnell has been appointed factory manager for the Magnavox Co., Fort Wayne, Ind. He succeeds Frank Genshlea for 16 years with Magnavox, who is returning to his home on the West coast. Mr. Quinnell, who started with the company in 1930, has been successively production engineer and coordinator of engineering. He is a graduate of the University of Illinois with a B.S. in electrical engineering.

LaVerne E. Quinnell, newly appointed factory manager for Magnavox



Behind all mechanical precision

DISCIPLINED Electrical Power

WHEN EACH SMALL PART, as it comes from the machine—each finished article, as it comes from the assembly line—*varies not at all* from the others, the problems of QUALITY production have been solved, and QUANTITY production presents small difficulty.

Modern electrically operated manufacturing equipment is expertly designed to produce with *absolute exactness*. That's the miracle behind today's output. *But*, the mechanical perfection of each individual unit must be matched by an unfailing, unvarying power supply. Every unit, however small, must be responsible for its own security. That is why SOLA Constant Voltage Transformers are widely used to provide protection against damaging voltage variation.

Where this control is lacking, electrically operated or controlled equipment is highly vulnerable to voltage fluctuations. Devices designed to operate at rated voltages *react differently* to drops or increases in voltage. Then uniform accuracy and synchronization of the production line no longer exists. Precision work becomes impossible. Rejects increase in number.

SOLA "CVs" protect equipment and instruments, absorbing voltage sags and surges up to 30% and deliver an unchanging, specific voltage regardless of input variations from over-loaded supply lines.

Automatic and instantaneous in action, SOLA "CVs" allow no jolts or sags to slip through. They are made with the same modern exactitude as the most intricate equipment. Immediately available in standard units, capacities from 10 VA to 15 KVA, SOLA Constant Voltage Transformers can also be built to your specification.

Note to Industrial Executives: *Where there is a problem involving voltage control, no matter what its nature, SOLA "CV" Transformers can help solve it. Ask for bulletin 10CV-74.*

SOLA Constant Voltage Transformers

Transformers for: Constant Voltage • Cold Cathode Lighting • Mercury Lamps • Series Lighting • Fluorescent Lighting • X-Ray Equipment • Luminous Tube Signs Oil Burner Ignition • Radio • Power • Controls • Signal Systems • Door Bells and Chimes • etc. **SOLA ELECTRIC CO., 2525 Clybourn Ave., Chicago, Ill.**

Army Reveals New Flux Gate Compass

First details of the gyro flux gate compass, made by Pioneer Instrument Division of Bendix Aviation Corp. in its Philadelphia plant, have been made public by the Army. The compass, long used by the armed forces, permits accurate readings to within five degrees of either of the earth's poles as compared with 20 degrees with other equipment. The device uses the magnetic field enveloping the earth to develop minute electrical impulses which are amplified and used to actuate a selsyn motor on the compass card, which in turn controls any required number of remote compass indicators. The impulses are gathered by the "flux gate," a triangular shaped coil maintained horizontal to the earth's surface by means of a gyroscope.

Exporters Plan for Postwar

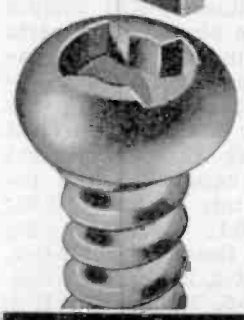
Ad. Auriema, Inc., manufacturers' export managers, 89 Broad Street, New York, 4, N. Y., have elected Richard Bohn and J. W. Cowan, vice-presidents of the corporation. Mr. Bohn has long been identified with the export division of the Continental Radio & Television Corp., as export manager, and will continue to devote the greater part of his time in this capacity. Mr. Cowan has been in charge of air-conditioning and refrigeration sales. In the postwar period he will direct the sales of all electrical and mechanical equipment. Both have travelled extensively abroad and have a wide knowledge of foreign markets and their specific requirements.

Projected Television

Projected, large screen television came a step nearer with issuance late last month of two more patents (2,330,171 and 2,330,172) to Scophony Corp. of America which company is associated with Television Productions, Inc., a subsidiary of General Precision Equipment Corp., which in turn is associated with 20th Century-Fox Film Corp. The Skiatron tube, which is the basis of the system, also makes possible, according to president Arthur Levey, not only black and white projection but the projection of color television, as well as providing a long step toward three-dimensional pictures. Scophony has also patented a method whereby pictures may be scrambled at the source and unscrambled at the receiver, thus providing for a selective service on a subscriber basis.

This Farmer Would Laugh

if he were asked to send his dull blades back to the factory for reconditioning. He has a way of his own. Equally simple and economical is the restoration of original efficiency to the Center Pivot Assembler's Bit used with CLUTCH HEAD Screws. A brief application of the end surface to a grinding wheel is all that is needed to send it back to the Line with a new lease on life . . . ready again for another long spell of uninterrupted service. This is an important factor in time and money saving on assembly lines. Yet, *it is just one of several exclusive* CLUTCH HEAD *features* that contribute to faster, better, safer, and lower cost production. The wide roomy clutch invites confidence for higher speed . . . even with "green" operators. Natural self-centering entry removes the hazard of slippage. Vertical clutch walls reduce the driving effort required. The Lock-On feature, uniting screw and bit as a unit for easy one-handed reaching, eliminates dropped screws and fumbling with "mechanical" fingers. Add to these, the fact that CLUTCH HEAD is the only modern screw operative with ordinary type screwdrivers . . . so important to service and adjustments in the field.



CLUTCH HEAD Screws, used today in important wartime work, are available in Standard and Thread-forming types for every purpose. Their production is backed by the extensive resources of this Corporation and by responsible Licensees.

CLUTCH HEAD SCREWS

So that you may get a first-hand understanding of these many advantages, United invites you to send for an assortment of CLUTCH HEAD Screws and sample Center Pivot Assembler's Bit . . . also fully illustrated Brochure.

UNITED SCREW AND BOLT CORPORATION

CHICAGO CLEVELAND NEW YORK

Mica Capacitor Committee

The formation of an Industry Advisory Committee to conduct a program of conservation in the mica capacitor field was completed in mid-October by the War Production Board. The Committee membership is: Government Presiding Officer; E. R. Crane, Products and Facilities Branch Chief of the WPB Radio and Radar Division; F. E. Hanson, Western Electric Co., Kearny, N. J.; G. M. Ehlers, Centralab, Inc., Milwaukee; Jack Davis, Galvin Mfg. Co., Chicago; T. M. Gordon, Radio Receptor Co., New York; M. R. Johnson, General Electric Co., Bridgeport, Conn.; Byron Minnium, Erie Resistor Co., Erie, Pa.; Dorman D. Israel, Emerson Radio & Phonograph Corp., New York; and Herbert L. Spencer, Bendix Radio Corp., Baltimore.

Case to Hamilton

Nelson P. Case has been appointed director of the newly created engineering design and development division of Hamilton Radio Corp., 510 Sixth Ave., New York, manufacturer of Olympic radio. He was formerly connected with Hazeltine Electronics Corp. and until the present war was chairman of the receiver section of Radio Manufacturers Association.

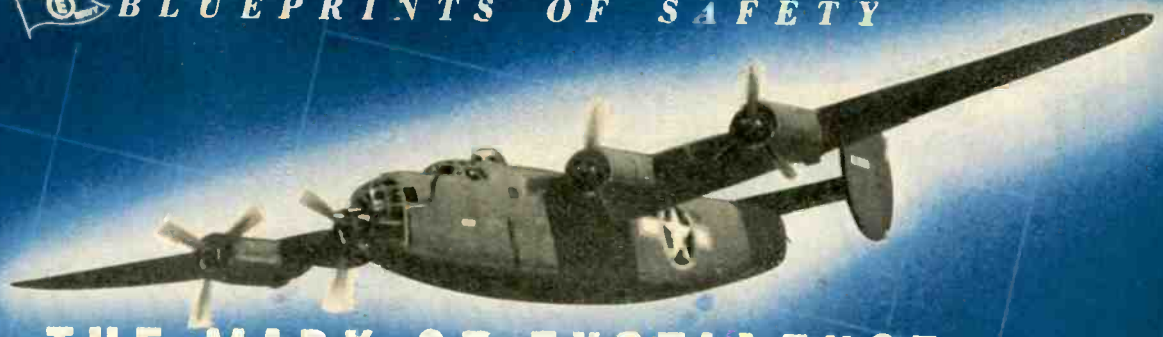
Worner Products Renamed

Worner Products Corp., formerly 1019 W. Lake Street, Chicago, engineers, designers and manufacturers of electronic equipment, has reorganized as Worner Electronic Devices. Leon Worner continues as chief executive. New enlarged laboratory and production facilities were occupied on November 1, at 848 North Noble Street, Chicago.

Disappearing Decimal Points

Decimal points occasionally have a disconcerting way of disappearing in the reproduction of blueprints and that is what happened to some of those which should have been quite plain in the parts list accompanying the wiring diagram of the special compressor appearing with the article on the OWI New York studios in the last issue. Following are the correct values of the capacitors and resistors: Capacitors (mfd)—C-1,25; C-2, C-3,C-4, 0.1; C-5,C-6,C7, 15; C-8,C-9, 0.01. Resistors: R-1,R-2, 0.25 megohm; R-3, 2000 ohms; R-4, 25000 ohms; R-5, 7500 ohms; R-6, 0.25 megohm; R-7, 500 ohms; R-8, 0.25 megohm; R-9,R-10, 25000 ohms; R-11,R-12, 0.5 megohm; R-13, 1.0 megohm.

BLUEPRINTS OF SAFETY



THE MARK OF EXCELLENCE

AAC Products

TRANSMITTERS

and other communications equipment

FOR AIRCRAFT AND GROUND OPERATION

USED BY THE ARMED FORCES — PREFERRED BY LEADING AIRLINES — AVAILABLE FOR OTHER SERVICES

BC-452 — A two channel 300 Watt Transmitter with A1, A2, and A3 emission. Designed by Aircraft Accessories Corporation Engineers and used by the Armed Forces.

Starting in 1937 as a supplier to leading air lines of ground station radio equipment and airplane parts, A. A. C. Electronics Division is today one of the country's largest producers of racio transmitting and receiving equipment. At the present time practically all of our facilities are devoted to war production. However, we welcome your inquiries for commercial equipment which can be supplied in limited quantities, if adequate priority ratings are available . . . . . .

A. A. C. products in transport planes, cargo carriers, troop ships, bombers . . . airport traffic net, police or other services where communications are crucial. can be depended upon as uniformly well engineered and built to our exacting "Blueprints of Safety" . . . .

Rudolph E. Wolfner PRES.

PRODUCTS OF

A. A. C. ELECTRONIC DIVISION

TRANSMITTERS . . . AIRCRAFT ANTENNAS
QUARTZ CRYSTALS . RADIO TEST EQUIPMENT

AIRCRAFT ACCESSORIES CORPORATION

MANUFACTURERS OF

PRECISION AIRCRAFT EQUIPMENT

HYDRAULICS . . . . ELECTRONICS

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An Announcement

TO THE RADIO INDUSTRY

MISSION BELL RADIO

ONE OF THE COUNTRY'S OLDEST
SET MANUFACTURERS

AND

Mitchell–Hughes
Custom Built

CUSTOM BUILDERS OF RADIO-PHONOGRAPH
COMBINATIONS FOR ARTISTS AND CONNOISSEURS

HAVE COMBINED THEIR FACILITIES AND MANPOWER INTO THE

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RADIO CORP.

3430 SOUTH HILL STREET · LOS ANGELES, CALIFORNIA

PRODUCING FOR VICTORY —— PLANNING FOR PEACE

As one of the country's leading builders of communications and precision measuring equipment for the armed forces

With a complete line of Radios and Radio-Phonograph combinations aggressively advertised and merchandised

New FM Call Letters

Forty-nine frequency modulation broadcasting stations started using their new call letters Nov. 1 and it was interesting to note that thirty of the stations used call letters which did not contain the designation FM. Only 19 stations asked the FCC for the right to use the term FM following newly assigned calls.

The FCC had allowed the FM stations the right to use new call letters which eliminated the former combination of letter-numeral calls so that the listening public will not become confused.

Professor Edwin H. Armstrong, the "father of FM," was given the right to incorporate FM in the call letters of his Alpine, N. J., station which now broadcasts under the call of WFMN. One of the largest radio companies wanted a five-letter call incorporating FM but was refused by the Commission. The Commercial Radio Equipment Co. (Kansas City) received the intriguing call of KOZY. Many of the leading broadcasting companies and stations fixed FM calls under their present key station call letters with FM added, such as the Bamberger-Mutual key station WOR-FM; Columbia Broadcasting's stations WBBM-FM (Chicago) and WABC-FM (New York); National Life's station at Nashville, Tenn., WSM-FM; Travelers Broadcasting Service Corp. at Hartford, Conn., WTIC-FM; and Westinghouse's stations WBZA-FM (Springfield, Mass.), KYW-FM (Philadelphia), WBZ-FM (Boston) and KDKA-FM (Pittsburgh). It was understood that a number of the stations wanted calls now used by the Army and Navy but these will not become available until the war ends.

Product Organization, Radio Division WPB

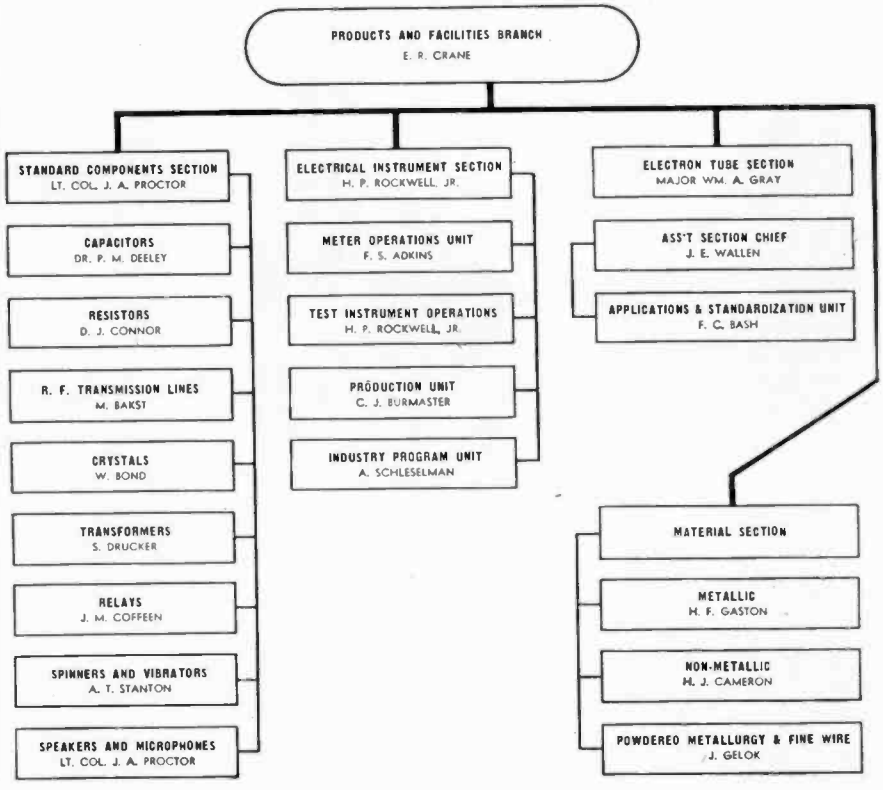
Last month we presented the new chart of the reorganized Radio and Radar Division of the War Production Board, operating under the direction of Ray C. Ellis. As shown on page 124 of the October issue, John S. Timmons is deputy director under Mr. Ellis, and there are three assistant directors—Sidney K. Wolf for production, J. W. Abney for internal management, and Harold Sharpe for labor.

Various branches operate under the above general supervision. These include branches headed Program, Distribution and Scheduling, Domestic and Foreign, Products and Facilities, End Products, and Industrial Instruments.

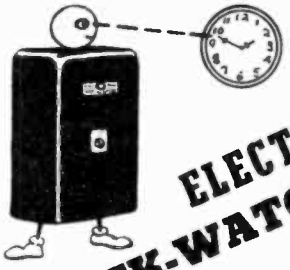
The important Products and Facilities Branch is headed by Elmer R. Crane, who came to the War Production Board from the Bell Telephone group. The accompanying branch chart shows the details of organization of the Products and Facilities Branch supervised by him, and lists the officials in charge of each commodity.

Similar branch charts showing details of organization of the other branches of the Radio and Radar Division will be available later.

Complete organization of the Products and Facilities Branch of the Radio and Radar Division of WPB



HELP WANTED? *Try electronic production aids*



ELECTRONIC CLOCK-WATCHER

Why pay men to watch a clock? G-E electronic timers handle precise timing operations, release workers for more useful work elsewhere in the plant. Five ranges to choose from—between 1/20 second and two minutes. Special ranges on request. Consistent. Stepless time range controlled by knob on front. Only one moving part. Only one tube. Can be used to time injection-molding machines, induction furnaces, conveyors, photographic exposures, laboratory operations, and for many other purposes. Thousands in use. 110 or 220 volts, a-c. Price, $28 and up. Write, stating your timing problem.

PHOTOELECTRIC RELAYS IN STOCK!

Limited quantity of high-speed relays (CR7505N100). More than 450 operations a minute. Operate on light-intensity change of ½ foot-candle. Time delay up to ½ second for holding relay closed after light impulse, which may be as short as 0.001 second. Excellent for simple register-control jobs. Automatic seal-in circuit if desired. Relay contacts handle up to 10 amp at 230 volts. Operate on 115 or 230 volts, a-c; 50/60 cycles. Power consumption, 30 watts. Many special features.

ARE YOU MAKING MOTORS?

OR TRANSFORMERS? **Now you can test winding insulation right on the production line. New G-E electronic winding-insulation tester simulates severest operating stresses and tests turn-to-turn, coil-to-coil, and coil-to-ground insulation. Reveals shorted turns, wrong number of turns, or incorrect connections. Complete test takes only a few seconds on production line and may save your customers hours of repair work later. Operates on 115-volts, single phase, 60-cycles. Write for more information.**

LESS MAINTENANCE on Resistance Welders

—by replacing mechanical contactors with G-E ignitron contactors. No moving parts! No contactor tips to dress. No noise. No open arc. No time lag. Faster production. More exact timing. These electronic contactors use long-life G-E ignitron tubes. One installation paid for itself in four months. More information in Bulletin GEA-3058B.

SIMPLIFY ADJUSTABLE-SPEED DRIVE ELECTRONICALLY

New G-E Thy-mo-trol drive gives you full, stepless speed control on a single dial. Operates from a-c power. No gears, clutches, or belts needed to vary speed. Smooth, shockless acceleration at maximum permissible rate. No current peaks on line. Dynamic braking for quick stops. Holds speed within plus or minus 2 per cent, from no load to full load under full field. Maximum torque at low speeds! It pulls and pulls and pulls. Compact. Easy to install. Motor is the only major moving part. Ask about CR7507. Now supplied in sizes from ⅛ to 15 hp. Special forms and ratings if you need them.

DO YOUR WORKMEN SQUINT

—WHEN DAYLIGHT DIMS? *G-E electronic light control turns on lights whenever daylight level is too low—turns them off when daylight is sufficient. Saves eyes, helps maintain production, saves power. Low cost. Bulletin GEA-2679B gives installation information, diagrams.*

READY-MADE SKILLS FOR NEW WORKERS

Electronic apparatus for timing, sorting, counting, and controlling is making many wartime jobs easier to learn and easier to do. For example, one manufacturer found that the training period for new riveters was shortened considerably, and results were improved, by using electronic timers to automatically time the riveting hammers. Electronics may be the answer to a similar training problem in your plant. *General Electric Company, Industrial Control Division, Schenectady, N. Y.*

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

GENERAL ELECTRIC

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General Electric, Sec. B676-109
Schenectady, N. Y.

Please send me the bulletins checked:

- ☐ Photoelectric relays, GEA-1755E
- ☐ Electronic contactors for resistance welders, GEA-3058B
- ☐ Automatic light control, GEA-2679B
- ☐ Thy-mo-trol drive
- ☐ Electronic timers
- ☐ Winding-insulation tester

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QUALITY

VACUUM TUBE MANUFACTURERS HAVE NEED FOR THIS

IONIZATION GAUGE

This gauge is indispensable for the speedy production of quality vacuum tubes . . . because it is the simplest way to accurately determine the degree of vacuum in a system. Convenient, stable, trouble free . . . this Ionization Gauge has four ranges and measures down to .01 micron. Controls are conveniently placed and clearly marked for direct reading. Rugged, neatly assembled . . . it is available in stationary units or can be mounted on portable work.

Licensed by Litton Engineering Laboratories.

We invite your inquiry . . . Reasonable deliveries can be made on adequate priorities.

GENERAL ELECTRONICS INC.

101 HAZEL STREET, PATERSON, N. J.

SPECIALISTS IN ENGINEERING AND MANUFACTURING VACUUM PRODUCTS FOR ELECTRONIC APPLICATIONS

WASHINGTON

Latest Electronic News Developments Summarized by *Electronic Industries'* Washington Bureau

RECONVERSION POLICY—A uniform program and policy for the War and Navy Departments and other government agencies on the problems of terminating or revising war contracts and the reconversion of industry and plants from war use to normal civilian production is to be crystalized as a result of President Roosevelt's plan in setting up a unit in the Office of War Mobilization under former Justice James F. Byrnes. For the electronics and radio industries because of their huge 5½ billion dollar program for the next year from the Army and Navy, the formulation of a uniform program and policy is a matter desired for future planning, but peak war production is the problem of the moment.

• • • —

"FIRST THINGS FIRST" — President Roosevelt stated that, while it is necessary to prepare for postwar adjustments, "this preparation must not interfere with programs which are ahead of us." One of the highest authorities in the Signal Corps stressed that it was a case of "first things first" and, while there had been admitted slow processes of contract termination settlements, it was the paramount task of the Signal Corps to get the production of the vital communications and detection equipment completed and rolling at the rate to meet the requirements of the armed services and the Allied Forces. When military production slackens, it was pointed out that the personnel of the Army will then be available to concentrate on contract settlement and reconversion.

• • • —

NEW CYCLE OF PRODUCTION — The dominant cause for contract terminations by the Army Signal Corps and the Navy Bureau of Ships' Radio Division has been the revising of contract requirements for the production of new developments or more modernized superior equipment. The research activities, to which the Office of Scientific Research and Development headed by Dr. Vannevar Bush, and the National Defense Research Committee have contributed so much during the past year, have produced many marvels of new electronic and radio devices and equipment vital to the war effort. When new developments are vastly superior to the present apparatus, the Army and Navy naturally want speedy production. Then, too, when the enemy becomes aware of American armed services' equipment, it is often necessary to improve upon it and modify it to bring out its full utility for combat purposes.

• • • —

MANPOWER SITUATION MOST SERIOUS—That the manpower situation in the electronic and radio industry is not only a difficult problem now but is likely to become more serious in the next few months is a well recognized fact. Under the production requirements of the armed services for the next year, officials of the WPB Radio and Radar Division predict between 90,000 and 100,000 new workers will be needed, with unskilled women employes constituting about 80 per cent of this new labor force. As one WPB Division official told "Electronic Industries," "we are getting splinters in our fingers from scraping the bottom of the manpower barrel."

• • • —

TURNOVER PROBLEMS—The major difficulty is not so much the scarcity of the labor supply as the turnover because of the differential in wage rates paid by the aviation and ship-building industries and, while the electronic and radio industries might try to meet such pay rates, it would undoubtedly precipitate an upward wage spiral in these other fields which would mean another gulf in pay scales. To combat these shortages a number of electronic manufacturers are displaying considerable initiative. For example, the Farnsworth Company has established small assembly lines in farming communities where rural men and women, now relieved of the heavy burden of their agricultural work, are available for such electronic production. In heavy industry areas there is a shortage of male workers but a better supply of female labor. The labor shortages are worse in the electronic component plants.

• • • —

FM AND TELEVISION ALLOCATION—With the interest in FM and television having increasing importance at the FCC in terms of inquiries, the allocations studies of the Commission and other governmental agencies are being intensified to determine the proper number of channels for these two services—at the same time balancing them against other essential radio services like aviation, communications and government needs. The FCC engineers are closely surveying the needs for adequate nationwide television service and relay television.

• • • —

INTERNATIONAL ASPECTS—The international aspects bulk large in the studies because the bands assigned by the U. S. to television, it is hoped, would also be used in other countries not only in terms of uniform service but to aid American manufacturers in marketing their products. Another international aspect is that some of the ultra-high bands will be used after the war on international air and sea routes for anti-collision devices. In preparing for the future allocations the FCC field offices are now making continuous recordings of FM stations to determine long disance interference and likewise are conducting tests on interference from the E layer, the troposphere and the sporadic bursts from the ionosphere. The results of the studies will give important information in regard to future allocations and help in indicating whether the present bands should be retained or be extended in the spectrum. There is some thought that FM may require space higher than 100 megacycles in order to avoid skywave interference.

NEW BOOKS

Hyper and Ultra High Frequency Engineering

By Rovert I. Sarbacher, Sc.D. and William A. Edson, Sc.D. both of Illinois Institute of Technology. Published 1943 by John Wiley & Sons, Inc., 440 4th Avenue, New York City, 1943. Approximately 650 pages. Price $5.50.

This complete text includes basic electrostatics and magnetostatics from a field equation standpoint with particular relations as given by Poisson's and Laplace's equations. Maxwell's equations are developed in both integral and differential forms for plane waves. These equations are then solved for boundary conditions in plane wave guides, rectangular wave guides and cylindrical wave guides. Included in the treatment of guides is the common coaxial line as well as elliptic wave guides. Following the theoretical development of wave propagation in guides is the chapter on experimental apparatus showing types of equipment used as probes as well as E_o—H_o transducer, impedance matching systems and wave launching systems. The subject of transmission lines is developed in a standard differential circuit element manner and a number of illustrations are given to show the distribution of current voltage along the line. Open and shorted reactance diagrams are given as well as typical circuits using transmission line sections as resonant networks.

Cavity resonators are well covered from a theoretical standpoint with mathematics and diagrams. Typical radiation diagrams are given for horn type radiators and reflectors.

The remaining chapters in this book treat the behavior of conventional grid control tubes at ultra-high frequencies from the standpoint of input admittance as controlled by cathode lead inductance, transit time, etc., and typical uhf oscillators such as the magnetron and Klystron. Standard amplifier technic including wide band shunt and series compensated circuits is included in a separate chapter.

Negative grid oscillators, as well as the positive grid type of high frequency oscillator are also dealt with. The operation of the magnetron is covered with a mathematical treatment of the electron motion in the two fields for the two and four segment types. Velocity modulation including the Klystron in the standard and reflex types is treated along with the inductive output tube in the last chapter.

A large number of references are made to current literature.

