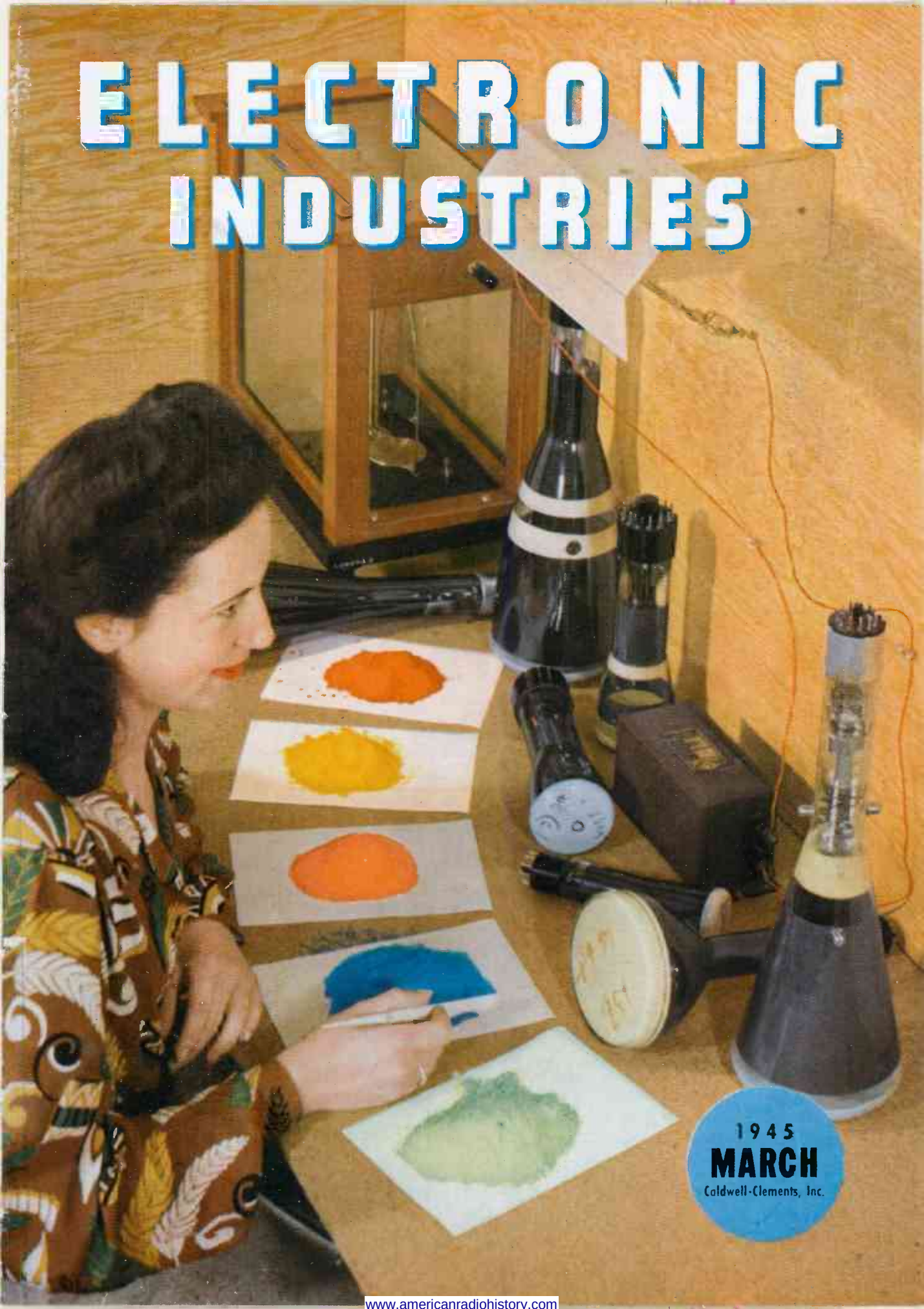
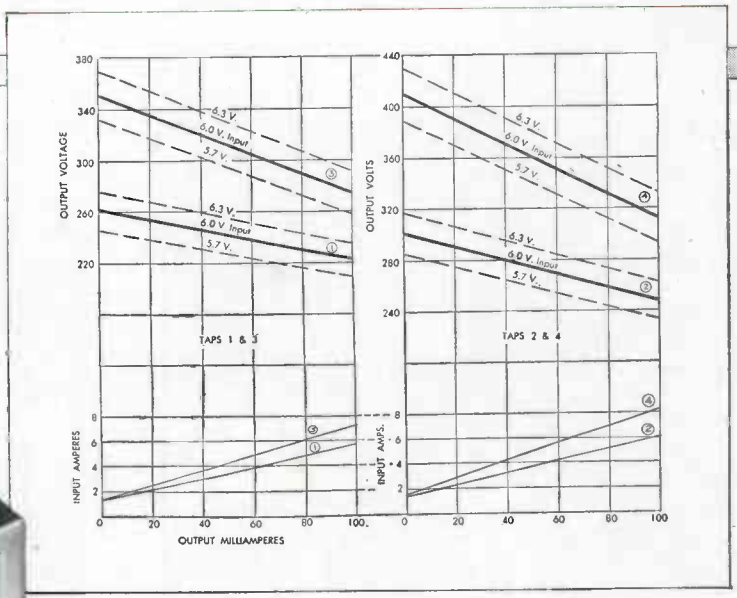
ELECTRONIC INDUSTRIES



1945
MARCH
Caldwell-Clements, Inc.

MALLORY VIBRAPACK*

Provides Dependable Plate Power for Portable Electronic Equipment



Operating characteristics of Mallory Vibrapack VP-552

Wherever dependable high voltage is required from a low voltage DC source, Vibrapacks* are built to deliver plate power efficiently and economically over a long life. Vibrapacks are used successfully in operating radio receivers, transmitters, PA systems, direction finders and other electronic apparatus on police cars, aircraft, automobiles, farms, boats, in military, naval, forestry and lighthouse service . . . wherever a source of commercial AC is not available.

Features of Mallory Standard Vibrapacks include:

Nominal input voltages of 6, 12 and 32 volts DC.

Nominal output voltages from 125 to 400.

Models available with switch for four output voltages in approximate 25-volt steps.

All *standard* Vibrapacks are equipped with new Mallory Hermetically-Sealed Vibrators for top performance in extremes of atmospheric pressure or humidity.

Heavy-duty Vibrapacks are available that will deliver up to 60 watts power. You can obtain Mallory Vibrators and Vibrapacks at your nearest Mallory Distributor. Ask him for literature, or write us today.

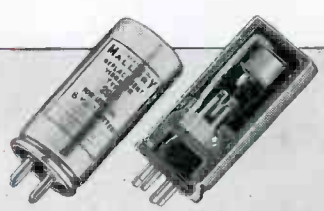
Inquiries are invited from manufacturers for Vibrators and Vibrapacks for use in original equipment.

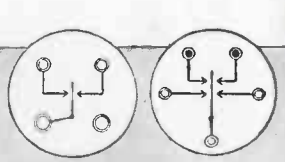
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

**Reg. U. S. Pat. Off.*

P. R. MALLORY & CO. Inc.

MALLORY





VIBRATORS and VIBRATOR POWER SUPPLIES

ELECTRONIC INDUSTRIES

Including INDUSTRIAL ELECTRONICS

★ IN THIS ISSUE — MARCH, 1945 ★

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Why

AMPEREX

WATER AND AIR COOLED TRANSMITTING AND RECTIFYING TUBES

In the production of *Amperex* tubes every construction step is carefully watched to insure greater operating efficiency and lower operating costs. Welding, for instance, is done in an inert or reducing atmosphere in specially designed apparatus. This *"Amperextra"* means that there is no oxidation of metal parts. As a consequence, there is much less liberation of gas later on in the life of the tube, and a more consistent *hard* vacuum is maintained.

More than 70% of all electro-medical apparatus in this country is equipped with Amperex tubes. More than 40% of the nation's broadcasting stations also specify our products as standard components. There's an *Amperex* type for *every application in every field* using transmitting and rectifying tubes. Your inquiries, for present or peacetime assignments, receive prompt attention.

AMPEREX
...the high performance tube

NOTE: *Many of our standard tube types are now available through leading radio equipment distributors.*

AMPEREX ELECTRONIC CORPORATION

79 WASHINGTON STREET . . . . . BROOKLYN 1, N. Y.
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NOW IS THE TIME WHEN YOUR DOLLARS COUNT PLEASE SUPPORT THE RED CROSS WAR FUND

To fulfill Long Life is the goal of every

Tobe Capacitor

even under extreme temperature conditions

★

Long Life and Tobe are interchangeable trademarks

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

SPECIFICATIONS OF JUST ONE TYPE OF THE MANY TOBE OIL-IMPREGNATED AND OIL-FILLED PAPER CAPACITORS . . .

OD*-CAPACITORS

RATINGS:			
600 VDC	Single Units	.05, 0.1, .25	Mfd.
	Dual Units	.05, 0.1,	"
	Triple Units	.05, 0.1,	"
1,000 VDC	Single Units	.05, 0.1	Mfd.
	Dual Units	.05, 0.1	"
	Triple Units	.05	"

STANDARD CAPACITANCE TOLERANCE plus or minus 20.%**

TEST VOLTAGE . . . . . twice DC rating

GROUND TEST . . . . . 2,500 Volts DC

OPERATING TEMPERATURE . . . 55°F. to 185°F.

SHUNT RESISTANCE:
.05 to 0.1 Mfd.—20,000 Megohms
.25 Mfd. —12,000 Megohms

POWER FACTOR . . 1,000 cycles—.002 to .005

CONTAINER SIZE:
Width 9/16," length 1-11/16," height 1-17/32"

MOUNTING HOLE CENTERS . . . . . 2-1/8"

Illustration shows capacitor with bottom terminals. Capacitors also available with top terminals.

OD-CAPACITOR

*Data sheets showing complete code number for units having a specific capacitance value and voltage ratings available on request. **Other tolerances available.

A SMALL PART IN VICTORY TODAY — A BIG PART IN INDUSTRY TOMORROW

THE COVER

The original Kodachrome photograph, made especially for "Electronic Industries," illustrates one phase in the preparation of special phosphers such as are used for cathode ray tubes. Samples of luminescent material, normally colorless, are examined under irradiation from the overhead ultra violet lamp which brings out their colors; after-glow may be examined by switching off the lamp. For cathode ray tube screens, phosphers must be carefully selected to obtain the highest efficiency or brightness. In addition they must be accurately proportioned to obtain the desired color. It is the chemist's problem to produce high efficiency phosphers of suitable colors which will remain stable during tube manufacturing and which will give satisfactory performance in the tube in use.

10 Million Crystals

If you have been wondering about quartz and quartz crystals, consider this: Western Electric has manufactured nearly ten million frequency controlling crystals for the tank radio transmitter (BC604) alone. Incidentally, these crystal units are about seven millimeters square and less than one millimeter thick. They are what are known as CT cut, have a zero temperature coefficient at a specified temperature and less than 0.02 per cent variation between —40 and +130 degrees Fahr.

Two-Watt Radio

A new type radio set, which uses only two watts, will soon be for sale in liberated Holland, according to Aneta, Netherlands news agency. This represents a great saving in electric current as compared with older models now in Dutch homes that require ten to twenty watts. Cost of the radio will be forty-five guilders ($24.30).

During the German occupation Hollanders had their radios confiscated; thousands of sets were sent to Germany. However, many persons were lucky enough to retrieve their radios after the liberation as scores of sets were found stored in warehouses. But even those fortunate enough to have their radios back found little use for them; with the extreme shortage of electricity and fuel, it has become necessary in Eindhoven and other large cities to curtail their usage. Between the hours of 6 and 10 p.m. listening is prohibited, though it is common knowledge that not too much attention is paid to the prohibition.

Metals for G-E electronic tubes are scoured clean at heats up to 2,000°F

As a user, you gain importantly from G.E.'s policy of building tubes for toughness and top performance

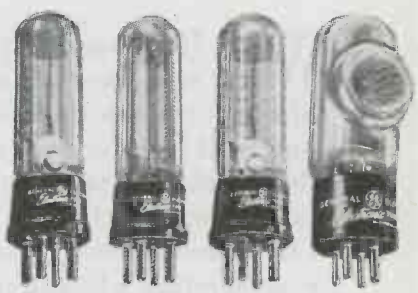
Methods of heat-treatment employed by General Electric mean much to the dependability of your electronic tubes, their efficiency and low replacement average. Burning hydrogen gas is forced into white-hot metals which later will become tube cathodes, grids, and anodes operating at high temperatures. One result is to scour the metals free of gas-forming and other impurities that mar tube performance and shorten life. Another is to anneal parts to withstand vibration.

G. E. *carries through* afterwards by requiring all workers who touch or handle metals to wear gloves in order that parts may stay clean. Moreover, in the General Electric tube factory in Schenectady—most modern of its type in the world—the air is filtered to remove dust, and conditioned.

The end result of this watchfulness at every stage is *built-in* quality which pays dividends to you, the user of G-E electronic tubes, in better, longer tube service.

For ratings and full information on any industrial tube in G. E.'s *complete* line, consult your nearest G-E office or distributor, or write to *Electronics Department, General Electric, Schenectady 5, N. Y.*

Hear the G-E radio programs: *"The World Today" news, Monday through Friday 6:45 p. m., EWT, CBS. "The G-E All-Girl Orchestra," Sunday 10 p. m., EWT, NBC. "The G-E House Party," Monday through Friday, 4 p. m., EWT, CBS.*



GL-868/PJ-23 PJ-22 GL-441 FJ-405

TYPIFYING G-E STANDARDS OF *BUILT-IN* QUALITY ARE

PHOTOTUBES

These General Electric tubes that "see" are widely known for unfailing service. Of the representative types shown, GL-868/PJ-23 is gas-filled and the other three are vacuum types. Spectral response of GL-868/PJ-23 (R. M. A. standard) is S1, sensitivity to light 90 micro-amperes per lumen, anode voltage 100—price $2.60. For PJ-22 the same ratings in order are S1, 20 mu a, 500 v—price $2.60. For GL-441 ratings are S4, 45 mu a, 250 v—price $4.50. For FJ-405 (a special ultra-violet-responsive tube) ratings are S6, 12 mu a, 200 v—price $42. Within these rating limits G. E. also manufactures other phototubes designed for specific uses. Detailed data on any G-E phototube or the complete line will gladly be sent.

THERE ARE 265 G-E AND GRAYBAR MAIN SUPPLY OUTLETS FOR G-E ELECTRONIC TUBES, BACKED UP BY CENTRALLY LOCATED STOCKS IN 26 LARGE CITIES FROM COAST TO COAST

GENERAL ELECTRIC

162-05-8850

A STATEMENT OF POLICY TO THE EQUIPMENT MANUFACTURER CONCERNING *Gammatron Tubes*

WE at Heintz and Kaufman Ltd. believe that equipment manufacturers, many of whom are making their long-range plans now, will be interested in the policies for the standardization and stabilization of tube types which have been established for Gammatrons. These policies merit consideration when designing equipment either for military or civilian use.

Practically all tubes now sold to the Government must conform to specifications covering electrical standards and physical dimensions.

We are heartily in favor of the Signal Corps and Bureau of Ships joint standardization of electronic component parts. The good work of the Radio Manufacturers Association likewise deserves the highest commendation. We believe that the Joint Army and Navy Specifications for Vacuum Tubes ("JAN specs") will be accepted voluntarily by tube manufacturers as post-war commercial standards, since they offer many advantages to the equipment manufacturer.

All H&K Gammatrons when again manufactured for commercial use will conform to the rigid physical and electrical specifications now required by "JAN specs."

Thus when you design equipment around Gammatron tubes you can be sure that neither electrical nor physical changes in these tubes will make redesign of equipment necessary, or replacement difficult.

We plan to tell you more about our standardization and development policies in future advertisements. So please be on the watch for them each month.

BUY WAR BONDS

HEINTZ AND KAUFMAN LTD.

SOUTH SAN FRANCISCO • CALIFORNIA

Gammatron Tubes

More often than not the socket in service is a "CINCH"

IT'S "KNOW HOW"

For reliable Communication all factors must be coordinated. So the CINCH contribution to the electronics program, the radio tube socket is a record of achievement. From the first socket manufactured sixteen years ago to the complete line now in service everywhere . . . a volume of increase that always exceeded the pace of the industry. Such a record signifies "KNOW HOW". As evidence of intensive research and resourceful engineering, CINCH was the first in the field with a complete line of miniature socket assemblies, together with nut straps, shield and associated items.

CINCH *Fasteners ★ Miniature Sockets*
Filler Necks ★ Octal Sockets ★ Lugs
Terminal Strips ★ Metal Stampings

CINCH MANUFACTURING CORPORATION
2335 West Van Buren Street, Chicago 12, Illinois
Subsidiary of UNITED-CARR FASTENER CORPORATION, Cambridge, Mass.

"My Make-Believe Ballroom Needs Transcription Equipment That's Really Rugged!"

"That's why our installation is PRESTO"

"Our PRESTO transcription turntables get a real workout here at WNEW," says Martin Block, popular announcer and director of the *Make-Believe Ballroom* program. "We keep them running almost continuously throughout the day. And they're giving the same fine, clear reproduction today that they gave when we installed them years ago. As an announcer, that means a lot to me. It's a nice feeling to know that my transcribed show is getting out 'in good voice!'"

From users of PRESTO equipment all over the country comes the same story: "It's rugged, it's dependable, it stands the gaff!" The increased use of transcribed material in wartime broadcasting has placed a heavy burden on all recording and playback equipment. PRESTO users—including many of the major broadcasting stations—have found that their equipment is handling the job with ease. That's because PRESTO devices are products of integrity—built to do *more* than will ever be expected of them.

WORLD'S LARGEST MANUFACTURER OF INSTANTANEOUS SOUND RECORDING EQUIPMENT AND DISCS

PRESTO

RECORDING CORPORATION

242 West 55th Street, New York 19, N. Y.

Walter P. Downs Ltd., in Canada

Ideal General Purpose Condensers

ERIE CERAMICONS*

REG. U. S. PAT. OFF.

When Erie Resistor introduced the first silvered ceramic condensers in this country several years ago, engineers were provided with a simple method of compensating for frequency drift in other components.

Expanded war time demand for condensers has definitely proved that Ceramicons are also superior as general purpose condensers in circuits where some moderate degree of capacity change with temperature is permissible. For example, Ceramicons make excellent coupling condensers, particularly plate-to-grid, where high insulation resistance is of paramount importance.

When specifying Ceramicons under JAN-C-20 for general purpose use, temperature coefficient characteristic "SL" should be given. If Erie designations are used, specify "any temperature coefficient between P100 and N750." The temperature coefficient of these Ceramicons will be between +150 and —870 parts/million/°C, as determined by measurement at 25°C and 85°C. Particularly in the low capacity ranges, this temperature coefficient limit will, in many cases, permit us to ship quickly from stock, since the Ceramicons can be selected from any one of the 10 standard temperature coefficients between P120 and N750. The capacity range for equivalent physical size is given in the table below.

May we submit samples of Erie Ceramicons to you for your general purpose applications?

CHARACTERISTICS

CAPACITY RANGE IN MMF	JAN-C-20 STYLE	ERIE STYLE	MAXIMUM OVERALL DIMENSIONS
1 to 51	CC20 CC21	A K	.200 x .400 .250 x .562
52 to 110	CC25 CC26	B L	.200 x .656 .250 x .812
111 to 360	CC35 CC36	C M	.265 x 1.125 .340 x 1.328
361 to 510	CC40	D	.375 x 1.110
511 to 820	CC45	E	.375 x 1.560
821 to 1100	CC45	F	.375 x 2.00

** Ceramicon is the registered trade name of silvered ceramic condensers made by Erie Resistor Corporation.*

Electronics Division

ERIE RESISTOR CORP., ERIE, PA.

LONDON, ENGLAND • • TORONTO, CANADA

ARMY E NAVY

FOR HIGH ACHIEVEMENT IN WAR PRODUCTION

★ ★ ★ Do More Than Before—Buy EXTRA War Bonds ★ ★ ★

Coordinating military movement . . .

land, sea, air

Radio and electronic products built by Delco Radio are serving in every theater of war . . . helping to coordinate the action of all units of the armed forces. Good performance is essential. Dependability must be insured under extreme conditions of service. These characteristics are attained through Delco Radio's effective combination of engineering vision, manufacturing precision. Delco Radio Division, General Motors Corporation, Kokomo, Indiana.

KEEP BUYING WAR BONDS

Delco Radio
DIVISION OF
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MEMO TO Purchasing Dept.

For postwar, recommend we standardize on Solar's hermetically-sealed, patented special twist-prong base Type DY electrolytic. They're properly protected against moisture.

E.M.