Serving

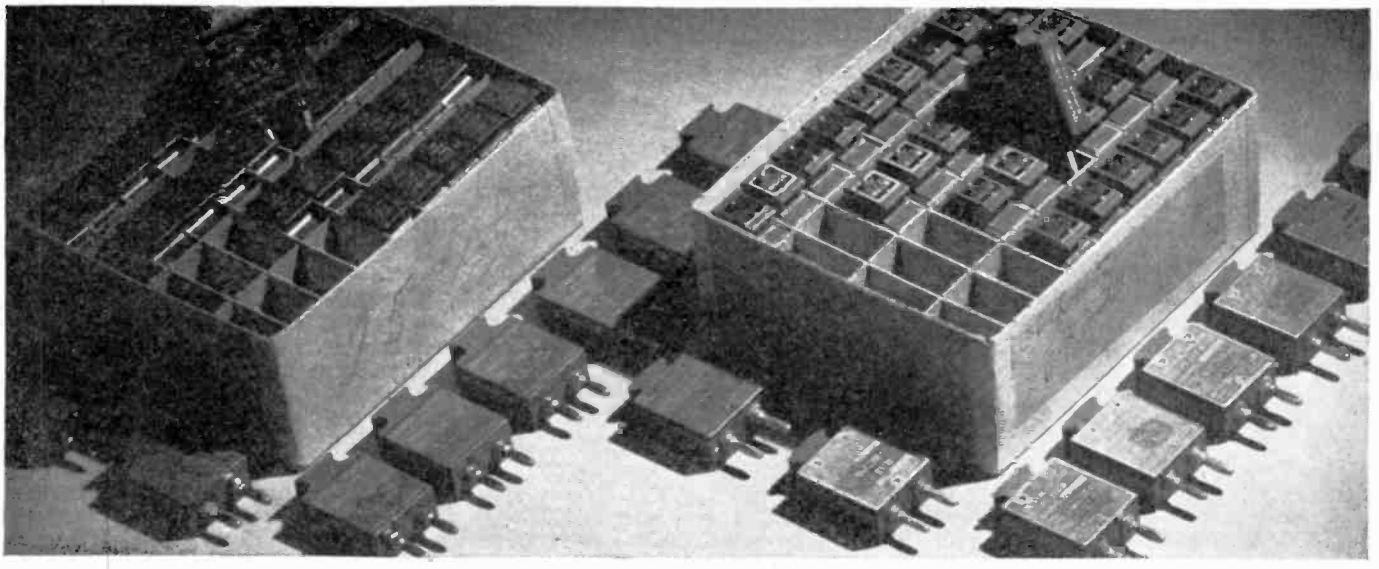
with the famous SCR-299 built by Hallicrafters

THE SCR-299 high powered mobile transmitter, using Quartz Laboratories crystals has more than met the expectations of the U. S. Signal Corps and has received high praise from leading military authorities, one of whom said, "My observations in the theatres of war make it possible to say that the SCR-299 hit the jackpot in the mobile radio field as has the jeep in transportation."

Quartz Laboratories is proud of its contribution to this fine transmitter unit.

QUARTZ LABORATORIES

KANSAS CITY, MO.



NEW BULLETINS

Throat Microphones

Universal Microphone Co., Inglewood, Calif., has published a new catalog (No. 961) descriptive of U. S. Army Signal Corps throat microphone, type T-30-S. Diagrams include operational circuits and extension cord assemblies. Illustrations include the CD-318 cord assembly and a cutaway view of the microphone, neckband and component parts. A photograph illustrates the method of wearing the T-30-S. Descriptive data includes the functions of the instrument, complete description, wearing methods, handling of the T-30-S, resistance, microphone current, repairing, dimensions and component weights. The leaflet closes with current price list.

Plastic Nameplates

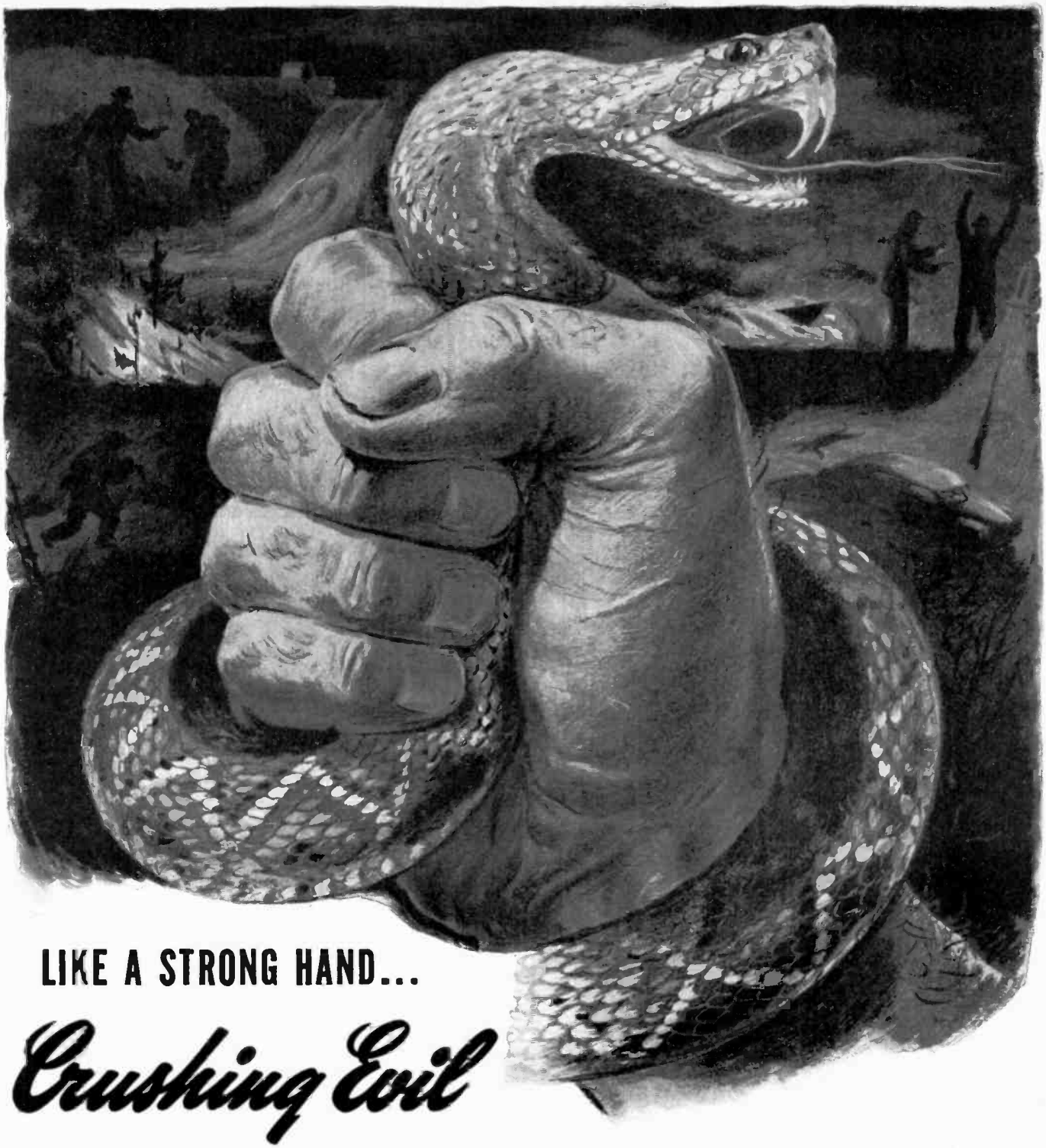
A rather interesting booklet (6 x 9, 16 pages, two colors) has been produced by G. Felsenthal & Sons, 4110 West Grand Boulevard, Chicago, on the application of plastic materials to the production of such things as nameplates. Illustrated are a number of aircraft navigational instruments, protractors, scales, etc., as well as a wide variety of nameplates. One feature of plastics for the purpose is that any printed matter may be sandwiched between transparent sheets, perfectly protecting it.

Kenyon Transformers

Kenyon Transformer Co. Inc., 840 Barry St., New York, has released a 24-page catalog on quality transformers. The company's complete line of transformers, with physical, electrical and operating characteristics, together with list prices, are given. Five large charts are included: converting loss or gain into decibels; ohms, current, decibels conversion graph; watts vs. decibels; ohms, voltage, decibels conversion graph; and reactance, capacity, inductance, resonant frequency.

Electronic Heaters

Electronic equipment for heating metals is featured in a new, illustrated 8-page bulletin (GEA-4076) issued by the General Electric Co. The publication describes the electronic method of heating metals and gives in detail the specifications of both the 5-kw and the 15-kw, 550-kc electronic heaters. Included are illustrations of many important small parts which may be brazed, soldered, or surface hardened by electronic heating.



LIKE A STRONG HAND...

Crushing Evil

The first duty of government is the protection of its people. Protection from dangers at home, as well as from enemies abroad. Protection from fire and flood—from prowling thieves, kidnappers, killers—from danger of injury by reckless motorists.

In modern communities emergency communications systems developed by RCA play a vital part in organizing the forces of society to combat these evils. RCA Police Radio Systems, and RCA radio systems for fire departments, forest rangers, highway patrols, public utilities, and flood control organizations, provide instant two-way communication between fixed or mobile points, for transmission of emergency information and instructions essential to maintenance of public order and safety.

RCA will gladly answer any questions about any type or application of RCA Emergency Communications Equipment. While present availability of this equipment is limited by war priorities, plans can be based on information you give us now that will speed an effective installation to meet your needs when the war permits.

★ *BUY MORE WAR BONDS* ★

RCA EMERGENCY COMMUNICATIONS

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

Timing Motors

Haydon Mfg. Co., Forestville, Conn., manufacturer of synchronous motor-driven, and electronic-timing devices, has released a new 24-page illustrated catalog. New applications of Haydon timers, brought on by wartime demand, include radio keyers, time delay mechanisms for the protection of vacuum tubes, various types of multiple circuit repeat cycle timers, etc. The catalog contains an outline of the principles employed in Haydon timing motors, both ac and dc, with cut-away views of the motor, brake unit, reset unit, and friction device. Technical data is included on the full range of timing applications.

Selectro-Plater Booklet

Rectifier equipment which is most in demand for war production is described and illustrated in a 12-page booklet published by W. Green Electric Co., Inc., 130 Cedar St., New York. Two circuit schematics, supplemented by operating characteristics, are included.

Crystal Pickups and Cartridges

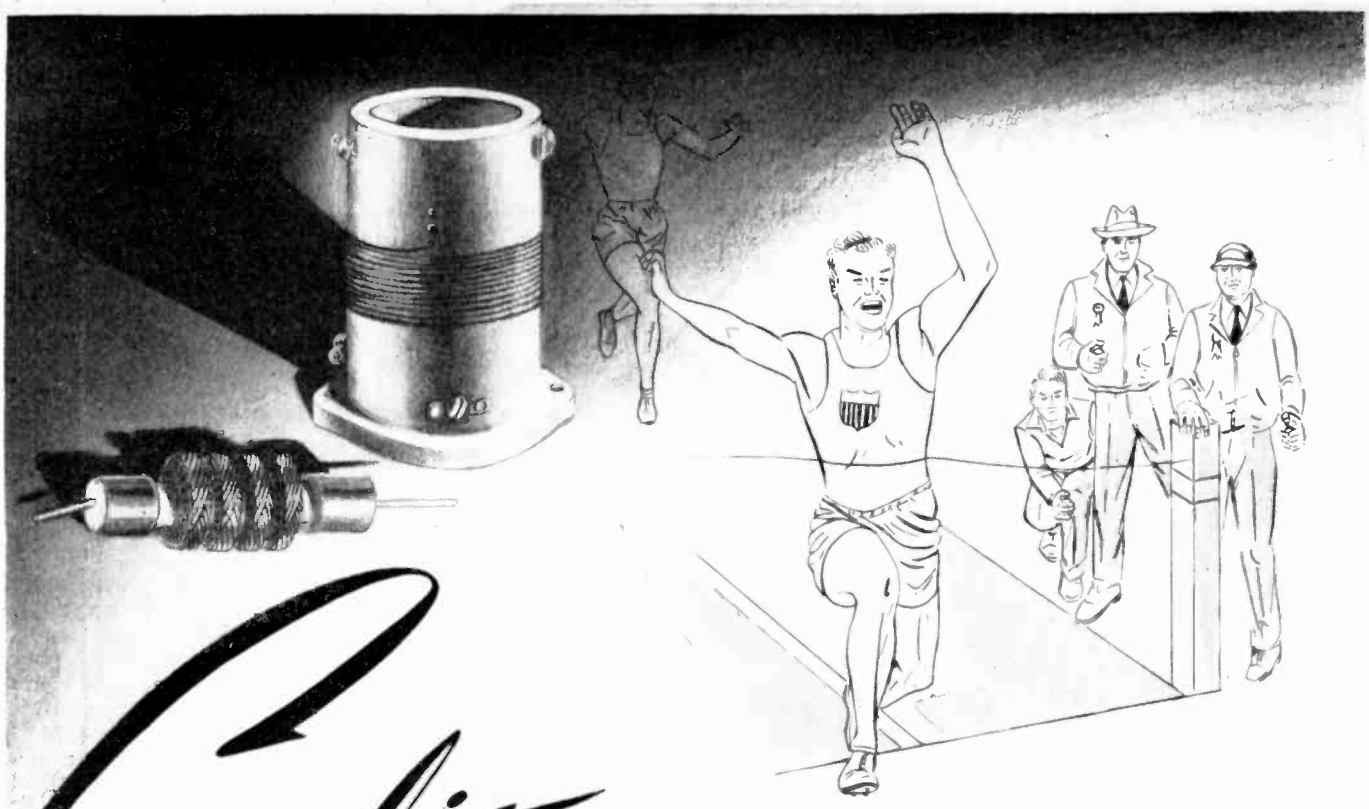
A table for replacement of crystal pickups and cartridges in radio-phonograph combinations, has recently been published in a new bulletin by Webster Electric Co., Racine, Wis. Precautionary measures against rough handling, temperature extremes and moisture, are suggested therein.

Locking Ring

Bardwell & McAlister, Inc., 7636 Santa Monica Blvd., Hollywood, Calif., has released Bulletin No. 2 describing the Rosan locking system for threaded inserts and studs. The system is claimed to lock a steel insert or connection permanently to another material. A locking ring, serrated both inside and out, engages its inner teeth with a serrated collar on the insert or stud. The outer teeth of the locking ring broach their way into the parent material at the surface of a counterbore when struck with a hammer and a drive tool.

Beryllium Copper

Instruments Specialties Co., Little Falls, N. J., has released an eight-page bibliography on beryllium copper which has been compiled after four years of research by its engineering staff. The bulletin is arranged in chronological order.



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Power and Transmitting Tubes

Complete illustrated descriptions of the various types of power and transmitting tubes manufactured by Electronic Enterprises, Inc., 65 Seventh Ave., Newark, N. J., are contained in a newly issued brochure of 10 pages. Included is complete technical data on these types: 866A/866, 872A, 575A, 836, 371B, 8020, EE200, 100TH.

Heat-Resistant "Lucite"

Physical properties which make heat-resistant "Lucite" methyl methacrylate resin molding powder unique among plastic formulations are disclosed in a bulletin issued by the plastics department of E. I. du Pont de Nemours & Co., Wilmington, Del.

"Lucite" in the new form, known as HM-119, is now available commercially. Some of the uses where the plastic will probably be applied are: airplane flying light lenses, airport signal light lenses, reflectors for military vehicles, cases for lamps and batteries, dial and meter faces, railroad signal light lenses, automobile blackout lenses, insulation for radio equipment, medical and dental instruments, aircraft instrument lenses and automobile instrument lenses.

Testing Instruments

The new catalog on aircraft and industrial testing instruments by Televiso Products, Inc., 6533 N. Olmsted Avenue, Chicago, is divided into five sections covering aircraft gyro test instruments, aircraft vibration test instruments, aircraft industrial production testers, industrial vibration measuring instruments, and electro-mechanical laboratory and production test equipment.

Each section contains pictures and descriptions of main functions and applications.

Visual Training Directory

A new type 80-page catalog directory, classifying a wide range of visual training aids now available to the electrical industry, has been prepared by The Jam Handy Organization, 2900 E. Grand Blvd., Detroit (11), Mich., for general distribution. By a new system of indexing, cross-indexing, and classifying many varied teaching slidefilms and motion pictures for electrical training purposes, the instructor is enabled to quickly locate the subject wanted. In addition, previews of each slidefilm and motion picture are provided in the form of large illustrations reproduced directly from the films.

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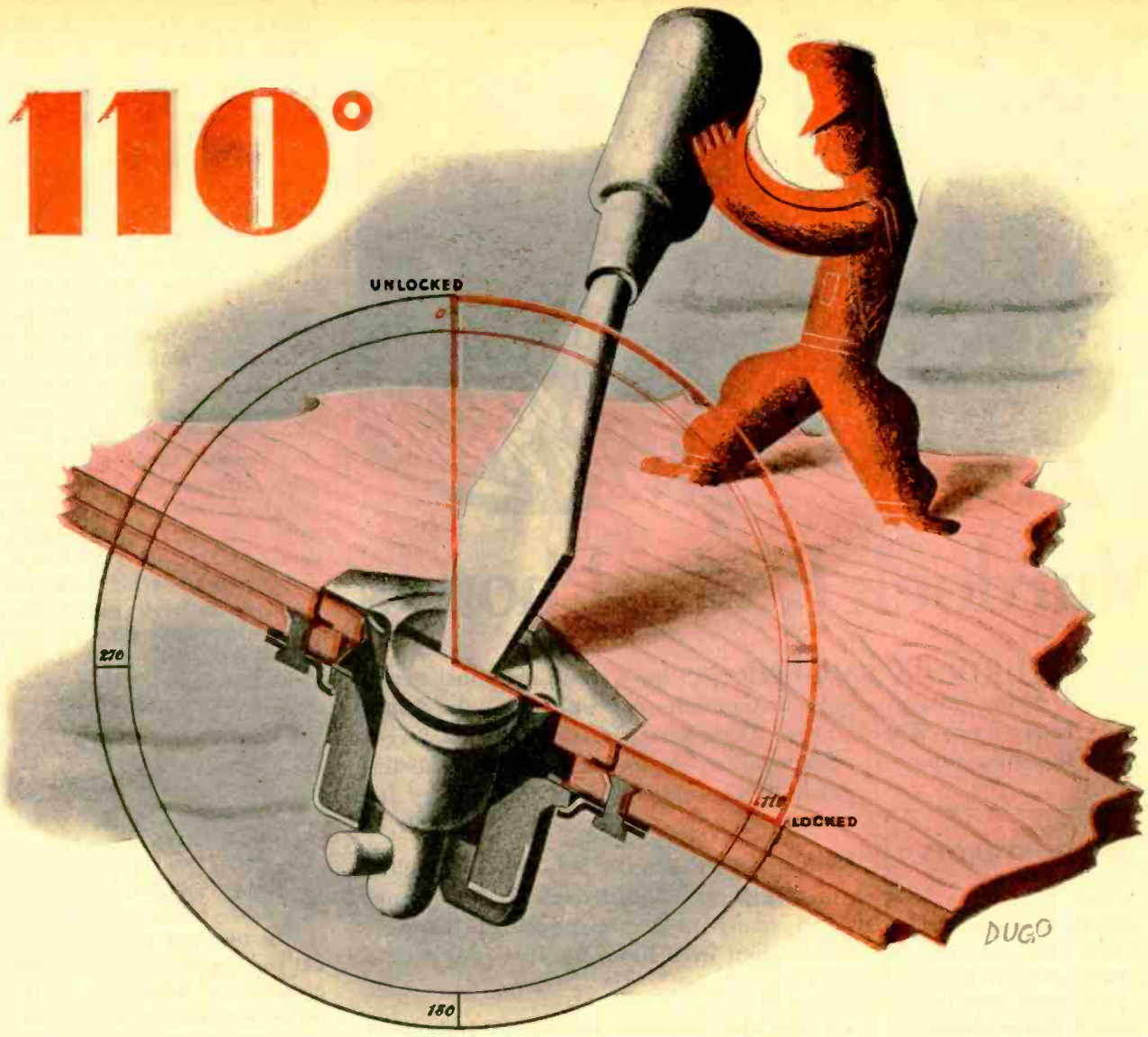

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MILESTONES TOWARD THE ELECTRONIC ERA

Edison's "Etheric Force" Experiments of 1877

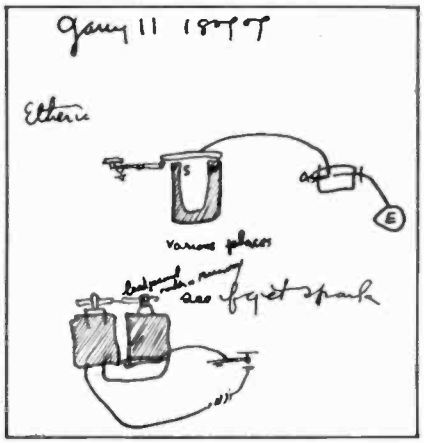
In the present year of 1943 which marks the 60th anniversary of Thomas A. Edison's discovery of the Edison Effect, basic phenomenon of all the electronic arts, it is also interesting to survey some even earlier experiments of the great inventor, which led him very near to the phenomena of radio or high-frequency radiation.

These were the famous "etheric force" or "black-box" experiments which began as far back as 1875, and were revealed in detail some years ago when a forgotten box of old notebooks was unearthed in the laboratory at Orange, N. J. These notebooks, as reported by the New York Times of the period, contained the only record yet found in Edison's own hand of his experiments with what he recognized as a "strange, new force," twelve years before the work of Hertz and twenty years before Marconi's.

"All-diffusive"

But when, back in the seventies, Edison announced his experiments with "etheric force" many scientists jeered. As for laymen, in the '70s there was no popularization of science books. The generation that Currier & Ives and Godey's Lady's Book did so much to commemorate was absorbed in headlines on the Tichborne case, the escape of Boss Tweed, who had looted New York of $20,000,000, and so on. In the large cities skyscrapers had not yet begun to mount, for there were no elevators, no incandescent electric light. There were no subways, no trolleys, no automobiles, no airplanes. This was before the day of the telephone.

Noting the tendency of the new phenomenon to diffuse itself through the



Edison's own sketches of his "etheric force" apparatus, made in 1877 when he carried on his black-box experiments

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air and through material bodies, Edison called it first "etheric" and then "etheric force." Hertz later named it "electric force." Edison also used such terms as "etherism," "ethericity," and "etherodes" to distinguish it from electricity as then understood.

"Tried everything"

In his experiments in 1875, of which the notes were kept by an assistant, Charles Batchelor, the inventor tried twenty-eight metals. Of these, iron and cadmium were the most satisfactory. He also tried with negative results more than fifty solutions of different substances to ascertain if the "force" would mark on paper with these solutions.

The early experiments are dated at the "Menlo laboratory," and at the Ward Street shop, Newark.

Aside from their scientific content these old notebooks are significant for the light they throw on the personality of the inventor. His characteristic disregard of day and night soon becomes apparent. "Quit work at 6 A.M.," reads an entry of Jan. 12, 1877.

Lab notes

Most unusual is his memorandum on Jan. 7, 1877. "Been sick last three days," it reads, "eyes very bad, couldn't do much." These eyes years later still served him through long hours of daily work.

Once he writes, "This page is a failure," and signed his name repeatedly as if in a moment of relaxation; the signature being witnessed by Batchelor, Adams and Johnson, assistants. The page ends with a favorite quotation written in his most perfect vertical hand. "Now in the Winter of our discontent made glorious Summer by this sun of York."

His comments on experiments run the scale from "Discovery," "Extra First Class," "Phenomenon," "Beautiful Experiment" to "Curious," "Unreliable," "Quite Stinking"—the solution not the experiment, "Nix." Suggesting the democratic relationship between him and his staff is the inquiry from one of them: "Edison, what do you think if I make the rubber half as thick?"

Vibrator apparatus

Any bright lad could duplicate today the apparatus that the inventor was using when he first noticed "etheric force." "A vibrator magnet," says the first notebook entry, "consisting of a bar of Stubb's steel fastened at one end and made to vibrate by means of a magnet." In the course of

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his experiment, the electromagnet and interrupter were connected to gas pipes and a dark box was set up in another part of the building. It contained two adjustable conducting points, lead pencils (graphite) close together. An eye piece made it possible to observe the length of sparks between them.

When Edison saw electric energy manifesting itself in open circuit, he did not know that this was due to electric waves in free space. He recognized, however, that he was dealing with a new power and maintained his view in the face of ridicule.

In 1881 *the inventor included "etheric force" in his exhibit at the Exposition Internationale d'Electricité at Paris. Here was shown the dark box of the Menlo Park experiments. This was later in possession of the New York Edison Company.*

His only wireless patent

In 1903 *Edison sold to the old Marconi Company, the only patent he ever took out on the subject of wireless communication.*

The principle behind this later wireless patent was that of induction. The apparatus was to provide a system of transmitting signals electrically to be used between ships at sea, between ships and the land, and between distant points on land. While not radio, it contained many of the elements of wireless. It had elevated masts carrying condenser surfaces to spread electrical impulses, what are very like antennas on the masts of ships, and a detecting apparatus. If Edison had thought of applying his discovery of "etheric force" to this invention, he would have had perhaps a complete system of "wireless."

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of ELECTRONIC INDUSTRIES, published monthly at New York, N. Y., for Oct. 1, 1943, State of New York, N. Y., County of New York, N. Y.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Orestes H. Caldwell, who, having been duly sworn according to law, deposes and says that he is the Editor of ELECTRONIC INDUSTRIES and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, M. Clements, Rumson, N. J. Editor, Orestes H. Caldwell, Catrock Road and Bible St., Cos Cob, Conn. Managing Editor, none. Business Manager, M. H. Newton, 583 W. 215th St., New York, N. Y.

2. That the owner is (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Caldwell-Clements, Inc., 480 Lexington Avenue, New

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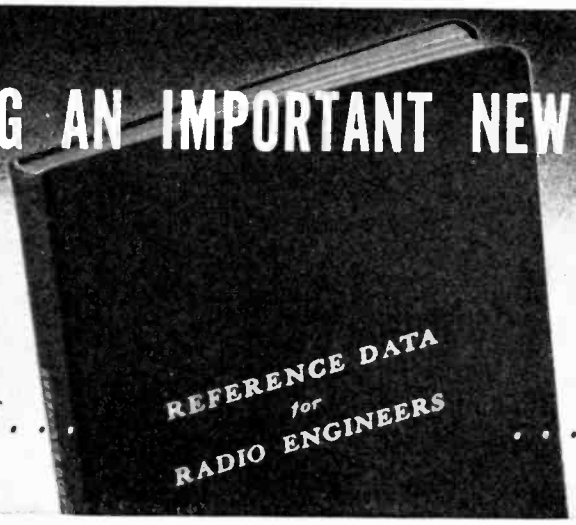

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Appreciating the present special need for radio reference data in compact, convenient form, the Federal Telephone and Radio Corporation presents *"Reference Data for Radio Engineers"* as an aid to radio research, development, production and operation.

In selecting material for this book, the aim was to provide for the requirements of the engineer as well as the practical technician. Hence, more fundamental data are included than usually found in a concise radio handbook, in order to fill a gap that has existed in the past between handbooks and standard radio engineering text books. Special effort also was directed to making the material useful both in the laboratory and in the field.

A glance at the table of contents, listed at the right will show the wealth of subject matter included. All material is presented in a concise, practical form generously illustrated, with more than 175 charts, graphs and tables — all conveniently arranged for ready use.

Material for this Reference was compiled under the direction of the Federal Telephone and Radio Laboratories in collaboration with other associate companies of the International Telephone and Telegraph Corporation. This group of companies (including their predecessors) possesses experience gained throughout the world over a period of many years in the materialization of important radio projects.

This handy new reference should be on the desk of every radio engineer. Order your copy today — only one dollar, in serviceable green cloth binding. The order form at the right is for your convenience.

CHECK THIS TABLE OF CONTENTS NOW

General Engineering Tables. Conversion Table, Fractions of an Inch with Metric Equivalents, Copper Wire Table, Copperweld Wire: Mechanical and Electrical Properties, Standard Stranded Copper Conductors, Screw Head Styles and Method of Length Measurement, Standard Machine Screw Data—Chart for Hole Sizes.