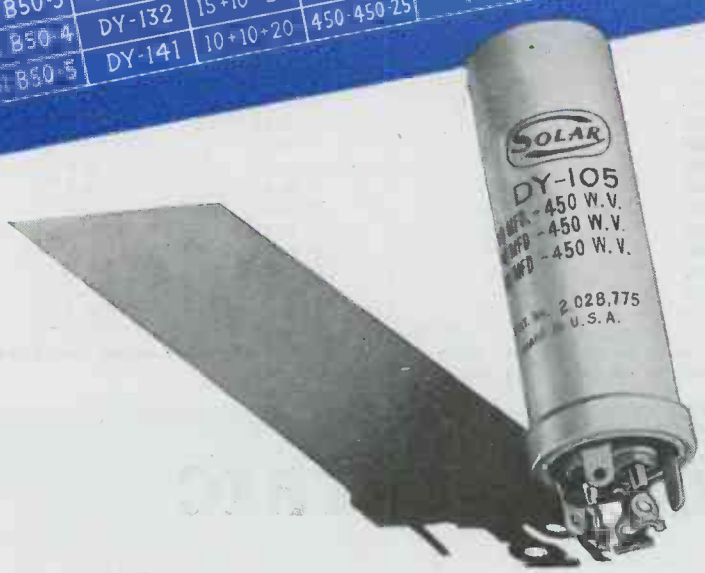
ENGINEERING SPECIFY Solar DEPARTMENT

LEADING MANUFACTURERS EVERYWHERE

PART NO.	SOLAR PART NO.	CAP'Y MFD.	WKG. VOLTS	DIMENSIONS "A"	DIMENSIONS "B"
51 B50-1	DY-61	20+20	150	1"	2"
51 B50-2	DY-92	20+20	450	1"	3-3/8"
51 B50-3	DY-94	10+10	450	1"	2-1/2"
51 B50-4	DY-132	15+10+20	350-350-25	1"	2-1/2"
51 B50-5	DY-141	10+10+20	450-450-25	1"	3"

DRAWN E.O.H.
TRACED M.
APPROVED J.C

DATE 1/4/45
DWG. No. 51 B50
ISSUE



Prominent engineers consistently show their preference for Solar Capacitors. Solar pledges continued production of superior quality capacitors to merit that preference. Solar Manufacturing Corporation, 285 Madison Avenue, New York 17, N. Y.

ARMY NAVY

SOLAR CAPACITORS & ELIM-O-STATS

7759

ELECTRONICS DESIGNER'S

Now Available!

G-E CAPACITORS

that conform to

AMERICAN WAR STANDARD

Fixed paper-dielectric G-E capacitors that conform to American War Standard proposed JAN C-25 (superseding C-75.16—1944) are now available with characteristics E and F, and with capacitance tolerance of 10 per cent (K), in the following case styles:

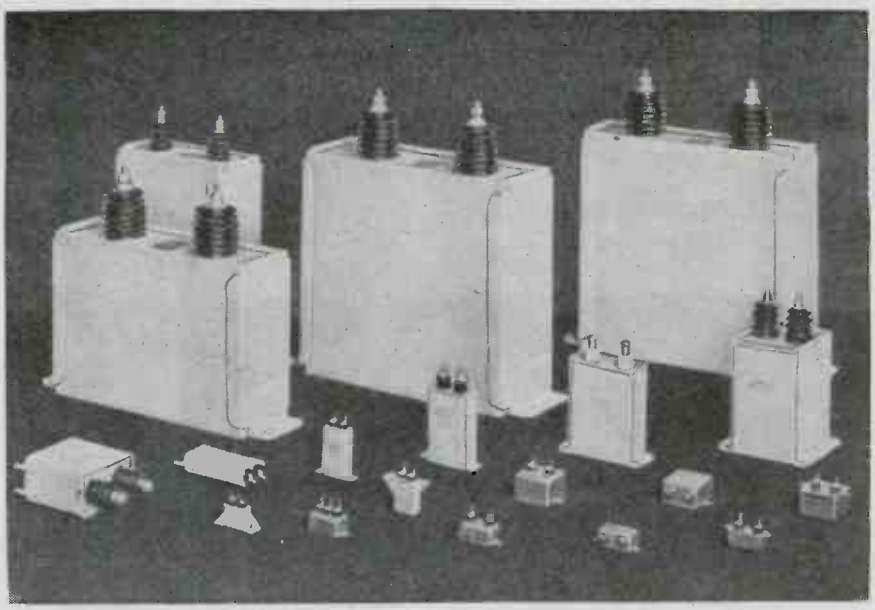
CP-50, -51, -52, -60, -62, -64, and -70.

The CP-70 units are available with B (solder lug) terminals, and with D and E (pillar insulator) terminals.

Removable mounting brackets of either the footed type or the screw-spade-lug type can be supplied for mounting the CP-70 units.

The service reliability of these G-E capacitors is backed by more than a quarter century's experience in the manufacture of capacitors of all types. For complete data, write for Bulletin GEA-4357.

Buy all the BONDS you can
—*and keep all you buy*



Some of the fixed paper-dielectric G-E capacitors that conform to American War Standard

STANDARD RATINGS

CP-50, -51, AND -52 — **CHARACTERISTIC F**

Voltage	Range of Capacitance Values in Mu f		
	Single Section	Dual Section*	Triple Section*
600	.05 to 2.0	.05 to 1.0	.05 to .5
1000	.05 to 1.0	.05 to .5	.05 to .25

CP-60, -62, AND -64 — **CHARACTERISTICS E AND F**

Voltage	Range of Capacitance Values in Mu f	
	Single Section	*Dual Section
600	.05 to 1.0	.05 to .5
1000	.01 to .5	.01 to .25
1500	—	.01 to .05

CP-70 (SINGLE SECTION) — **CHARACTERISTICS E AND F**

Voltage	Range of Capacitance Values in Mu f		
	B Terminals	E Terminals	D Terminals
600	.25 to 10	.25 to 10	—
1000	.1 to 15	.1 to 15	—
1500	.1 to 15	.1 to 15	—
2000	—	.1 to 15	—
2500	—	.1 to 12	.1 to 6
3000	—	.1 to 6	.1 to 6
4000	—	.1 to 4	—
5000	—	.1 to 4	—
6000	—	.1 to 2	—
7500	—	1.0 to 2	.1 to .5
10000	—	.1 to 2	—
12500	—	.5 to 2	.1 to .25

*Capacitance per section of dual and triple section units. Dual and triple section units have capacitance tolerance of plus 20 per cent, minus 10 per cent (V).

GENERAL ELECTRIC

DIGEST

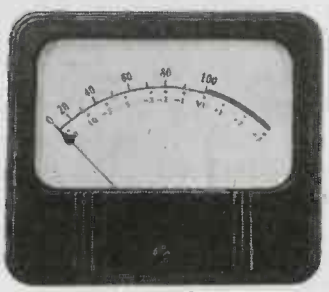
A LOT OF INSTRUMENT
in a little space

These thin, internal-pivot panel instruments have high torque, good damping, and a lightweight moving element that withstands vibration. They respond rapidly and accurately. They give you more instrument in less space, because the internal-pivot construction makes the entire element assembly 20 per cent thinner than outside-pivoted types. Ask for details of the Type DW voltmeter or ammeter—milli, micro, or radio frequency. Bulletin GEA-4064.

TO KEEP TABS ON TIME

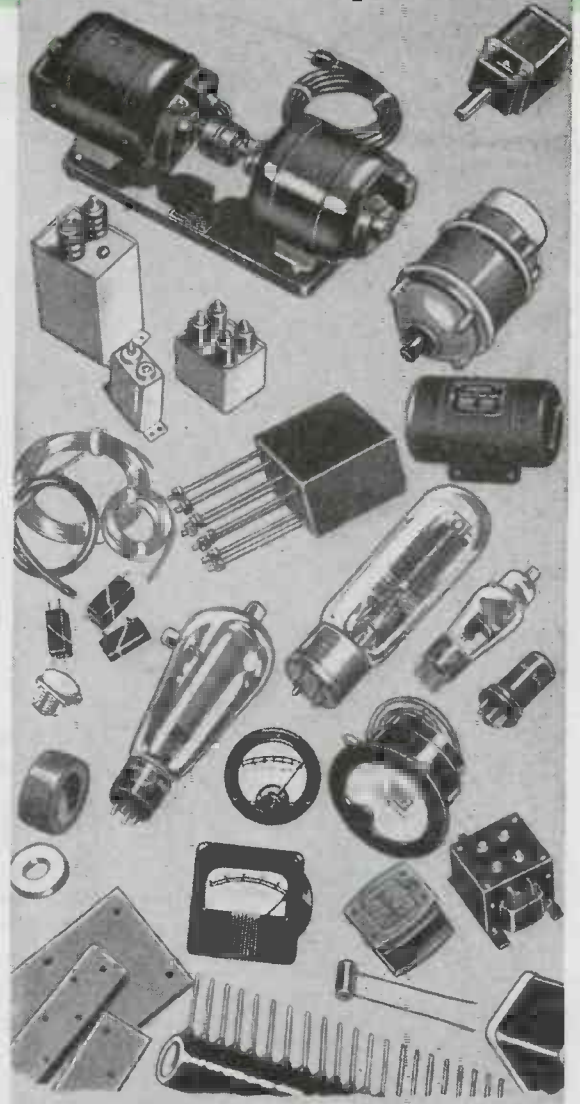
For applications in which it is desired to keep track of the total operating time of electronic tubes or other electric devices, our Type KT time meters can provide an accurate record—in hours, tenths of hours, or minutes. Powered by precise, long-lived Telechron synchronous motors, these meters are available for panel or conduit mounting, and in portable form. For use on 60-, 50-, or 25-cycle circuits of 11 to 460 volts, to match the operating characteristics of various machines. Bulletin GEA-3299.

VOLUME-LEVEL INDICATION
via vu standard



To standardize measurement of sound, and make broadcast monitoring more effective, these vu volume-level indicators were developed to meet the rigid electric, dynamic, and mechanical specifications formulated by NBC, Columbia, and Bell Telephone Laboratory engineers. This G-E instrument employs the vu, a new standard of measurement. The zero reference is one milliwatt in a load of 600 ohms, and the vu unit is numerically equal to the number of decibels above or below this reference level. Ask for Bulletin GEA-3145A.

Timely Highlights on G-E Components



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Schenectady 5, N. Y.
Please send me

. . . . . GEA-4357 (on fixed paper-dielectric capacitors)
. . . . . GEA-4064 (on small panel instruments)
. . . . . GEA-3299 (on time meters)
. . . . . GEA-3145A (on volume-level indicators)

NAME .....
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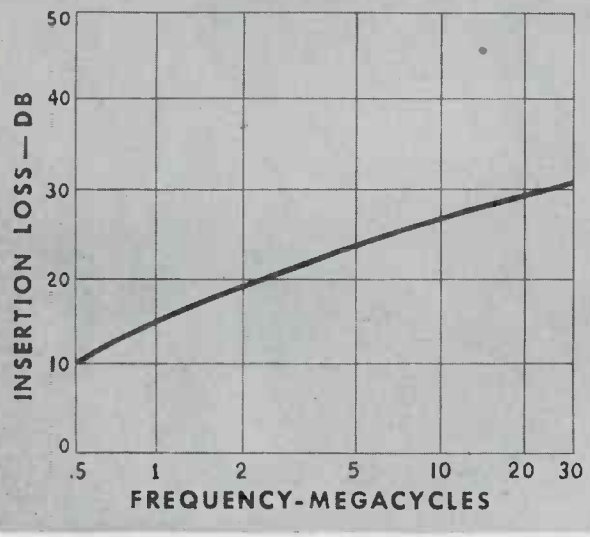
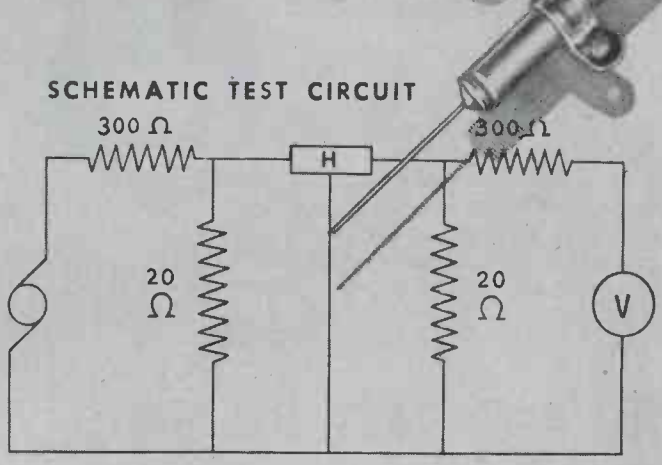
CITY ..... STATE .....

SPRAGUE HYPASS CAPACITORS



Curve showing insertion loss of a Sprague HYPASS Capacitor.



The Solution to "WHAT TO DO WITH ANTI-RESONANT FREQUENCIES?"

Conventional methods of getting rid of vibrator "hash" usually call for the use of a by-pass capacitor, shunted by a mica capacitor. This system, however, has at least one anti-resonant frequency. Of course the engineer juggles his constants so that this anti-resonant frequency comes where it causes the least trouble—BUT, in today's all-wave devices, there just isn't any such place!

The New Sprague Method is simply to utilize the Sprague HYPASS Capacitor. Technically, this is a 3-terminal network which, at low frequencies, "looks" like a capacitor in respect to its capacity, voltage rating, and size. At high frequencies—well, the above diagram tells the story. Although accurate measurements of their performance at the very high end of the spectrum are difficult to obtain as yet, qualitative indications show that HYPASS units do the job at 100 megacycles and more—so much so that, if you have a "hash" problem, we'd welcome an opportunity to stack them against it.

SPRAGUE ELECTRIC COMPANY, *North Adams, Mass.*

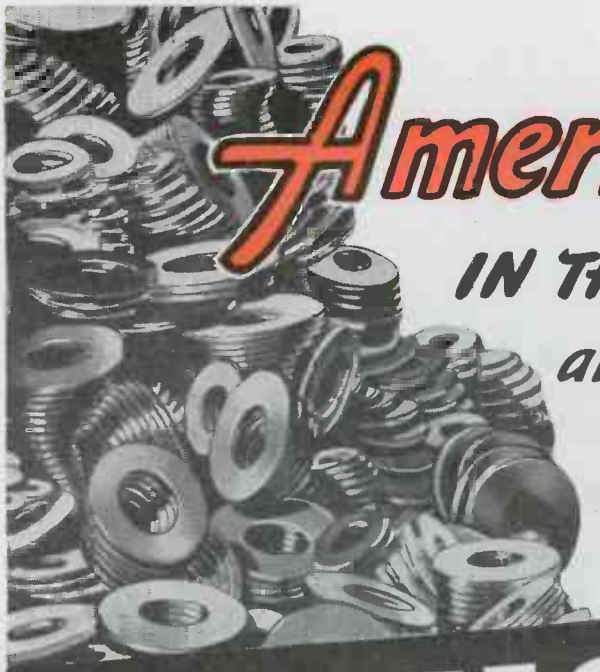
(Formerly Sprague Specialties Co.)

*T. M. REG. U. S. PAT. OFFICE

ARMY E

SPRAGUE

CAPACITORS — *KOOLOHM RESISTORS



America's Leaders IN THE ELECTRICAL INDUSTRY are MAKING WASHERS on the HOVIS UNIVERSAL MASTER WASHER DIES

They have been making Washers for more than 4 years from materials such as

BERRYLIUM COPPER	COPPER
PHOSPHER BRONZE	BRASS
SILVER SOLDER	FIBRE
MICARTA	BAKELITE
ASBESTOS PAPER	CARDBOARD
FISH PAPER	CANVAS
LEAD	STEEL
STAINLESS STEEL	FELT
RUBBER	LEATHER
MASONITE	VELLUMOID
ALUMINUM	DURAL

The outstanding Manufacturers in the electrical field recognize the tremendous advantages in using the Hovis modern way of making washers. No longer do they have to resort to the old, expensive and slow method of making a complete new die for each new size and type of washer. Instead, they make a nominal investment in MASTER WASHER DIES which do not become obsolete. From these dies it is possible to easily and quickly remove FIVE SMALL INTERCHANGEABLE PARTS without dismantling the die. These parts are held in place by the patented Hovis Screwlock principle, the same as is used in holding interchangeable punches and button dies.

Once the initial investment is made in Master Washer Dies of the sizes to meet requirements, the 5 small interchangeable parts are the only items necessary to purchase to make any size washer. It eliminates process engineering, tool designing, tool making and tool tryout. Saves time, storage space, material and labor. Washers made on short notice as you need them. . . . No necessity for large inventories.

Write for literature today.

Made in 5 sizes:
3/4"—1 1/2"—2 1/2"—4"—6".

HOVIS SCREWLOCK COMPANY

8096 E. NINE-MILE ROAD • VAN DYKE, MICHIGAN

Suburb of Detroit . . .
***Phone:* CENTERLINE 1575**

New in Principle!

Revolutionary in Range!

CML MODEL 1200

STROBOSCOPE

"FREEZES" MOTION IN RANGE OF 600 TO 600,000 RPM

Rotary speeds from 600 to 600,000 RPM—or vibrations from 10 to 10,000 CPS—can be "stopped" and studied with the Model 1200 Stroboscope. The light source is mounted in a small probe at the end of a five-foot flexible cable.

This makes it easy to examine small objects at close range. Provision is made to operate the unit from external tuning fork or crystal standards, where extreme accuracy is required. The motion of objects moving at irregular speeds may also be "stopped" with the Model 1200.

An accurate repetitive pulse rate is obtained, as the pulses are derived from a stable audio oscillator.

Not only does this eliminate the necessity for constant readjustment of the repetitive rate, but it also insures clearly defined images at high speeds.

For greater flexibility, a light intensity control switch is also provided. This enables the user to control both the intensity of the light and the duration of the pulse length.

SEND FOR COMPLETE DESCRIPTIVE BULLETIN

COMMUNICATION MEASUREMENTS LABORATORY

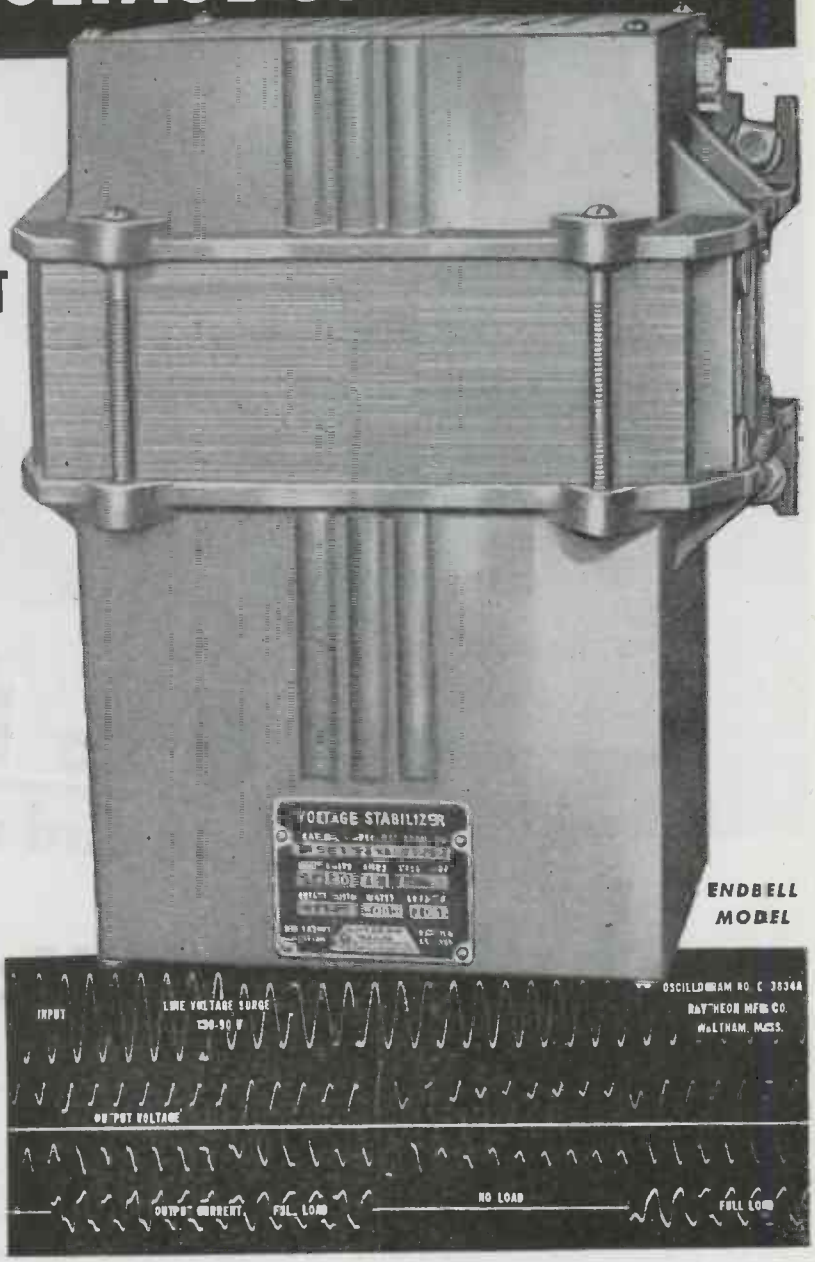
Rotobridge · Electronic Generators · Power Supply Units

116-118 GREENWICH STREET **NEW YORK 6, N. Y.**

RAYTHEON VOLTAGE STABILIZERS

INSURE ACCURATE OPERATION of ELECTRICAL EQUIPMENT

Stabilize Varying Input Voltage Within 2 Cycles to Constant Output Voltage at ±½ of 1%



Raytheon Voltage Stabilizers, incorporated into electrical equipment, insure accurate, dependable operation by providing stabilized A. C. voltage to ±½ of 1%. They are available in three designs . . . uncased, cased and endbell . . . to meet every installation requirement whether it is to be built into new equipment or products already in use. Entirely automatic in operation, it is ideal for equipment in unattended locations.

Write for Bulletin DL 48-537. It gives the complete story.

TIME CONSTANT

Transient changes in output voltage result from variations in line voltage. These transients disappear entirely in 6 cycles. The major effect of the transient recovery is practically complete in 2 cycles. These changes are not evidenced on a volt meter of normal characteristics and their behavior is usually unimportant. Transients resulting from connecting or disconnecting the load require somewhat longer time for recovery. Smaller changes in load cause proportionately smaller transient disturbances in output voltage. This characteristic is shown above.

Tune in the Raytheon radio program: "MEET YOUR NAVY", every Saturday night on the Blue Network. Consult your local newspaper for time and station.

RAYTHEON
MANUFACTURING COMPANY
Electrical Equipment Division
190 WILLOW STREET, WALTHAM, MASS.