Engineering and Material Data. Insulating Materials, Plastics: Trade Names, Physical Constants of Various Metals, Fusing Currents of Wire, Melting Points of Solder, Temperature Chart of Heated Metals, Spark Gap Voltages, Thermocouples and Their Characteristics, Characteristics of Typical Thermocouples, Head of Water and Approximate Discharge Rate, Wind Velocities and Pressures, Weather Data: (Temperature Extremes, Precipitation Extremes, World Temperatures, World Precipitation.) Principal Power Supplies in Foreign Countries, Audible Spectrum, Ether Spectrum, Radio Frequency Classifications.

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Rectifiers, Special Connections and Circuit Data for Typical Rectifiers, Selenium Rectifiers.

Vacuum Tubes and Amplifiers. Vacuum Tube Design: (Nomenclature, Coefficients, Terminology, Formulas, Electrode, Dissipation Data, Filament Characteristics.) Ultra-High Frequency Tubes, Vacuum Tube Amplifier Design: (Classification, General Design, Graphical Methods,) Resistance Coupled Audio Amplifier Design, Negative Feedback, Distortion, Army and Navy Preferred List of Vacuum Tubes, Cathode Ray Tubes, Approximate Formulas.

Telephone Transmission. Power Ratio, Voltage Ratio, Decibel Table, Transmission Line Data and Constants.

Radio Frequency Transmission Lines. Transmission Line Data: (Surge Impedance of Uniform Lines, Transmission Line Types and Their Characteristic Impedance, Impedance Matching with Shorted Stub, Impedance Matching with Open Stub.) Wave Guides and Resonators.

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Noise and Noise Measurement. Wire Telephony, Radio.

Non-Sinusoidal Waveforms. Relaxation Oscillators, Electronic Differentiation Methods, Fourier Analysis of Recurrent Waveforms, Analyses of Commonly Encountered Waveforms.

Dimensional Expressions.

Greek Alphabet.

Mathematical Formulas and General Information. Miscellaneous Data, Mensuration Formulas, Formulas for Complex Quantities, Algebraic and Trigonometric Formulas, Approximations for Small Angles, Quadratic Equation, Arithmetical Progression, Geometrical Progression, Combinations and Permutations, Binomial Theorem, Maclaurin's Theorem, Trigonometric Solution of Triangles, Complex Hyperbolic and other Functions, Great Circle Calculations.

Mathematical Tables. Logarithms of Numbers and Proportional Parts, Natural Trigonometric Functions for Decimal Fractions of a Degree, Logarithms of Trigonometric Functions for Decimal Fractions of a Degree, exponentials (e^n and e^{-n}), Natural or Naperian Logarithms, Hyperbolic Sines, Hyperbolic Cosines, Hyperbolic Tangents, Bessel Functions.

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(Signed) Orestes H. Caldwell

Sworn to and subscribed before me this 27th day of October, 1943.

R. M. Philips

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Notary Public N. Y. County Clerk's No. 442.
Notary Public N. Y. County Register's No. 4P249.

(My commission expires March 30, 1944.)
New York County Commission expires March 30, 1944.

*Represents minority stock interest which was purchase price for Radio & Television Retailing. Majority stock and control continue in hands of O. H. Caldwell and M. Clements.

General Radio in Chicago

General Radio Co., Cambridge, Mass., has established a new office in Chicago at 920 South Michigan Ave. L. E. Packard, who has been in charge of the company's New York office at 90 West St., will be in charge of the Chicago office. Martin Gilman, formerly at the factory, will have charge of the New York office.

Andrew Exports to Frazar and Hansen

The Andrew Co., Chicago, manufacturer of gas-filled coaxial cables and other antenna accessories, has appointed Frazar and Hansen, San Francisco, its export representatives, effective immediately.

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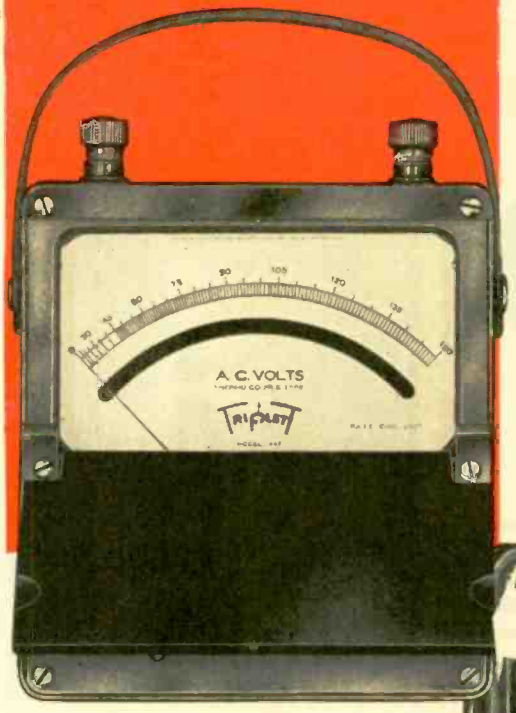

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For additional engineering information on Model 645 and other instruments of the same case style write for 645 data sheet.

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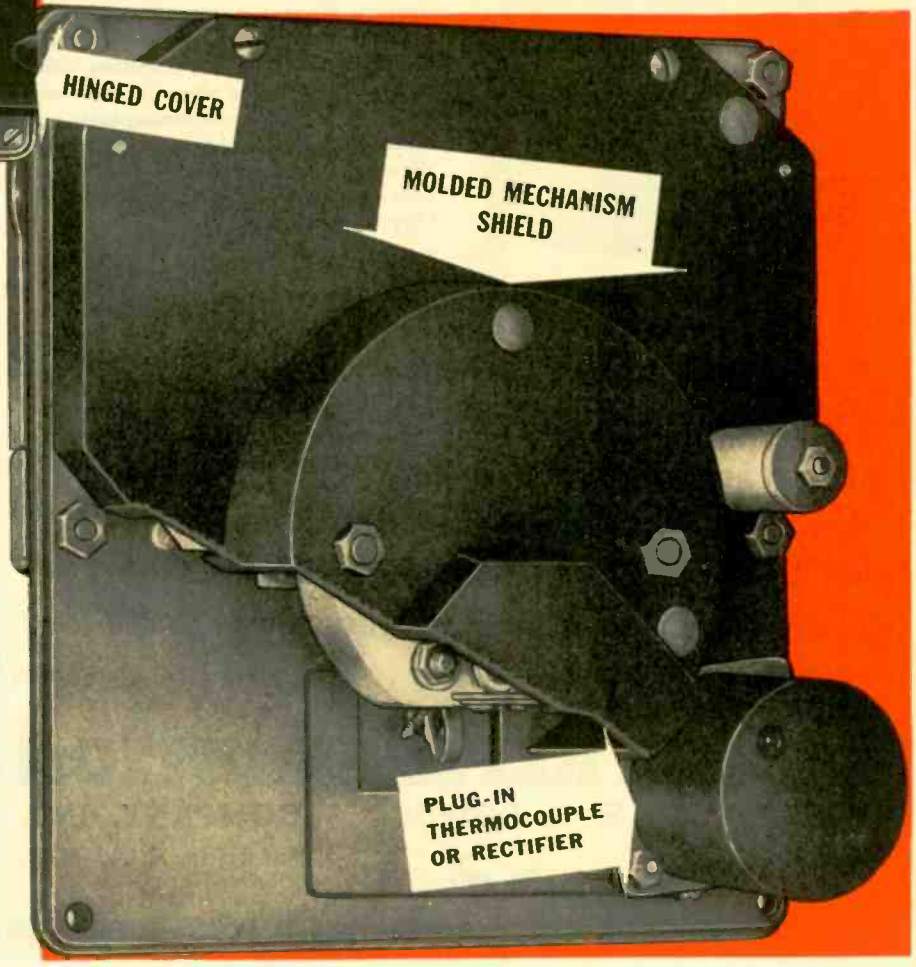


Index in Preparation

A complete index to all editorial material which has appeared in "Electronic Industries" is in preparation and will be available in December. The index will cover a total of fourteen issues, including that for December this year, and thus will list all articles which have appeared since the inception of the publication.

Another Reason for Radio

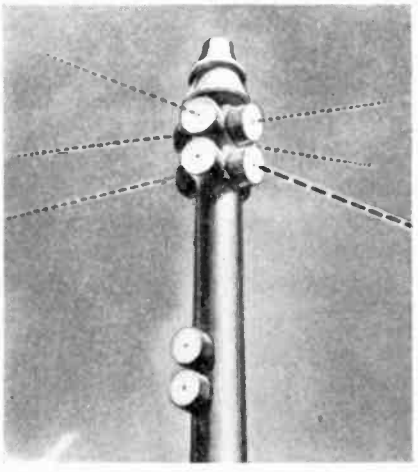
White ants in Australia eat up complete telephone poles in four months, reports Major Jack Lea, formerly of the Information Department of the A. T. & T. Long Lines Department, who is now in the Signal Corps in the "land down under."

While the U. S. Army is constructing telephone lines in areas of Australia which never saw a pole before, Major Lea wrote that the poles have to be metal ones. Otherwise, a pole line of wooden poles and crossarms would be completely devoured by the white ants in four months' time. The curious Americans in the Signal Corps had to be "shown" and put in one wood span near the regular line of metal poles and Major Lea reported, "Sure enough, all we found later was the glass insulators, wire, bolts and braces and the empty holes."

Great Television Network Promised

The extent to which television broadcasting may develop in the postwar period is anyone's guess. But in the opinion of Ralph R. Beal, research director of RCA Laboratories, there surely will be tremendous expansion. He even envisages vast networks extending to the far corners of the earth, and the means that will make this possible, he believes, is a new type of "lighthouse" radio relay station recently developed by RCA. He believes that such unattended relay stations located 20 to 50 miles apart will not only link television stations into national networks but will open up a new era in international communications, through development of trunk lines over such areas as Russia and China.

It is to be expected, he says, that television stations will first go on



Upper section of one of the RCA proposed television "Lighthouses"

the air in such broadcasting centers as New York, Chicago, and Los Angeles. But television will not be limited to the larger cities. The radio map will be dotted with stations. By the use of radio relays, smaller cities, too, will become outlets for the television network which before many years pass after the war, will weave from the east across the Mississippi and the midwest plains to meet a Pacific Coast link striking eastward across the Rockies. A relay station atop Pike's Peak might well be the key station to complete a transcontinental television chain.

Cover the world

Pointing out that radio relay stations may also bring about a vast change in worldwide communications, Mr. Beal points out that, "the routes of these radio relays will extend to any part of the world. They can go through the jungles, from island to island, across mountains and the polar wastes. Neither tropical heat, nor arctic snow, neither

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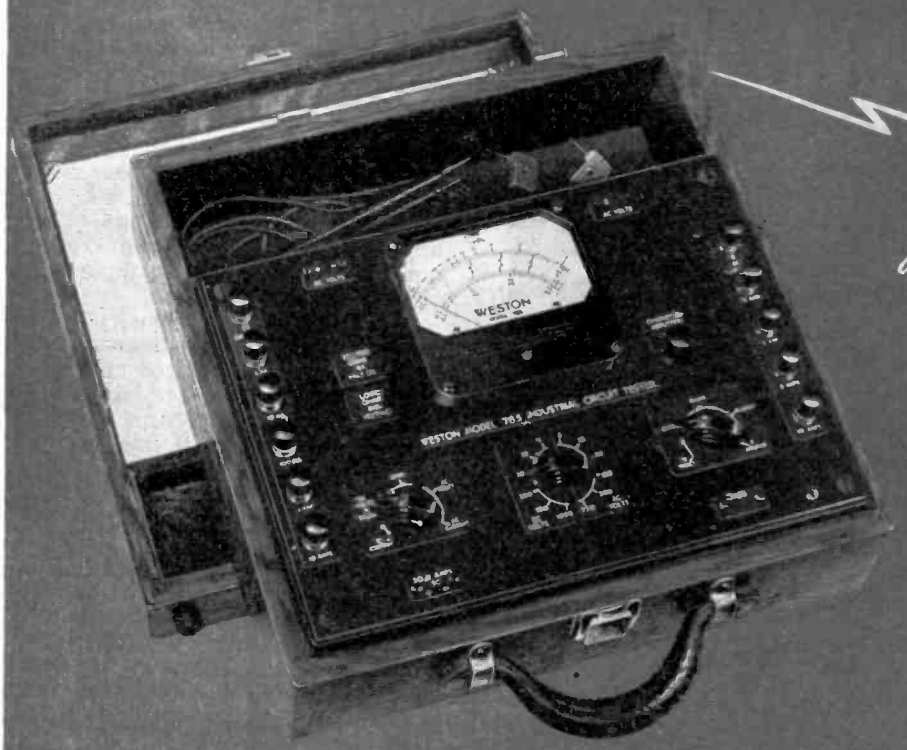

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FOR OVER 55 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

fog nor hurricane will 'cut' the global lines. They can be built to be practical, efficient, and foolproof."

Radio relaying will be a comparatively simple process, Mr. Beal explains. The relay transmitters will operate on microwaves with the energy concentrated almost in a beeline. Practically all the power is made to serve a useful purpose; it is not scattered as in broadcasting. Therefore, relatively small amounts of power will operate the relay transmitters. The apparatus is neither cumbersome nor complicated. It is simple and compact.

The radio relay system is to be no one-way ethereal street as Mr. Beal charts it. Multiple channels make it all the more promising in efficiency, flexibility, and service. The relay towers will handle numerous circuits, for example, down and back from New York to Washington. Furthermore, the circuits can be multiplied to any reasonable extent, not only to carry one television program but several simultaneously, as well as FM sound broadcasts, telegraphic traffic and facsimile. In fact, relay circuits should be among the busiest in the air.

OCD Establishes National Security Award

Radio communications companies and plants manufacturing radio communications equipment may now receive the newly created National Security Award established by the Office of Civilian Defense through formation of a National Board of Review to pass final judgment on the protection and security records of plants nominated for the award.

The National Security Award is granted by OCD to plants and other essential facilities for outstanding achievement in protecting their employes, physical property and production processes against air raids, fire, sabotage, accident and other dangers. The Review Board is composed of delegated representatives of seven major labor, management and safety organizations.

Television Broadcasters Association

Organization of a Television Broadcasters Association has been undertaken by the Society of Television Engineers, of which P. G. Caldwell is president. Representing a committee of this engineering body, Klaus Landsberg and C. F. Wolcott have addressed a letter to prospective television broadcasters suggesting the new association and enclosing proposed by-laws.

POOR COMMUNICATIONS COST 2000 LIVES

What about Ours Today?

THE unnecessary war of 1812 was declared two days after Lord Castlereagh announced in England that the "Orders in Council" (which caused the quarrel) would be repealed — but the Congress of 1812 didn't get the news in time.

The final battle of New Orleans, costing 2,000 lives, was fought fifteen days after peace was signed at Ghent — but the armies hadn't heard the news.

Today news, propaganda, and battle orders can girdle the globe in a second if communications equipment is functioning perfectly.

Radio parts made of Formica help civil and military communications function perfectly because of Formica's excellent insulating qualities at radio and audio frequencies. In addition, Formica is light, strong, tough, moisture resistant, and readily machined. A material possessing such properties will have many new uses in the close knit world of tomorrow, some uses in your product no doubt.

THE FORMICA INSULATION COMPANY
4647 Spring Grove Avenue, Cincinnati, Ohio

ELECTRONIC TOMORROWS

Tube-Actuated Conveniences in the Home of 194X!

Specifications (if we believe all the predictions we hear):

(a) *Entire exterior painted with newly developed invisible paint. Eliminates maintenance because "what you can't see won't hurt you." Also reduces hazard of unexpected guests.*

(b) *Newly developed and super-automatic mail box. Opens and sorts mail, files bills alphabetically in special "future business" compartment, types answers to important correspondence and deposits completed letters on desk in den, ready for signature.*

(c) *Newly developed roofing with impregnated vitamin concentrates — eliminates all vitamin deficiencies. Can also be furnished with mosquito repellent, hay-fever-reducing hormones, and anti-asthma atomizer attachments. (Slight additional cost.)*

(d) *Newly developed, radio-activated, hydro-pneumatic gadget control. Can be adjusted, by simple dial setting, to do the following in sequence: (1) Ring alarm clock; (2) mix baby's formula; (3) prepare breakfast; (4) put the cat out; (5) wash dishes; (6) make the beds; (7) let the cat in; (8) change the linens, and (9) the baby.*

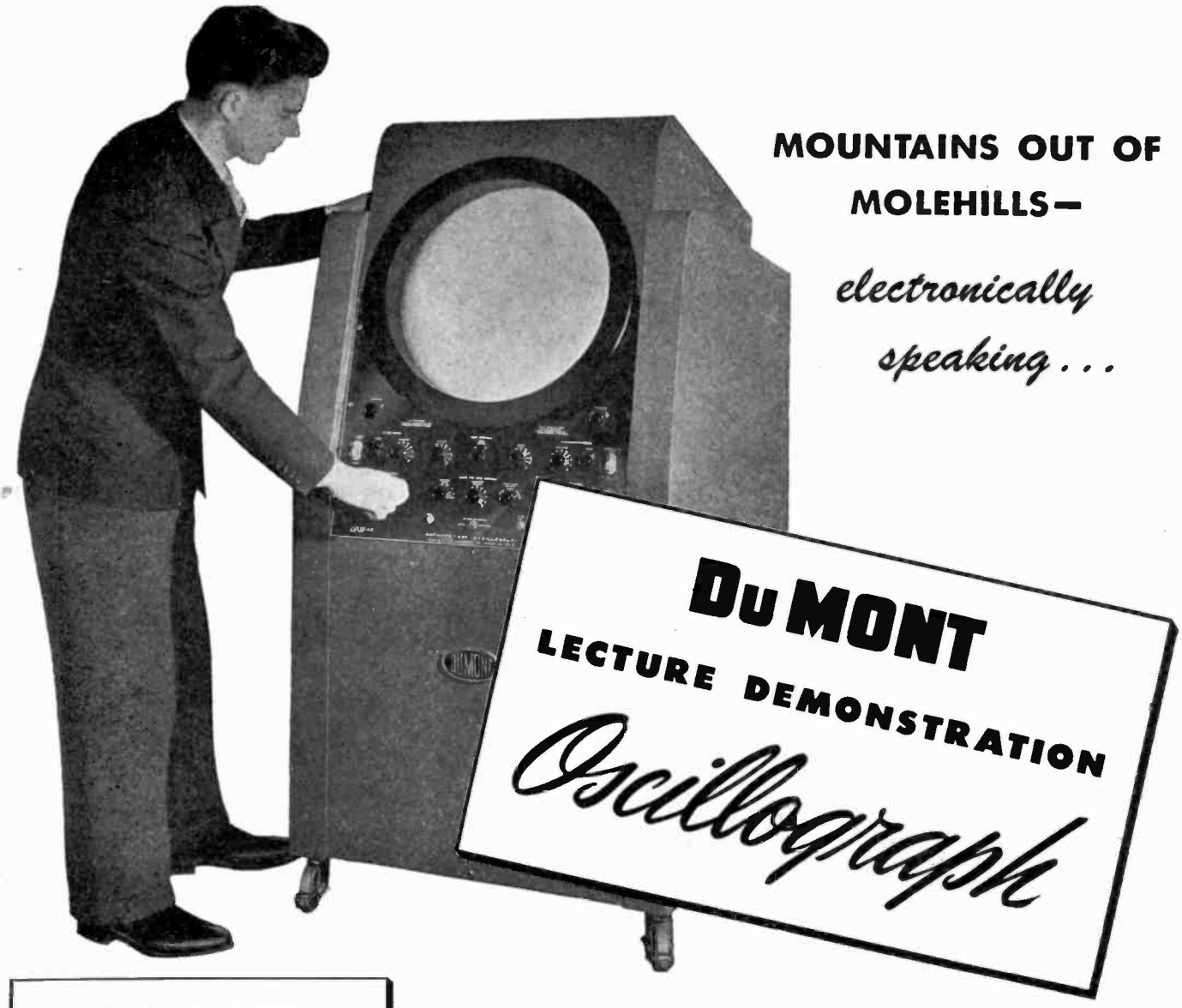
(e) *Newly devoted heating, ventilating and refrigeration system — completely automatic. Provides temperature range from —30 deg. to +120 deg. F. Converts swimming pool to skating rink in 45 seconds.*

(f) *Newly developed multiple-rotating partitioning—converts living room to library to kitchen to bathroom by simple electronic control. Ideal for invalids and inebriates.*

(g) *Newly developed visible doorknob. Serves as landmark in locating entrance to home. Turn of knob automatically cleans and polishes shoes, ejects dog from favorite chair, and tunes in news program.—From advertisement in "Architectural Forum" by Kollsman Aircraft Instruments, Square D Co.*

Preference Rating Order P-133 Revised

The WPB has revised Preference Rating Order P-133 to make it the exclusive controlling order for obtaining maintenance, repair and operating supplies for radio communication and radio broadcasting. At the same time, the WPB stated that CMP Regulations 5 and 5A governing expenditures up to $500 for capital equipment, under the MRO rating no longer apply to these businesses. The amended



MOUNTAINS OUT OF MOLEHILLS—

electronically speaking . . .

DuMONT TYPE 233 OSCILLOGRAPH

DuMont Type 20AP1 intensifier-type 20" dia. cathode-ray tube. Medium-persistence green screen. 6000 v. total accelerating potential.

X- and Y-axes arranged for either conductive or capacitive coupling through stepped attenuator. Z-axis and synchronizing circuit capacitively coupled.

X- and Y-axes amplifier frequency response 2 to 75,000 c.p.s. Z-axis, 10 to 750,000 c.p.s.

Linear time-base generator: frequency of sweeps, single or continuous. Frequency range, 8 to 30,000 sawtooth c.p.s. Synchronized with either positive or negative polarity of power line frequency, external signal or Y-axis signal.

Instantaneous type of positioning circuits.

Elimination of trapezoidal distortion of image and non-symmetric deflection.

Dimensions: 60" high x 28" wide x 36" deep. Weight: Approximately 325 lbs.

Self-contained power supply. 115 v. 50-60 c.p.s A.C. Approximately 350 watts.

DuMont Type 233 cathode-ray oscillograph is a giant-screen instrument of moderate cost. Suitable for lecture demonstration. Or for laboratory studies in which detailed analysis of fine-structure wave forms is required. This instrument is already playing a vital role in the war effort.

The 20-inch DuMont cathode-ray tube provides a brilliant trace observed with ease at distances normally encountered in lecture halls and even large auditoriums.

Other essential features are the identical amplifiers for signal deflection along both horizontal and vertical axes; the Z-axis amplifier for intensity modulation of the cathode-ray; a linear time-base generator; and the associated power and control circuits. Sturdy metal cabinet mounted on locking casters. Sloping control panel directly below screen. Completely self-contained. Plugs into usual A.C. outlet.

Write on your business letterhead, for bulletin describing this instrument, or for manual and catalog on entire DuMont line. Type 233 is available for early delivery, on proper priority.

DUMONT

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

P-133 Order continues to give the AA-1 preference rating and use of the allotment symbol "MRO" to persons engaged in the radio communications business and the AA-2 rating and "MRO" symbol to those in radio broadcasting for obtaining maintenance, repair and operating supplies. The amended order establishes the rating of AA-5 without the "MRO" symbol for supplies obtained for sound recording for commercial purposes, which had previously been rated AA-2X. The amended order also exempts international point-to-point radio communication carriers from the necessity of obtaining special authorization for the purpose of expanding existing facilities and equipment (but not buildings) to the extent of $1,500 for any one project, and permits the use of the rating and allotment symbol. Other changes include a clarification of tube inventory restrictions, but no important change in the average radio station's stock is likely to result from the changes, it was stated.

Hazeltine Protests Contract Cancellation Delays

Criticism of delays in the settlement of electronics contract terminations by both the Navy and the Army Signal Corps and the General Accounting Office was presented by John D. Grayson, Comptroller of the Hazeltine Electronics Corp. at a mid-October hearing of the Senate Military Affairs Sub-Committee studying renegotiations and contract terminations.

Mr. Grayson brought out in his testimony that the long delays in the settlement of these terminated contracts blocked the distribution of critical materials which took up a lot of factory storage space. He pointed out that companies which had terminated contracts and substantial supplies of critical materials as a result of such actions were contacted frequently by Army and Navy Inspectors who wanted the release of these critical materials, but the management of the companies had their hands tied until the settlement was completed.

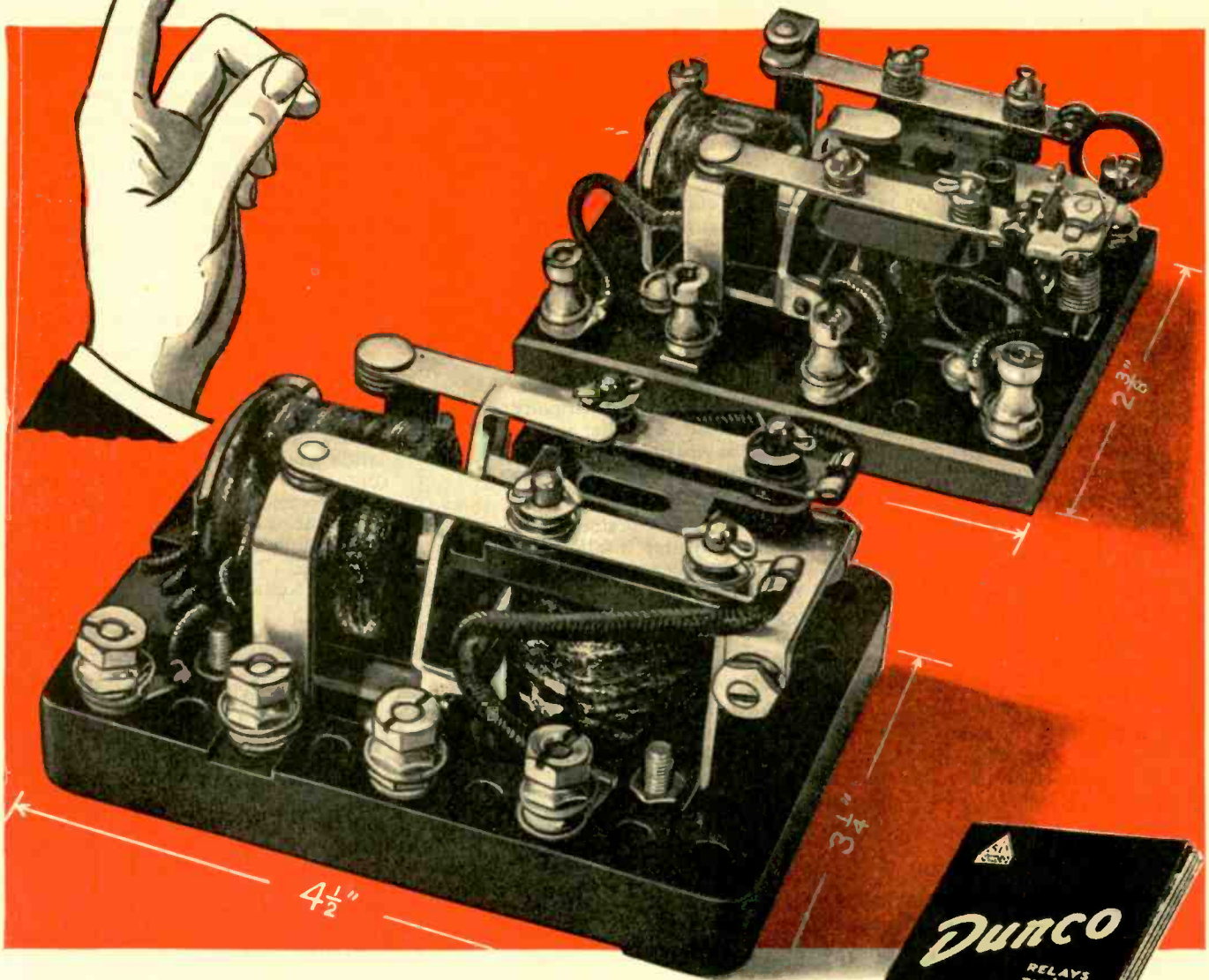
The Navy contract of $5,500,000 was given to the Hazeltine Corp. under a letter of intent in January 1942, with the actual contract being transmitted the following October. A preliminary cancellation was transmitted to the company in January, 1943, and the detailed cancellation notice was received May, 1943. The Hazeltine Corp. filed its cancellation claim of $1,007,000 on June 8, 1943. A settlement was signed by the company and the Navy Department on August 6, but the payment is still being held up by the General Accounting Office.