The coveted Army-Navy "E", for Excellence in the manufacture of war equipment and tubes, flies over all four Raytheon Plants where over 16,000 men and women are producing for VICTORY.

Devoted to research and manufacture of complete electronic equipment; receiving, transmitting and hearing aid tubes; transformers; and voltage stabilizers.

5 YEARS AHEAD OF ITS TIME

FM
AM
CW

27.8 to 143 Mc

Covers old and new FM bands

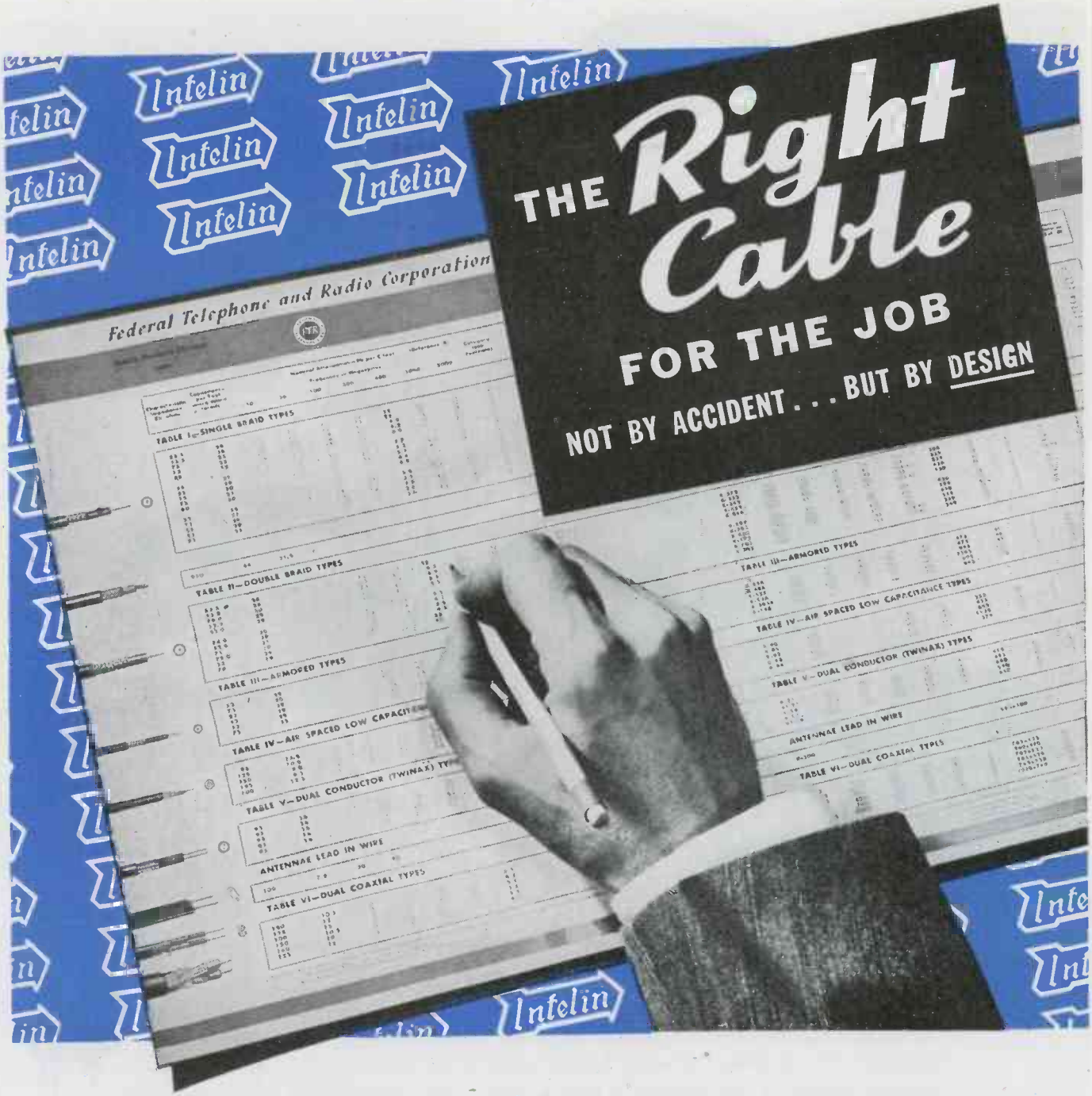
hallicrafters Model S-36

EXACTLY five years ago – in 1940 – Hallicrafters introduced a very high frequency communications receiver with a range of 27.8 to 143 Mc. This model was clearly five years ahead of its time in its anticipation of new and exciting possibilities for superior performance on the higher frequencies. Today Model S-36 stands by itself as the only commercially built receiver covering this range. It is outstanding for sensitivity, stability, high fidelity. With its extraordinary VHF versatility it is ready for immediate application in the ever widening fields of FM and higher frequency development work. Engineering imagination at Hallicrafters is reaching out beyond the next five years, beyond the present known limits of radio technique so that Hallicrafters equipment will continue to be always ahead of its time, above and beyond your best expectations.

BUY A WAR BOND TODAY!

hallicrafters RADIO

THE HALLICRAFTERS COMPANY, MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.



To assist the equipment designer Federal offers comprehensive data on high frequency cables.

This technical information sheet provides the design-engineer with pertinent electrical and physical characteristics...including impedance, capacitance, attenuation, diameter, materials, and weight . . . for Federal's wide variety of high-frequency cables.

Single and double braid, armored, dual conductor and dual coaxial, air-spaced, low capacitance lines, and antenna lead-in wire . . . there's a right type for your job, backed by the built-in superiority that's a tradition with Federal.

Special developments in flexible low-loss cables by Federal have resulted in superior cables for all types of transmission. For a better job, see Federal first.

Write for your cable information sheet today.

Federal Telephone and Radio Corporation

Newark 1, N. J.

An IT&T Associate

more efficient ...in miniature

The modern hearing aid is a fine example of greater efficiency . . . in miniature. No longer does the awkward ear trumpet or an apologetic "a little louder please" embarrass the hard of hearing. The compact hearing aid of today with its inconspicuous ear button, now admits these people to a world from which partial deafness had formerly isolated them. This has been made possible by smaller tubes.

In countless applications, TUNG-SOL Miniature Tubes do everything the large old style tubes did and in most cases are doing it better.

To manufacturers of radio sets and electronic devices, size and weight reduction is so important that TUNG-SOL is now producing many of the new miniature types. The development of other miniature types to function where larger tubes are now used is also foreseen.

Designers of electronic equipment are invited to work with TUNG-SOL engineers in the planning of circuits and in the selection of tubes. Consultation work of this character is held in strictest confidence.

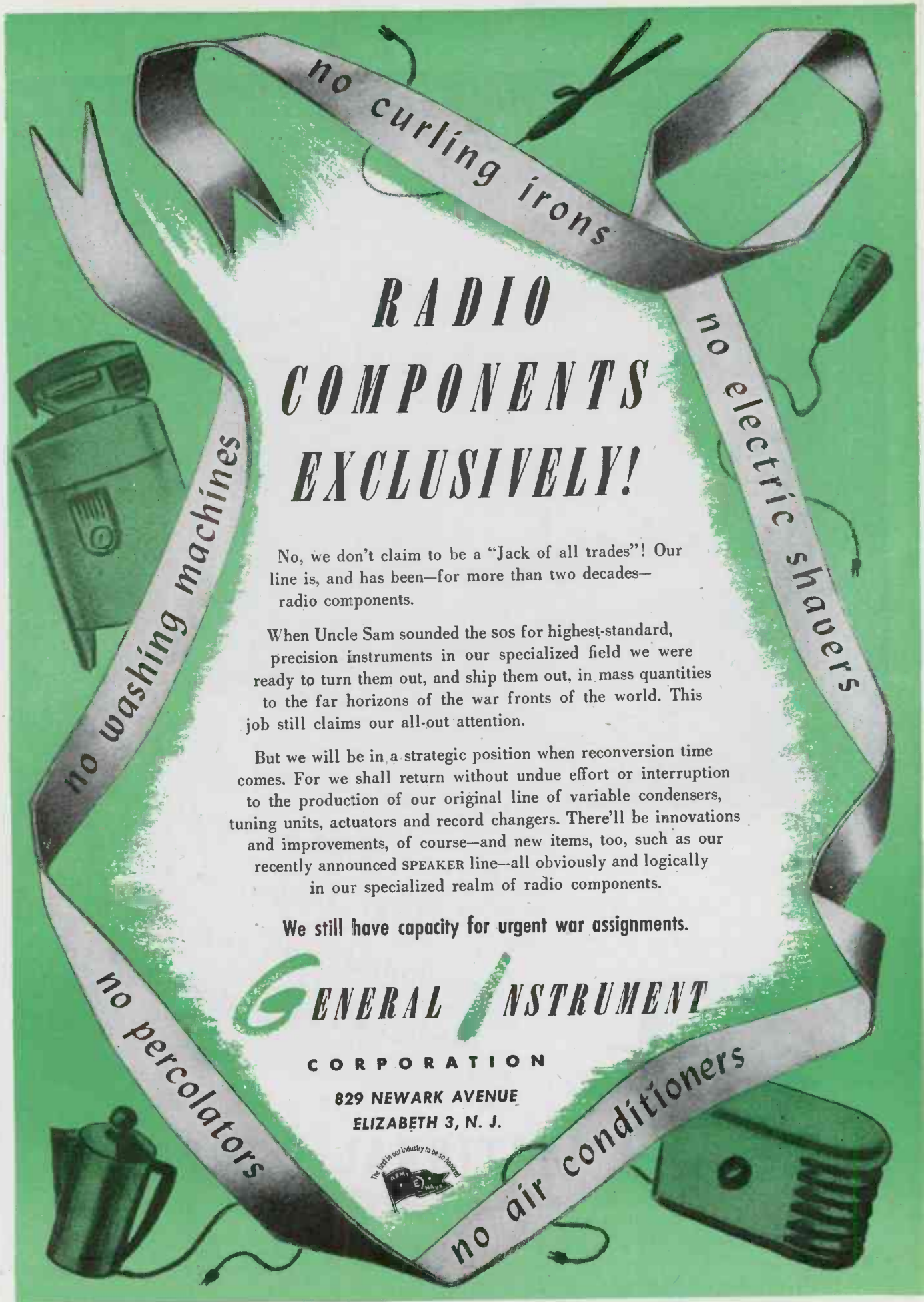
TUNG-SOL

vibration-tested

ELECTRONIC TUBES

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

Also Manufacturers of Miniature Incandescent Lamps, All-Glass Sealed Beam Headlight Lamps and Current Intermittors



RADIO COMPONENTS EXCLUSIVELY!

No, we don't claim to be a "Jack of all trades"! Our line is, and has been—for more than two decades—radio components.

When Uncle Sam sounded the SOS for highest-standard, precision instruments in our specialized field we were ready to turn them out, and ship them out, in mass quantities to the far horizons of the war fronts of the world. This job still claims our all-out attention.

But we will be in a strategic position when reconversion time comes. For we shall return without undue effort or interruption to the production of our original line of variable condensers, tuning units, actuators and record changers. There'll be innovations and improvements, of course—and new items, too, such as our recently announced SPEAKER line—all obviously and logically in our specialized realm of radio components.

We still have capacity for urgent war assignments.

GENERAL INSTRUMENT CORPORATION

829 NEWARK AVENUE
ELIZABETH 3, N. J.

The first in our industry to be so honored

OUR 2,000,000th ANNIVERSARY

. . . CELEBRATING THE PRODUCTION OF OUR TWO MILLIONTH CRYSTAL!

More than just a number, the production of our two millionth crystal is the symbol of long years of work ...the product of an experienced organization...the result of technical research in the manufacture of precision crystals. All this, plus adequate facilities, are at the service of the radio industry today. A limited number of inquiries is invited.

Crystal PRODUCTS COMPANY

1519 McGEE STREET, KANSAS CITY, MO.

Producers of Approved Precision Crystals for Radio Frequency Control

Here's your copy of the most informative catalog of crystal unit design and specifications—just

MAIL THIS COUPON!

CRYSTAL PRODUCTS CO.,
Dept. O, 1519 McGee, Kansas City, Mo.
Gentlemen: I would appreciate a copy of your new catalog. I am interested in

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EVERYDAY IS WASHDAY AT Triplett

• The special equipment and solutions with which jewels are washed are minor parts of the Triplett method of manufacturing fine electrical measuring instruments but they are significant. They typify the dozens of out-of-sight Extra Precautions that assure your permanent satisfaction with Triplett Instruments. These Extra Care provisions are routine in Triplett plants but through them Triplett maintains in mass production the hand-made quality of fine instruments.

Extra Care in our work puts Extra Value in your Triplett Instrument.

Precision first ...to last

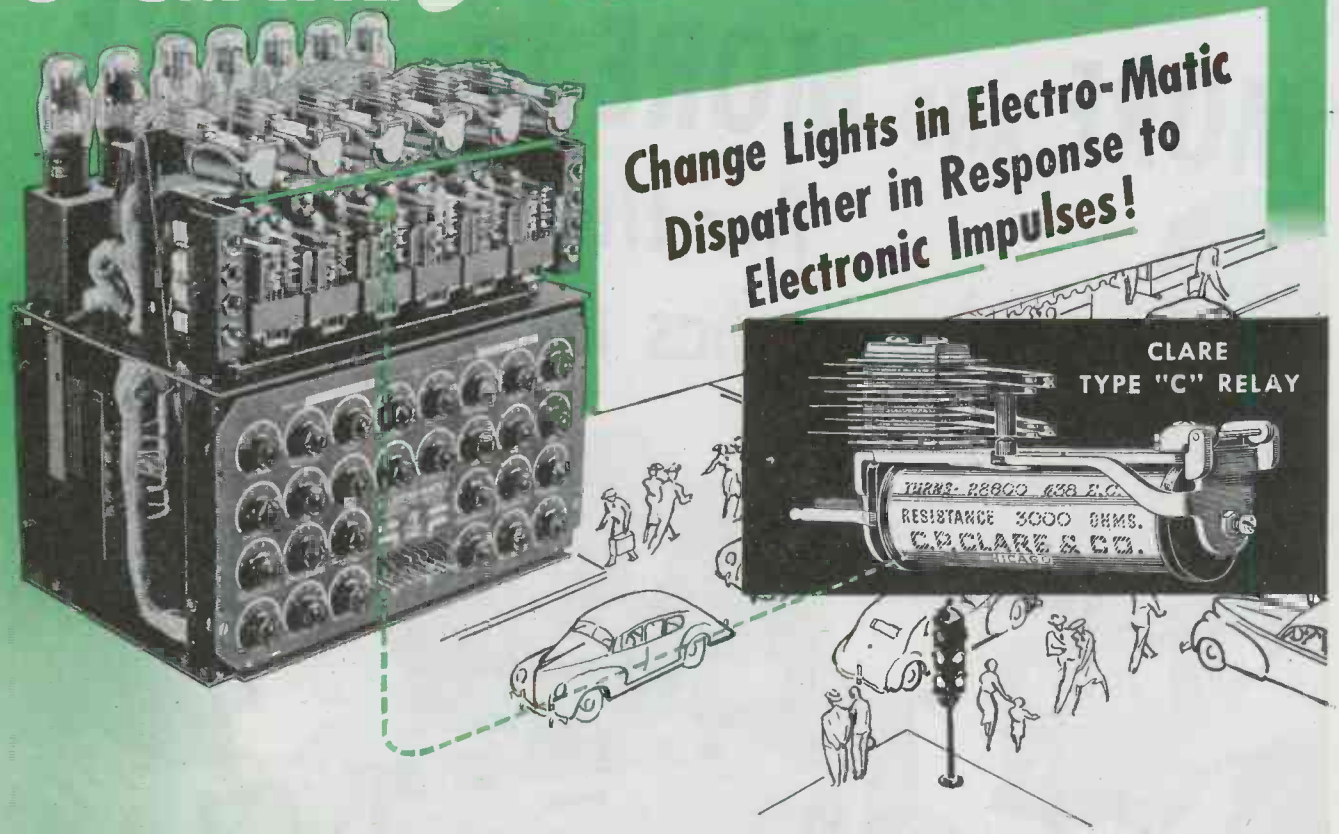
STANDARDS ARE SET BY TRIPLETT

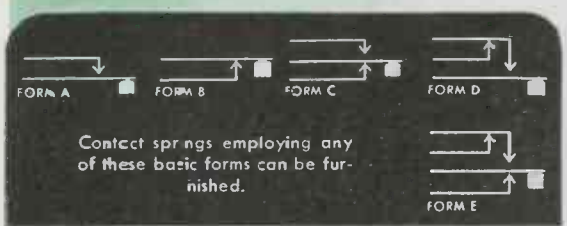
Triplett

ELECTRICAL INSTRUMENT CO. BLUFFTON, OHIO

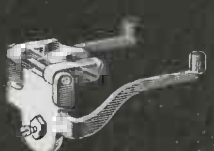
6 CLARE "Custom Built" RELAYS

Change Lights in Electro-Matic Dispatcher in Response to Electronic Impulses!





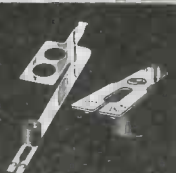
Contact springs employing any of these basic forms can be furnished.



Double arm armature assembly of stainless steel shaft, operating in a marine brass yoke. Pole piece, core and armature assembly are of magnetic metal.

Contacts are welded to nickel silver springs by special process. May be of precious metals or alloys in 12 different standard or special types and sizes.

High voltage spring pile-up insulators of special heat-treated Bakelite. Has minimum cold flow properties, low moisture absorption content and permits punching without cracks or checks.



Spring bushing insulators are made of Bakelite rod under patented process. Resist vibration and withstand heavy duty service.

The Electro-Matic Two-Phase Dispatcher, manufactured by the Automatic Signal Corporation of East Norwalk, Conn., is a distinct advance in modern traffic control. It literally counts and times the cars in heavy traffic.

Six Clare Type "C" Relays open and close the contacts . . . cause the lights to change at the proper time . . . on actuation by electronic impulses.

These Clare "Custom-Built" Relays were selected by the Automatic Signal Corporation for this "super traffic cop" because of their accurate and precise operation, their ability to open and close circuits quickly and their rugged construction of the finest materials.

The Clare Type "C" d.c. Relay, like all Clare "Custom-Built" Relays, has that unusual flexibility which permits design and production engineers to have just the relay for the specific function required.

By "custom-building" to exact specifications, Clare Relays assure exceptional service in spots where hard usage, long life and absolute dependability are prime factors. Special features of Clare construction adequately meet severe conditions of temperature, humidity, atmospheric pressure, voltage and vibration.

Pictured and described here are a few of these Clare "Custom-Built" Relay features that make it possible for Clare Relays to reduce overall relay cost, simplify installation and insure more dependable performance in such applications as sequence control of machine tools, radio, radar or other electronic controls, electric eye controls, counting equipment and alarm systems.

Whatever your design problem, there is a Clare "Custom-Built" Relay to meet it. Clare engineers are ready at all times to assist in developing a relay "custom-built" to your exact requirements. Send for the Clare catalog and data book. Address: C. P. CLARE & CO., 4719 West Sunnyside Avenue, Chicago 30, Illinois. Sales engineers in all principal cities. Cable Address: CLARELAY.

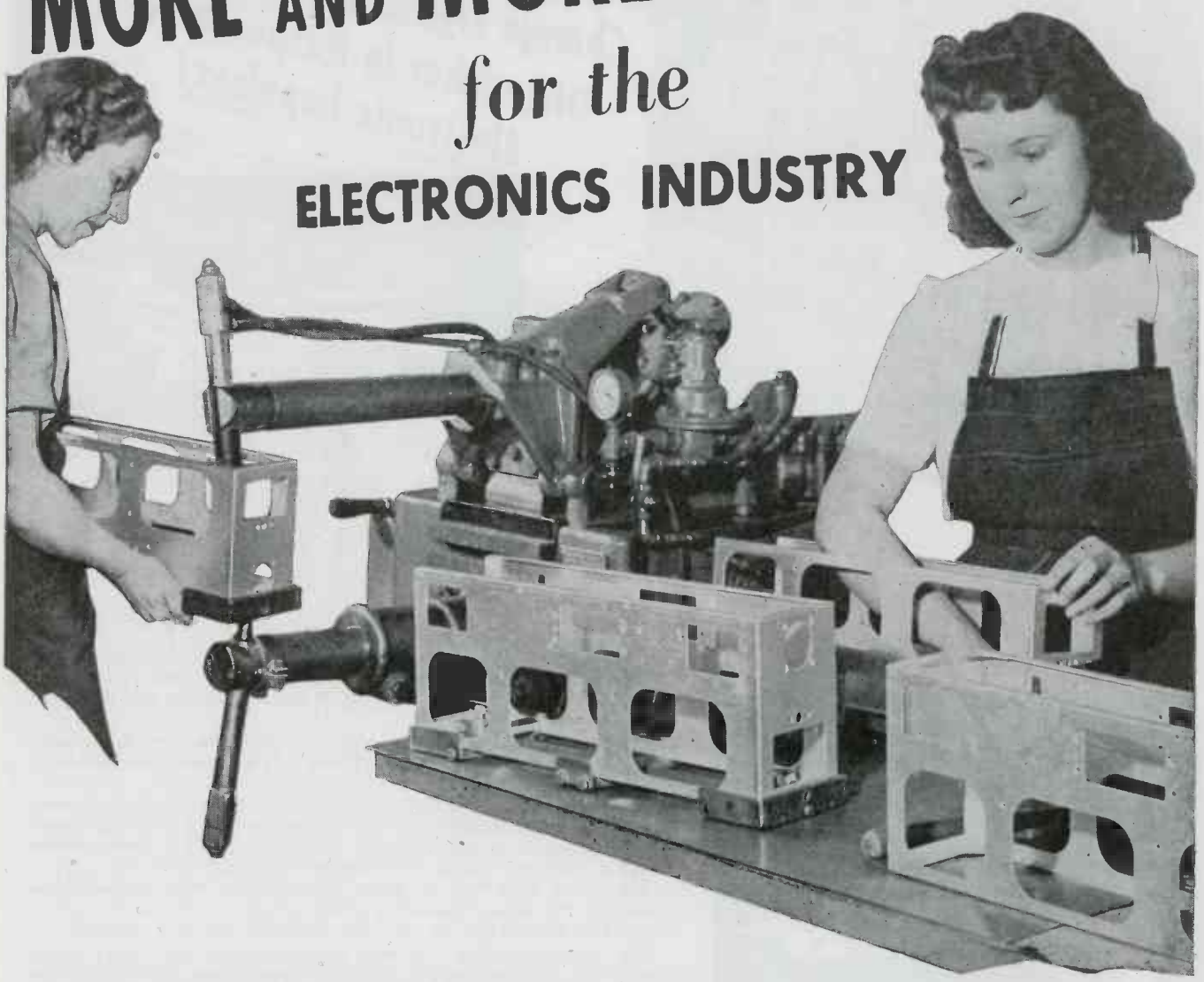
CLARE RELAYS

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

MORE AND MORE AND MORE

for the

ELECTRONICS INDUSTRY



We took up the production of electronic equipment as a part of our war effort. It was quite a change for a manufacturer of steel office furniture — took a little time to acquire the know-how of a business foreign to our own.