Dunco "Memory" Types

THE RELAYS THAT NEVER FORGET

Struthers-Dunn Mechanical Latch-in, Electrical-Reset Relays have fool-proof memories. They indicate what operations have been made on your equipment. They guard against mistakes. The contacts "remember" unfailingly which coil was last energized—*by remaining in position until they are released by energizing the other coil.*

Hundreds of jobs throughout industry are being performed better, more efficiently because these Struthers-Dunn Memory Relays permit of no forgetting. They are made in both the large (Series 5) and the "midget" (Series 51) sizes as well as aircraft types, and with practically any contact or mounting arrangement. You'll find these Relays described in detail on Pages 14F, 15F, and 16F of the Dunco Catalog and Relay Data Book (see below).



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STRUTHERS-DUNN, Inc.

1321 ARCH STREET, PHILADELPHIA, PA.

"Trail Blazers to Radionics"

About two years ago, when frequency modulation first began coming into general use, Zenith's engineering correlator, Miss Elizabeth Kelsey, prepared a bibliography of existing literature about this new method of radio transmission and reception. It was designed for use in Zenith's own engineering department, but news of it spread through the industry, and Zenith was swamped with requests for copies.

Last year Miss Kelsey prepared a "Reference Guide to Ultra High Frequencies," which was enthusiastically received by thousands of physicists, radio engineers, college and high school teachers, laymen, and men in the communications divisions of our armed forces.

So rapid is the progress in ultra high frequency research that any bibliography on the subject must soon become incomplete. There was also need for another section comprising brief biographical sketches of the great men of science who have contributed, directly or basically, to the development of radionics in all of its branches. Hence this new edition, "Trail Blazers to Radionics."

10,000 copies mailed

About ten thousand copies were mailed last month to owners of the earlier edition who had requested a place on the mailing list. In response to requests already thousands of additional copies are on their way, not only to the armed services and their schools, but to laboratories and factories that supply them with aircraft and with radionic equipment, as well as to schools, communications companies, etc.

So long as Zenith can get the paper to print them, the company will continue to fill all such requests, free of charge, as a contribution from Commander McDonald, president of Zenith, to the victory program.

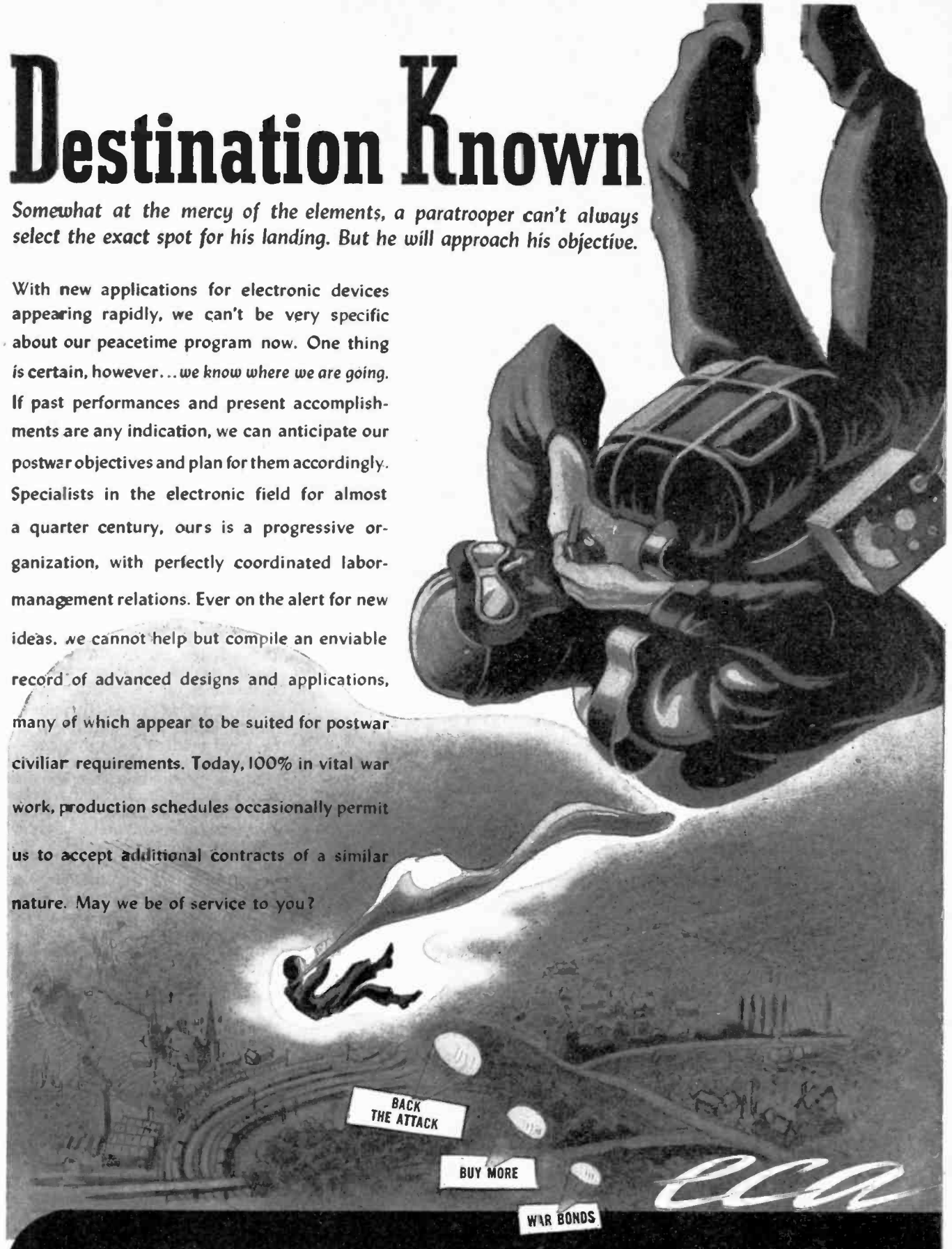
"Now a word about the author," adds Zenith's Ted Leitzell. "Her standing in professional and technical circles is described in the book's preface, but that is only part of the story. In appearance she is much more like an attractive young college student than an erudite physicist. Moreover, she is an accomplished violinist, an artist whose oil paintings have received wide recognition, and a photographer whose salon prints have won trophies in exhibitions all over the country."

Requests for copies of "Trail Blazers to Radionics" should be addressed to E. Kelsey, Zenith Radio Corporation, 680 North Michigan Ave., Chicago 11, Ill.

Destination Known

Somewhat at the mercy of the elements, a paratrooper can't always select the exact spot for his landing. But he will approach his objective.

With new applications for electronic devices appearing rapidly, we can't be very specific about our peacetime program now. One thing is certain, however... *we know where we are going.* If past performances and present accomplishments are any indication, we can anticipate our postwar objectives and plan for them accordingly. Specialists in the electronic field for almost a quarter century, ours is a progressive organization, with perfectly coordinated labor-management relations. Ever on the alert for new ideas, we cannot help but compile an enviable record of advanced designs and applications, many of which appear to be suited for postwar civilian requirements. Today, 100% in vital war work, production schedules occasionally permit us to accept additional contracts of a similar nature. May we be of service to you?



ELECTRONIC CORP. OF AMERICA

45 WEST 18th STREET • NEW YORK 11, N. Y. • WATKINS 9-1870

Functional Work of Radio and Radar Branches

In connection with the reorganization of the Radio and Radar Division of WPB, charted in the last issue of "Electronic Industries," Director Ellis has made public some details of the specific work of the various branches.

The Products and Facilities branch, under Elmer R. Crane, has the task of determining and administering plans for the production of components required for electronics equipment. The requirements of the Armed Services and the productive capacity of the components industry is reported in terms of a common denominator known as prototypes. When the demand for particular prototypes exceeds the available supply, steps must be taken to expand productive capacity or to find a suitable substitute. (See chart on page 162.)

The End Products branch, under L. J. Chatten, develops and recommends to all claimant agencies plans for the procurement of electronics end products to meet military requirements, making the most efficient use of existing facilities. Where facilities are inadequate, it recommends expansion or new facilities. The branch expedites corrective measures through appropriate agencies where current deliveries or estimated future deliveries fail to meet requirements.

The Industrial Instruments branch, under E. A. Capelle, acts as the focal point for all problems affecting the production and distribution of products within its jurisdiction. Manufacturers report regularly their production and backlog of orders for pyrometers, tube system instruments, industrial thermometers, flow instruments, combustion control equipment, dial pressure gages, pressure controllers, control valves, regulators and liquid level instruments and the components primarily used in their manufacture.

Armed force requirements

The Program branch, under Frank S. Boland, screens and correlates the requirements of all programs for procurement manufacture and distribution of electronics equipment for the armed forces, for export and for essential civilian requirements. It establishes the relationship of such programs to the policies of WPB and plans the implementation of resulting WPB programs. The chief operating function of the branch is to plan and supervise the operations of the Controlled Materials Plan with respect to the electronics industry at the claimant agency, or consumer, level as distinguished from the dis-

OVER 100 MILLION ACCEPTED!

BUY WAR BONDS

In 8½ years, equipment designers have called for RCA metal electron tubes to the tune of over 100 million. Metal tubes — whose development was declared by Electronics magazine (April, 1935) to be "the most radical design change since the days of the Fleming valve" — have become an industry favorite.

Acceptance like that is based on merit.

Put to the test, metal tubes have produced results attributable in no small part to the many advantages inherent to their metal design.

If you would like the help of RCA electronics engineers in connection with your tube application problems, write, *outlining your problem*, to Radio Corporation of America, Commercial Engineering Section, 528 South Fifth Street, Harrison, New Jersey.

Here, Mr. Electronics Engineer, are some of the present-day points of superiority that RCA metal tubes make available to you:

1. EXCELLENT SELF-SHIELDING — gives you great freedom in locating tubes with respect to other equipment components.
2. COMPACTNESS — means compactness of equipment design because of important reductions in overall dimensions.
3. SHORT LEADS — make metal tubes suitable for high-frequency applications.
4. SIMPLE GROUNDING — is provided since all ground connections can be made to No. 1 socket terminal.
5. OCTAL BASE — provides self-aligning feature and generous pin-contact area.
6. CLOSE DIMENSIONAL TOLERANCES — reduce space allowances necessary for tube-size variations.
7. LOW OVERALL COST — results from simplification of equipment design, wide acceptance, and high production.
8. WIDE SELECTION — is afforded by well-diversified metal-tube types to meet various equipment-design requirements.
9. ACCEPTANCE BY YOUR CUSTOMERS — has been created by the steady growth of confidence gained by users in nearly a decade of experience with metal tubes and their performance capabilities.

FREE! Write RCA, 522 South 5th Street, Harrison, N. J. for latest list of Army/Navy Preferred Type Tubes

The Magic Brain of All Electronic Equipment Is a Tube . . . and the Fountain-Head of Modern Tube Development Is RCA

TUNE IN "WHAT'S NEW?" RCA'S great new show, Saturday nights, 7 to 8, E. W. T., Blue Network

RADIO CORPORATION OF AMERICA

tribution or manufacturers level. As part of its functions, the Program branch establishes the statistical controls and systems necessary to remain cognizant of the current status of requirements, production and materials flow.

The Distribution and Scheduling branch, under Arthur J. Wilson, is responsible for receiving and processing applications for critical materials and scheduling production and delivery of products and critical components.

The Domestic and Foreign branch, under Frank M. McIntosh, is responsible for production and distribution of components and equipment for broadcasting stations, international communications systems, public address systems and ship-to-shore communications. All matters pertaining to civilian radio requirements are referred to the branch for appropriate action.

The Field Service branch, under Frank S. Horning, administers all field problems outside the Washington level. It is made up of 37 Radio and Radar specialists in 13 regional offices throughout the United States, who coordinate activities of producers of electronics equipment. From the regional offices, manufacturers may obtain detailed information regarding all programs and proper interpretations of L and M orders pertaining to the industry.

War Radio Needs Stepped Up Twelvefold

At the recent War Department conference in Washington of Industry, Labor and Press leaders, the requirements of the Army in the radio and electronic fields were highlighted by Brigadier General John R. Gardner, Assistant Chief and Distribution Service, who stated of the Signal Corps' Procurement that the needs of the Signal Corps for radio, telephone, wire and other communications equipment, call for deliveries in 1943 totaling about $3,250,000,000, or 2½ times the 1942 production. In 1944, $4,500,000,000 worth of materiel must be produced, or 1/3 more than in 1943, he said. General Gardner stressed that "from now on, monthly production must exceed 12 times that of the entire prewar radio industry."

Citing that since September, 1941, the Signal Corps has ordered $7,000,000,000 worth of communications equipment, General Gardner pointed out that in 1944 the volume of all Air Forces Signal equipment will be approximately two-thirds greater than 1943 so that intensive effort will be necessary to meet the 100 per cent increased requirements for 1944. While somewhat more stabilized and with their production continuing at peak 1943

production rates, he noted that ground radio, wire communications and miscellaneous equipment programs are equally important, and declared that the next year and a quarter "will be strenuous for ourselves and our 5,000 contractors," but schedules "must be met in spite of shortages of manpower, engineering ability and rapidly changing military requirements."

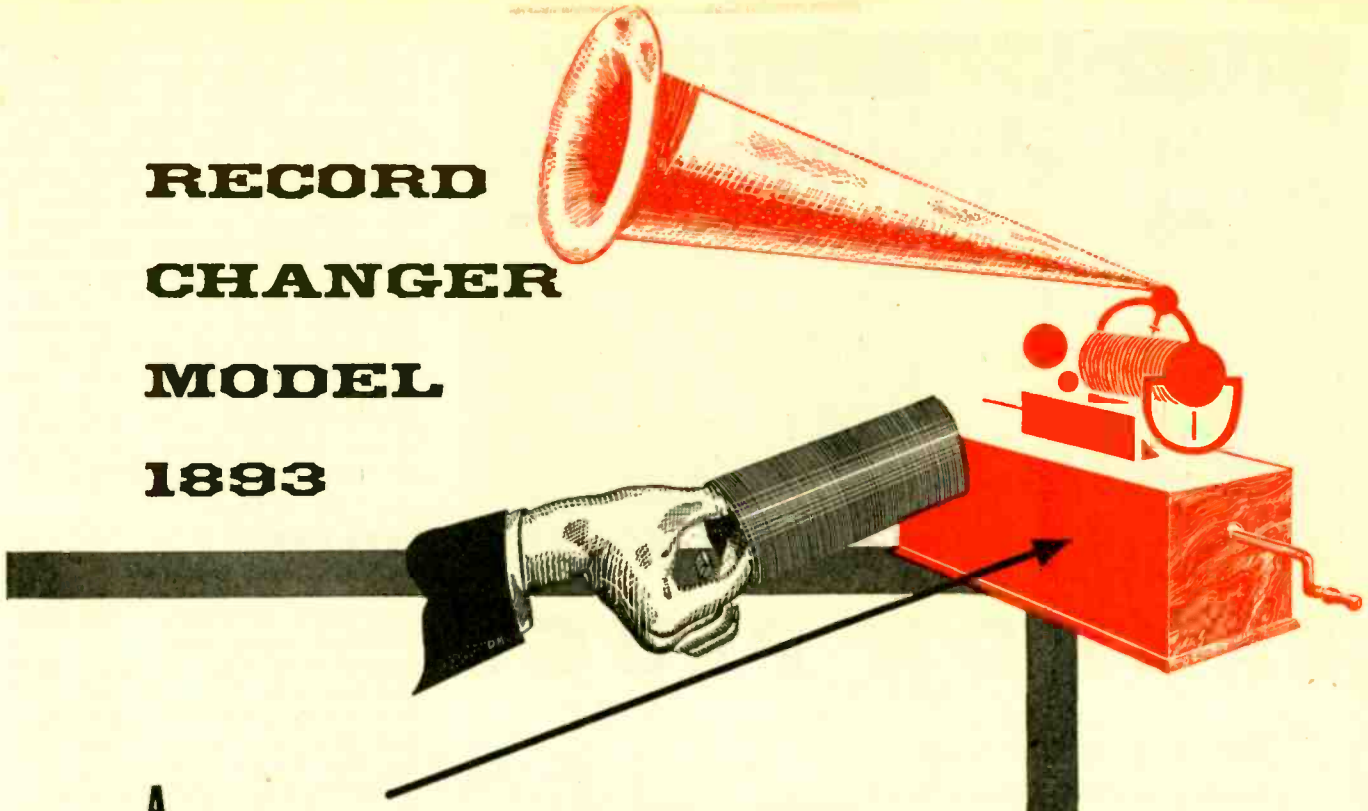
Signal Corps in Sicily

In his report on "Logistics," Major General LeRoy Lutes, Director of Operations of the Army Service Forces, gave a description of the Signal equipment requirements for the Sicilian attack. Radio sets were furnished just prior to the attack, including a number of the 17,000 pound truck-and-trailer-mounted radios, the basic Signal equipment for infantry and motorized divisions. These were obtained through the postponement of the fulfillment of some demands for training requirements in the United States although no sets were pulled back that were already in the hands of troops in this country. He noted that mine detectors, because of the British and French demands and requirements for replacement, had to be flown by air to North Africa to meet the invasion deadline. The same kind of expediting by fast shipments was needed in the case of the handy-talkies and several hundred larger sets, a hundred of which were lent to the Navy for the combined operations. In addition, General Lutes stated there were tremendous quantities of telephones, switchboards, wire, pole and line hardware and teletype equipment.

Communications the key

"Any large scale amphibious operation depends heavily upon communications," General Lutes stated, "and our Signal supply men were simply blitzed this past spring with requisitions from General Eisenhower for the attack on Sicily. For other reasons, this flood of requisitions was beyond all previous estimates, even for an over-water operation. First of all, as the Tunisian campaign developed, they had to carry the communication system in Africa farther to the East than originally planned. Also, the very excellence of the U. S.-made Signal equipment had brought urgent requisitions on General Eisenhower from our British and French allies for radios, mine detectors, etc. Consequently, when General Eisenhower began requisitioning more Signal supplies in April and May, the quantities needed were far beyond what the Army Supply Program had estimated."

RECORD CHANGER MODEL 1893



A FLEETING GLANCE in retrospect is a convincing revelation of how far we have come along the pathway of science and invention in a half century. It is also a promise and a prediction of what goals may be reached in the years ahead.

The AUTOMATIC RECORD CHANGER—today a specified unit of modern phonographs—is a striking example of this progress. Prior to Pearl Harbor G. I. Record Changers had won distinct recognition for their long-term, service-free dependability, their permanence of factory adjustment and ease of installation. But our record changers of the future will definitely surpass those of yesterday, for normal advancement has been accelerated by the improved designing and production skill demanded by the present great emergency.

While we cannot plan all the details now, we can lay the foundation for the new devices and products which are the harvest of wartime ingenuity. Our thinking—our designing and potential production facilities can be of value to you if you include them in your own post-war plans. We would be happy at the opportunity to call and sit down with you to discuss it.

General Instrument CORPORATION

ARMY E NAVY

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

Another officer, Colonel Emmett O'Donnell of the Air Corps, in his report on "Supply by Air" pointed to the network of visual air warning stations, each equipped with radio, that were set up in the India-Assam territory, to give notice of the approach of heavy Japanese air squadrons raiding the Assam air fields. "Upon observing the approach of the Japs, radio notification from these outposts permitted our fighters to get off in time for interception . . . and made these enemy forays so costly that they now visit us only rarely. The secret of our fighter success lay in this air warning reporting system."

"Sun Radio" Adds "Electronics"

In order to associate the firm's activities more closely with the rapidly developing electronic field, the Sun Radio Co., 212 Fulton St., New York, has modernized its name and will henceforth be known as the Sun Radio & Electronics Co. Established in 1922, the company is presently devoting its efforts to furnishing priority requirements for radio—electronic supplies to industrial organizations, research laboratories, schools, colleges, training centers, U. S. Army Signal Corps, U. S. Navy, telephone-telegraph companies, broadcasting stations, public utilities, civilian defense leagues, aircraft plants, shipyards, railroads and others engaged in the war effort.

Electronic Heating Produces 2500% Speedup

Some war production operations have been speeded up by as much as 100 to 2500 per cent by the use of electronic devices for industrial heating, declared Henderson C. Gillespie of the RCA Victor Division, Radio Corporation of America, at the October 13 meeting of the New York Electrical Society.

Addressing the 587th meeting of the Society at New York, Mr. Gillespie cited the experience of several firms in the aircraft and plastics industries. Introduction of radio-frequency heating through electronic devices to prepare compregwood propeller blades for molding, reduced the time required for the molding cycle from seven hours to three. One electronic device stepped up the soldering of bases of radio condenser cans from 100 cans an hour to 2,500.

In addition to soldering and the pre-heating of wood and plastics for molding, Gillespie said, radio-frequency heating applied through electronic devices, has proved its advantages in terms of improved

Design Engineers!

Kollsman Offers This New Line Of Miniature Motors For Special Applications

A new line of miniature motors with special remote indication and electronic control applications has been developed by Kollsman Instrument Division of Square D Company. Design engineers of electrical and electronic equipment manufacturers will find Kollsman engineers ready to assist them in applying and adapting these motors to their specialized requirements.

Complete information and performance data on the five units described here can be obtained from this catalog. Write to Kollsman Instrument Division of Square D Company, 80-12 45th Avenue, Elmhurst, New York.

A: KOLLSMAN TWO-PHASE GENERATOR—High impedance, permanent magnet, two-pole generator, capable of operating at speeds up to 2500 R.P.M., delivering up to 83 volts. Compact, light in weight, and designed to operate under widely varying temperature and humidity conditions.

B: KOLLSMAN TELETORQUE UNITS—Self-synchronizing motors operating in same manner as Telegon units. Capable of remotely indicating movement produced by relatively low torque prime movers but may be used advantageously in some remote control applications. Up to 1.56 in./oz. peak torque.

C: KOLLSMAN DRAG CUP MOTOR—Specially designed high-speed precision motors for applications requiring quick starting, stopping and reversal characteristics. This performance is obtained through the use of a light-weight, low inertia rotor of unique design. Stalled torque, .50 to .70 in./oz.

D: KOLLSMAN ROTATABLE TRANSFORMERS—Two-pole motor-like devices with high impedance phase windings and single phase rotors. Voltage output range 0 to 56 volts with 60 cycle, 32 volt input and 0 to 193 volts with 400 cycle, 110 volt input. May be rotated at any speed up to 1800 R.P.M.

E: KOLLSMAN TELEGON UNITS—Self-synchronous motors for use where only an extremely small amount of torque is available from prime mover. Also suitable for use as a rotatable transformer on such applications.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

ELMHURST, NEW YORK • GLENDALE, CALIFORNIA

products and savings of time, space and labor for case-hardening, annealing, and welding of metals, baking paint, tacking plywood, seaming thermoplastic fabrics, drying textiles, and other industrial operations.

Demonstrates "nail gun"

Mr. Gillespie demonstrated to members of the Society the use of the RCA "radio nail" gun or spot gluer, designed especially for use in "tacking" thin layers of wood as they are laid up on a mold in the fabrication of shaped plywood parts, and a rivet detonator, used in connection with an explosive rivet developed for riveting in inaccessible places.

The "radio nail" gun, resembling a small automatic pistol, shoots a charge of radio-frequency current through the top layer of wood to form a bond in glue which has previously been applied between the layers, thus preventing the layers from slipping as they are laid up.

The rivet detonator sends a charge of current into the head of a special rivet, setting off a small charge of explosive which spreads the other end of the rivet on the "blind" side which cannot be reached.

By comparison with flames and other usual sources of heat for industrial processes, Gillespie said, radio-frequency heating is not only quicker but also permits closer control as to the area to be heated, provides more uniform heating, and for many processes is more efficient and more easily adapted to mass production methods.

Accurate control of heating

The degree of control, he said, is illustrated by the fact that one end of a set screw can be brought to a white heat while the other end remains cool. This is an advantage, he pointed out, in the manufacture of many machine parts which function best if one portion is case-hardened while adjacent areas remain unhardened.

A good example of the desirability of uniform heating throughout a piece of material is found in the pre-heating of plastic materials to prepare them for molding, he said. Heat from conventional sources must pentrate the raw material from the outside, which tends to pass through the desired "tacky" stage and harden before the inside becomes workable. With radio-frequency power, which generates heat within the pre-form itself, the entire piece becomes workable at one time.

Other advantages stem from the fact that radio-frequency heating generates heat in the object treated, with no transfer of heat required, Mr. Gillespie said. This means that heating of associated elements is unnecessary, there is little heat loss to surroundings, no actual contact with materials to be heated is required, corrosive gases are eliminated, and surfaces of material being worked are not adversely affected.

"Insurance" Reserves Needed

Some excellent reasons why industry should be permitted to accumulate reserves for use through the coming reconversion period have been advanced by John Meck, head of the Plymouth, Ind. company, which bears his name.

"The man working for peace right now is coincidentally working for his dismissal check, unless reserve funds to tide his employer over the reconversion era are provided for immediately," he says, pointing out:

"Heavy Federal taxes are prohibiting such a reserve, and termination of war contracts will strand the manufacturer with large stocks of worthless, unfinished goods, plus the expense of reconverting his equipment and rebuilding his peacetime business. Large percentages of war workers will be out of the immediate postwar picture entirely.

WHEN WAR began, among products high on the "critically needed" list were N. U. power tubes. To operate thousands of field and ship transmitters, these tubes were needed in quantities which called for vastly increased facilities *plus some entirely new thinking along mass production lines.*

With a thoroughness that could not miss, National Union engineers went to work on this assignment. Soon they not only had the increased volume required—but in addition we had found the answer which many a tube engineer and production man had long sought, even prayed for . . . the Tube Industry's first automatic exhaust and sealing machines to operate successfully with this type of tube.

Such resourcefulness and engineering capacity have played no small part in making National Union one of the Tube Industry's largest producers of war goods. For improved types of tubes and installation data to keep their post-war business in step with electronics progress, service engineers can *count on* National Union.

National Union Radio Corporation, Newark, N. J.

Factories at Newark, N. J.; Maplewood, N. J. Lansdale, Penna.; Robesonia, Penna.

NATIONAL UNION

RADIO AND ELECTRONIC TUBES

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

"With no backlog of funds, tax-free and renegotiation-free, the employer cannot afford to cripple his business further by maintaining an overgrown payroll during the reconstruction period. If there is a specific reserve for the purpose however, we can put all our employes to work on peacetime products immediately after the war is over," he adds.