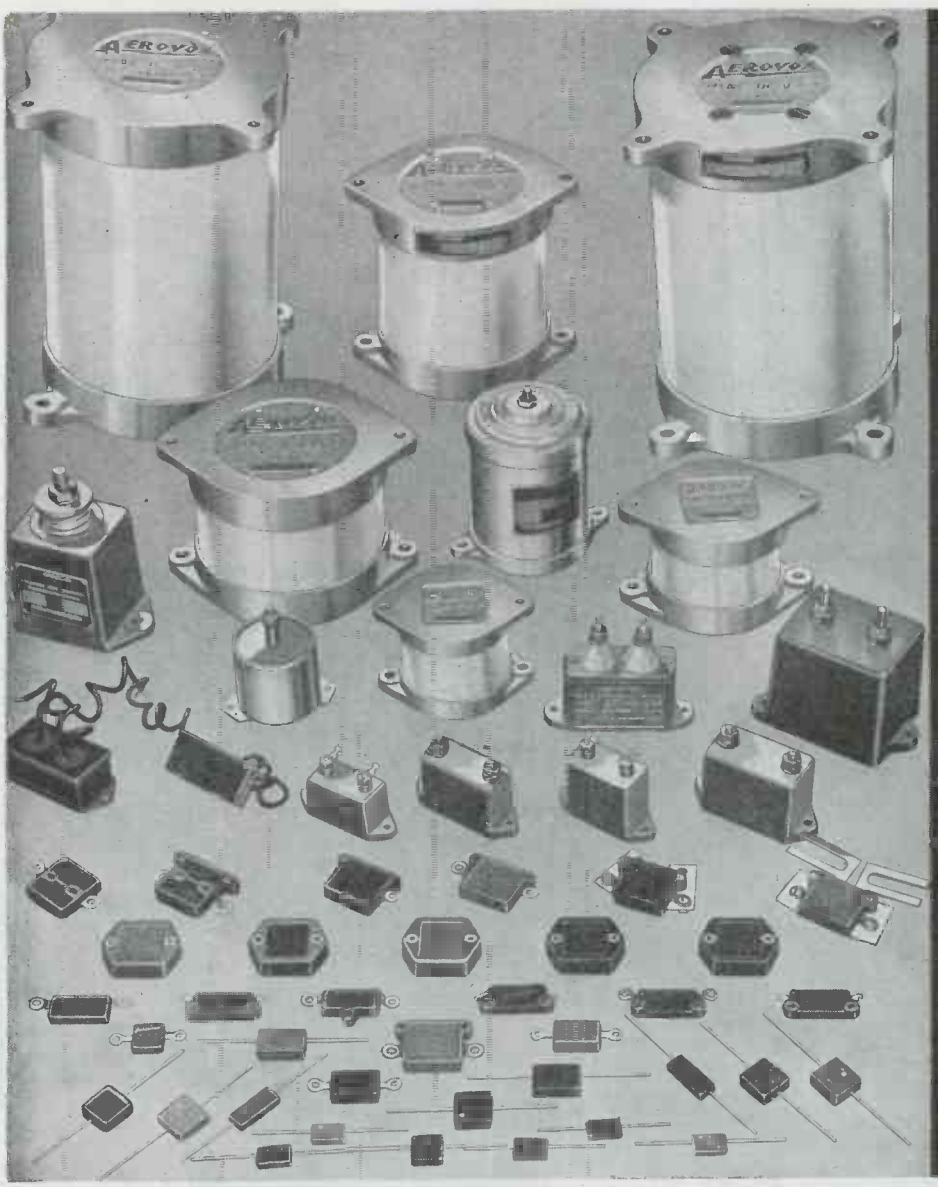
Gradually we picked up speed and volume. As we went along we picked up more and more compliments on the quality of our production. Today we feel definitely at home in the electronic equipment field. We want to stay in it after the war in addition to our office furniture work.

We'd like to prove to you that we have earned and deserve your consideration now and in the future, too. You can give us that opportunity by sending us your specifications — today.

BUY WAR BONDS

CORRY-JAMESTOWN
MANUFACTURING CORPORATION
CORRY, PENNA.

Steel Age



THERE'S A TYPE FITTED *PRECISELY* TO YOUR NEEDS...

AEROVOX MICA *Capacitors*

SPECIFY AEROVOX

Be sure you have the Aerovox Capacitor Manual in your working library, for general guidance. And for final insurance covering satisfactory results, just specify Aerovox Capacitors.

● Aerovox selection ranges from tiny "postage-stamp" molded-in-bakelite units to giant porcelain-cased stack-mounting units. These many varied types are standard with Aerovox—in daily production—available at quantity-production prices.

The following factors are suggested in guiding your selection:

Electrical: (a) Capacitance and tolerance; (b) D.C. voltage rating; (c) Current-carrying capacity and frequency characteristics; (d) Allowable temperature rise and maximum operating temperature; (e) Special characteristics such as temperature coefficient, retrace, etc.; (f) Special operating conditions such as high humidity, altitude, extreme temperatures, etc. *Mechanical:* (g) Basic type; (h) Terminals; (i) Case; (j) Mounting holes; (k) Nameplate data.

Yes, Aerovox expects you to *select* that type best fitting your particular requirements *in every way*. And Aerovox is ready to help you make the proper selection. Remember, *Aerovox Application Engineering*—that "know-how" second to none in the industry—can make all the difference between disastrous makeshifts and the most satisfactory results.

AEROVOX *Capacitors*

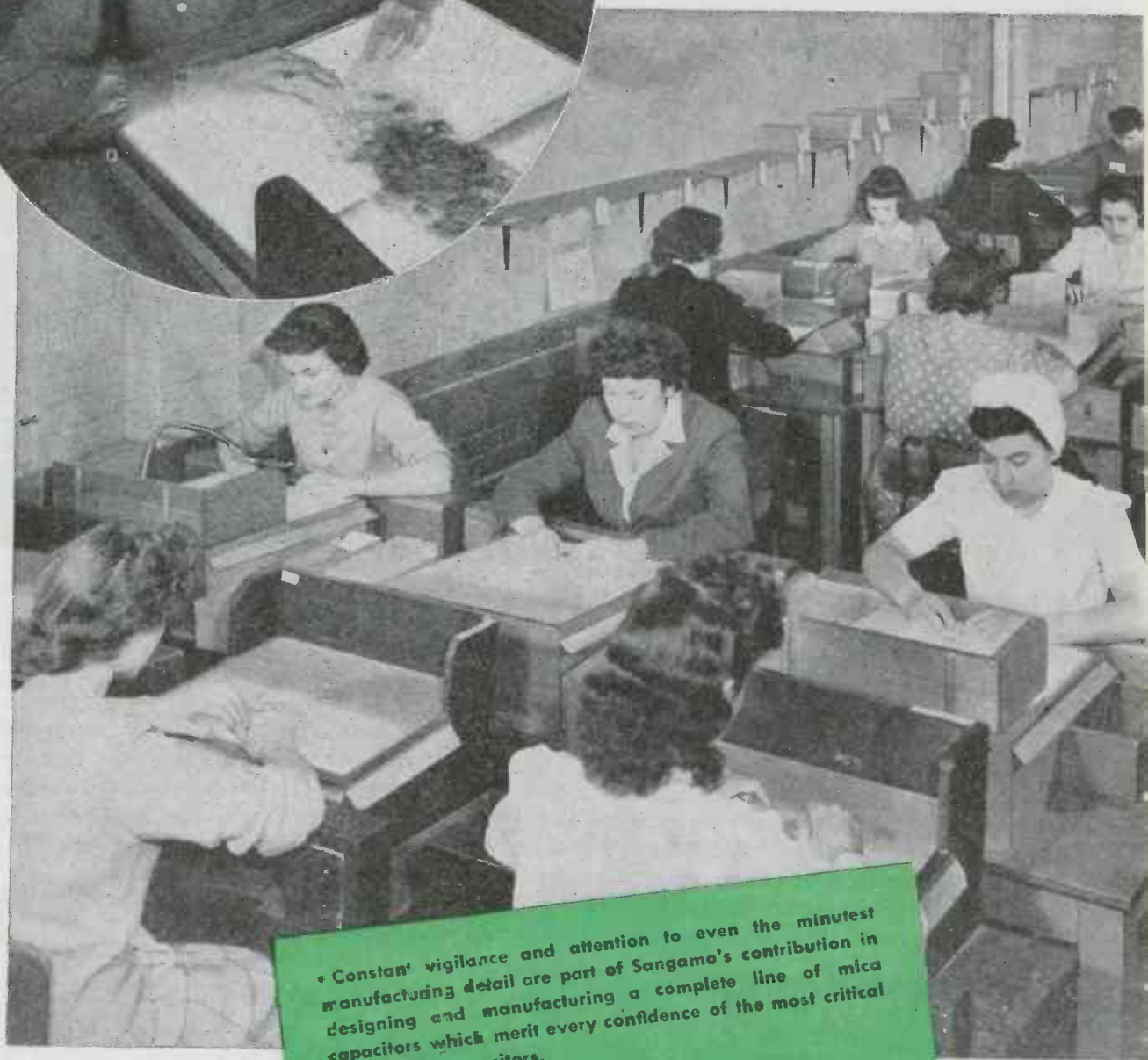
INDIVIDUALLY TESTED

AEROVOX CORPORATION, NEW BEDFORD, MASS., U. S. A. • SALES OFFICES IN ALL PRINCIPAL CITIES

Export: 13 E. 40 ST., NEW YORK 16, N. Y. • Cable: 'ARLAB' • In Canada: AEROVOX CANADA LTD., HAMILTON, ONT.

WATCHFUL EYES *This ideally arranged Mica Inspection Department is equipped with most modern facilities so that accuracy beyond a doubt is at all times possible. Each inspector is highly trained in this important job of inspection. Mica Capacitors play a vital part in the correct functioning of many types of equipment. Thus, expert inspection must be maintained constantly.*

HOW EXCELLENCE

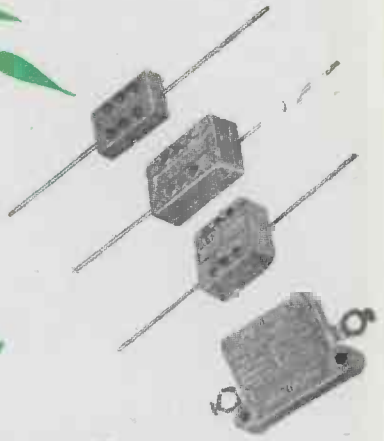


• Constant vigilance and attention to even the minutest manufacturing detail are part of Sangamo's contribution in designing and manufacturing a complete line of mica capacitors which merit every confidence of the most critical user of capacitors.

SANGAMO ELECTRIC

ESTABLISHED 1898 • • • MICA CAPACITORS • • •

IS BUILT INTO Sangamo MICA CAPACITORS



Mica Inspection

Long trouble-free life of mica capacitors is entirely dependent upon the quality of the mica dielectric used in the capacitor. Careful splitting, precision gauging, accurate sorting, and clean punching of mica sheets, contribute to long trouble-free life of finished capacitors. Every piece of mica must be carefully inspected before it is assembled into a capacitor unit. Such inspection is necessary to assure freedom from all flaws such as fractures, cracks, air bubbles, pinholes, or the inclusion of metallic or other extraneous material.

The slightest fracture at the edge of a mica film will tend to run when the capacitor is moulded and will ultimately result in dielectric breakdown of the entire unit. Ultimate failure of the dielectric may also be expected when air bubbles are present. The inclusion of impurities in mica result in higher losses and, in many cases, in ultimate failure of the capacitor.

The keen eyes of alert, well trained operators are quick to detect the slightest imperfections of the punched mica sheets, so that only mica films free from flaws are passed to be used in the final assembly operations.

★ ★ ARMY E NAVY ★ ★

COMPANY SPRINGFIELD ILLINOIS

. . . WATT HOUR METERS . . . TIME SWITCHES . . .

Because the Common Screwdriver operates

CLUTCH HEAD Screws . . . and because the screwdriver is a universal tool . . . there need be no "stalling" in the performance of *your* product in the field. Even in the absence of an ordinary type screwdriver, a piece of flattened steel rod or any flat blade will do, the only requirement being that the blade be reasonably accurate in width. Because of the roominess of the CLUTCH HEAD recess, the thickness of the blade is a secondary consideration.

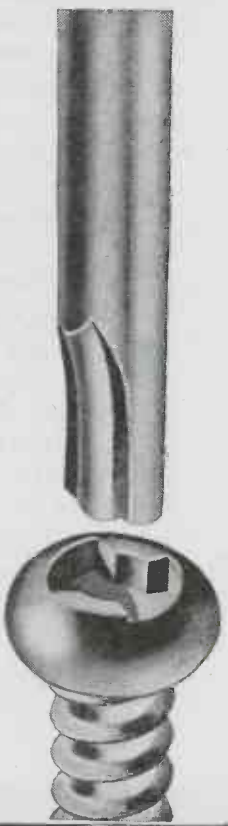
Note, if you please, that CLUTCH HEAD is the only recessed-head screw on the market that is specifically designed for screwdriver operation to eliminate field service "headaches" and, at the same time, to give you all the advantages of safer, faster, and lower-cost power driving on the assembly line with the CLUTCH HEAD Type "A" Bit.

Personal examination will reveal to you many additional economy features incorporated in this modern screw. Ask us to mail you a package assortment of CLUTCH HEAD *Screws and sample Type "A" Bit with fully illustrated Brochure.*

Production of CLUTCH HEAD *Machine Screws in regular and thread-forming types is backed by the resources of this organization and by responsible Licensees.*

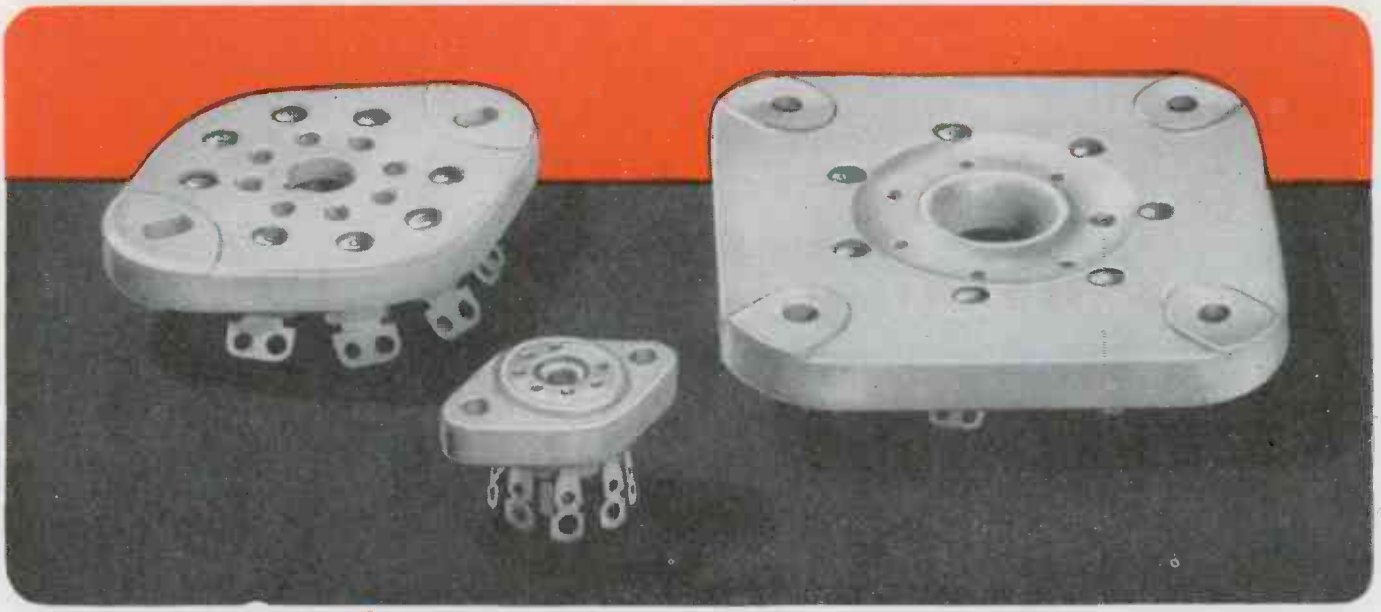
CLUTCH HEAD · SCREWS ·

For tool economy, compare the durability of this rugged Type "A" Bit for longer continuous service . . . also for repeated "No-cost" reconditioning to original efficiency.



UNITED SCREW AND BOLT CORPORATION

CHICAGO 8 CLEVELAND 2 NEW YORK 7



WHO *first* MADE IT?

Pardon us, if we presume to insert the "first," but in casting about for suppliers you've asked that question, perhaps hundreds of times.

Users of ceramic sockets will recognize the types illustrated. The No. 267 was the first ceramic miniature socket — still widely used, and formed the basic design for the later types with cylindrical metal shield base. (Yes, Johnson makes them too, our No. 277B.)

The No. 228 octal is one of a series of oval ceramic wafer sockets originated 7 years ago. Engineering improvements then made over existing types (such as mounting bosses, countersunk rivet heads, "non-turning" contacts, etc.) established it a favorite for Signal Corps and Navy equipment.

Almost equally familiar is the basic square design of the No. 247, a series started 6 years ago, embodying essential features of the smaller Johnson sockets.

But to get back to the first question, "Who (first) made it?" when you're looking for original parts, tube sockets, or other components why not avail yourself of our kind of engineering and production experience?

Ask for catalog 968(O)

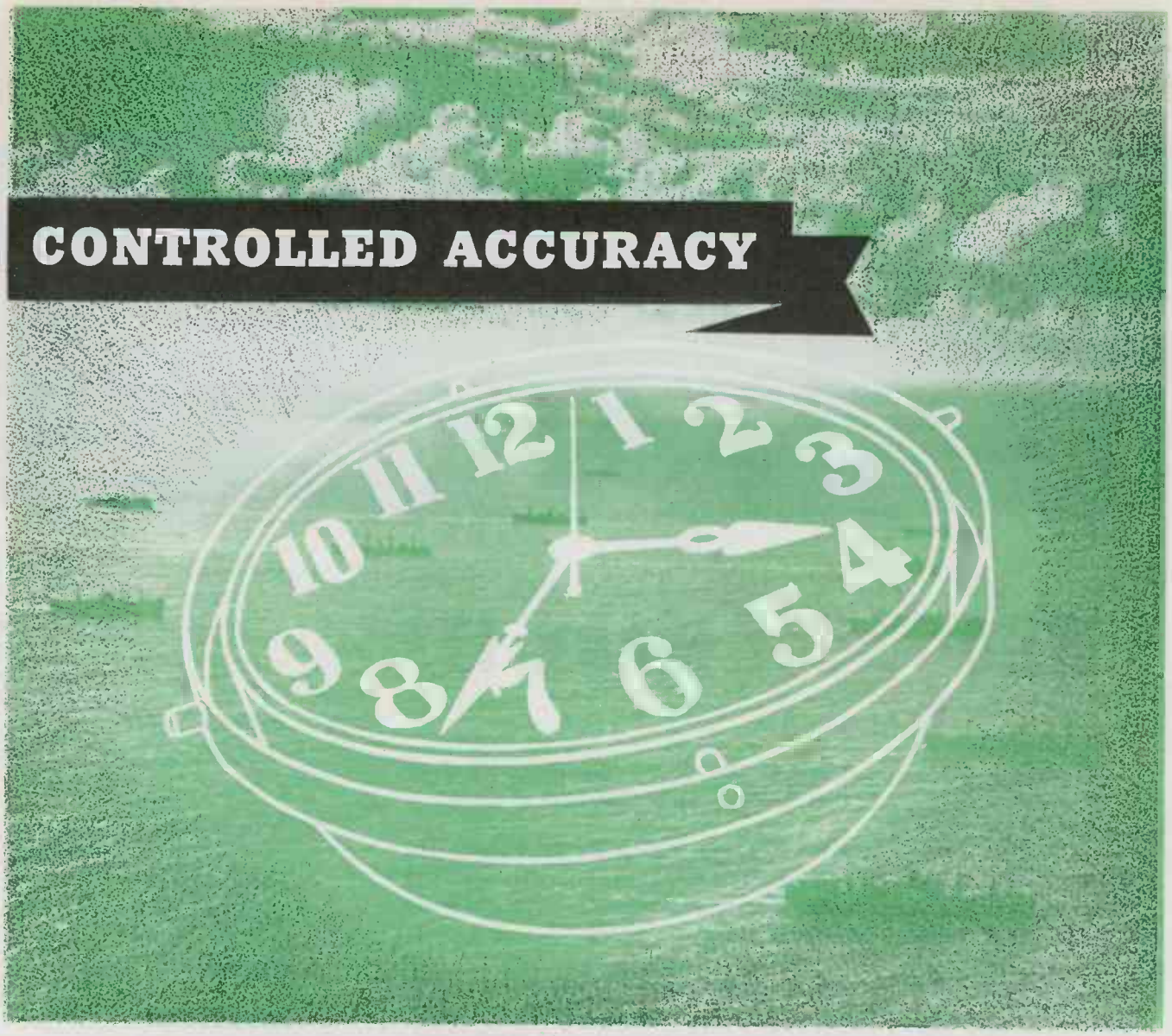
Specialists in

- CONDENSERS
- INSULATORS
- SOCKETS
- PLUGS
- INDUCTORS
- CHOKES
- COUPLINGS
- ANTENNA PHASING UNITS

JOHNSON

a famous name in Radio

E. F. JOHNSON COMPANY • WASECA • MINNESOTA



Tiny precision wire for springs gives Chronometer-timed convoys split-second timing.