RMA Committee Chairmen

In addition to organizing the new RMA Committee on Postwar Planning, President Paul V. Galvin has realigned the Association's standing and special committees, for a second year on a wartime basis. RMA committees dealing solely with civilian radio problems still are generally suspended, except for committees on civilian replacement parts. All RMA activities continue to be centered on the war program of the industry, which now is projected into 1945. The RMA war effort will continue under the direction of the Association's Executive Committee and Board of Directors, plus the new activities of the Postwar Planning Committee.

RMA committee chairmen appointed by President Galvin for the ensuing year are:

By-Laws and Organization Committee—Leslie F. Muter, Chicago

Credit Committee—T. A. White, Chicago, Eastern Vice-Chairman; H. A. Pope, Newark, N. J.; Western Vice-Chairman, E. G. Carlson, Chicago

Engineering Department—Director, Dr. W. R. G. Baker, Bridgeport, Conn; Assistant Director, Virgil M. Graham, Emporium, Pa.; Manager, RMA Data Bureau, L. C. F. Horle, New York

Export Committee—Walter A. Coogan, New York

Legislative Committee—J. J. Nance, Chicago

Membership Committee—Roy Burlew, Owensboro, Ky.

Service Committee—F. E. Smolek, Chicago

Traffic Committee—O. J. Davies, Camden, N. J.

Organization of Radio Technical Planning Board Committee—A. S. Wells, Chicago

Postwar Planning Committee—R. C. Cosgrove, Cincinnati

Replacement Parts Committee—Robert C. Sprague, North Adams, Mass.; Vice-Chairman, Arnold O. Braun, Indianapolis

RMA-OEW Export Committee—Walter A. Coogan, New York

Special committees

Another special committee on advertising is to be established later by the RMA Set Division, under Chairman R. C. Cosgrove. President Galvin also is empowered by the RMA Board of Directors to appoint additional committees necessary in the war program and also on any other industry projects.

The RMA Replacement Parts Committee, headed by Chairman Sprague, will cooperate with the WPB Radio Division, particularly with Chief Frank H. McIntosh, Domestic and Foreign Branch, on the future WPB program for civilian replacement parts, similar to the present cooperation, on the WPB replacement tube program, of the RMA Tube Division headed by Chairman Max F. Balcom. The parts program is now scheduled to follow WPB completion of the tube program. In addition to Chairman Sprague, the following are members appointed to the Replacement Parts Committee: Directors H. C. Bonfig, Camden, N. J.; J. J. Kahn, Chicago, and Messrs. H. E. Osmun, Milwaukee; Ernest Searing, Philadelphia; F. E. Smolek, Chicago, and Fred D. Williams, Philadelphia.

Legislation, membership

The new Legislative Committee under Chairman J. J. Nance consists of M. F. Balcom, Emporium, Pa.; R. C. Cosgrove, Cincinnati; J. R. McConnell, Camden, N. J.;

THROUGH ELECTRONICS

we knew it would be a nice day for a boat ride

Man's ability to forecast weather is close-knit with his whole economics of living.

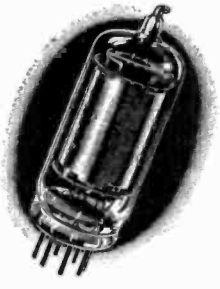
Electronics in the form of the Radiometeorograph is the modern method of collecting weather data. Carried by a small balloon high above the earth and there released by parachute, the Radiometeorograph sends out radio impulses that accurately indicate atmospheric conditions at given points. An analysis of many such reports gives your weatherman a basis for accurate predictions.

The Electronic Tube is the heart of the Radiometeorograph. Such tubes are built by TUNG-SOL. Other TUNG-SOL tubes of all types are helping to supply the vital needs of our armed forces. After the war a new and complete line of TUNG-SOL tubes will be available for civilian uses. Right now TUNG-SOL engineers will gladly assist in the planning and development of post-war electronic devices.

TUNG-SOL

vibration-tested

ELECTRONIC TUBES



TUNG-SOL LAMP WORKS, INC., NEWARK, 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

Ray F. Sparrow, Indianapolis, and Fred D. Williams, Philadelphia, and includes the chairman of the RMA Set, Tube and Parts Divisions. The Committee will have general jurisdiction over radio legislation, both congressional and state. Included are several pending measures of special industry interest such as the revision of the war contract renegotiation and patent laws and the bill of Senator Kilgore for federal mobilization of technical resources.

Membership Committee

The RMA Membership Committee, of which Director Roy Burlew is chairman also includes Dr. W. R. G. Baker, Bridgeport, Conn., and Henry C. Forster of Chicago.

The committee on By-Laws and Organization with Treasurer Leslie F. Muter as Chairman includes H. C. Bonfig, Camden, N. J.; R. C. Cosgrove, Cincinnati; A. S. Wells, Chicago, and Fred D. Williams of Philadelphia.

German Radio Inferior, Signal Officer Reports

Apparently because the Nazis standardized their radio apparatus during 1934 to 1938, German radio equipment is "five years behind our own," Captain James P. Lipp, Signal Corps officer assigned to Allied Force Headquarters in North Africa, reported Oct. 26 to the War Department. (It was a significant statement because Major General Roger B. Colton, Chief of the Signal Corps' Engineering and Technical Services in the War Department, recently stressed in a press statement that United States electronic and radio equipment is the finest in the world and that the American army, due to the inventions and complete cooperation of Prof. Edwin M. Armstrong, "father" of frequency modulation, is the leader in the use of FM in the war.)

The inferiority in design, components and construction of the German radio apparatus is due to this standardization and to the fact that they have not attempted further improvements, Captain Lipp said in his report on captured enemy equipment. "German sets are well built and have a great deal of strength," Captain Lipp stated, "but those we have tested were certainly not made for Africa." He cited that the German sets lacked waterproofing and were not dustproofed. There were many stop-gap measures used, he related in his analysis of the captured apparatus, with tape and sealing compounds used to make the sets resistant to corrosion and to exclude dust.

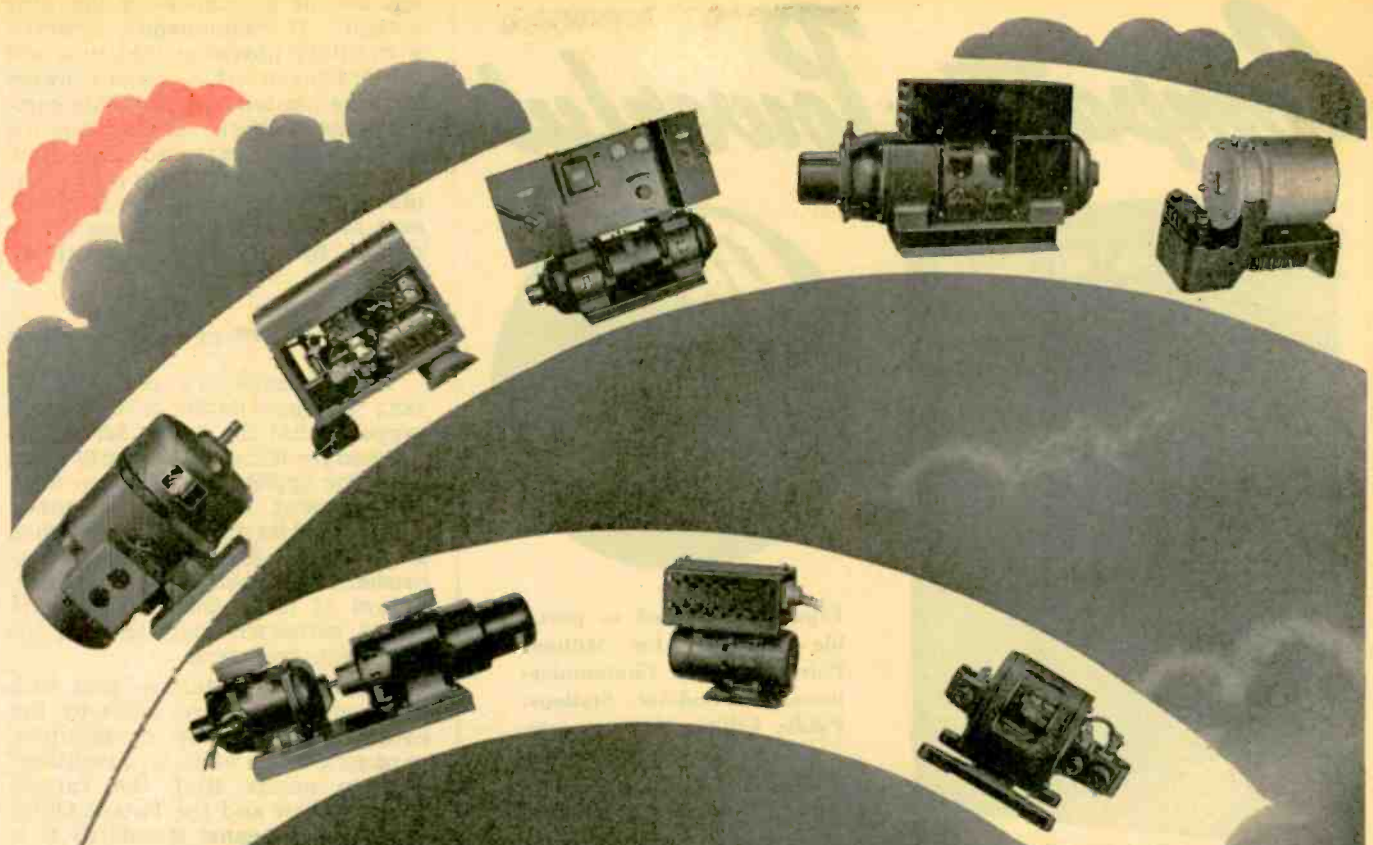
Recommend Wide Change in Patent Laws

Shortening of the patent term to twenty years from the application date, the recording of all patent agreements with the United States Patent Office to expose any secret, improper or illegal understandings and the throwing open for manufacture of any invention necessary for national defense, public health or safety are among recommendations made to President Roosevelt by the National Patent Planning Commission appointed in December, 1941, to investigate the American patent system.

Chairman of the commission is Charles F. Kettering and the members are Chester C. Davis, Francis P. Gaines, Edward F. McGrady and Owen D. Young.

Among changes is the compulsory recording in the United States Patent Office of (1) all existing agreements to which one of the parties is a citizen of a foreign country, (2) all existing agreements regardless of citizenship of the parties which include any restrictions as to price, quantity of production, geographical areas or fields of use, (3) all future agreements regardless of restrictions or citizenship of the parties.

The commission decided against the incorporation in American pat-



FORERUNNERS

The development and production of special motors and power generators for front line duty . . . the major Leland contribution to the winning of the war.

The designs here shown illustrate the various electronic applications of this equipment.

A moment's thought will suggest these several units as the forerunners of the motors and generators Leland will contribute to future electronic development and progress.

Leland engineering staff now available for immediate consideration of your particular problem, either war or postwar.

Leland

THE LELAND ELECTRIC CO.,
Dayton, Ohio, U. S. A.

FOR BETTER DESIGNED POWER GENERATORS

ent law of a compulsory licensing system. It recommends, however, a statutory provision that in a suit for infringement a patent owner shall be limited to reasonable compensation without prohibiting the use of the patented invention whenever the court finds that manufacture of the invention is necessary to the national defense or required by the public health or safety.

20-year term limit

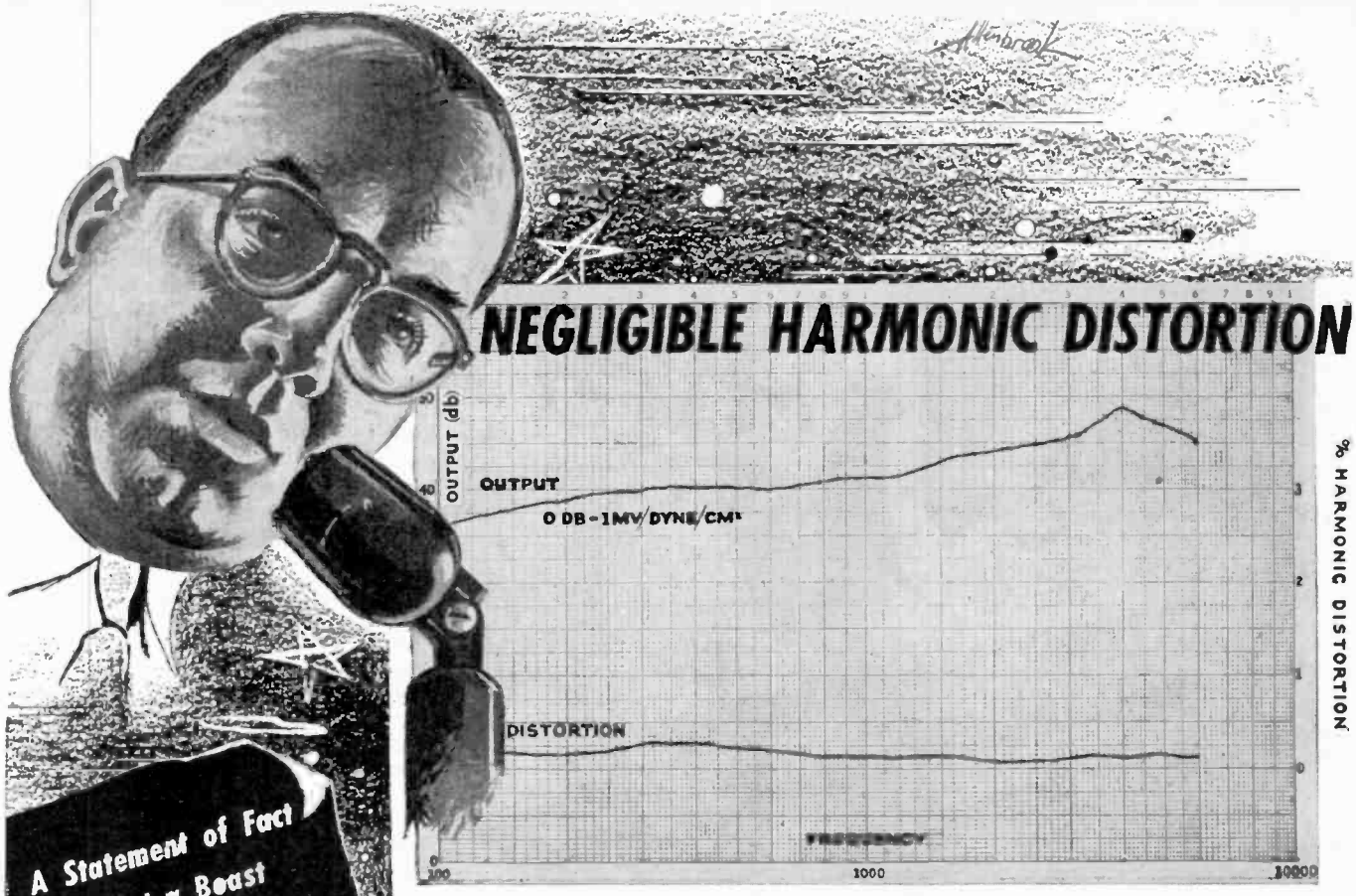
The commission's most important recommendation is that which proposes that the patent term shall not endure more than twenty years after the application has been filed. The present term of seventeen years would be retained except when a time longer than three years was consumed in obtaining a patent. Delays of more than three years would correspondingly shorten the seventeen-year term.

Two recommendations deal with the review of patent cases by the courts. To provide a definitive yardstick as to what is "invention" and to assure that the various courts of law and the Patent Office shall use the same standards it is proposed that Congress shall declare a national standard whereby patentability of an invention shall be determined by the objective test of whether it advances the arts and sciences. It is further proposed that when the validity of a patent is challenged in an infringement suit the court record shall be referred to the Patent Office for its opinion in the light of any new evidence or facts developed during the trial. Finally it is proposed that a single court of patent appeals be established.

Circuit Symbols

Anent the subject of the double system of circuit symbols mentioned in an editorial of our September issue, we have selected a set of "hybrid" symbols for use in the colored chart on Resistance Welding Control, which borrow from both sets now in use by the power and communication groups of engineers respectively. It is believed that none of these symbols are so far out of the way that they are not understood by either group although it seems that neither set of symbols can be tolerated by the other.

It is suggested that communication circuit workers carefully investigate the system of showing the relay contacts for each particular relay at the point of the circuit where they conveniently fall, even though they may be quite far removed from the actuating coil. This system avoids a great deal of the

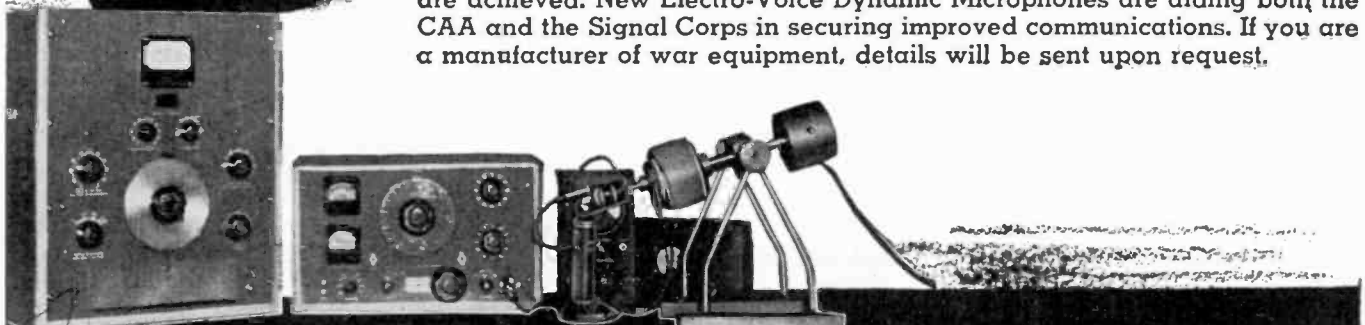


A Statement of Fact —Not a Boast

Every microphone manufactured by Electro-Voice has been designed and developed by our engineers—many in collaboration with the U. S. Army Signal Corps.

Harmonic distortion is the addition of spurious frequencies to the fundamental in definite harmonic relationship. Though the frequency curve may be excellent, harmonic distortion turns up as raspy reproductions, with an unnatural twang, in microphones, amplifiers and speakers. Five percent is considered a satisfactory upper limit for good reproduction, and as much as fifteen percent is allowable for speech communication.

Now come new Electro-Voice Dynamic Microphones with radical innovations in diaphragm fabrication, reducing harmonic distortion to a lower degree than hitherto possible. Cleaner, crisper, more highly intelligible reproductions are achieved. New Electro-Voice Dynamic Microphones are aiding both the CAA and the Signal Corps in securing improved communications. If you are a manufacturer of war equipment, details will be sent upon request.



The Harmonic Wave Analyzer measures the presence of spurious frequencies introduced by microphone distortion. To the ear, such frequencies give the feeling of ragged and false speech quality that may be unintelligible under the stress and strain of battle.

Electro-Voice engineers have found a way to eliminate harmonic distortion in microphone design, as proved by the Wave Analyzer; and the completely natural reproduction from the new Electro-Voice microphones.

Electro-Voice MICROPHONES

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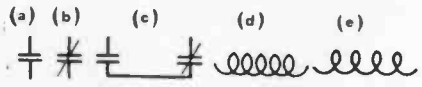
Export Division: 13 East 40th Street, New York 16, N. Y. — U. S. A. Cables: ARLAB

notorious complexity of the communication circuit, although there seems to be no regular way of showing unusual relay contact forms such as a "make - before - break transfer" so frequently used. In power control circuits, the only combinations usually found are "make contacts" as at (a), "break contacts" as at (b) and "transfers" as at (c). The latter are always shown as a "break" and a "make" and the two parts of this single set may be shown at the opposite ends of the diagram if it is simpler to do so! These symbols would therefore be:



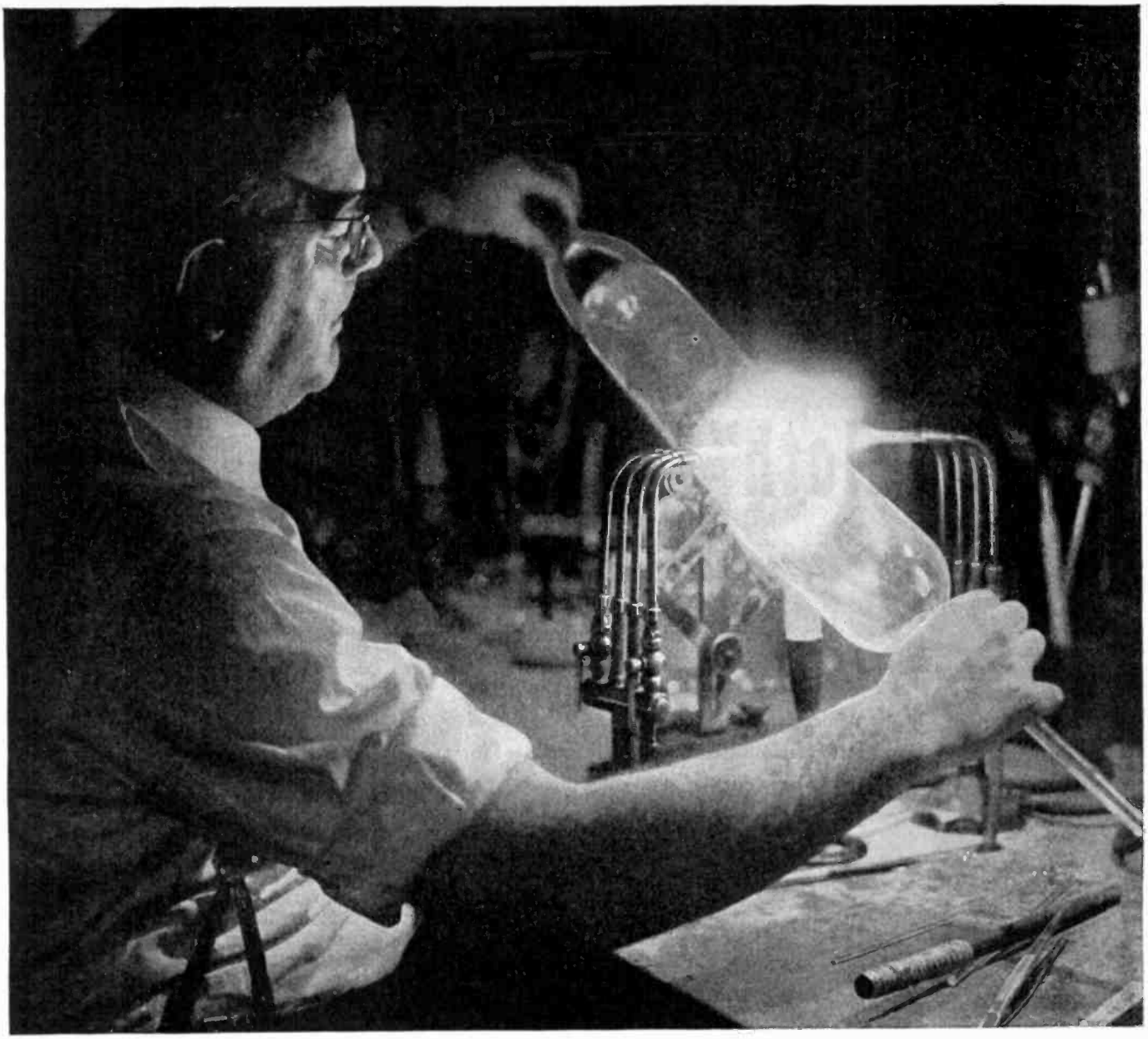
As to the other symbols, we believe that coils and windings should be shown as a coil or winding and not as the time-honored symbol for resistance that is shown in practically every engineering textbook. The excuse that the coil symbol is more difficult for the draftsman is hardly of import when a possible confusion results.

There are two well known ways to draw an inductance: (1) using a compass to make an equi-spaced series of partially closed circles (as at d) and (2) using a lettering stencil to make a series of letter O's, to be linked together by a wavy line (as at e). Either system gives an acceptable symbol for any circuit diagram.

Using this symbol leaves the resistor symbol to signify a resistor which is as it should be. The capacitor symbol is more difficult as long as the same symbol is used as a contactor. The alternate symbol is not so convenient but its use does require a "revised method of thinking" when analyzing a circuit that is usually complicated enough anyway.

It is believed that all windings for a single transformer should be shown at one spot. If a transformer contains many windings in an electronic circuit, the chances are that most of them are heater circuit windings for the tubes. It is not absolutely essential for these wires to be drawn over to the respective tubes anyway. In most electronic circuits, a transformer is a link between two associated parts of the system and it seems that primaries and secondaries should always be shown together even at the expense of a few lines in the diagram.

These compromises are submitted for study and comment by groups that are charged with providing standard symbols, believing that a single set is necessary for this vast field of industrial electronics which has borrowed so freely from the practices of the older arts.



Tomorrow's hopes are sealed in glass tubes

made by Western Electric

THIS vacuum tube is first of all a war weapon. Second, it is a crystal ball in which you may look beyond the war.

Since Pearl Harbor, research at Bell Telephone Laboratories, and manufacturing techniques at Western Electric have teamed together to keep pace with war demands. Result—more than one third of all electronic and communications equipment produced in the United States for war has come off Western Electric's assembly lines!

You can count on this team to continue to lead in the development and manufacture of the finest electronic equipment for a world at peace.

★ *To bring Victory sooner — buy War Bonds, more War Bonds, and still more War Bonds* ★

C-R TUBE LIFE TESTING

(*Continued from page* 91)

from the power supply into the rack. Each bus has been marked by an identification tab. A switch with these identification letters and numbers appears on the control panel of the unit in order that voltages may be read across any part of the bus.

All three cathode ray life test units have a timeclock and a master anode power push button station which has none but a direct relation to the timeclock. The clock will record the time that the anode power to the tubes was on. The station and timeclock are located in the center of each control panel.

Assuming that the rack has been operating and that the screen of one tube has been found to be chemically defective, pushing the "OFF" button of the station, will turn off all dc voltages to the tubes under test. An operator may then open the door of the rack, disconnect socket and remove the old tube, set in the new one, close the door, check and record the time clock readings, push the "ON" button of the station and the entire unit is again in operation. Differences in the new tube against the old are recorded. If the differences are checked and they indicate some error in the new tube, a temporary stop in the production of that tube in another part of the plant may be made until the fault has been discovered.

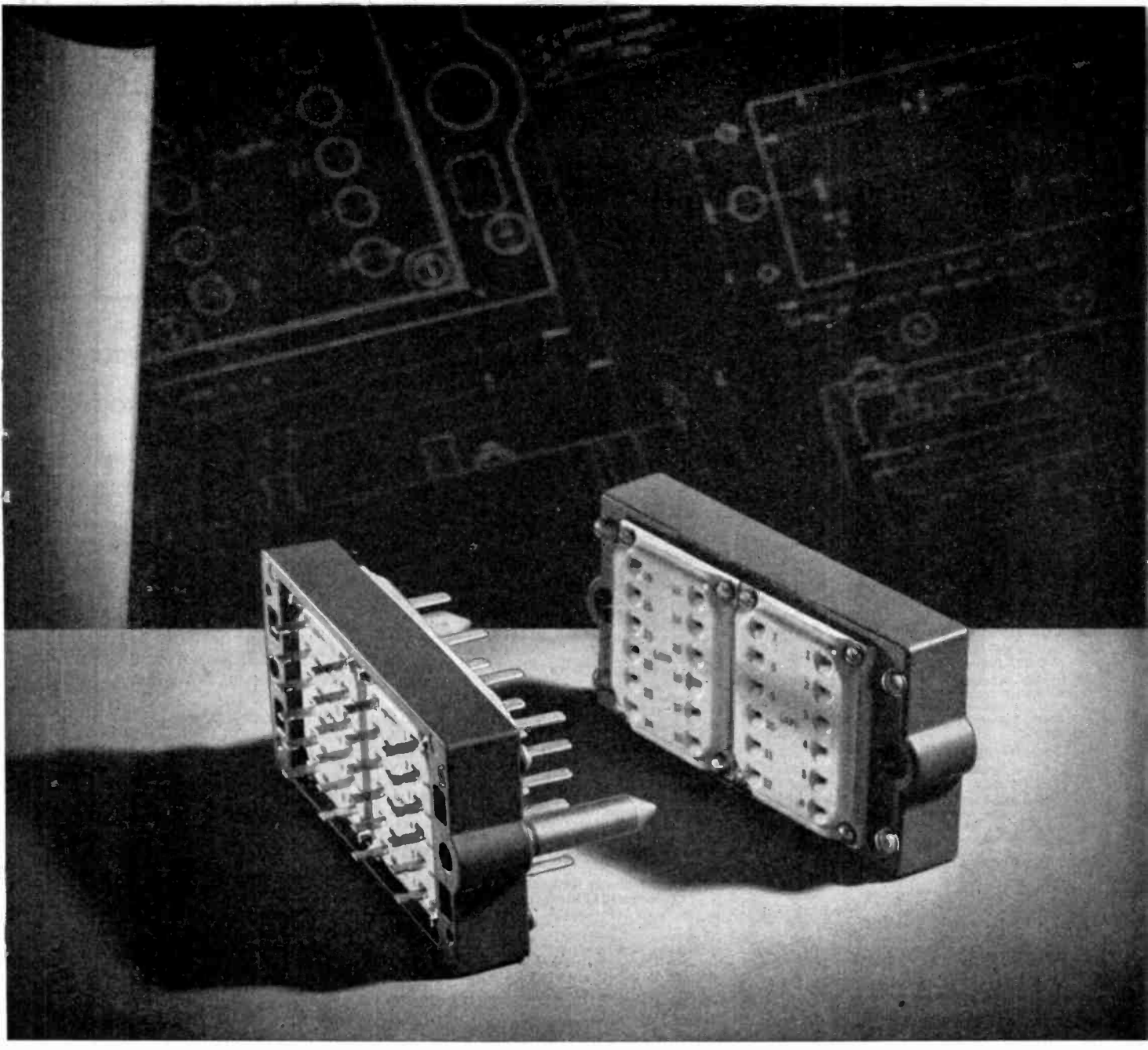
If the initial check on the tube is satisfactory, the tube will be run continuously and will from time to time be checked for mechanical, electrical and chemical weaknesses. The duration of time between good and bad of the same tube is accurately recorded by the operating personnel. The manufacture of these C-R test units by the Transmitter Equipment Mfg. Co. adheres to the typical design standards of Temco radio transmitters being built to government specifications.

SOUND STUDY LABORATORIES

(*Continued from page* 99)

installed in the room. Audio frequency signal lines are provided so that the soundproof room may be connected to any other part of the acoustic laboratory.

Most electro-acoustic transducers have magnetic systems. These include electro-magnets, permanent magnets, transformers and field structures. The specifications of the large pole type magnetizer in the magnetic laboratory are: a magnetomotive force of 200,000 amp. turns. The pole pieces are 18 in. in diameter. The unit will



An Electronic Part... ENGINEERED TO A SPECIFIC NEED

This is a special-purpose electronic part. It is a plug-receptacle assembly for use with rack-panel type of mounting. Twenty-four silver-plated phosphor-bronze contacts are provided, each male and female contact full floating between steatite plates. Heavy guide pins and matching holes in the frame assure perfect alignment.

We don't know that your product has any need for such a part as this. We do know, however, that this part is most exactly suited to its special requirement, just as are hundreds upon hundreds of other parts which have been created through Lapp engineering and Lapp production facilities directed to the solution of specific problems.

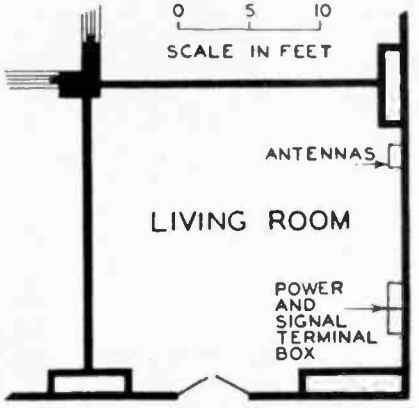
With a broad basic knowledge of ceramics—their capabilities and their limitations—Lapp has been able to simplify and to improve many types of electronic equipment through engineering and production of sub-assemblies that make most efficient use of porcelain or steatite and associated metal parts.

There may be a way you can improve performance, cut costs and cut production time through use of Lapp-designed and Lapp-built sub-assemblies. We'd like to discuss your specific requirements with you. *Lapp Insulator Co., Inc., LeRoy, N. Y.*

Lapp

ARMY (E) NAVY

carry 3,500,000 maxwells with negligible magnetomotive force loss in the magnetizer structure. A smaller type magnetizer is suitable for small structures. An impulse magnetizer employing 3600 microfarads and an ignitron will deliver 2000 amps. Apparatus is provided for standard magnetic measurements.



Plan of the living room

In addition to those facilities there is a field laboratory designed for outdoor testing of acoustical systems. It is on relatively open flat ground at a distance from the main laboratory.

Two heavy poles are provided so that equipment up to 2000 lb. may be elevated 40 ft. Audio frequency and power outlets at a point midway between the poles are connected to the field laboratory building. In this way standard response recording equipment may be set up permanently in the field laboratory and connected to the outside test locations.

WIDE READING

(*Continued from page* 127)

relatively high water absorption. Dielectric constant, power factor and conductivity as well as mechanical properties were measured, and it was found that the requirements of the U. S. Coast Guard specifications for the insulation of submarine cables were met by a composition containing 40 parts of gilsonite by weight per 100 parts of Buna S and 12 parts of other ingredients.

Condenser-Input Rectifiers

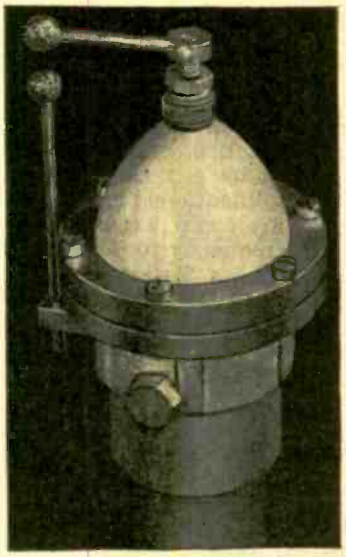
R. G. Mitchell (Wireless Engineer, London, September, 1943).

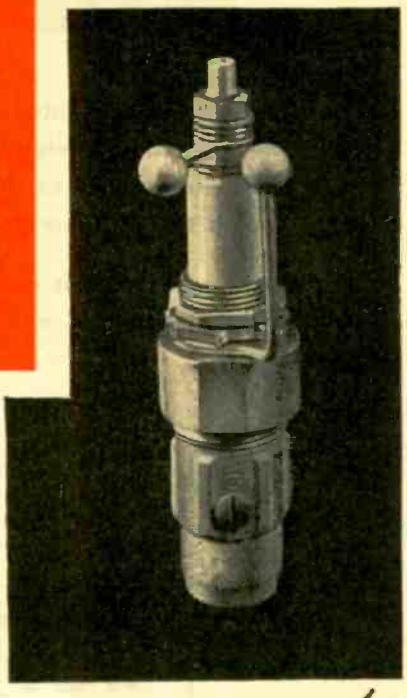
A method for graphical analysis of single-phase half-wave and full-wave as well as of bi-phase half-wave rectifier performance is derived. Based on assumptions justified in most practical applications, formulas are given showing the relations between voltage conversion ratio, charging period, condenser ripple current, ratios of load resistance to charge resistance and of reactance of reservoir condenser to charge resistance, peak charg-

Pioneers in COAXIAL EQUIPMENT

JOHNSON coaxial transmission line is widely used for efficiently transferring electrical energy from transmitter to antenna or for interconnecting transmitter stages. Both inner and outer conducters are of copper insulated from each other with Alsimag number 196 beads.

Five sizes of line and associated fittings are available to handle power outputs of from 250 to 100,000 watts. If, as is common practice the line is to be operated filled with dry oil pumped nitrogen we will be glad to make the necessary arrangements for the gas and associated equipment. Inquire today!





General Products Catalog
9670
FREE on request

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a famous name in Radio

E. F. JOHNSON COMPANY • WASECA • MINNESOTA

ing current, plate dissipation. Several charts illustrating the various dependencies are included for ready reference.

Wide-Band Amplifier Design

E. M. Noll (Radio, July, 1943)

Gain formulas covering the low, middle and high frequency range, respectively, are derived for a resistance coupled pentode amplifier stage. A practical example is worked out to show the high frequency and low frequency drop in amplification, and the circuit diagram of a compensated wide-band amplifier stage is shown.

On Wide-Band Amplifier Design

E. M. Noll (Radio, September, 1943)

In the second article of a series the effect of a coil in the plate circuit of a resistance coupled amplifier is shown by a numerical example. Amplification factor and phase shift are computed. The effect on low frequency response and phase shift of an R-C decoupling circuit to compensate for the loss in gain due to the conventional coupling condenser is also worked out for the particular circuit.

Solution of Boundary Value Problems

Mark Kormes (Review of Scientific Instruments, August, 1943)

An iteration method of obtaining an approximate numerical solution of the equation $u_{xx} + u_{yy} = 0$ is outlined for any prescribed boundary curve. The process permits fully automatic computation and the use of standard punched card equipments.

X-Ray Diffraction of Cu_4FeNi_3

V. Daniel and H. Lipson (Proceedings of the Royal Society, London, July 28, 1943)

The diffraction pattern of the Cu_4FeNi_3 alloy was investigated during its transition from one single-phase face-centered cubic structure into two. It was observed that each line of a powder photograph was flanked by two sidebands, as compared with the single-phase state diffraction pattern.

Theoretical considerations as to the corresponding changes in the lattice structure indicate that the original cubic lattice is periodically deformed by segregation of the different atoms. However, the obtained line intensities do not fit in with the theory.

DEPENDABILITY AND PRECISION

Superbly engineered . . . mechanically and electrically, DeJur wire-wound potentiometers perform their functions dependably. There's a DeJur potentiometer to fill your needs. Here, we illustrate a few . . . however, we can and do produce these units to required resistances. We will gladly furnish technica data upon request.

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SHIELDED ROOM DESIGN

(*Continued from page* 119)

shielding. Since this screen impedes the free flow of air, some increase in size is necessary. Two intakes are required, one on each side near the ends of the room. Likewise, two exhausts are used, one on each side of the ceiling but at opposite ends.

The door on the average shielded room is difficult to open or close because the jamb is set on an angle and weather stripping is used for completing the shields across the door. Refer to the illustrations for details of a door that is a complete shield, yet opens or closes as easily as any house door. Instead of an angle for the jamb, a standard door, preferably 3 ft. wide or wider, is used. A 2 x 2 frame is built upon the door and covered with both the copper and Celotex. The important thing is to leave about ⅝ in. all around between jamb and door. This space is for the spring that will bond the copper on the door to the copper on the walls. Bend each copper sheet around the jamb of the door and fasten it down with a strip of brass 1/16 x 1. This means that on the jamb there will be two complete frames of brass, one for each shield.

Shield-tight door

On the door itself instead of flat brass strip, hold the copper sheet under a spring shaped somewhat like a letter S laid on its side, made of .005 in. spring brass. It can be readily seen that the springs do not exert a pressure tending to keep the door open or closed. Ordinary weather strip has such pressure that it binds the door. Using the method described, the travel of the springs is enough to permit good contact without binding.

After the room is walled, a 48-in. sheet of ¼-in. plywood is fastened to the lower half of the wall on the inside and the outside to protect the soft Celotex. Since most work benches are about 34 in. high, this wood will protect the wall from instruments being slid along the table top and eliminate the marring of the Celotex. The plywood should pass completely around the room and the door.

Illumination methods

An important problem is that of lighting. About 45 foot-candles should be supplied. Illustrated is one method of obtaining this, but other methods could be applied if they supply the necessary light. However, to avoid noise, incandescent lights should be used. Flush ceiling lights are better looking but, since the size of bulb is limited, quite a number would have to be

"They Were the Last to Leave" . .

"Our boys in Shanghai kept their circuits going until ten minutes before the Japs walked in. Even after Jap soldiers were posted at the front entrance of our building, our boys kept working. Finally, our lookouts gave the signal, the manager herded everyone into a freight elevator and we escaped through a back door as the Japs marched in the front."

—From an eyewitness account of the capture of Shanghai.

The Press Wireless offices in Shanghai were the last communications points to close their doors when the Japs seized the city. In keeping with the traditions of the Company, Press Wireless operators, at the risk of their lives, sent news and other important dispatches up to the last moment. Some faced other perils in escaping through the Jap lines to Chungking to help staff a new station there.

In communications as in combat, today's warfare calls for loyalty, courage and enterprise of the highest order. Press Wireless, Inc., is proud to be serving front communication lines throughout the world.

PRESS WIRELESS, INC., IS DEVELOPING AND MANUFACTURING

- HIGH POWER TRANSMITTERS
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- CHANNELING DEVICES
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- FACSIMILE MACHINES

AND OTHER TYPES OF RADIO AND COMMUNICATIONS EQUIPMENT

Awarded to Our Hicksville Long Island Plant for Outstanding Achievement in War Production

PRESS WIRELESS, INC.

Executive Offices 435 N. MICHIGAN AVENUE, CHICAGO

Sales Office, Manufacturing Division 1475 BROADWAY, NEW YORK CITY

used. In any case the housing is bonded to the inner shield and the outer shield cut away from the housing. This means that grounded conduit cannot be run to the lamp.

Each lamp must have an ungrounded flexible lead from it to an outlet which should be located as near as possible to the lamp housing. Even though the conduit is not grounded, if it went from lamp to lamp, ac loops could be set up on the outer shield by bonding different points. The advantages of this (through the ceiling) mounting of the lights is that the heat is vented to the outside and does not go into the room; also, the conduit is entirely outside the room.

The on-off switch should be located outside, beside the door. A switch, separate from the lights, should be provided for the fan, in the same location.

Electrical circuits

Circuits for the soldering irons and instruments will be in two lines. One will pass along the front of the bench with double outlets every four feet, pointing down. These boxes should be fastened on the underside of the overhang of the top. Pointing them down decreases their chances of being knocked out by brushing against them. The second line of outlets passes along the rear of the bench, for instruments. All wiring should be in threaded conduit rather than in Greenfield or Steeltube. As a further aid in eliminating bothersome IR drops, a copper bond is run along the conduit and is soldered to it on each side of each discontinuity.

A convenient bench is one shaped in the form of an L, along one side and one end of the room. The point at which the conduit enters the room makes a good place to bond the two shields securely, making sure there is only one point of bonding.

The upper half of the inside of the room should be painted white to diffuse the light more efficiently. A darker color should be used on the lower half so as not to show dirt. The outside of the room can be painted to conform with the surroundings.

Conduit leads

All conduits should go unbroken to a 4-in. box on the top of the isolation transformer. For this reason, the transformer should be located close to the outside wall. Since much of the electrical disturbances will come in on the power lines, the transformer should be carefully designed for the job. It should have a capacity of at least 2 kw. An efficient electrostatic shield is essential and its lead

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"

should be brought out separately, that is, not grounded within the case. The secondary should be center tapped and its lead also brought out. The room bond, the electrostatic shield lead and the center tap lead and a good ground (if possible) are fastened to the transformer at one point.

Whether or not the room needs further isolating, such as by filters, will have to be determined. If only a narrow band of frequencies will be used, a simple pi network will suffice. But if all frequencies will be used, a complex recurrent filter will have to be designed. For most cases, if the room is carefully made, the additional filtering will be needed only for the most exacting measurements.

CALIBRATING SPRINGS

(*Continued from page* 121)

The potentiometer in the plate circuit of the push-push 117L7GT's is for adjustment of the threshold bias for firing the 885. The potentiometer in the plate lead of the 885 together with the condenser from plate-to-ground form the conventional sweep-timing R-C circuit, used here to dictate the minimum firing interval between successive spring releases.

TECHNICAL INFORMATION

(*Continued from page* 100)

quency is developed which designates the base line during dynamic tests later. Wherever the resulting oscillograph trace crosses this line indicates an equality of pressure.

Temperature variations can be taken care of in the calibration, but if with some gases a change of the dielectric strength is a factor that is difficult to take care of, a similar diaphragm operating on a magnetic variation (inductance shift) may prove better.

RADIO PICTURE TRANSCEIVER

(*Continued from page* 93)

cast, which is quite a bit more than the number transmitted over a controlled commercial circuit in the same time.

All facsimile systems use a scanning device at the sending terminal for converting graphic material into a variable amplitude current or voltage. In the subcarrier frequency modulation process this variable quantity representing the point by point density of the copy is used to swing or shift a subcarrier tone over a definite predetermined range. This constant amplitude frequency modulated tone is then sent out by means of a standard amplitude modulated transmitter. At the distant ter-

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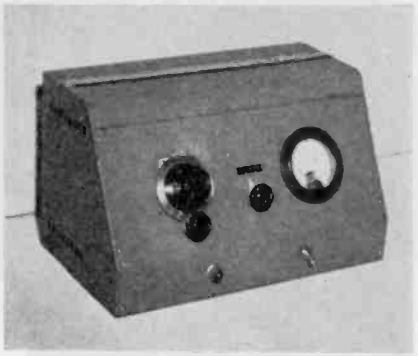
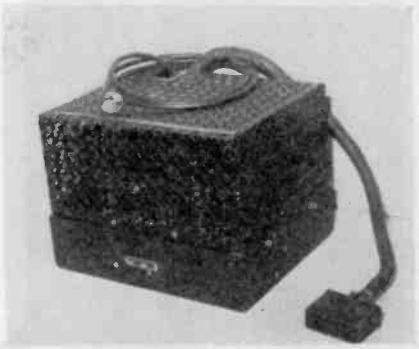
VULCANIZED FIBRE ★ RUBBER ★ ASBESTOS AND OTHER MATERIALS

minal all amplitude variations resulting from fading effects are removed by a limiter and a frequency discriminator circuit converts the received signals back to the conventional varying amplitude wave.



FM unit serves for both reception and transmission



Power supply is arranged for line operation or batteries

The primary reason for the great improvement is due to the fact that sub-carrier frequency modulation offers the equivalent of a linear amplitude variation system which functions independently of signal level fluctuations caused by fading phenomena which always occur on long distance radio circuits. Since the picture intelligence is conveyed by frequency modulation of the sub-carrier tone, variations in amplitude can be completely removed by means of a limiting device. Since changes in amplitude as great as 70 db can be eliminated, signal fading can have very little influence on the reproduced copy. Only when the signal drops well below the prevailing noise level does it become unusable.

Pictures are received direct on film and when developed become negatives from which any required number of prints can be made for distribution. This means, of course, that the equipment when used for reception must be operated in the equivalent of a photographic dark room. The standard size picture transmitted is 7 x 9 in. and the transmission requires about seven minutes.

RECTIFIER TESTING

(*Continued from page* 104)

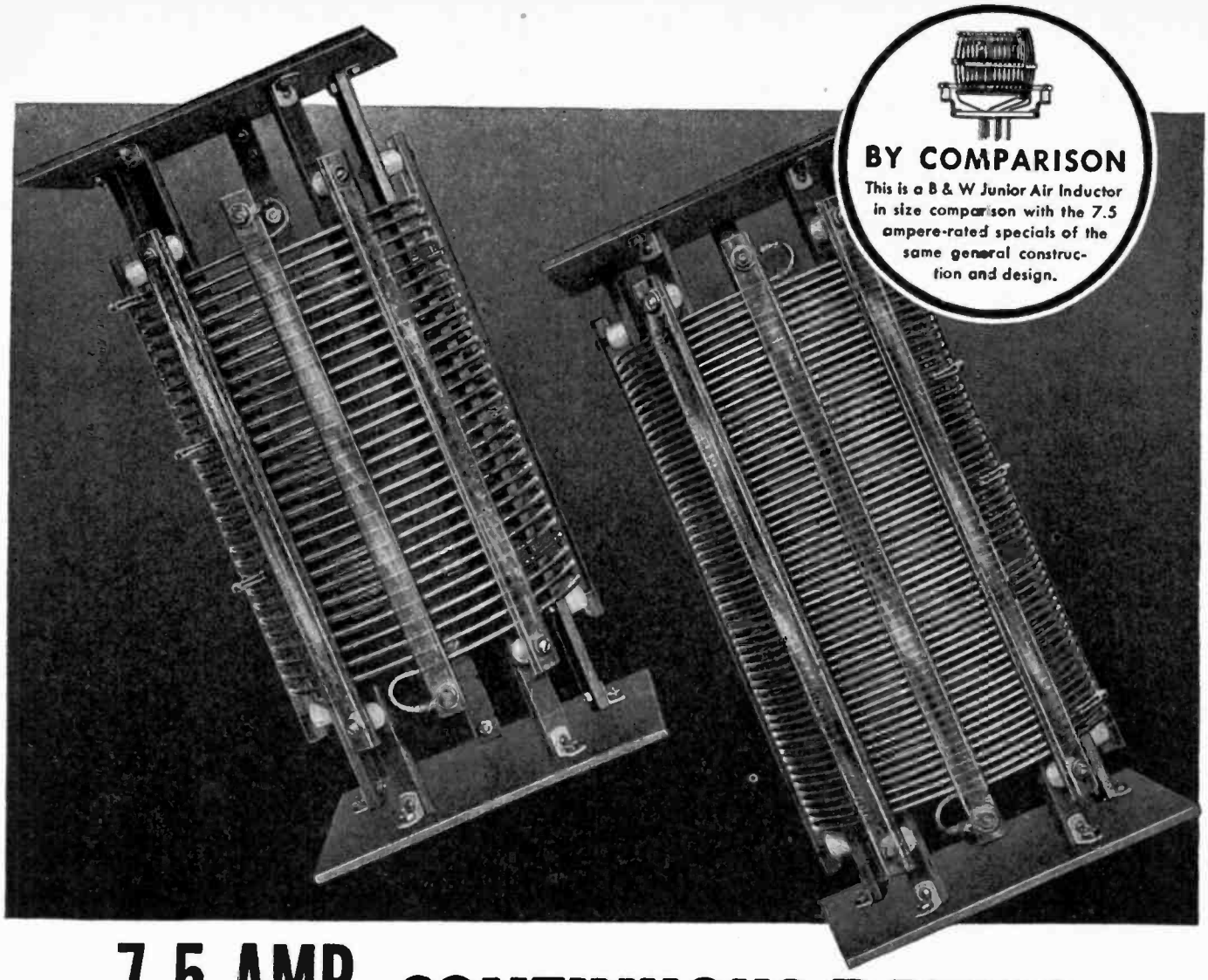
screen. Next, the anode-load voltage used in conjunction with ignitron No. 2 should replace that first applied to the oscilloscope. Again the curve resulting from it should be traced on the coordinate paper. This process is continued until all the anode-load voltages have been applied to the oscilloscope and the traced curve due to each one identified.

With the aid of the several waves thus traced it is possible to determine whether the anode voltage connections to the rectifier are correct. Earlier it was pointed out that there is a phase difference of 60 electrical degrees between the voltages applied to anodes of tubes whose numbers differ by unity; and that the tube having the higher number receives the lagging voltage. Therefore, if the anode wiring of the rectifier is correct, waves traced on the coordinate paper that are due to consecutively numbered tube anode-load voltages, starting with No. 1, will be found displaced to the right of that produced by anode-load voltage of ignitron No. 1 by distances corresponding to integral multiples of 60 electrical degrees.

Identifying traces

More concretely presented, this result states that if the anode-load voltage of No. 1 ignitron produces the first wave, starting from the left of the coordinate sheet (and that would happen provided the synchronizing or actuating voltage supplied to the sawtooth oscillator were in phase with this particular anode-load voltage) the corresponding voltage of No. 2 ignitron would produce a sine curve whose origin would be to the right of the first by a distance amounting to 60 electrical degrees. The anode-load voltage of No. 3 ignitron in turn would give rise to a curve starting 120 electrical degrees to the right of the first; and so on. Of course, in the event, that the anode circuits of the rectifier were incorrectly connected, the phase relationships of the several voltages would not appear as described, but any in error would become known immediately.

Practically an identical procedure might be followed in the studies of the auxiliary anode voltages and the ignitor electrode voltages. About the only difference is that these voltages could be selected more readily between their connection points to ignitron electrodes and the cathode bus. An optional procedure, yet one providing all necessary data on phase relationships of voltages associated with any given ignitron, is to apply suc-

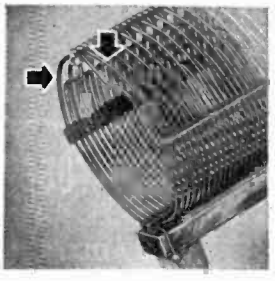


7.5 AMP. CONTINUOUS RATING

But the only thing "Special" is the size

Actually, these 20" giant B & W Air Inductors, wound with #8 solid wire, are simply grown-up war versions of the famous B & W Junior "Air Wound" Coils of amateur radio fame. The only special feature is the size plus, of course, the attendant bracing of triple x bakelite strips and plates for absolute mechanical rigidity. They're attractive in appearance, sturdy as you'd ever expect coils to be, and serve as interesting examples of B & W's unexcelled facilities for the production of special units—often with only a minimum of change from standard designs of unquestioned dependability.

Coils of this type are available through the entire broadcast frequency range. Adaptations are available for specific applications on any frequency. Other B & W coils in both "Air Wound" and form-construction types can be supplied for practically any inductance requirement. Details on any type, or quotations to your specifications, gladly sent.



HOW TO TAP SMALL COILS—EASILY

Ever try to tap a tiny coil where the turns were so close together you felt as though you were trying to fasten a rope to a middle tooth of a fine-tooth comb? Then you'll appreciate this special B & W small coil indent feature. The windings on either side of the turn you want to tap are indented out of the way, thus making tapping quick and easy, anywhere on the Inductor.

B&W

AIR INDUCTORS

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cessively its anode-load voltage, auxiliary anode-cathode voltage, and ignitor electrode-cathode voltage to the oscilloscope. From the relative positions of the three curves produced by these voltages on the oscilloscope screen one is enabled again to conclude whether or not the ignitron in question is being properly energized as a unit.

HF WELDING

(*Continued from page* 101)

discharges through the primary cause large welding currents in the few turn secondary, is shown in Fig. 2. Here the small mercury discharge tube produces rectification, being triggered off by the voltage from a standard neon sign transformer once each cycle. This rectified voltage charges the condenser which at a selected time discharges through the weld transformer. The latter discharge is also brought about by an electrostatic field from a pulse of voltage from another "neon sign" transformer. Experiments with this set-up show that the weld current wave is so highly damped that not more than the second half of the first cycle is effective.