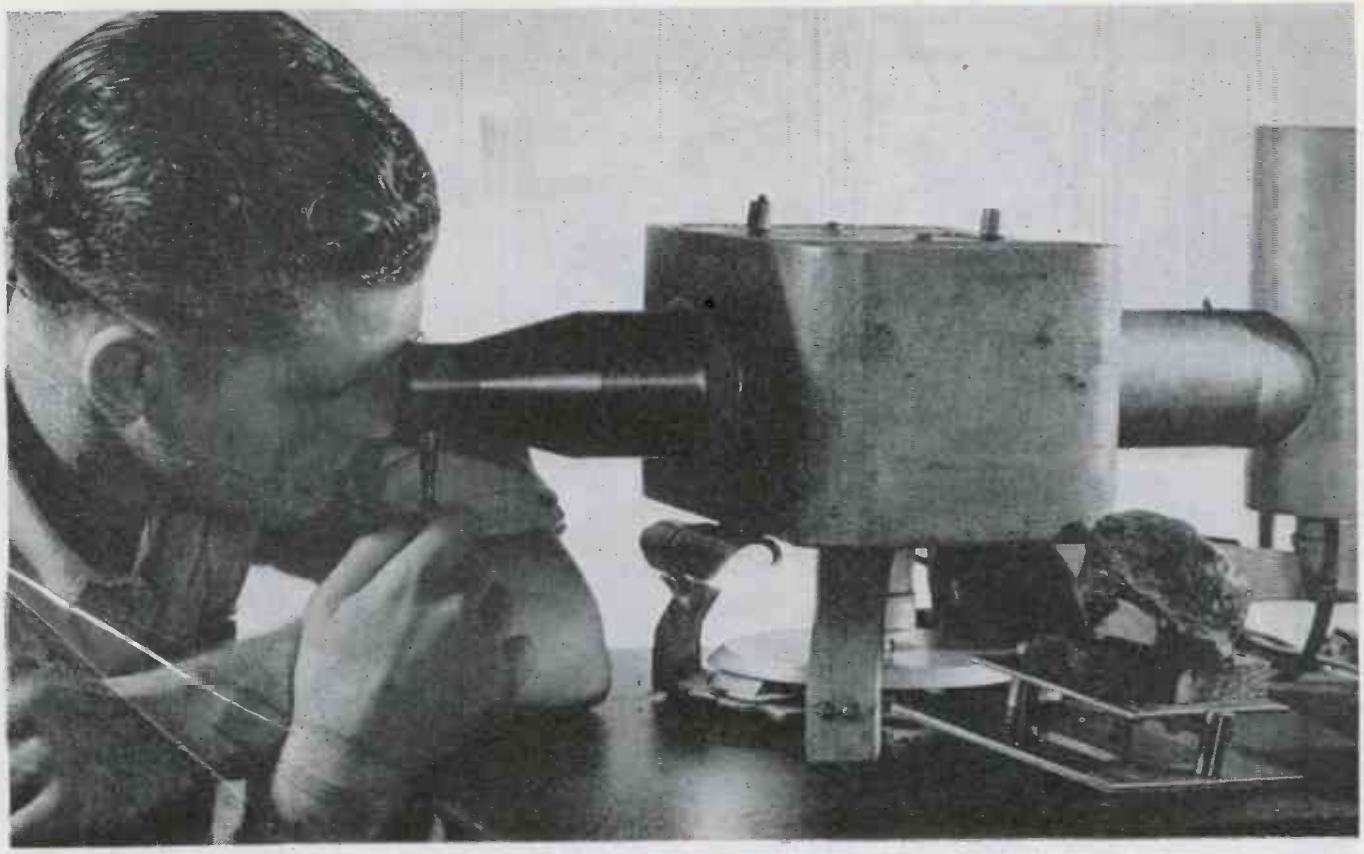
★ ★ ★ ★ ★

SPENCER *Precision* WIRE

★ ★ ★ ★ ★

FINE STEEL AND ALLOY WIRE

Spencer Wire Company
WEST BROOKFIELD PLANT
WEST BROOKFIELD • MASS.



MECK

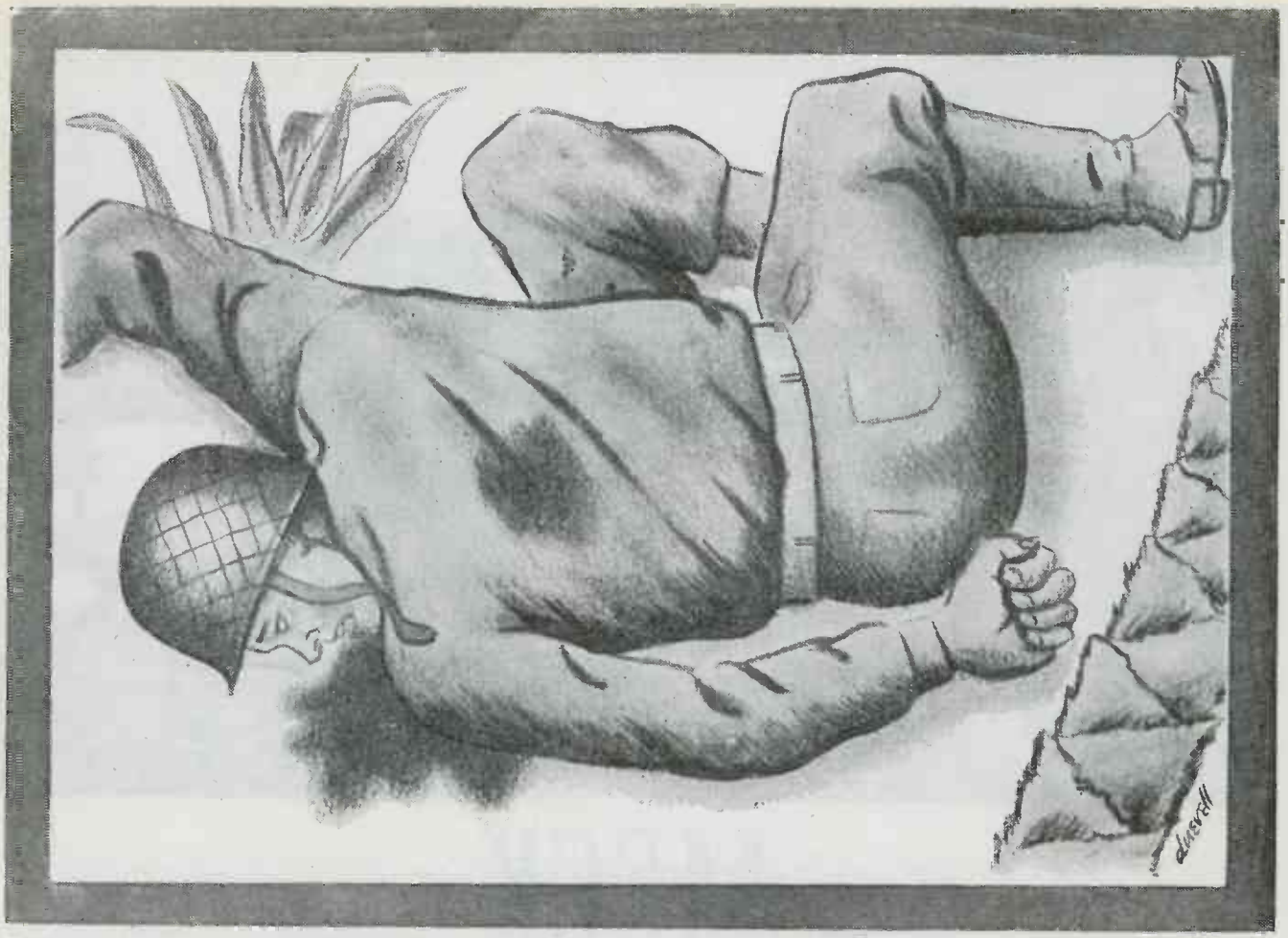
★ ★ MEANS PRECISION ★ ★

John Meck crystals are now—and always will be—characterized by high quality and rigid precision. In an industry as exacting in mechanical design and as intricate in conception and execution as the field of sound electrically controlled and amplified, the engineering staff must work to standards of "absolute" precision. This devotion to accuracy is reflected in the attitude and work of every individual contributing to the completion of John Meck products. The low percentage of final test rejections at John Meck Industries is a tribute to the splendid, conscientious personnel and their ability.

JOHN MECK INDUSTRIES, INC.
PLYMOUTH, INDIANA, U. S. A.

John Meck Industries, Inc., will produce radio receivers and phonographs on the resumption of civilian production. Your salesmen will find that our purchasing department is interested in establishing dependable sources for parts and supplies. Our requirements will represent a growing volume of business through the years.

John Meck



Portrait of a man who no longer cares about the cigarette shortage, the meat shortage...or gas shortage!

It's just a question of time when all shortages will be replaced by plenty—thanks to this boy and to millions like him.

Give them a helping hand.
Buy Bonds — Donate Blood.

We, the management and employees alike, at Kenyon, are building better transformers than we ever built before — and building them faster for the armed forces.

THE MARK OF *EXCELLENCE*

KENYON TRANSFORMER CO., Inc.

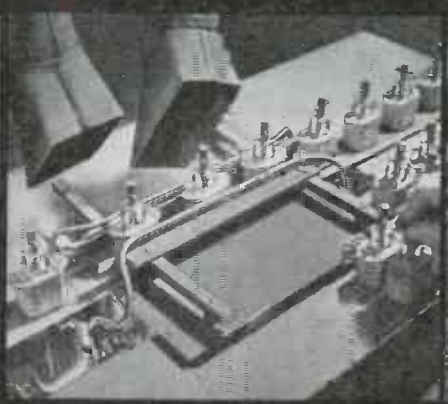
840 BARRY STREET
NEW YORK, U. S. A.

The Seal

THAT MEANS PERFECT HERMETIC SEALING

AMER TRAN

IMMERSION VACUUM TEST of each unit—not just random units—after final assembly, is standard procedure at AmerTran. Quality control of hermetic sealing is thus rigidly maintained.



INDUCTION SOLDERING insures quality sealing of all case seams enabling the unit to withstand vibration and severe air pressure changes.

VACUUM IMPREGNATION with varnish removes moisture from coil and provides excellent turn, layer and section insulation, resulting in long trouble-free life.

Other Safeguards like infra-red preheating of cores and coils before compound filling, torque-gauging and resilient gaskets to protect ceramic terminals provide full protection against moisture, temperature changes, and pressures encountered in airborne service. Yet AmerTran Hermetically Sealed Transformers are designed to minimum weight and dimensions. Write for complete details.

THE AMERICAN TRANSFORMER CO., 178 Emmet St., Newark 5, N. J.

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMER TRAN

How many places can you use this *VERSATILE CERAMIC*?

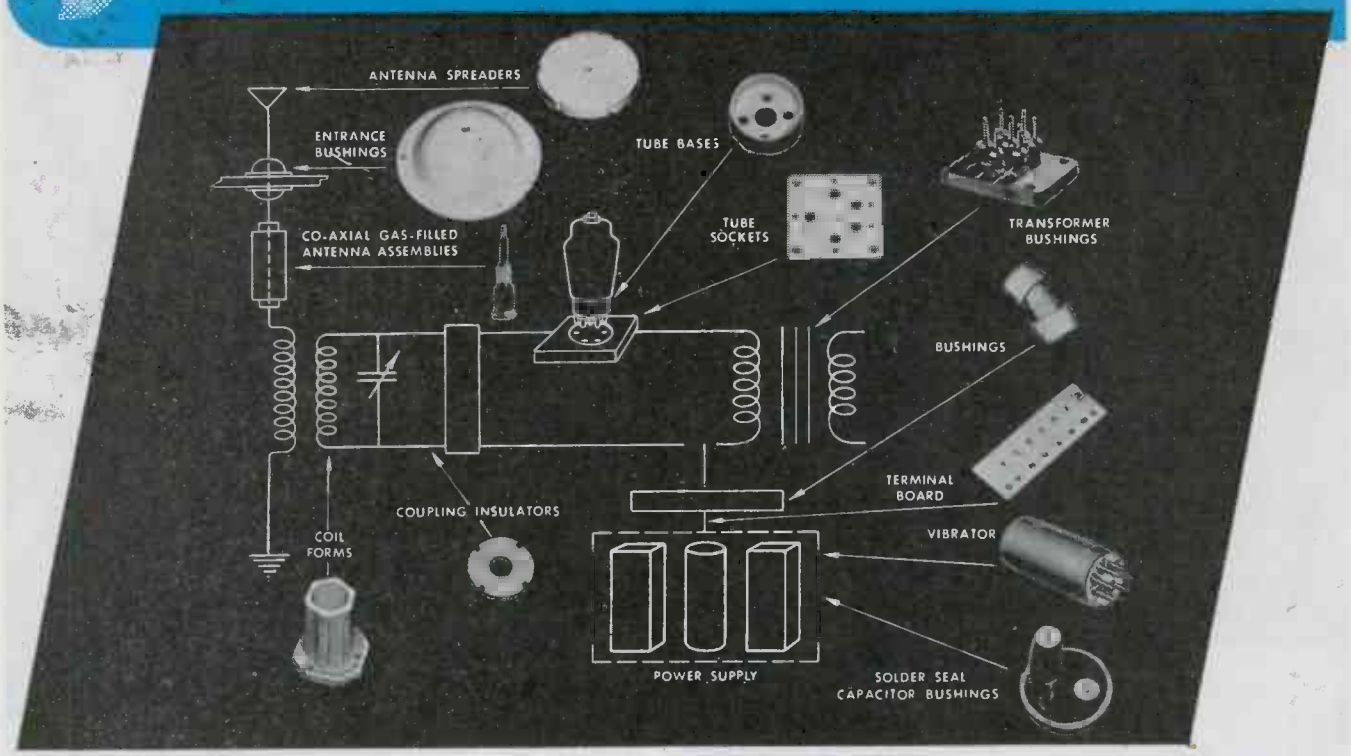


Illustration from Westinghouse book B-3244

NEW HIGH-STRENGTH ZIRCON PRESTITE IMPROVES INSULATION ON EVERY TYPE OF COMMUNICATIONS PRODUCT

This new, strong Zircon Prestite created by Westinghouse brings many advantages to designers and manufacturers of every type and size of communications equipment.

Zircon Prestite is a low-loss ceramic with exceptionally high resistance to thermal and mechanical shock (see table). Combined with the exclusive Westinghouse Solder-Seal process, it provides a gas-tight hermetic seal that excludes dirt, moisture and corrosive atmospheres permanently and maintains dielectric characteristics of enclosed gases regardless of temperature, humidity and pressure cycles.

Your nearest Westinghouse office can give you complete information on the many uses of this versatile Zircon Prestite for modern communications and electronics equipment. Or write Westinghouse Electric & Mfg. Co., P.O. Box 868, Pittsburgh 30, Pa. J-94660

How ZIRCON PRESTITE compares

Property	*Zircon Prestite	High-Tension Porcelain
Specific Gravity	3.68	2.4
Water Absorption in %	0.00	0.00
Dye Penetration	None	None
**Linear Coeff. of Thermal Expansion (20 to 700 deg C) per deg C	4.9 x 10-6	5.3 x 10-6
Tensile Strength, lbs per sq in	12,700	5,000
Compressive Strength, lbs per sq in	90,000	48,000
Transverse Strength, lbs per sq in	25,000	11,000
Impact Resistance (modified Charpy method) in gm per sq cm	17,800	6,000

*Approved as L-4 material by the Army-Navy Electronics Standards Agency.
**This is one of the characteristics that gives Zircon Prestite its remarkable thermal shock properties and warrants comparison with other low-loss, high-frequency ceramic materials.

Westinghouse

. . . one of many Westinghouse contributions to improve electronic and communication design

Zircon Prestite is just one of many Westinghouse developments to improve modern electronic and communications design.

Weight reduction, high altitude and humidity resistance, greater strength and sensitive measurement are typical of the problems solved by these new Westinghouse developments.

Here is a quick check list of these important products . . . what they are, where to use them, what they will do. Like Zircon Prestite, each possesses characteristics giving designers greater freedom in design.

Your nearest Westinghouse office can give complete data on any of these exceptional communications products. Ask for the book number shown in parentheses on each item.

A QUICK CHECK LIST OF WESTINGHOUSE COMMUNICATIONS PRODUCTS

Hipersil . . .

Hipersil cores—made of new electrical steel with 1/3 greater flux-carrying capacity—eliminate time-wasting stacking of tissue-thin core laminations by hand. Available in 3 types for low to very high frequencies, pre-assembled Hipersil cores are delivered in two ready-to-assemble pieces for each core. (B-3223-A)

Dynamotors . . .

Smooth, functional design gives Westinghouse dynamotors high flexibility for radio equipment where space is precious. Lightweight and compact, these long-lived dynamotors are supplied for input ratings from 12 to 28 volts. (B-3242)

Capacitors . . .

Light weight, small volume and high reliability are advantages of Westinghouse Inerteen Capacitors for d-c service at 400 to 250,000 volts. Aluminum foil electrodes, noninflammable Inerteen and Westinghouse Solder-Sealing give these capacitors outstanding performance values. (B-3300)

Insulating Materials . . .

Westinghouse "Tuffernell" Insulating Materials will supply the *right* grade needed for numberless communications jobs. Backed by more than 50 years of field tests, these materials are adequately tested and proved for every application. (B-3322)

Electronic Tubes . . .

Uniform, trouble-free, long-life service of electronics equipment depends to a high degree on the tube itself. Westinghouse electronic tubes are made with complete quality control in every stage of production for the complete Westinghouse line . . . Pliotrons, Kenotrons, Phototubes, Thyratrons and Ignitrons.

Instruments . . .

Westinghouse instruments range in sizes and types from miniature panel instruments to 4-foot boiler room indicators for all types of mountings—round, wide-flange; round, narrow-flange; rectangular; and American War Standard. (B-3283)

EQUIPMENT FOR THE COMMUNICATIONS INDUSTRY

HOLD ON BOYS! WE SAID ALBION HAD PLENTY OF COILS—NOT GOILS!

SUPER-QUALITY COILS AT REASONABLE PRICES

More and more every day, the industry is turning to Albion for fast, quality and quantity production of coils, chokes, and transformers. That's because here you benefit from the unbeatable combination of management "know how," skilled workmanship, streamlined facilities, and central location. Your requirements will be given prompt and thoughtful attention.

ALBION
COIL COMPANY
ALBION, ILLINOIS

R. F. AND TRANSMITTING COILS AND CHOKES;
I. F. TRANSFORMERS

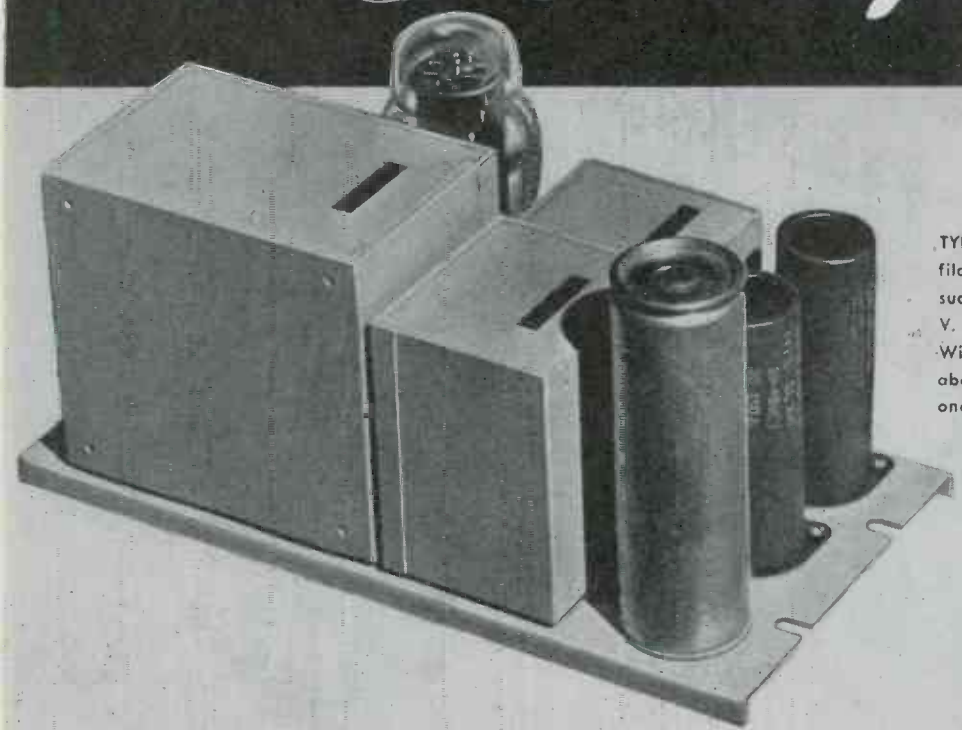
Among all the miracles that have been talked about for a great and glorious postwar era, here is one thing on which you can *really* count: JENSEN Speakers will be built around the wartime developed ALNICO 5 ¶ JENSEN naturally pioneered in the use of this remarkable new magnet material which weighs only a fraction of other magnetic alloys of equal strength. Thus JENSEN postwar speakers with ALNICO 5 will be lighter and more compact, but still as highly efficient and rugged as ever. ¶ JENSEN military loud speakers are now using ALNICO 5 in great quantities. And as soon as conditions permit, ALNICO 5 will become a feature of JENSEN PM Speakers.