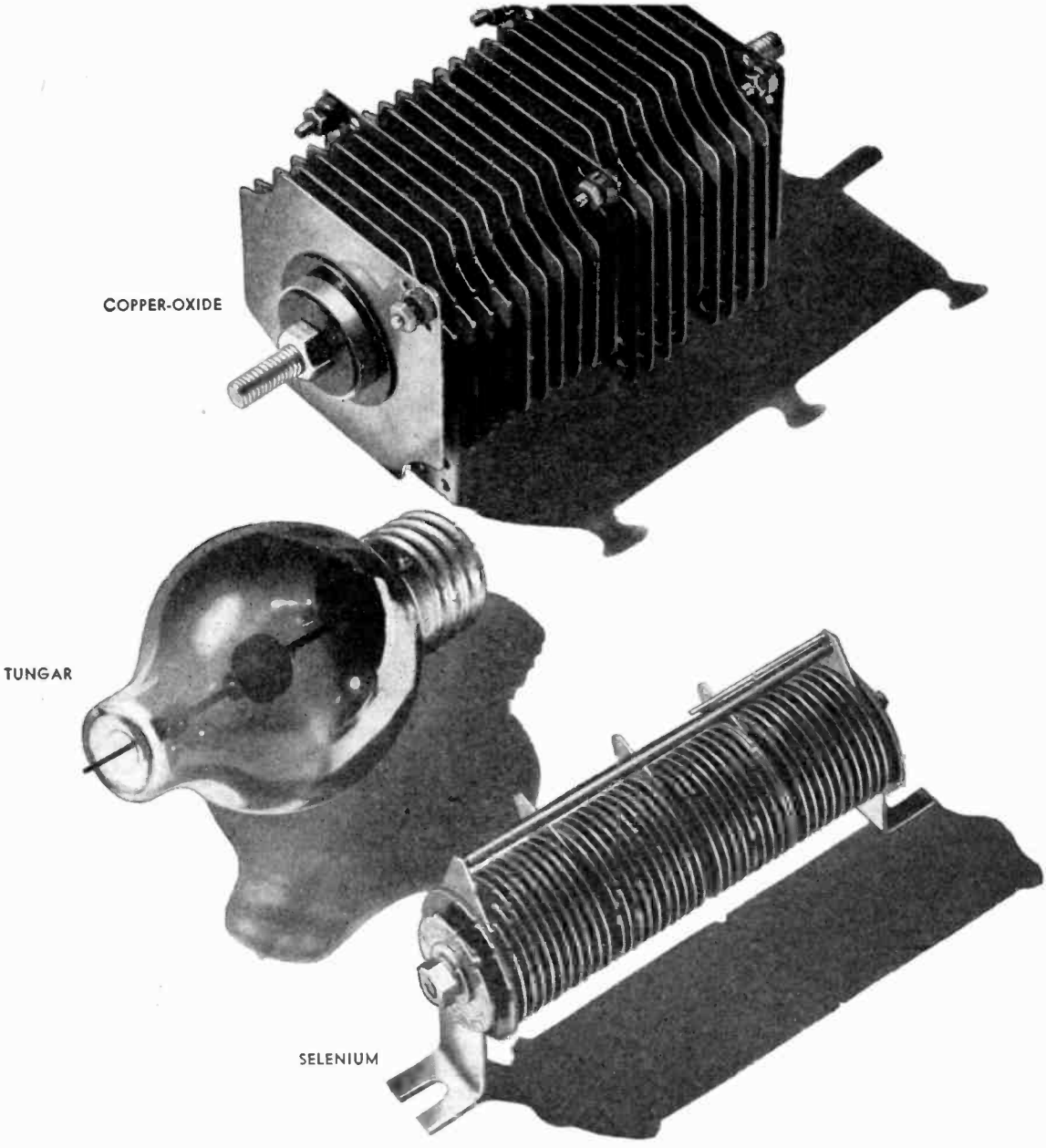
The new mercury tubes are relatively simple to construct, although much research was completed before an arrangement was devised to carry large amounts of current indefinitely.

According to Mr. Vang, the resonant system can take care of standard welding jobs with considerably less equipment than with other systems, which permits a substantial reduction in the total capacitance needed. This is due to the greatly reduced flow time of the weld current. Suppose 20 mfd. charged to 5000 volts is discharged during the two halves of a single cycle of a highly damped 3000 cycle oscillation. Therefore, approximately the watt-seconds delivered is

$$\tfrac{1}{2} \frac{20 \times 10^{-6} \times 5000^2}{.00033} = 750 \text{ KVA}$$

equivalent energy.

Although there can be no direct comparison of efficiencies with other welding systems, except by direct measurements under equivalent conditions, it is found that many capacitor welding systems produce a discharge interval possibly 10 times or more longer, so that an equivalent increase in capacitance is required and consequently greater heating up of the welded parts. Commercial installations have substantiated the validity of this approach to the problem of welding any classes of materials to each other without destroying their metallurgical characteristics, and doing it with a minimum of energy storage capacity.



Need a Rectifier?

Then you will want to know which type is best for your specific requirements—Copper Oxide, Selenium or Tungar.

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When next you need a rectifier you can get a valuable consulting service (no obligation, of course) through G-E Tungar and Metallic Rectifier Engineers. Address inquiries to Section A1137-24, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

PLANNING BOARD

(*Continued from page 83*)

play havoc with communications unless radiation is properly controlled.

"But, you may ask, where do we stand on allocation? Who is doing what, and is it possible that this or that may be done before we reach a solution of the broad problems involved in allocation?

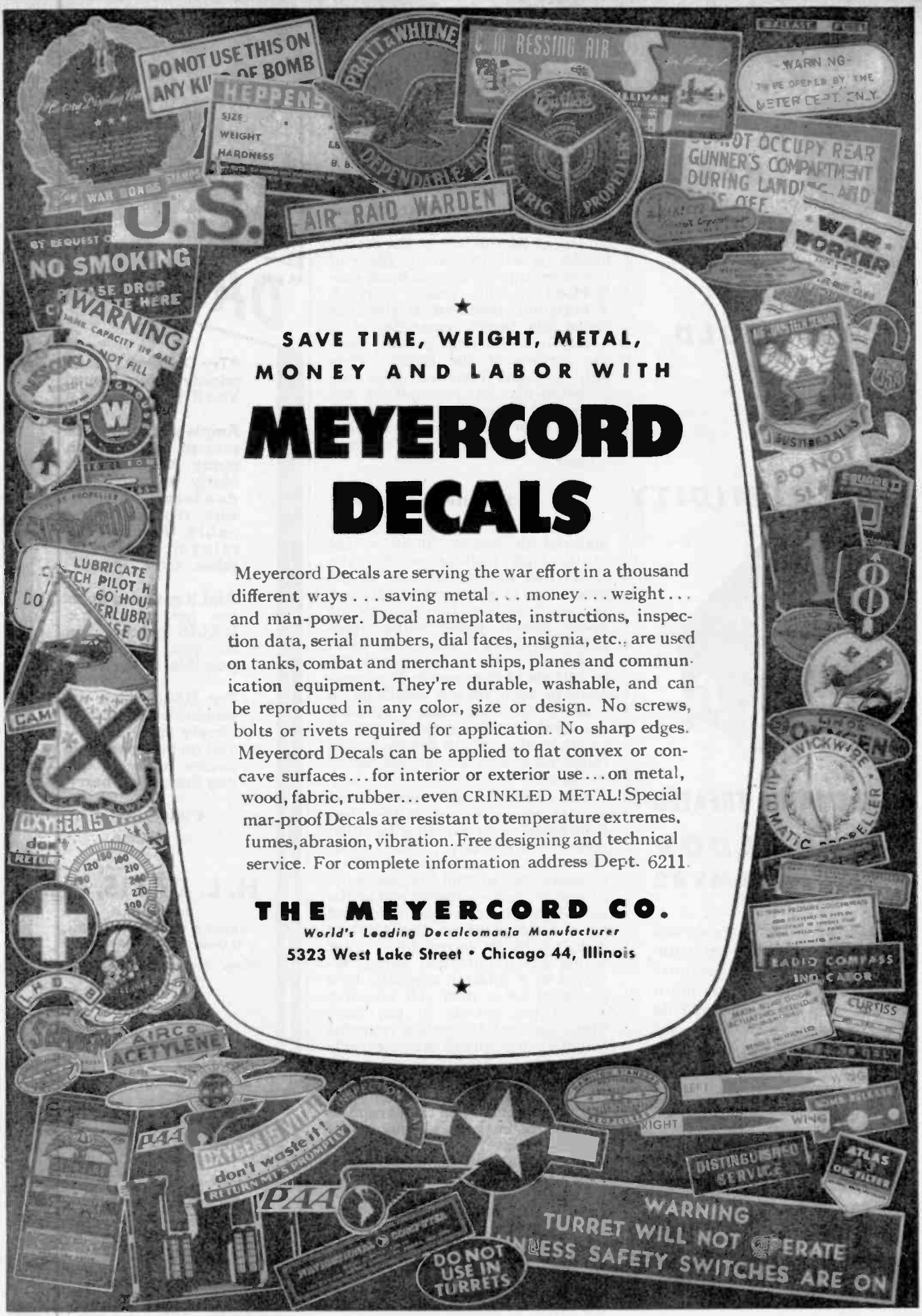
"The foregoing are difficult questions to answer. Every man who operates a radio station or who desires to operate one, thinks first about his own interests. That, of course, is only natural. Government and industry engineers, however, cannot and do not think in terms of any one activity at this particular stage of our planning work. Engineers' time is at present occupied with respect to service needs, and before we can get the policy for a given service we must obtain more information with respect to equipment standards, channel widths, propagation, etc.

Problems interrelated

"Thus, it will be observed that before engineers can think in terms of one service, say television, they must know what the frequency demands will be for other services and what technical improvements can be incorporated in the standards affecting the operating of each service. Aviation, for example, might desire to use most of a given portion of the spectrum which, if authorized, would relegate some other useful and necessary services to other bands which are not technically suited for their purpose. Engineers must, therefore, determine the proper number of channels required for each service, both domestic and foreign, and work out an allocation that will give the best facilities for postwar operation.

"Those who are able to set forth the best technical arguments for a given amount of space in the spectrum will probably meet with more success than those who sit back and wait for the government or someone else to plan for them. We must not forget, however, that many experts who have a real interest in this work are now in the Armed Forces and, therefore, progress is bound to be slower than in normal times.

"While all of us will give our first attention to problems relating to the winning of the war, there should still be available some time that can be devoted to problems relating to civilian needs. The work must necessarily be accomplished on a cooperative basis through the appointment of committees and representatives of the government and of industry organizations."



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★

INDUSTRIAL X-RAY

(*Continued from page* 81)

The pure tungsten filament is usually arranged in a cylinder or spiral with its vertical axis directed towards the anode. A funnel or hood surrounding the cathode and maintained at the same potential constitutes the "electron-gun" which directs the cathode rays at the target in a circular or rectangular beam. The target may consist of the surface of the copper anode, or a thin disk or plate of tungsten, iron or molybdenum embedded in the anode surface. X-radiation, produced as electrons strike the target, emanates in a nearly hemispherical pattern from the surface of the target. Thus only a slight variation from the perpendicular is required of the target to direct the X-radiation over a wide area, roughly at right angles to the path of the electron stream.

Tungsten for targets

Tungsten is the most popular material for targets, chiefly because of its high melting point. The X-ray tube has an efficiency in the production of radiation of only one per cent or less, the rest of the anode circuit power being dissipated as heat. Thus the chief problem is to secure target material to withstand the terrific bombardment by high velocity electrons. A number of anode cooling schemes are used employing circulating oil or air blasts and are designed with radiating fins on the outside end of the anode.

The rotating anode tube enables greater concentration of the electron beam while avoiding too high target temperature. The anode consists of a chamfered disk with a tungsten face around the periphery, as seen from the cathode end of the tube. The electron beam is focused on a fixed point on the rotating disk, which is driven by a rotor acting as an induction motor, revolved by a rotating magnetic field produced by a field coil mounted around the outside of the tube. Thus, the heat dissipation from the target spot is spread over a considerably greater area of actual metal.

Since X-rays cannot be focused, the size of the target spot should be a point source. (The radiograph or fluoroscope image is a shadow picture.) However, the heat dissipation limitation on the smallness of the target spot may be relieved slightly in fixed anode tubes by means of what is known as the line-focus principle. The shape of the electron beam is made rectangular by means of the focusing electrode. The rectangle is seen as a square on the angled surface of the target as viewed from the posi-

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Given his first trial in 1935, this mighty midget immediately won many laurels for himself and Sanborn Company by making possible the first of several types of vacuum-tube electrocardiographs which have been recognized by the medical profession as leaders in their field.

This first successful coordination of electronic possibilities and Sanborn engineering skill proved valuable groundwork for present day assignments of war communications instruments, where once again the amazing energy of this workman is bringing new distinction to Sanborn Company.

Giving support to the wartime use of his unlimited imagination are fully-equipped machine shop, assembly facilities, and testing laboratories which had been already accustomed to working to strict requirements as a result of experience in meeting the necessarily exacting demands of the medical profession.

The electron tube has become the most valuable worker at Sanborn Company, not only for past and present accomplishments, but for the future of his versatile potentialities.

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MAKERS OF ELECTRONIC INSTRUMENTS
CAMBRIDGE 39, MASS.

Research, development, and production of electronic-mechanical instruments of precision which include communications war devices and medical diagnostic equipment. Openings in production schedules are occasionally available for new electronic problems.

tion of the object being X-rayed. The effective size of the source of X-radiation is thus smaller than the actual target area being bombarded.

Since practically all of the emitted electrons are attracted to the anode at the normal operating voltages on the X-ray tube, the actual voltage used controls the wavelength of the X-radiation.

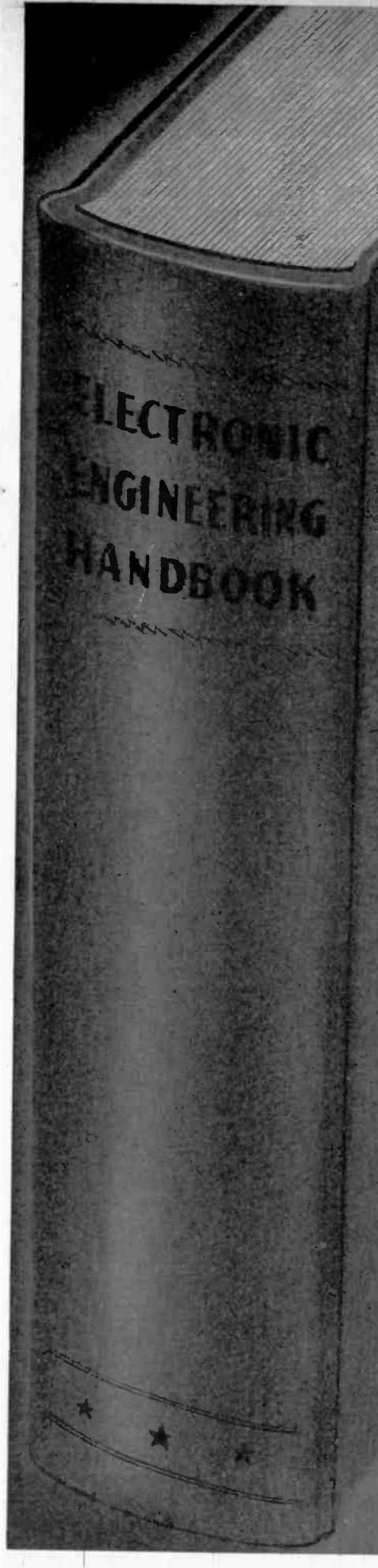
Penetrating power in general is a function of the wavelength. So-called "soft" X-rays or Grenz rays, produced with anode potentials from 5 to 15,000 volts, are capable of penetrating only such materials as botanical specimens, paper, etc. Materials such as ceramics, thin steel, beryllium bronze and others common in manufacturing are radiographed or fluoroscoped satisfactorily with voltages from 50,000 to 200,000. Equipments operating on 200 to 600 kv are capable of penetrating materials up to 6 in. thick in a reasonably short time. All such units operate normally at from 5 to 35 milliamperes anode current. Tubes using 1,000 to 10,000 kv at two to three milliamperes generate short-wave X-rays in or near the gamma ray region and easily penetrate up to a foot of steel. Typical X-ray exposures range from a few seconds to five or ten minutes or more.

X-ray applications

In general, X-rays are used to examine products for (1) product control (2) process control. Product control may be important for either one of two reasons. First, to insure safe operation of vital parts which will be highly stressed in a machine or vehicle. As an example, we have castings and welded tubing in high pressure steam systems or structurally critical aircraft engine parts, gun parts, or other forged or cast members. Second, to save time and tools which would otherwise be lost in complex machining if the work were found to have internal defects towards the end of the machining process. Complex castings or moldings are an example. In like manner, small parts which are to become part of a larger unit may be examined.

Castings may contain such defects as blow-holes, gas pockets, spongy metal, inclusions of sand and slag or other unwanted foreign inclusions. X-ray radiography and fluoroscopy have found wide application in such delicate assembly procedures as the manufacture of vacuum tubes, where spacing of the various grids and other electrodes must be held to within close limits.

In the field of process control, proper application of X-ray aids immeasurably in the development of dies, patterns, molds, and in actual product design for ease and



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ELECTRONIC DEVELOPMENT ASSOCIATES
114 East 47th Street New York 17, N. Y.

reliability of manufacture. As a routine process control spot check X-raying, or straight percentage-of-output X-ray examination of the product, serves as a check on workmanship or foundry practices. The knowledge on the part of the operators that their work will be checked periodically has been found in most cases to result in more careful attention to quality. Other uses for conventional X-ray or fluoroscopy technic include many tasks of identification. The obvious example would be the separation of a metal-reinforced plastic or other molded product from a batch made without the insert.

The recently developed high speed X-ray should prove of interest wherever it is desired to study internal behavior of members or mechanisms under dynamic conditions. The one-millionth second X-ray operates by storage of a charge of 100,000 to 300,000 volts. The discharge through the tube may amount to several thousand amperes.

X-ray diffraction

The relatively new technic of X-ray diffraction is of invaluable aid in many fields. X-ray diffraction equipment generally uses a single-port beryllium-window tube with an iron, copper, or molybdenum target operated at potentials from 5,000 or 50,000 volts and yielding "machromatic" radiation. A thin beam of X-radiation is diffracted by the object or material sample, and its diffraction-pattern recorded on film. The process has revealed much new information concerning the atomic structure of many materials, the effects of machining and heat treating, and stress analysis of parts which have failed under test, to mention but a very few applications.

An application of X-ray diffraction well known to the radio-electronic industries is the method of orientating quartz crystals or blanks with respect to their natural atomic planes or phases.

In its simplest form, an X-ray unit consists of a tube, a high voltage transformer, a filament transformer and the necessary controls. Such a unit would involve self-rectification and would have limitations imposed by the inverse breakdown voltage of the tube at the anode-operating temperatures permissible. However, for some applications self-rectification is adequate. Due to the variation of anode voltage from zero to maximum during each cycle, a wide band of X-rays of low penetrating power is produced along with the desired high voltage component.

In general, half-wave, full-wave, bridge, or full-wave 3-phase recti-

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Remember, the bond charts of today are the sales curves of tomorrow! Not only will these War Bonds implement our victory—they'll guard against inflation, and they'll furnish billions of dollars of purchasing power to help American business re-establish itself in the markets of peace.

So get this new family income plan working at once. Your local War Finance Committee will give you all the details of the new plan. Act today!

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fiers are used. Control of the kilovoltage impressed across the tube is through an autotransformer in the primary circuit of the high voltage transformer. Control of the quantity of X-radiation is achieved by means of varying the filament current. A voltmeter across the primary of the high voltage transformer may be calibrated in kilovolts of secondary voltage.

Since it is generally more convenient to make a visual inspection, eliminating the need for developing films, etc., the fluoroscopy method is preferred when its limitations do not make radiography essential. The X-ray film or radiograph, under normal conditions, can reveal differences in density or thickness of the object being examined, of 2 per cent or less. Fluoroscopy is capable of a sensitivity of approximately 10 per cent.

Clark, G. L., "Applied X-rays" (2nd Ed.)
St. John, A., and Isenburger, H. R., "Industrial Radiology"
Pullin, V. E., "Engineering Radiography"
Muncheryan, H. M., "Industrial Radiology and Related Phenomena"

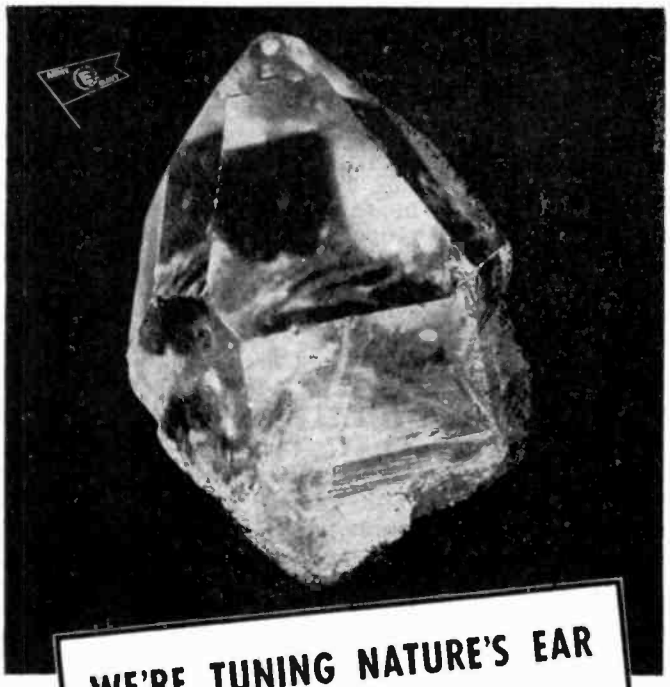
FLIP-FLOP CIRCUITS

(*Continued from page 79*)

A greatly improved version of the single tube flip-flop is shown in Fig. 3. In this circuit a special type 6L7 tube is used in which the screen grids instead of being tied together are brought out to separate socket terminals. In this circuit the initiating voltage is applied on grid 1 whereas the actual flip-flop action takes place between grids 2 and 3. This provides for a desirable separation between the input and the flip-flop action which is also made substantially independent of the output by grid 4 which acts as a screen grid. It is interesting to note that in this circuit the internal action of the tube as determined by the potential of the input flip-flop grid produces a potential on the output flip-flop grid which is always in phase with the input grid. Therefore with respect to these two grids the mutual conductance is negative.

A television application of this circuit is illustrated in Fig. 4 which shows a sweep circuit for vertical deflection in cathode ray tubes. In this circuit a 60 cycle alternating voltage is impressed on the grid of the flip-flop tube which, as has already been explained, produces a square wave output voltage. In order to produce the necessary sharp impulses on the grid of the 6J7, this square wave is differentiated by the R-C network which couples the 6J7 to the flip-flop tube.

The discharge of the condenser C through the 6J7 produces a sawtooth output voltage on this tube in the conventional manner. The sawtooth voltage is peaked to the wave form necessary for magnetic deflection, by the resistor R. A



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block diagram showing the wave form in various parts of this circuit is given in Fig. 5. The absolute synchronism of the flip-flop action and the alternating control voltage insures perfect timing of the sweep thereby eliminating irregularities and moving of the picture due to a possible imperfection in this direction. Although the properties of flip-flop circuits make them especially suitable for use in television camera and picture tube synchronizing and deflection circuits, their characteristics indicate other possible applications.

METALLURGICAL ANALYSIS

(*Continued from page* 87)

ability of a cathode ray oscillograph to delineate differences under many conditions so rapidly that the eye does not distinguish individual check points but sees only a birdseye view of the overall test. As indicated in the block diagram the same circuits that control the oscillogram also operate relays and mechanical traps that make actual separation as to groups, at the same time.

From the above, it is seen that there can be no one set of operating instructions or a single group of associated accessories that can be universally applied to any but a few of the thousand of items that can be checked with this equipment. For this reason the equipment is obtainable only on lease, with full engineering service to take care of the various problems that come about in setting up for each particular item.

Control relay operation

In the oscillograms resulting from this set-up, and as in Fig. 3, the variation of the vertical ordinates between the top and bottom edges is to be noted. This difference at several particular points along these edges gives the "answer" for any particular grouping of items as far as the control relays' operation is concerned.

To measure average case hardening depth, the steel part is inserted in a suitably fitting oscillator circuit coil, which must be designed and built for particular piece being tested. The instrument is then checked with several standard samples with known case hardening depths and variations noted for future use in setting up rejection-acceptance limits. All pieces having a case depth identical to the correct piece or the standard can then be picked out. Besides this, the arrangement will evaluate proportionately the case depth of all other similar items as fast as they can be run through. The operation of the instrument is simple enough so that tests can be carried out by

the average plant worker, without technical or metallurgical skill.

For some tests a typical auxiliary calibration standard uses precision tapered steel bars that have been uniformly case-hardened throughout their length, and then ground back again to cylinders.

The instrument has already proved of value in many industrial plants, as for example in:

1. Sorting SAE and NE steels according to chemical analyses.
2. Sorting pieces of steel of the same analysis according to heat treatment.
3. Sorting non-ferrous metals according to structure.
4. Separating case-hardened from non-case-hardened pieces.
5. Separating decarburized pieces from satisfactory pieces of steel.
6. Sorting pieces of metal in which the internal stresses are excessively high, or from others in which internal stresses are normal.

Some of these checks are being conducted in the illustrations.

The test pickup coils, relays, and other features will usually vary from one installation to the next in keeping with individual requirements of the test, the size of the item to be sorted and the test limits.

This has necessitated that an electronic engineering and metallurgical consulting service be established, the Du Mont Materials Test Organization, to facilitate application, maintenance, alteration and assure operational satisfaction in all particulars so that the equipment for the present is available on a lease or rental basis only.

LOOP ANTENNAS

(*Continued from page* 85)

the first time it is really possible to install a radio compass on the fastest aircraft without detriment to its speed, maneuverability and the radius of operations.

Fig. 1 shows relative dimensions of a streamlined housing for a typical air cored loop. A corresponding iron cored loop to give similar characteristics would be approximately one-third smaller,[1] and its housing would be elongated for better streamlining. New designs use more compact housing in the form of streamlined dome which further reduces dimensions and drag.

In their most general applications the loops may be tunable (high impedance) or untuned (low impedance); frequency range may vary from 20 kc to 20 mc so that the desired final shape requires different considerations and cannot be simply prescribed.

In loops of the tuned type, consideration of Q of the coil antenna

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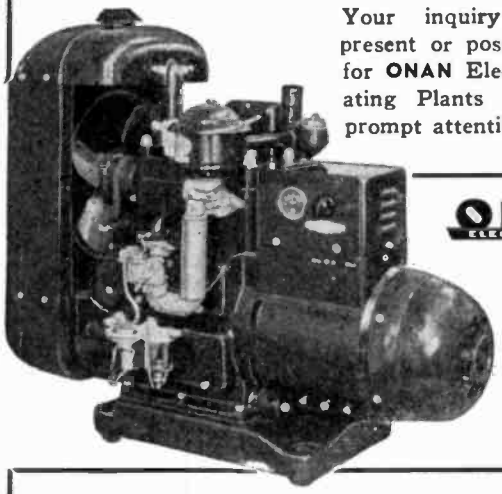

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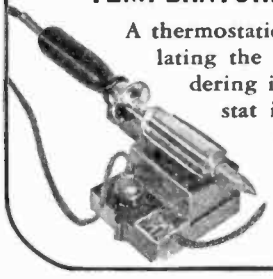

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is just as important as the permeability of the iron core since the pickup factor is proportional to Q and h_{eff} increase of both being desirable. The loop antenna may then take the shape of Fig. 2,[2] with Q of the order of 500 to 600 easily attainable on commercial frequencies plus an increase of effective height due to permeability. Such loop antennas with a core of about 6 in. diameter approach the performance of a similar air core job of 12 in. diameter in the frequency band 200-400 kc. It is of course a problem to maintain high Q in service conditions, but the work done by United Air Lines and American Air Lines indicates that proper sealing of the antenna can be accomplished.

High Q lines

From the standpoint of pickup, tuned loops have a decided advantage over low impedance loops, particularly for signal-to-noise ratio and therefore should be used in cases where frequency range is reasonably small and can be covered with one loop. The present practice, however, involves much greater frequency spectrum of operation so that it becomes necessary to use a low impedance loop which is fed through a low impedance to a set of step-up transformers each designed for a limited range. In these designs the transmission line and the coupling transformers should be of highest Q obtainable while the coupling between the loop and the tuned circuit should approach unity in order to get high efficiency and directivity.

The antenna coil itself should be of as large a number of turns as permissible for a given inductance defined by the highest operating frequency of the loop and by the capacity introduced by the line. A distinctive advantage of a small iron core loop with spaced sections is its low distributed capacity which permits the use of higher inductance with a larger number of turns. An elongated design such as shown in Fig. 3 permits high utilization of iron (effective permeability) and because of the spacing of turns their number may be increased. This represents one typical shape used for the antenna of low impedance type. An example of this design is known to be used by the German Luftwaffe. The core averages 3 in. in diameter and is 12 in. long and it is said to compare favorably with a 12 in. air coil antenna. The loop is installed in a blister located in the fuselage of an aircraft. Unfortunately, maximum effective permeability is not utilized, because the windings are considerably spaced from the core to reduce iron losses. The type of

blister used in the German design calls for a special construction of the fuselage of the plane.

United States technic favors the employment of a teardrop casing or equivalent construction installed outside the ship in which long loops cannot be used. In the housing such as shown on Fig. 1 a compromise between maximum parameters and μ_{eff} will usually produce an optimum design in which the length of the loop approaches its diameter in order to get a minimum drag with low weight of iron. This extra weight is fully compensated for by savings in other materials.

Thus one can see that in the design of iron core loops different applications demand a large variety of construction. It also calls for a proper choice of magnetic material which depends on the frequency of operation and highest permissible Q with maximum effective permeability.

With the advancement of iron powders, the useful range at which iron cored loops can be employed extends from 20 kc to 20 mc, beyond which frequency the loop applications are not practical because of "night effect."

Antenna shape factors

Referring back to the formula of effective height, we note the denominator contains λ which means that the loop is more effective at high frequencies of a band and its performance drops towards low frequencies. Very fortunately the iron improves Q at lower frequencies, thus providing a useful compensation in the pickup factor of the loop.

In most cases when elongated iron core ($L/D > 1$) is employed the centralization or condensation of magnetic fields due to iron is such that the loop exhibits inherently high directivity without any extra shielding. Attenuation of signal of the order of 20 to 30 db is easily obtainable at null position without additional shielding which is partly due to the fact that the core also acts as a ground around which the coil is wound. With simple shielding, directivity can be brought down to 60 db without impairing its sensitivity. It is interesting to note that the polar diagram of sensitivity of the loop becomes somewhat distorted, i.e., the maxima is somewhat reduced and the slopes towards minima become more acute. Fig. 4 shows an "ideal" polar diagram, and departures from it due to air and iron cored loops.

The term "directivity of a loop" has not yet been standardized and the writer takes this opportunity to suggest a convenient method to define the directivity of a loop:

In a booth equipped with a standard transmission line the loop

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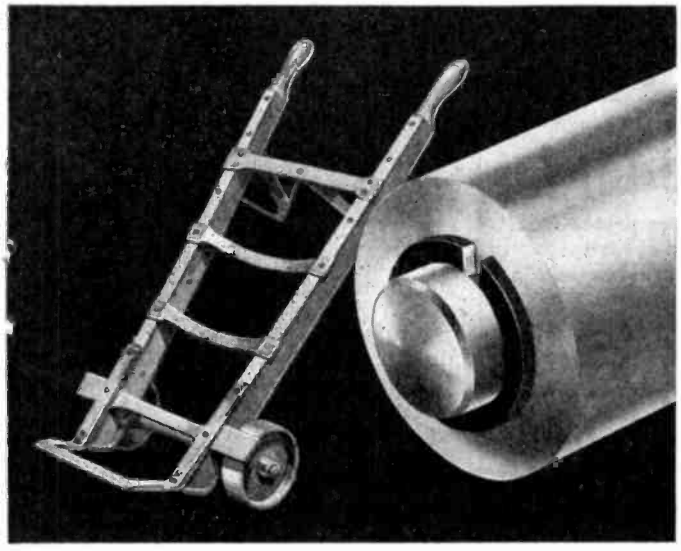

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is placed in the position of its maximum sensitivity and the input signal (microvolts per meter) is measured to supply a standard output in a receiver. The loop is then turned to its zero position and the input signal is increased until the same output is reached. The ratio of two signals represents the value of directivity. This ratio depends on frequency, shape and the adequacy of shielding of loops, and may vary from 20 to 70 db.

[1]Stewart-Warner Corporation, Chicago, Illinois.
[2](U. S. Patent No. 2,266,262.)

Aluminum Forming Films

To assist the training of government and war-industry metal workers, five new 16 mm. sound films produced by Wilding Picture Productions, Inc., for the Aluminum Co. of America, were the subject of a preview showing in New York, October 13th.

The titles are (1) General Sheet Metal Practice, (2) Blanking and Piercing, (3) Drawing, Stretching and Stamping, (4) Tube and Shape Bending, (5) Spinning. Each film runs approximately twenty minutes. Well planned, carefully photographed and recorded, the five films should be invaluable in speeding the training of sheet metal operators. Prints are available on request from the Aluminum Company at Pittsburgh, Pa.

Army-Navy "E" Awards

Brown Instrument Div., Minneapolis-Honeywell Regulator Co., Wayne & Roberts Aves., Philadelphia, Pa.

Stromberg-Carlson Co., Rochester, N. Y. (added star).

The Thomas & Betts Co., Inc., Elizabeth, 1, N. Y. (added star).

National Union Radio Corp., 15 Washington St., Newark, N. J.

Chicago Telephone Supply Co., Elkhart, Ind.

RCA Victor Div., Radio Corp. of America, Camden, N. J. (third star added).

Hazeltine Electronics Corp., Little Neck, N. Y.

Sprague Specialties Co., North Adams, Mass. (added star).

Solar Mfg. Co., 285 Madison Ave., New York, N. Y. (plants in Bayonne & West New York, N. J. —star added).

Scientific Radio Products Co., Council Bluffs, Iowa.

The Rola Co., Inc., 2530 Superior Ave., Cleveland, Ohio.

ENEMY PATENTS MADE AVAILABLE

by ARMAND EISLER

● Few members of American industry have, as yet, taken advantage of the vast fund of research represented by over 40,000 foreign patents and patent applications which are vested in the Alien Property Custodian under the President's war power. The 26,000 patents formerly owned by enemy nationals, with about 10,000 patents of citizens of enemy-occupied countries, and 4,000 patent applications which have been made available to industry without royalties are displayed in the Library of seized patents at 120 Broadway, New York City, and in Chicago. While in quality American industrial research is inferior to none, in quantity it can be greatly expanded. American manufacturers and engineers may find in these patents the solutions to many of the problems that beset them today. The permanent value of this collection will depend on American industry setting these inventions to work.

The government has established a comprehensive licensing policy. Where exclusive licenses are not already granted to American industry, non-exclusive and non-assignable licenses can be obtained by any reputable American firm or individual for the life of the patent. The licenses will be royalty-free until the expiration of enemy-owned patents.

According to the Custodian's statement of January, 1943, in the case of patents and patent applications vested from citizens of enemy-occupied countries' licenses will be royalty-free for the duration of the war and six months thereafter. At the end of this emergency period, reasonable royalties will be required, the amount of such royalties being determined either now or left for subsequent adjustment.

Policy regarding use

The policy with respect to enemy patents and applications would be to allow an existing American exclusive licensee to retain his sole right to exploitation of the patent, unless the issuance of other licenses is agreed upon with the present licensee or is determined to be necessary to the war effort.

When an American holds an exclusive license under a vested patent or patent application formerly owned by a national of an enemy-occupied country, the license and existing royalty arrangement usually will be allowed to stand and the royalties will be collected by the Alien Property Custodian's office. If for any reason a patent has been vested in error, and is returned to its former owner, so far as is possible this office will see to it that any licenses which have been issued will remain in force and that the licensee will be protected against claims.

The largest group of vested patents falls within the classification of "radiant energy" with 2,048 patents or patent applications. These represent the newest foreign developments in electronics, cathode-ray tubes, radio direction-finding means, systems for object detection and remote control, infrared rays, short waves, X-rays, etc. Fundamentally, these developments may be parallel to our industrial progress in this field; however, different research technic may have furnished improvements.

The patent applications reveal the newest processes and discoveries. If this material brings about developments, American industry could strike back with the same weapons with which the enemies tried to keep control over the field of electronics. A survey of these

seized electronic inventions shows the following typical examples which might stimulate a more thorough study of the patents themselves.

Fluorescent screens

This patent application, 242,441, published May 25, 1943 (Germany), points at the drawbacks of the prior art and provides fluorescent screens with filters preventing certain portions of daylight spectrum or of similar artificial illumination from reaching the fluorescent layer of the screens. It is necessary to provide a separate filter for each fluorescent material and to carry out experiments in order to determine the most advantageous type of filter. The object of the invention is the provision of a filter of a type that may be used for fluorescent screens having different fluorescent materials. The filter of the invention consists of an organic substance into which is embedded an absorbent for ultraviolet light. The filter may be very thin and have a thickness of about 0.1 mm. It is advisable to use substances which, even when used in small amounts, absorb ultraviolet rays, particularly the long wave part of the ultraviolet ray spectrum; for example, it is possible to use beta-umbelliferrone acetic acid which has the faculty of absorbing ultraviolet rays of light. This acid serves as adequate protecting means for preventing the detrimental components of daylight from reaching a fluorescent layer containing, for instance, zinc sulphide.

Filter components

In general, the screen consists of a base (1) of cardboard, rubber, wood, artificial resins or any other suitable substance, carrying a layer (2) of a fluorescent material and a binding ingredient (with the addition of a softening agent in certain instances). The fluorescent material may consist of zinc sulphide or the like. The fluorescent layer is covered by a filter (3) which has the faculty of absorbing the major portion of ultraviolet rays, such as a thin coating of acetyl cellulose. The skin may contain 0.5 mg of beta umbelliferrone acetic acid.

Cathode ray tube

This patent, U.S. patent 2,291,406, issued July 28, 1942 (Germany), relates to cathode ray tubes particularly for television and oscillograph purposes that use high anode potentials so that the production of X-rays must be taken into consideration. The tube is provided with an inner coating consisting of a material having a dark (preferably black) non-reflecting surface, impervious to the X-rays. The coat-

ing might consist of salt or oxides of heavy metals, such as lead sulphide (PbS), bismuth - sulphide (Bi_2S_3) or bismuth dioxide (Bi_2O_2), made up as a mixture containing a binder with adhesive properties, the X-ray absorbing material and a blackening agent such as finely divided carbon.

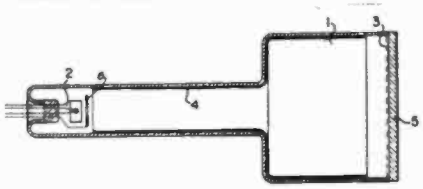

Fig. 2—C-R tube shielded against X-ray emanations

The illustration, Fig. 2, shows a cross-section of this cathode ray tube (1) containing an electron gun (2) and a luminescent screen (3). The inner wall of the tube is covered with the absorbent coating (4). The end of the tube (5) is left free of the coating material, because the light produced by the screen (3) must pass through the wall of the tube. This window (5) is therefore made preferably of lead-glass of sufficient thickness to avoid the passage of X-rays. Also, the part of the tube wall near the electron gun is free from coating, because this part is shielded by the anode.

Luminescent material

Another application referring to luminescent material was published on May 25, 1943, in the Application Ser. No. 372886 (Holland). Upon examination of the well-known luminescent mixture containing zinc-beryllium-silicates, the inventors found the unknown and surprising fact that with these silicates the active part responsible for the luminescence and its color, is a silicate of the composition Me_2SiO_4 (i.e., the orthosilicates of zinc, beryllium and manganese) which can be dissolved in acids. Whatever is left thereafter in the form of oxides and silicates does not affect the color, but only decreases the luminescence. Moreover, these admixtures may have a detrimental effect.

The best ratio contains 17 gr. mol. of beryllium silicate and about 25 gr. mol. of manganese silicate to 100 gr. mol. of zinc silicate. The silicate of the formula Me_2SiO_4 does not contain more than 17 gr. mol. and not less than 5 gr. of beryllium silicate and not more than 20 and not less than 0.1 gr. mol. of manganese silicate (Mn_2SiO_4) to 100 gr. mol. of zinc silicate. The oxides of zinc, beryllium, manganese and silicon in the pure state are mixed together in a ratio of 100 gr. mol., 11 gr. mol. and 56 gr. mol., respectively. The resulting admixture is treated from 24 to 48 hours in a ball mill and

heated at a temperature of 200 deg. C. or higher and then quenched. The product obtained can be advantageously used for fluorescent screens of cathode ray tubes and in gas or vapor filled lamps.

Glide path producing

Several methods of producing a slip-way or glide-path for landing airplanes are known, wherein radio transmitters emit a club-shaped bundle of rays at an angle to the earth's surface. In order to overcome the disadvantage of touching close to ground with too high a speed, attempts have been made to produce a glide path at an acute angle with the earth's surface. However, a slip-way radiation plane forming such an acute angle with ground requires two antenna fields having such different directivity characteristics that they intersect each other at a relatively acute angle. This requires very extended dimensions of the antenna system.

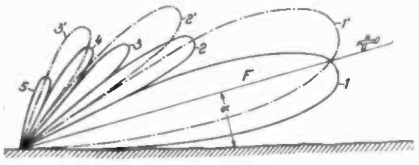

Fig. 3—Glide path antenna

The invention shown in Fig. 3 is a very simple antenna system, making use of the known effect occurring when the space between the earth's surface and an antenna system is a multiple of the operating wavelength. The U.S. patent number is 2,297,228, issued September 29, 1942 (Holland).

WPB Limits Consumption of High-Quality Mica

A new policy for the conservation of high-quality mica has been established by the War Production Board, to be effective December 1. Under this, users are being notified that the WPB will undertake to provide only sufficient quantities of the better qualities of mica to maintain consumption at the monthly rate prevailing during the first nine months of 1943.

Stockpiles of high-quality mica have been deteriorating since the first of the present year. Average consumption of good stained mica and of the better qualities, during the first eight months of the year, have totalled more than 50,000 lb. in excess of receipts. As a result, government stocks of the better quality micas used in capacitors are at a vanishing point. Industry stocks are also reduced in practically all cases and are at a minimum working inventory.

The new conservation policy has been formulated jointly by the Mica-Graphite Division and the Radio-Radar Division of WPB. The new plan will actually not limit mica-capacitor production, as there will be no restriction or allocation of the lower qualities of block and film mica.

Encourage use of lower grades

The results of the Bell Telephone-National Research Council capacitor research project will be made available to capacitor manufacturers to aid them in determining which of the various lower qualities they can use to best advantage. Stocks of the lower qualities have been building up rapidly during 1943, the WPB reported, having risen from 370,000 pounds on January 1, to 1,160,000 pounds last August 1.

WPB's Service Manual

A comprehensive practical manual on industrial salvage has just been published by the Technical Service Section, Industrial Salvage Branch, Salvage Division, War Production Board, and is now being distributed to industry.

The new book, entitled "Salvage Manual for Industry," contains 245 pages of systematically organized and classified information and data —most of it of a "how-to-do-it" nature—on industrial salvage practice in all its ramifications. Material is presented in 26 chapters, grouped into 6 major sections. There are 2 chapters on organizing and planning the salvage department; 3 on the administrative factors; 12 on methods of handling (finding, identifying, segregating, collecting, reclaiming, storing, selling, etc.) metal scrap; 3 on nonmetallic waste; 7 case histories demonstrating exemplary practice; a 17-page compilation of practical hints for handling specific waste materials; and a 9-page index. Procurable through the Superintendent of Documents, Government Printing Office, Washington, D. C., at fifty cents a copy.

NEMA Electronic Meeting

The electronic section of the National Electrical Manufacturers Association was scheduled to hold its Fall meeting at the Waldorf-Astoria Hotel, New York, N. Y., Wednesday, Oct. 27th, in connection with the annual convention of the parent association. H. J. Hoffman of Westinghouse Lamp is chairman of the electronic section of NEMA, and D. V. Edwards, of Electronics, Inc., is secretary. A program of routine section business was planned for the Oct. 27th meeting, with the election of officers for the coming year.

Motion Picture Engineers Discuss Electronic Subjects

Two engineering achievements that are contributing toward making the American soldier the best-trained fighting man in the world were described in technical papers presented at the fifty-fourth semi-annual conference of the Society of Motion Picture Engineers in the Hollywood-Roosevelt Hotel in Hollywood, October 18 to 22nd.

Both are motion picture sound recording equipments that are built for the road. Developed by engineers of the Radio Corp. of America, one is a completely self-contained and self-powered mobile unit mounted on a truck chassis—a fully-equipped recording studio on wheels, while the other, identified as the PM 45, can be packed into a truck and quickly set up on location.

Basically the new lightweight double film system, which is identified as the PM 45, consists of a two-channel mixer amplifier, the main amplifier cabinet which includes a voltage amplifier, compressor and high and low pass filters, and the recorder. Five easily mounted motors are available for the recorder, permitting operation of the equipment from as many different sources of power including battery operation.

Mobile recorder

In the mobile unit, described in a paper by J. L. Fields, of RCA's Hollywood engineering staff, all facilities are compactly and conveniently installed on either side of a center aisle running the length of the coach. Some idea of this accomplishment may be gained when the facilities are enumerated; they include a recorder, motor generator, B-voltage dynamotor, cable reels, amplifier equipment, power control panel, mixing panel, monitor speakers, storage batteries, and spare parts storage.

New ideas in the science of sound which make it possible to "stretch" the acoustical dimensions of an orchestra shell and to separate vocal solo or chorus and accompaniment and modify and remix them as desired were described by M. Rettinger, of the Radio Corp. of America, John P. Livadary, of Columbia Pictures Corp., and Earl Mounce, of RKO Radio Pictures, Inc.

Concrete hall quality in the recording of orchestras up to 50 pieces has been achieved by the introduction of curved wall surfaces in sound stages of the Columbia studios, according to their joint paper. Separate adjustment of vocal music and orchestra, accomplished through the use of a separate room or "vocal booth" for the soloist and the engineering of a

multi-channel scoring system, was described in the papers.

Another development for the improvement of motion picture sound, which also has resulted in savings of critical film and savings in production time, was discussed in a paper by A. C. Blaney, chief engineer of RCA's Hollywood plant. His subject was the experience of the past four years in the direct positive push-pull method of recording.

Urging careful planning for post-war television, Klaus Landsberg, director of television for radio station W6XYZ, stated: "Television, I believe, would encounter difficulties in moving to higher frequencies where multipath transmission becomes a more serious factor." "Still," he added, "television will require more room in the frequency spectrum and plans must be made to provide it."

G-E Surveys Stockholders on Postwar Radios

As part of General Electric's post-war planning, an illustrated questionnaire asking the company's 227,-000 stockholders what type of a radio receiver they would like to buy after the war has been mailed with the company's third quarter dividend check. This survey asks what kind of a radio is now owned, if and when they plan to buy a new receiver, the style and type preferred, and whether or not they know about or are interested in FM, frequency modulation.

Automatic Burner Control

In U. S. patent No. 2,327,690 to H. S. Ackerman, an automatic burner control is described. The heating cycle is initiated by a temperature-responsive eleemnt which starts the pilot light and opens the supply valve for the pilot light. The next step is the opening of the supply valve for the main burner, effected by an electronic tube and relay combination. A safety device is included in the grid circuit of the tube to stop fuel supply to the main burner if the pilot light should have failed to ignite or combustion stops. Fuel supply is also interrupted when the water level in the tank sinks below a certain level or when the pressure exceeds a certain amount.

How Intense Sound Waves Kill in War

How intense sound waves kill men in the armed forces is told by Commander Bartholomew W. Hogan, Medical Corps, United States Navy, in a report to the International College of Surgeons.

This war has furnished the clinching evidence. The observed facts clear some long-standing

mysteries about death or injury of men whose bodies bear not a single external mark; they also reveal some new things.

As interpreted by Howard Blakeslee, Associated Press science editor, the deaths occur both in air and water, and of the two the water is the more deadly. In both cases the lethal blast is compression, which travels in a wave at the speed of sound, and which is in fact the sound the ears hear.

In air this speed is about 1,180 feet a second; in water 4,800 feet, more than four times faster. In air the thickness of the compression or sound wave is not well established. In water it is estimated at about five feet.

Commander Hogan lists the main injuries thus far seen, by himself and by others physicians and officers.

Annihilation from close-up

One is annihilation. This occurs in air, when a person is within three to ten feet of a sufficiently violent explosion. The human body then, he says, may be completely disintegrated by the blast wave alone, and thus be destroyed without fragment or trace.

Another, in air, he or his assistants saw when the torpedo, or torpedoes, which destroyed the aircraft carrier Wasp last September in the South Pacific, sent a V-shaped explosion up one side of the ship, sixty feet to the top deck, and above.

"Men standing in passageways near this area," he reported, "were seen to grab their abdomen, double over and collapse in death."

Causes brain injury

A third effect is brain injury. This happened apparently to some of the Marines at Guadalcanal who were in fox holes or running for cover when a bomb or shell hit close by, at times within 10 feet. The Marines were knocked down and were unconscious from a few minutes to 40 days.

No external injuries were apparent, but the men became lethargic, apathetic, dull, sometimes with impaired memories.

When these men were treated at the Naval Hospital, Oakland, Cal., there was evidence of bleeding near the brain linings. And when the fluids which had gathered from this bleeding were removed, the men recovered.

British officers told Commander Hogan of another disabling effect.

This was on men of a ship repeatedly bombed. Some men in an area of the vessel away from the blast were found sitting around in an apathetic state.

The apathy was so bad in some men that if they got into a particular position they were unable to summon energy to change it. If one of them should trip or fall, he might drown in a few inches of oil or water, because he was too apathetic to get up.

This shock wave is invisible, Commander Hogan says, but is what produces injury. Because of the five-foot estimated thickness of the wave, a man in water is entirely engulfed in it for a fraction of a thousandth of a second.

After the Wasp had been abandoned, Commander Hogan, himself in the water, describes some deaths he witnessed.

"I saw a group of men swimming toward a destroyer," he says. "A depth charge went off, the water blew high in the air and the surrounding water was churned and violently agitated. When it had quieted, there were very few bobbing heads, and these were lifeless.

"I felt this concussion wave. It was like some one grabbing you around the waist, holding you very tight and suddenly releasing you. It seemed to press your stomach to the backbone and suddenly release it."

What happens inside the human body is becoming fairly clear. It is believed that the shock, or sound wave, does not pass around the body, but goes right on through.

This speed through the body depends on the nature of the tissues and internal substances encountered by the wave.

In abdomen and lungs, where the sources of the sound wave deaths have been mostly confined, there are gas or air pockets. When the fast traveling wave hits one of these it is believed to shred off some of the lining of the surface which surrounds the air.

The air compresses as it transmits the sound wave, and then expands violently in recoil. This expansion is believed to drive holes, or perforations, in the already weakened lining.

In water the danger area varies from 100 to 150 feet, in air it is much shorter. At 100 feet the pressure wave from 1,500 pounds of T. N. T. is not lethal.

Nevertheless, the sound wave itself is one of the dangers, Commander Hogan says.

ELECTRONIC INDUSTRIES

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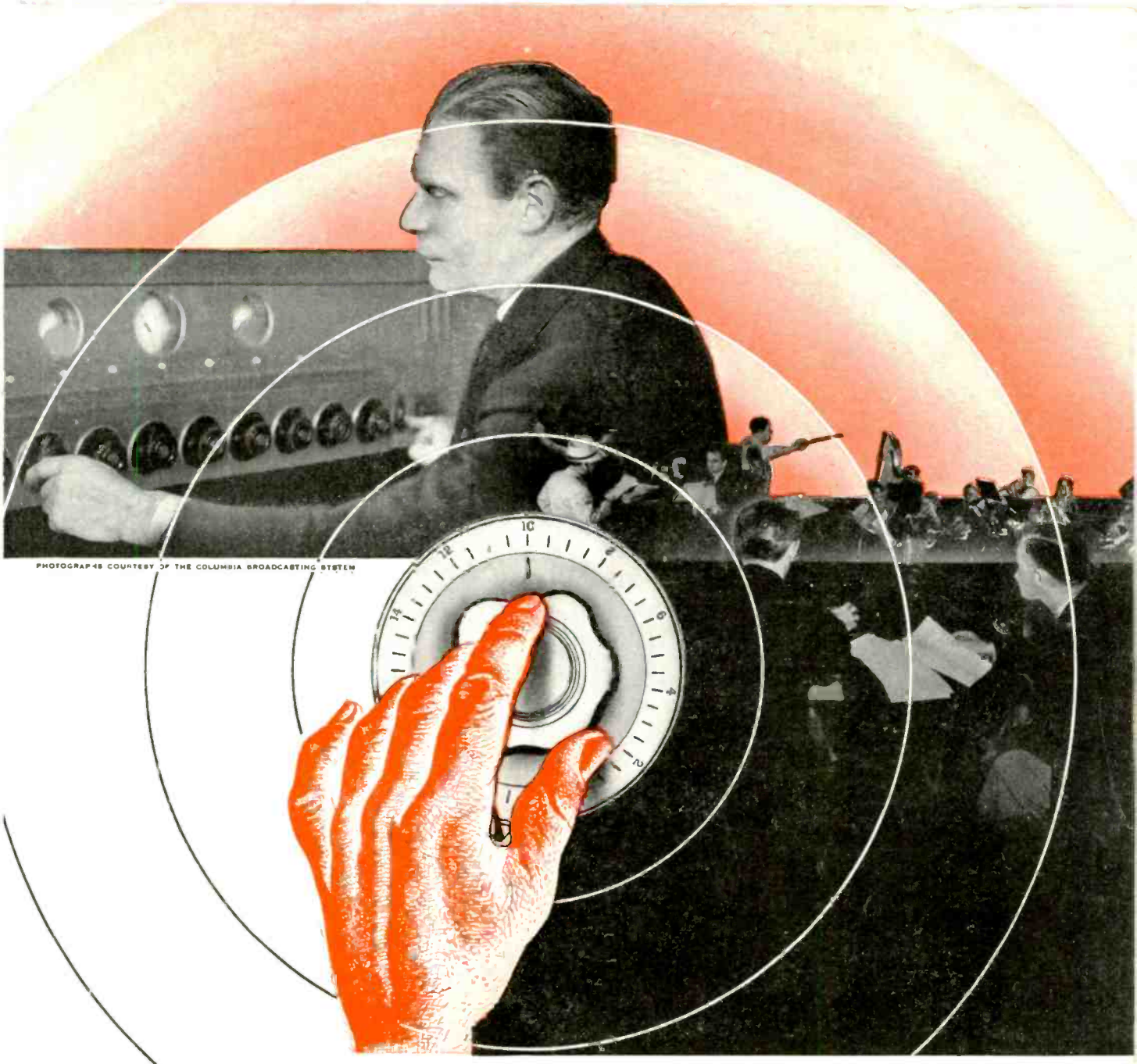

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