Jensen
SPEAKERS WITH
ALNICO 5

Specialists in Design and Manufacture of Acoustic Equipment

JENSEN RADIO MANUFACTURING COMPANY • 6601 SOUTH LARAMIE AVENUE, CHICAGO 38, ILLINOIS

201 SERIES *Rectifiers*



TYPE 201A RECTIFIER. Designed to furnish filament and plate current to line amplifiers such as the Langevin 102 Series. Delivers 275 V. at 75 M.A., 6.3 V. at 8 A. Length 10 3/32". Width 5 3/32". Maximum height 6½" (5½" above, 1" below mounting chassis). Occupies one third Langevin Type 3A mounting frame.

Type 201 Series Rectifiers consist of Type 201A, described above, and 201B. Type 201A is supplied with a single filter stage, whereas Type 201B has a dual filter stage. Latter type designed to supply filament and plate power for quiet pre-amplifiers such as Langevin Type 106 or 111. In addition supplies associated line amplifiers such as Langevin 102 Series. These units possess excellent regulation and low ripple content.

Send today for complete engineering information about these and other Langevin apparatus.

The Langevin Company
INCORPORATED
SOUND REINFORCEMENT AND REPRODUCTION ENGINEERING

NEW YORK
37 W. 65 St., 23

SAN FRANCISCO
1050 Howard St., 3

LOS ANGELES
1000 N. Seward St., 38

YOU'LL be in good company when you specify General Industries molded plastic parts or low-torque electric drives, or both. From one plant, under one management, we supply both these products to the most rigid specifications.

YOU CAN SPECIFY *BOTH* FROM GENERAL INDUSTRIES

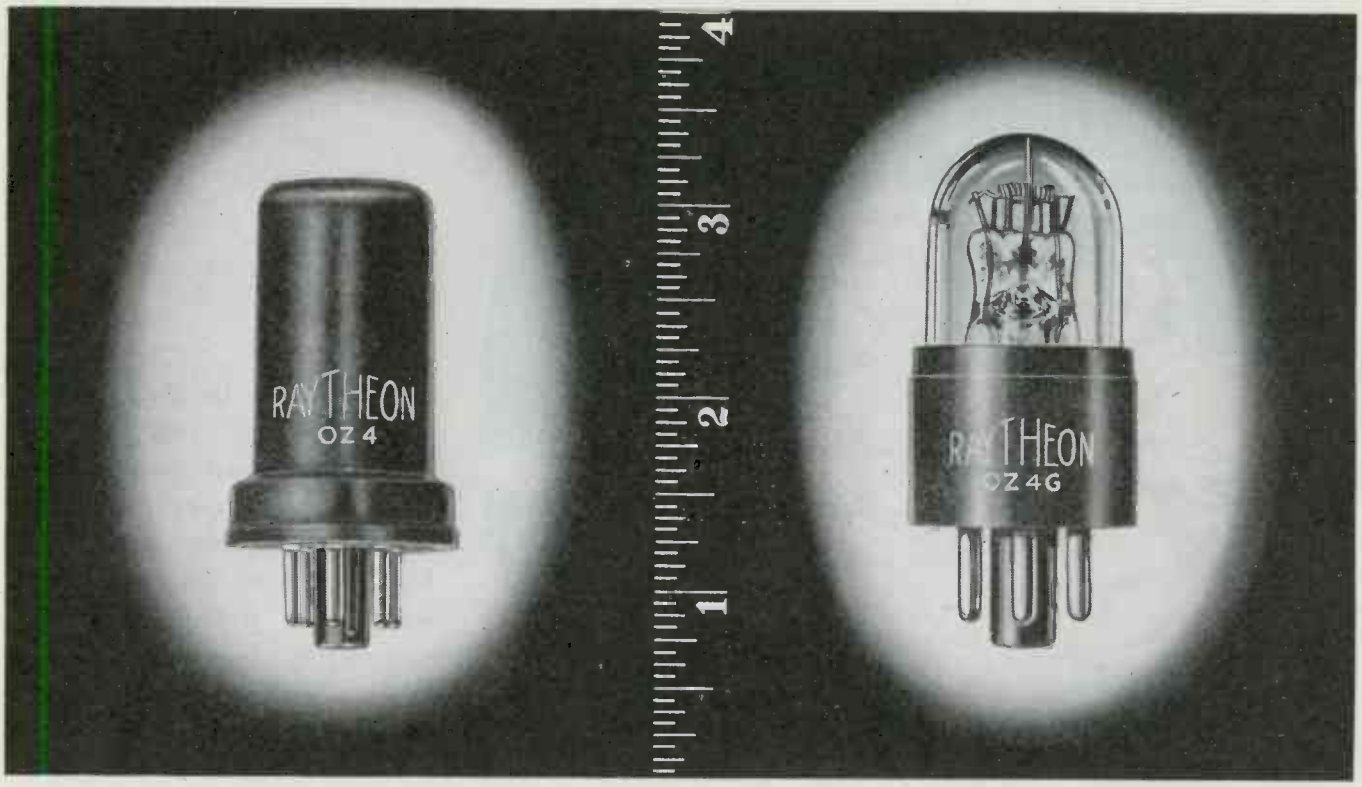
In our molded plastics division, we have the know-how to do large or small jobs, simple or intricate, in any quantities. While we don't attempt to design or redesign your parts, our skilled and co-operative team of engineers, mold makers and machine operators frequently make suggestions for better, faster or lower cost moldings that will meet or beat your specifications.

You'll find similar ability in our small motors division. For years, we've built *Smooth Power* drives for our own lines of recorders, record-changers and turntables, and for electric and electronic products of leading manufacturers. If one of our many standard motors or drive assemblies won't meet your specifications, we'll design and build one that will, exactly.

THE GENERAL INDUSTRIES COMPANY
ELYRIA, OHIO

ARMY E NAVY

So, if you're specifying molded plastics or small motors, we'd like to work with you. Definite commitments must wait until the end of our military work is in sight, but a start now may help you get to the markets quicker with your postwar products. It will be appreciated if you will address the specific division . . . *molded plastics* or *small motors*.



Increased Output from
RAYTHEON
OZ4 and OZ4G Tubes

Many manufacturers realize the advantages of small ionically heated cathode gas rectifiers which require no heater power, can be used under any atmospheric condition, and yet operate with very low internal power losses. Convincing evidence is the widespread use of such tubes in automobile radios and other equipment where maximum performance must be obtained with minimum power input.

Millions of Raytheon OZ4 and OZ4G tubes have given reliable and efficient service in such equipment . . . service which will prompt engineers to incorporate them in numerous postwar products.

First developed by Raytheon as a refinement of the BH to obtain internal drops comparable to the larger directly heated cathode types, these tubes are now further improved to the point where the output rating has been increased from 75 ma to 90 ma when functioning as a full wave rectifier. Hence, it can be used to advantage in supplying the extra "B" drain imposed by larger receivers or low-power mobile transmitters.

The OZ4 and OZ4G are examples of Raytheon's ability to design and produce *better* tubes . . . tubes which will be in great demand in the postwar radio and electronics industry.

Specifications of OZ4 & OZ4G

	OZ4	OZ4G
Maximum Overall Length	2-5/8 in.	2-5/8 in.
Maximum Seated Height	2-1/16 in.	2-1/16 in.
Maximum Diameter	1-5/16 in.	1-3/64 in.

Typical Operation Ratings as a Full Wave Condenser Input Rectifier:

Heater Power	None
Minimum DC Output Current	30 ma
Maximum DC Output Current	90 ma
Maximum Peak Anode Current	270 ma
Minimum Starting Voltage—Peak-(P to K)	320 volts
Average Dynamic Voltage Drop	24 volts
Maximum Peak Inverse Voltage	880 volts

RAYTHEON
RADIO RECEIVING TUBE DIVISION
Newton, Mass. · Los Angeles · New York · Chicago · Atlanta

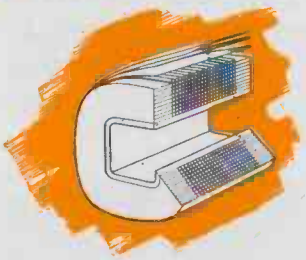
All Four Divisions Have Been Awarded Army-Navy "E" with Stars

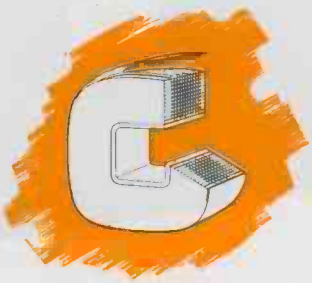
Listen to
"MEET YOUR NAVY"
Every Saturday Night
ENTIRE BLUE NETWORK
Coast-to-Coast
181 Stations

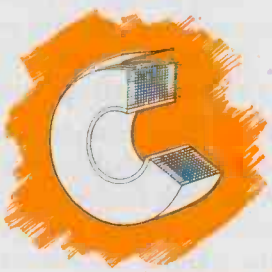
DEVOTED TO RESEARCH AND THE MANUFACTURE OF TUBES AND EQUIPMENT FOR THE NEW ERA OF ELECTRONICS

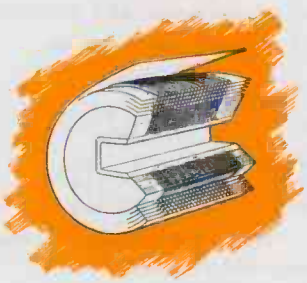
Anaconda Paper Section Coils

...all standard and special types









THE PAPER SECTION construction used by Anaconda is exceedingly flexible and a wide variety of coils can be made by this method. Standard Paper Section Coils may be wound on round, square or rectangular cores. The thickness of the inner layer of the paper is especially selected to suit the size of wire used for the winding.

In addition, special types of Paper Section Coils are designed for high voltages, ranging up to 85,000 volts or more, such as in the case of X-ray transformers.

Anaconda High Voltage Paper Section Coils are made with special methods of insulation and construction to accommodate high potentials. For example, the paper margin is substantially larger; the number of inter-layer paper wraps is graded throughout the coil; the inner and outer layers of wire are usually wound with increased pitch to separate the individual turns; the type of paper used is carefully selected to meet specific conditions.

Paper Section Coils are one of the many fine *engineered* products of Anaconda. Any of our sales offices will be glad to refer inquiries to our coil engineering staff. 44238

Magnet wire and coils

ANACONDA

ANACONDA WIRE & CABLE COMPANY

GENERAL OFFICES: 25 Broadway, New York 4 — *Subsidiary of Anaconda Copper Mining Company*

CHICAGO OFFICE: 20 North Wacker Drive 6 • Sales Offices in Principal Cities

For Low Power Voltage Control . . . these NEW

AUTOMATIC REGULATORS by SECO

RACK OR CABINET MODELS —
NO WAVE-FORM DISTORTION —
LOW COST PER KVA —
COMPACT — LIGHT WEIGHT

In the past, SECO Automatic Voltage Regulators have found wide use in maintaining constant voltage to equipment of 6 KVA capacity and greater. The introduction of SVR 4101 and SVR 4102 provides the SECO type of electronic voltage control for 1 and 2 KVA applications.

These new models possess many notable improvements to supplement the remarkable characteristics of larger SECO regulators. In addition to such features as zero wave-form distortion, high efficiency and adjustable output voltage, the SVR 4101 and SVR 4102 are compact and light weight. As illustrated, these models are available in self-contained cabinets and in rack units for installation as a component part of existing equipment.

SPECIFICATIONS

*Type	Input Voltage Range	Nominal Output Voltage	Output Voltage Range	Phase	Output Current	Output KVA	Over-all Dimensions
SVR 4101	95-135	115	100-120	1	10	1	9½" x 10" x 19⅝"
SVR 4102	95-135	115	100-120	1	20	2	9½" x 10" x 21½"
SVR 4106	95-135	115	100-120	1	52	6	9½" x 10" x 26½"

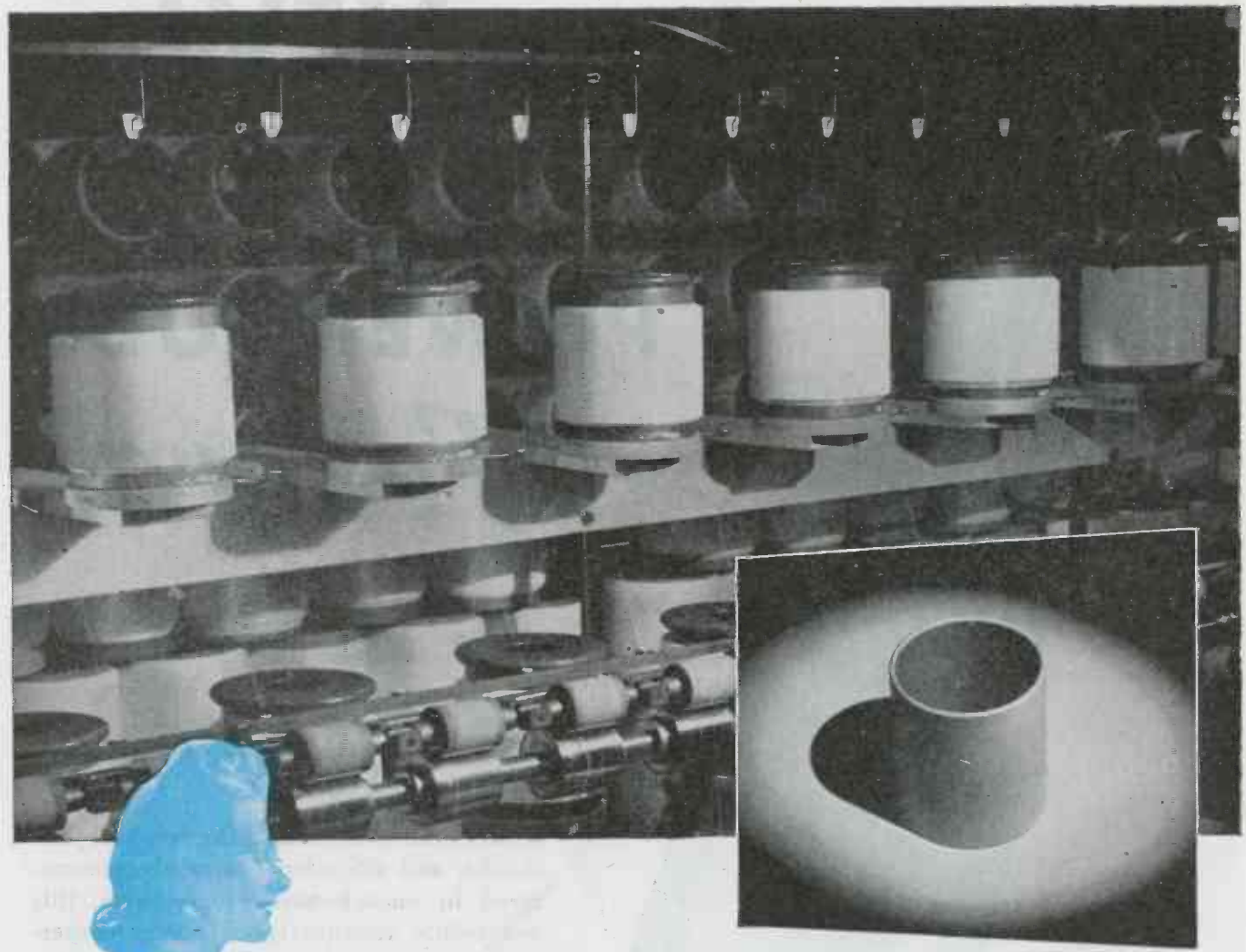
*When the regulator is used for mounting in customer's rack, add the letter "R" to the type number. For table or wall mounting add the letter "H".

Detailed information is gladly given by SECO engineers upon request.

Send for Bulletins 149 IE and 163 IE

SUPERIOR ELECTRIC COMPANY

462 LAUREL STREET • BRISTOL, CONNECTICUT



Phenolite Bobbins

help speed the production of high strength NYLON Yarn

No, not for ladies' hosiery right now, but for Uncle Sam's war needs—such as parachute fabrics and glider tow ropes—Phenolite laminated Bakelite Bobbins play an important role. Their exceptional resistance to deformation at high speeds and stresses—combined with their lightness in weight—contributes to the uniformity of the nylon yarn in the high speed "spinning" and "throwing" operations.

This application of Phenolite is typical, illustrating how the unusual combination of properties of this laminated plastic may be utilized in practically every industry to good advantage.

National Engineers are at your service to assist in the design of your improved products . . . in which Phenolite may have an advantageous application. Wire, phone or write today!

NATIONAL VULCANIZED FIBRE CO.

Wilmington, Delaware

Offices in Principal Cities

a NEW *Industrial* POWER TUBE *by* Federal

Federal presents a new and rugged power tube that fills an immediate demand — a power tube that has been *specially* designed for industrial use in high-frequency heating equipment, both dielectric and induction.

Really built to withstand the constant jars, shocks, and vibration commonly encountered in manufacturing operations, this heavy-duty vacuum tube is very conservatively rated, and will stand up under extremely hard usage.

Widely spaced, unusually sturdy filament and grid elements, without internal ceramic insulation, give this tube a ruggedness that makes it the logical choice for dependability in the design of industrial heating equipment.

For industrial power tubes, and also for rectifier and transmitting tubes, see Federal first . . . because "Federal always *has* made better tubes."

TECHNICAL DATA FOR TYPE F-5303

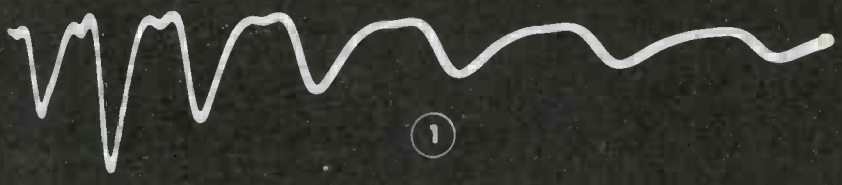
Filament Voltage	11.0 volts
Filament Current	27.5 amps.
Maximum Ratings for Maximum Frequency of 50 Mcs.	
DC Plate Voltage	3500. volts
DC Plate Current	1.0 amp.
Plate Dissipation	1200 watts
Overall Height	app. 7"
Maximum Diameter	3½"
Supplied with 6 "flexible copper leads, 2 on each terminal.	
Type of Cooling	Forced-air
(Also supplied for water-cooling, type F-5302.)	

FEDERAL TELEPHONE & RADIO FTR

Federal Telephone and Radio Corporation

An IT&T Associate

Newark 1, New Jersey

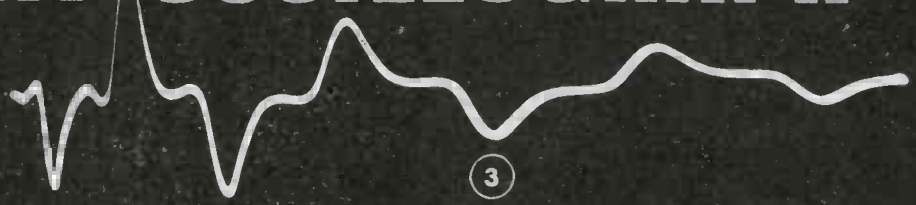


HAVE YOU CO-AX PROBLEMS?

ATTENUATION
TRANSMISSION TIME
CHARACTERISTIC IMPEDANCE
FAULTS . . .

You can get practical answers with the

TYPE 248
DuMONT OSCILLOGRAPH



The quickest method for determining co-ax line characteristics is that of applying a pulse to one end and observing reflections that follow. Type 248 Oscillograph, providing high-speed driven sweep and self-contained pulse generator, has proved invaluable for such work in our own laboratories and at the DuMont New York Television Station WABD.

Oscillograms herewith are typical of those obtained when testing a 200- or 300-foot 75-ohm cable, indicating respectively: (1) Reflections from an open-circuited far end; (2) The absence of reflections following the initial negative pulse, when line is correctly terminated; and (3) Reflections of reversed polarity from a shorted far end. (In each case the pulses are viewed at sending end, which is terminated in a resistance much greater than 75 ohms.)

Transmission time can of course be immediately determined from interval between reflections, using 1 or 10 microsecond markers available from oscillograph's timing circuit. Reflections illustrated are approximately 1 microsecond apart. Attenuation can be calculated from difference in height of successive peaks.

Proper terminating impedance can be found by varying resistance across receiving end until no reflections are visible. This resistance when measured gives characteristic impedance of cable very accurately. Any discontinuities along line give reflections indicating locations and natures of faults by their spacing and polarities.

Write for literature . . .

DUMONT *Precision Electronics & Television*

ALLEN B. DUMONT LABORATORIES, INC., PASSAIC, NEW JERSEY • CABLE ADDRESS: WESPEXLIN, NEW YORK

The illustrated unit typifies the many compact designs incepted by N-Y-T for mobile, airborne and portable equipment. Resourceful N-Y-T engineering, new materials and advanced techniques make possible full retention of desirable characteristics where such drastic paring of size and weight is imperative for efficient functioning.

A bitter pill for humanity is the realization that progress transcends ordinary development in time of war. Dually destroying—by death dealing devices, and advancing—by knowledge gained, the future is molded by mankind itself.

A ray of optimism and hope is the re-interpretation of warborne research for peacetime betterments. Already new techniques, new materials and new processes have added greatly to transformer efficiency. N-Y-T engineers have played an important part in these developments.

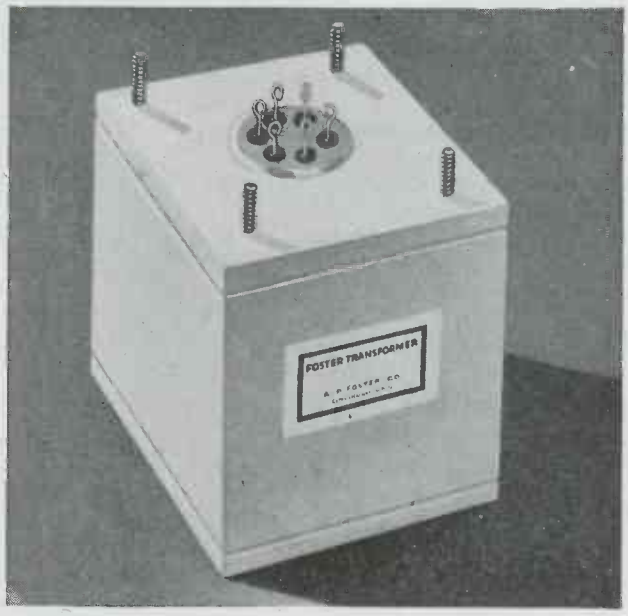
To you engaged in the fulfillment of America's future—through product or equipment utilization of transformers, solenoids or filters—a cordial invitation is extended for near-future collaboration.

NEW YORK TRANSFORMER CO.

22-26 WAVERLY PLACE NEW YORK 3, N. Y.

PERFORMANCE

in a tiny package



It had to be small, this new MULTIPLE CHANNEL BAND PASS FILTER, because it's destined to do a special military job. **FOSTER** designed and is building it, meeting the high performance standard required, kept it light in weight, and sealed it in a case that measures only **2¾ x 2¾ x 3¼"**!

Terminals are sealed in VITROSEAL, a basic advance in transformer manufacture, exclusive with Foster. VITROSEAL terminals are fused uniformly, simultaneously, into the metal, in multiple. The job is neat, fast, economical. The seal is sure and extremely resistant to vibration and thermal shock.

In the past 12 months Foster Engineers have solved more than 1000 individual transformer problems, designing and building entirely new units or "upping" the performance of units already in use.

If you manufacture electrical and electronic equipment, it may well be worth your while to address your special transformer inquiries to Foster.

REPRESENTATIVES

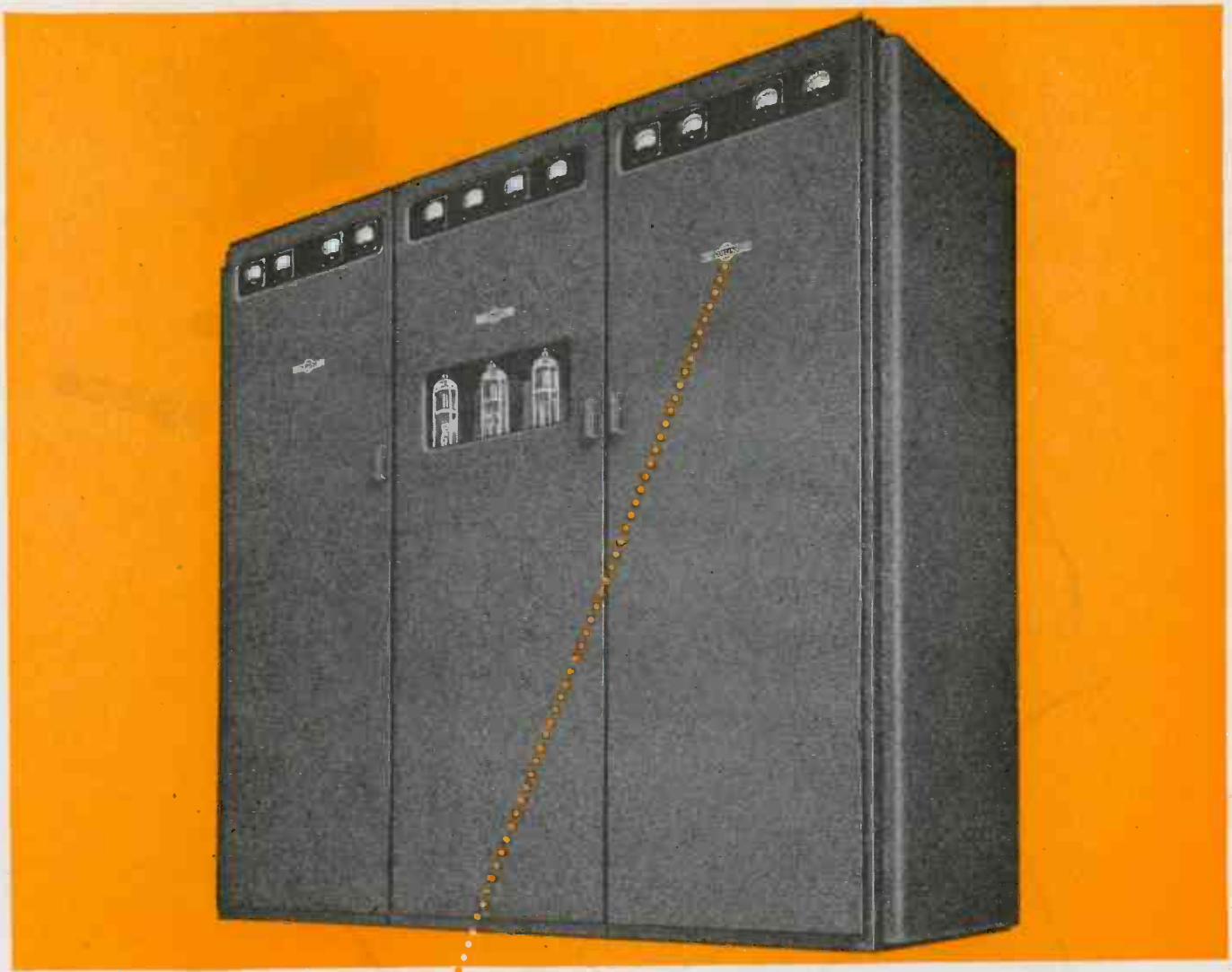
BOB REID	810 WEST 57TH STREET	INDIANAPOLIS 5, IND.	TELEPHONE: BROADWAY 2725
BAUMAN & BLUZAT	2753 WEST NORTH AVENUE	CHICAGO 47, ILL.	TELEPHONE: HUMBOLT 6809-10-11-12

SPECIALISTS IN BUILDING TRANSFORMERS SINCE 1938

A. P. FOSTER COMPANY

TRANSFORMER ENGINEERS & MANUFACTURERS

719 WYOMING AVENUE, LOCKLAND 15, OHIO (SUBURB OF CINCINNATI)



COLLINS 1000-C MULTI-CHANNEL TRANSMITTER

Smart engineering design halves the cost per channel

IN THIS 2500 watter, Collins engineering has struck an ingenious balance of quality, efficiency *and economy*.

The right hand cabinet contains two vertical rf sections. Through application of the principles of quick shift (less than 2 seconds) each section can be used interchangeably on two channels, such as may be called for by day and night transmission. These channels are not limited to the pass band of the rf circuits but may be located anywhere within the tuning range of the equipment—2 to 20 mc.

The cost per section is comparable to that of conventional single channel sections. The actual cost per channel is thus cut approximately in half.

In addition, relays permit selection of three crystals per channel (six per vertical section) spaced within 2% of the nominal center frequency. Twelve frequencies are therefore available in a single cabinet, arranged as needed within the four channels.

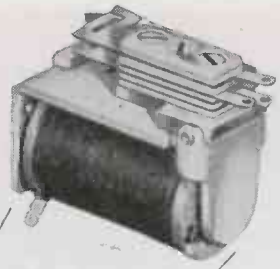
In the equipment illustrated above, the left hand cabinet contains the af and modulator sections. The power supply cabinet is in the center. All sections are of highly advanced design, and are of the vertical chassis type.

We shall be glad to discuss applications of this rugged, versatile equipment to suit your operating requirements.
Collins Radio Company, Cedar Rapids, Iowa.

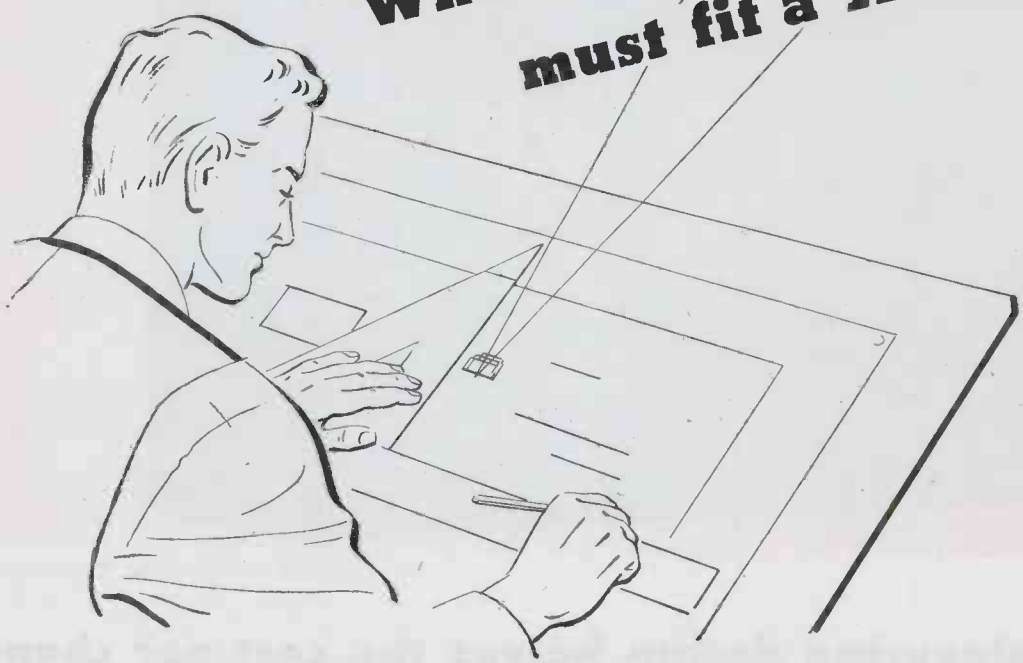
Available: Additional af-modulator and rf multi-channel sections . . . Supplemental Collins Autotune rf section . . . Frequency shift keying . . . Complete remote control, built to your requirements.

IN RADIO COMMUNICATIONS, IT'S . . .

COLLINS



When a lot of stamina must fit a little space



IF SPACE requirements dictate a small relay —and service conditions a powerful one . . . here's the relay to fit your needs. It's the Automatic Electric Class "S" Relay—tiny in size, light in weight, but dependable and packed with power.

Class "S" Relays have been designed especially to meet the exacting conditions of service on fast, modern aircraft. They offer a combination of features never before found on any relay, large or small. For example:

1. **Vibration-resistance is not just "added on"—it's designed right into Class "S" Relays. And they withstand with a large margin of safety the most rigorous operating tests of the Signal Corps and the Air Forces.**
2. **A unique spring design provides high contact pressure within small space limits.**
3. **An added assurance of reliability is provided by twin contacts.**
4. **The new type of pin-pivoted armature with full length bearing provides the Class "S" Relay with exceptionally long life even under the toughest conditions.**

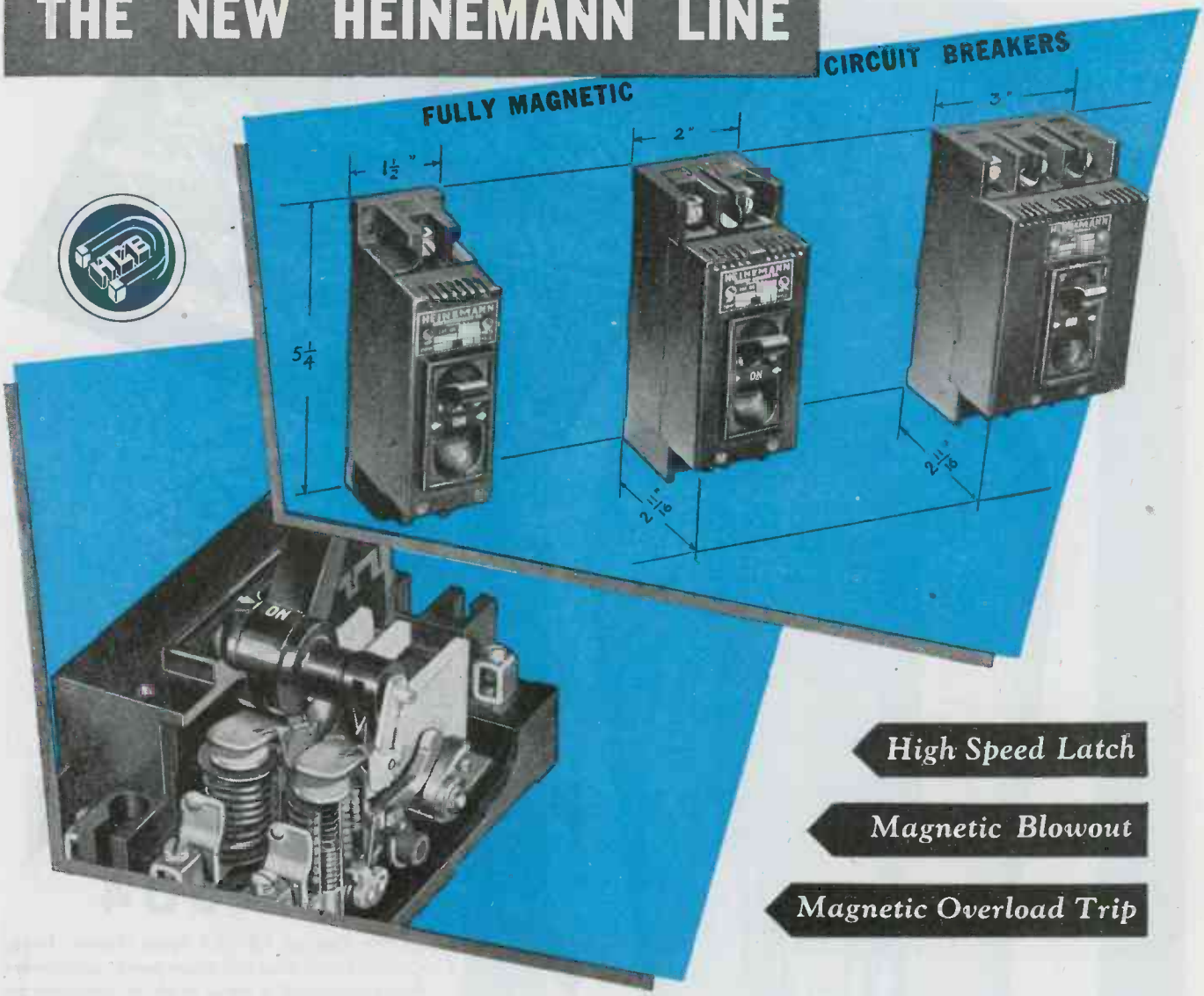
The Automatic Electric Catalog gives full details. Write for your copy.

Relays
AND OTHER CONTROL DEVICES
by AUTOMATIC ELECTRIC

AUTOMATIC ELECTRIC SALES CORPORATION
1033 West Van Buren St., Chicago 7, Ill.

In Canada:
Automatic Electric (Canada) Limited, Toronto

THE NEW HEINEMANN LINE



Of interest to designers and engineers of electrical apparatus is the new, smaller, more compact HEINEMANN Circuit Breaker with more efficient blowout action, faster latch mechanism and improved magnetic overload trip unit.

Of all known latches, this one acts with the least amount of friction and mechanical delay. The latch makes it impossible to hold the breaker closed against overload or short circuit.

Magnetic blowout contacts mounted in individual arcing chambers add speed to the arc interruption. As the strength of the current to be interrupted increases, the quenching effect becomes greater due to the intensified magnetic blowout field.

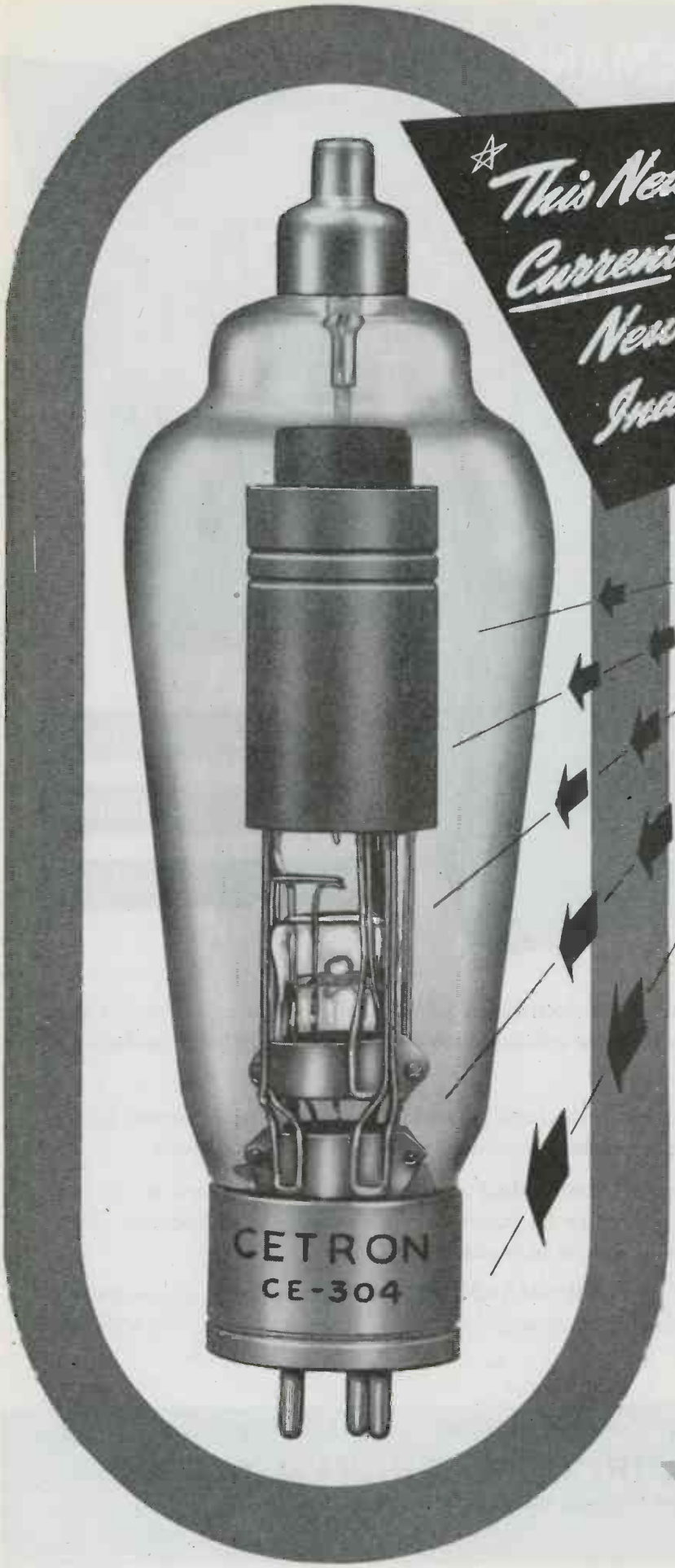
The overload trip unit is FULLY ELECTRO-MAGNETIC and has a fixed instantaneous trip point independent of its time-delay characteristics. The time delay is governed by a liquid contained in a hermetically sealed tube.

Send For Catalog Showing Complete Line and Engineering Data

HEINEMANN CIRCUIT BREAKER CO.

Subsidiary of Heinemann Electric Co., Est. 1888

137 PLUM STREET TRENTON, N. J.



☆ This New Cetron High Current Thyratron brings New Efficiency to Industrial Operations

CETRON
CE-304

In the Cetron CE-304 tube shown here, Continental Electric Company engineers have reached a new high in concentrating super-efficiency in the smallest possible space.

CE-304 is a mercury vapor filled tube with a peak current rating of 125 amperes and an average current rating of 12.5 amperes DC. This high current thyratron-type tube is designed to be particularly useful in welding control and motor control applications.

CE-304 uses industrial type 4-pin base; is sturdily constructed. Patented filament design gives exceptionally high output with minimum of cathode power.

CE-304 is built to give long life in all sorts of industrial and other applications where dependability is an important consideration.

Write for Bulletin No. 119

CONTINENTAL ELECTRIC COMPANY GENEVA, ILL.

★ CHICAGO OFFICE, 903 Merchandise Mart
NEW YORK OFFICE, 265 West 14th Street

The Greeks gave us a word for it . . . now we give it to *you*

WHEN Sperry first developed its velocity-modulated, ultra-high-frequency tube, the word "KLYSTRON" was registered as the name of the new device.

This name — from the Greek, as coined by scientists of Stanford University — is an apt description of the bunching of electrons between spaced grids within the tube.

"Klystron" is a good name. So good, that it has come into widespread use as the handy way to designate *any* tube of its general type, whether a Sperry product or not.

This is perfectly understandable. For the technical description of a Klystron-type tube is unwieldy, whether in written specifications, in conversation, or in instructing members of the Armed Forces in the operation of devices employing such tubes.

These conditions have prompted many requests from standardization agencies—including those of the Army and Navy—for unrestricted use of the name Klystron. In the public interest, Sperry has been glad to comply with these requests . . .

From now on, the name KLYSTRON belongs to the public, and may be used by anyone as the designation for velocity-modulated tubes of any manufacture.

Sperry will, of course, continue to make the many types of Klystrons it now produces, and to develop new ones.

On request, information about Klystrons will be sent, subject to military restrictions.

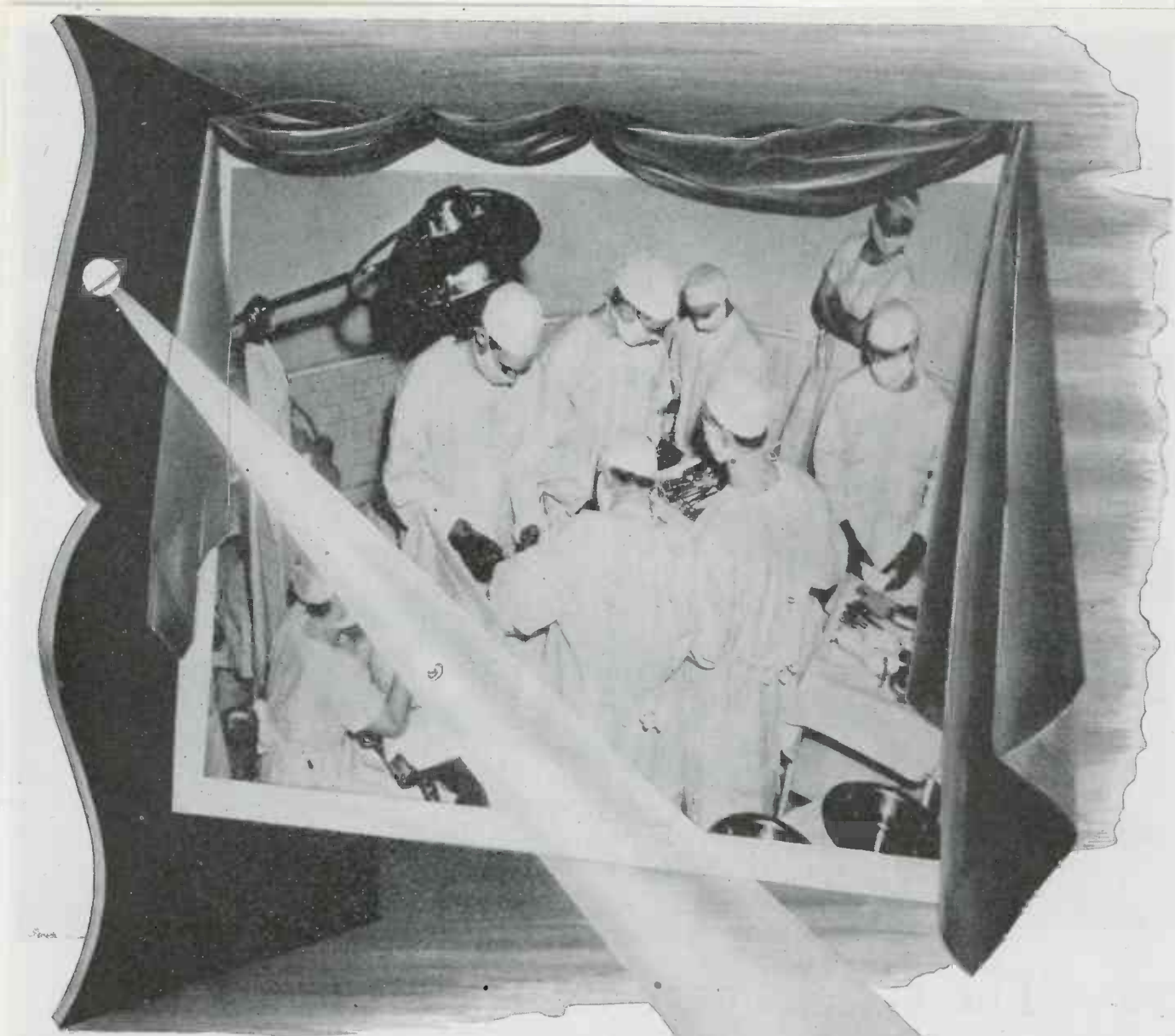
SPERRY GYROSCOPE COMPANY, INC. GREAT NECK, N. Y.

Division of the Sperry Corporation

★

LOS ANGELES • SAN FRANCISCO • NEW ORLEANS
HONOLULU • CLEVELAND • SEATTLE

GYROSCOPICS • ELECTRONICS • RADAR • AUTOMATIC COMPUTATION • SERVO-MECHANISMS



Light through an earlobe works an electric meter!

Any light source can be made to operate meters and meter relays without costly, bulky amplifiers. Luxtron* photocells, developed and manufactured by Bradley Laboratories, do this today for many purposes... such as looking at a patient's earlobe and instantaneously telling you the oxygen content of his blood . . . at a warehouse and warning of fire . . . or at a furnace to gauge its temperature.

New chapters in the story of the simplest way to transform light into electric energy are daily written by Bradley's Luxtron photocells. For information on how they can help you, write Bradley Laboratories.

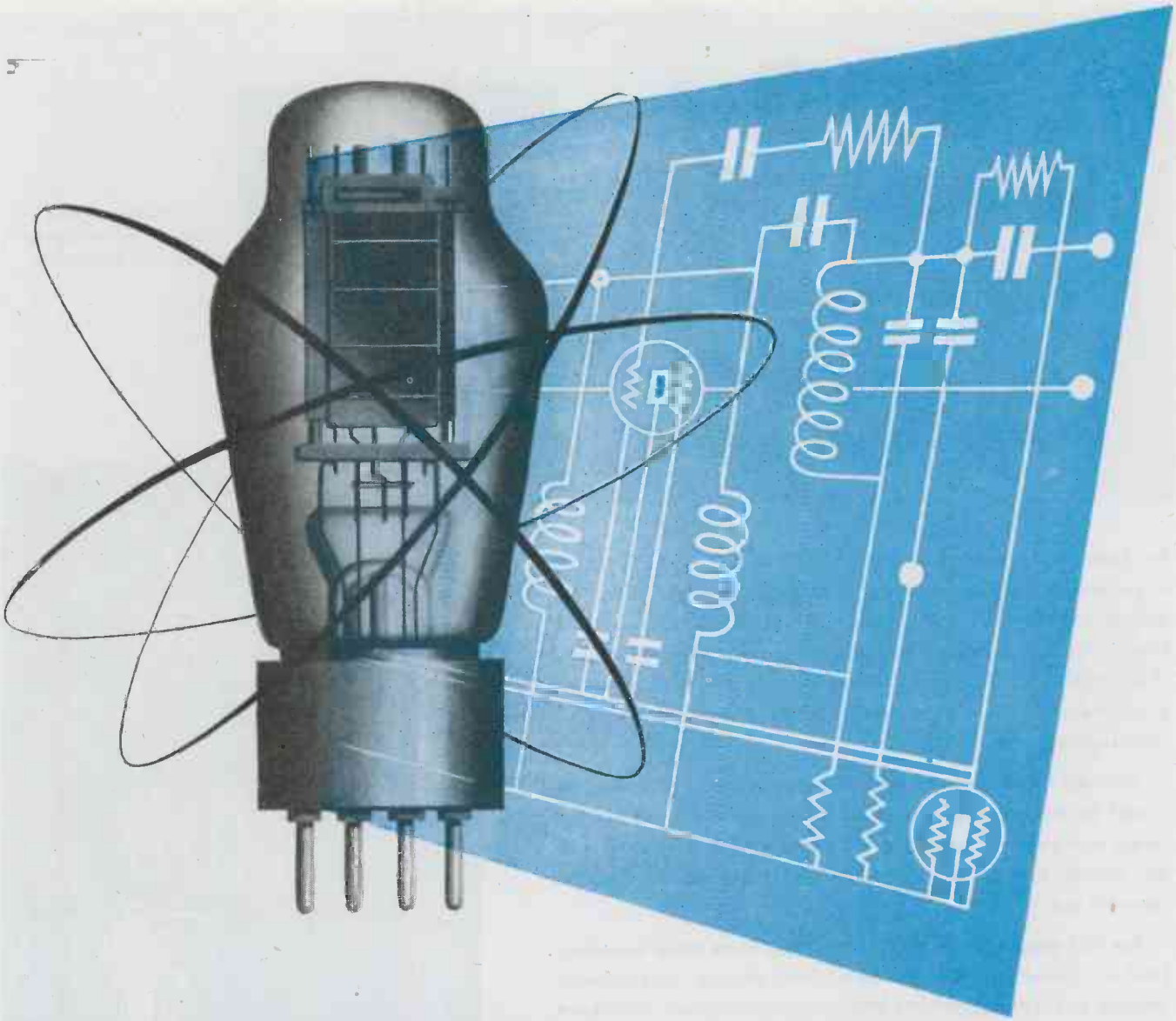
*TRADE MARK REG. U. S. PAT. OFF.

Copper Oxide Rectifier Advances

Bradley applies knowledge of electrical circuits to the development and manufacture of a unique line of "Coprox" rectifiers. Write for illustrated bulletin giving ratings and special advantages.

PHOTOCELLS—MASTERS OF LIGHT **BRADLEY** MASTER OF PHOTOCELLS

BRADLEY LABORATORIES, INC., 82 MEADOW STREET, NEW HAVEN 10, CONNECTICUT



Decide AT THIS POINT to use TAYLOR FIBRE

WHETHER YOUR POST-WAR PRODUCT will be in the field of electronics or aviation, automotive or home appliance, or any field in which light weight, ease of machineability, high insulating qualities or structural strength are important, decide now—in the blueprint stage—to give thorough consideration to the advantages of using Taylor Laminated Plastics. New, war-born developments in Phenol Fibre and Vulcanized Fibre may change your whole conception about the possible applications of Laminated Plastics. Our engineering department is ready to consult with you on this subject, without obligation, either in our plant or yours. Start the ball rolling, by writing us today.

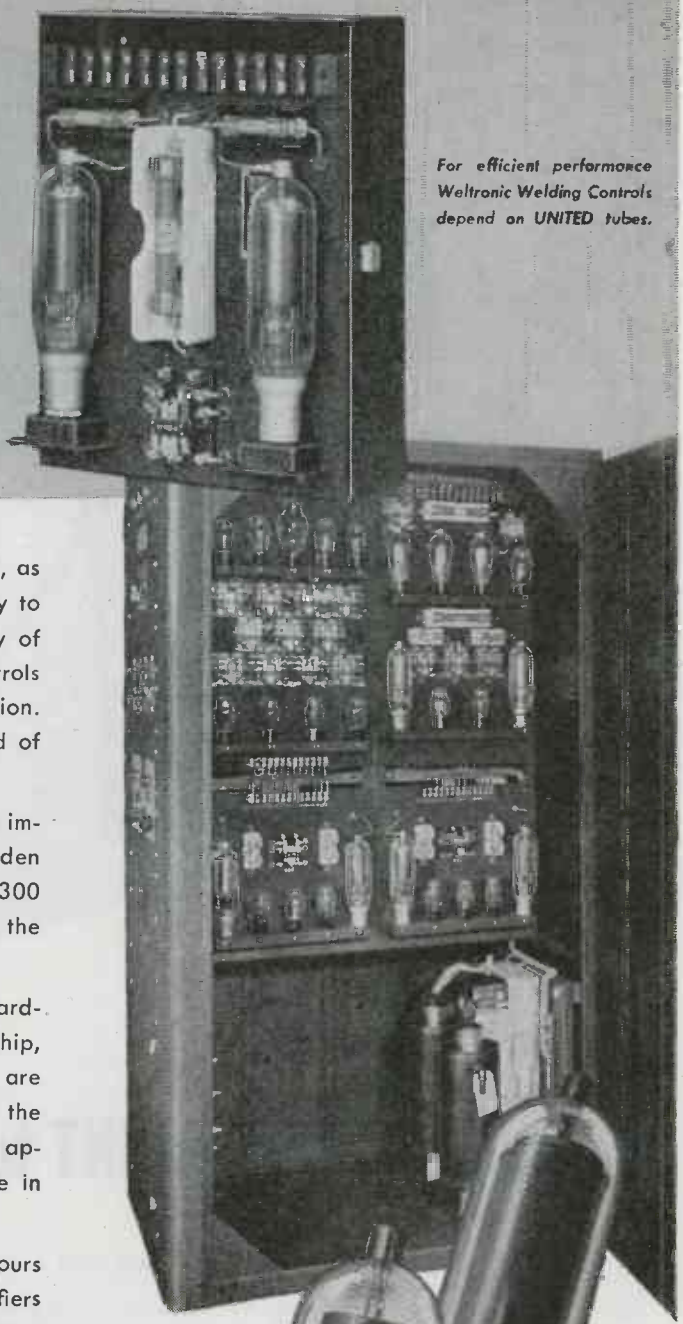
TAYLOR FIBRE COMPANY

LAMINATED PLASTICS: PHENOL FIBRE · VULCANIZED FIBRE · Sheets, Rods, Tubes, and Fabricated Parts

NORRISTOWN, PENNSYLVANIA · OFFICES IN PRINCIPAL CITIES · PACIFIC COAST HEADQUARTERS: 544 S. SAN PEDRO ST., LOS ANGELES

300 WALLOPS a minute

but still these tubes keep going



For efficient performance Weltronic Welding Controls depend on UNITED tubes.

For better and more precise control of stop-and-go currents, as in resistance welding, mechanical methods have given way to electronics. For this application the WELTRONIC Company of Detroit, Michigan, builds Electronic Timers and Welding Controls distinguished for their fine construction and efficient operation. In the heart of these units lies the toughest proving ground of tube stamina.

The rapid and instantaneous changes in load conditions imposed on the power tubes in this function would bring sudden death to tubes built to ordinary standards. Impulses up to 300 per minute are commonplace and put the best tubes to the severest test.

For this gruelling job WELTRONIC Engineers have standardized on United Mercury Rectifiers. Their sterling workmanship, unusual physical ruggedness and excellent electrical design are the reasons underlying this preference. Built to withstand the continuous, severe conditions of these and other industrial applications, tubes by United are appearing more and more in important places.

Where the going is extra tough and several thousand hours of dependable service are essential . . . United Mercury Rectifiers are demonstrating their superior qualities. Get the facts about these better tubes today. Write for a copy of our latest catalog.

UNITED

MERCURY RECTIFIERS

UNITED ELECTRONICS COMPANY • NEWARK 2, N. J.

Transmitting tubes exclusively since 1934

"Our Business, Like Yours, ...is Different!"

A few comments based on the first 50 years of the JAMES G. BIDDLE COMPANY

BUSINESSES, like people, usually have distinct, individual personalities. The smaller the business, the more clearly it will reflect the character of the man who built it.

In 1895, when the electrical industry was in its infancy, James G. Biddle went into business as a manufacturer's agent, selling electrical measuring instruments and scientific apparatus. One of his basic aims in the conduct of the business was to be more than a mere source of supply. He decided to provide a service that was outstanding by reason of its alert, interested, personal character. This aim has never been changed by Mr. Biddle or his associates during the last half century. It will continue to be an important factor in the policies of the James G. Biddle Company in the years to come. We are committed to this.

•

In celebration of our 50th anniversary, we have prepared a brief booklet entitled "Report at Mid-Century." It touches upon interesting points regarding the growth and advancements of the electrical field in general and our business in particular. We would be pleased to send you a copy upon request.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET • PHILADELPHIA 7, PENNA.

"MEGGER"* INSULATION TESTERS, GROUND TESTERS AND OHMMETERS • "FRAHM" TACHOMETERS AND FREQUENCY METERS • "JAGABI" RHEOSTATS • INDICATING HAND TACHOMETERS • SCIENTIFIC APPARATUS

*TRADE MARK REG. U. S. PAT. OFF.

COLE

STEEL EQUIPMENT COMPANY

Experience and "know-how" are why so many of America's leading manufacturers depend upon "Cole Steel Equipment" for

sheet metal fabrication

We welcome tough assignments . . . instrument housings . . . water-test boxes . . . chassis; some made to extreme precision, others to gauge limits. Send us *your* blueprints!

Send for our Brochure
"The Plant Behind Your Plant"

349 Broadway, New York 13, N. Y.
Factory: Brooklyn, N. Y.

COLE STEEL OFFICE EQUIPMENT

will again be available after the war

NO. 5 IN THE IRC NEW PRODUCT PARADE

IRC PRESENTS

THE NEW FRW FLAT WIRE WOUND RESISTORS

Flat as a flounder, efficient as a standard tubular wire wound . . . *and available right now for essential uses* . . . the new Type FRW packs a wealth of features to recommend it for many limited-space applications.

Five standard sizes, covering the 0.1 to 22,000 ohm range, are now being built to JAN-R-26 specifications for RW20, RW21, RW22, RW23 and RW24 requirements.

Non-magnetic mounting brackets extending through the resistor allow easy and economical mounting, aid in uniform heat distribution along the entire length of the resistor, and serve as conductors to transfer internal heat to the chassis.

FRW's may be mounted vertically or horizontally, either singly or "stacked." Although light in weight, they have exceptional mechanical strength and withstand severe vibration. They reflect in every detail IRC's traditional high quality.

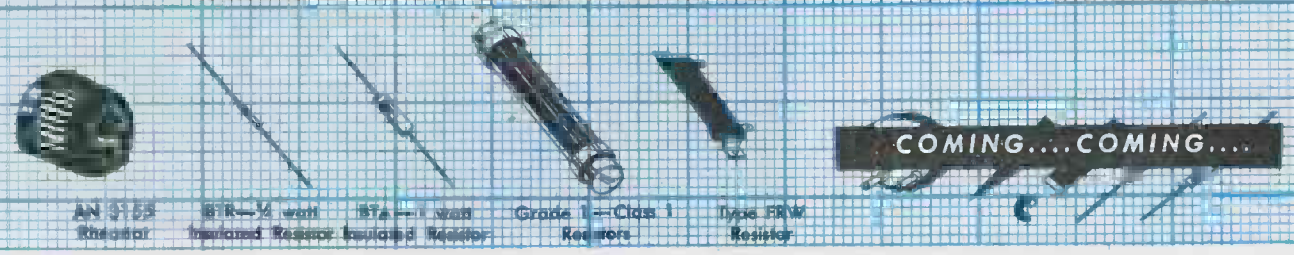
For more complete details write for FRW engineering data bulletin, now in preparation.

INTERNATIONAL RESISTANCE CO.

Dept. 2-C
401 NORTH BROAD STREET, PHILADELPHIA 8, PA.

IRC makes more types of resistance units, in more shapes, for more applications than any other manufacturer in the world.

PACEMAKERS FOR PERFORMANCE • FIXED & PORTABLE RESISTORS



AN 3155 Rheostat | BTR—½ watt Insulated Resistor | BTA—1 watt Insulated Resistor | Grade 1—Class 1 Resistors | Type FRW Resistor

Plugs FOR VICTORY

70 Types PLUGS & CONNECTORS

SIGNAL CORPS • NAVY SPECIFICATIONS

Types:		PL		
50-A	61	74	114	150
54	62	76	119	159
55	63	77	120	160
56	64	104	124	291-A
58	65	108	125	354
59	67	109	127	
60	68	112	149	

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

NAF

1136-1 No. 212938-1

Other Designs to Order

Remler is equipped for the mass production of many types of radio and electronic devices from humble plugs and connectors to complete sound amplifying and transmitting systems. Ingenious production techniques contribute to Remler precision, reduce costs and speed up deliveries. • The Axis is on the run and final Victory is in sight. Let us help you finish the job.

Wire or telephone if we can be of assistance

REMLER COMPANY, LTD. • 2101 Bryant St. • San Francisco, 10, Calif.

REMLER

SINCE 1918

Announcing & Communication Equipment

Put your hand here!

PARAGON

REG. U. S. PAT. OFF.

DRAFTING MACHINE

HANDLING is believing. Get the finger tips of your left hand on the control ring of a PARAGON Drafting Machine. The lightest pressure is all you need to set the scales at the angle you want, anywhere on the drawing board. Your right hand is always free. For the full story of PARAGON features, convenience and handsome modern appearance, write on your letterhead to Keuffel & Esser Co., Hoboken, N. J.

K+E

Drafting, Reproduction, Surveying Equipment and Materials. Slide Rules. Measuring Tapes.

KEUFFEL & ESSER CO.

EST. 1867

CHICAGO • DETROIT • ST. LOUIS • NEW YORK • HOBOKEN • SAN FRANCISCO • LOS ANGELES • MONTREAL

They Want To Know What Thermatron

ELECTRONIC HIGH FREQUENCY HEATERS CAN DO FOR THEM

"We are interested in doing some experimental work with high frequency for heating pre-form laminated sheets."

"We are manufacturers of paper bag and converting machinery and are interested in the Heaters as applied to laminating and heat sealing paper in the production of paper bags."

"As manufacturers of labels coated with a hot melt adhesive, we have the problem of applying the hot melt adhesive to the paper web."

"We are intersted in the application of heating and drying tobacco, particulary as to the drying in hogsheads."

"We are interested in your Thermatron electronic high frequency heating system for the drying of sole leather."

"Could it be used to partially dry ordinary building brick previous to burning them in the kiln?"

"We are interested from a viewpoint of drying textiles after they come from our wet processing."

The Answer IS THAT APPLICATIONS FOR **Thermatron** INTERNAL HEAT GENERATION ARE SO VAST THAT WE HAVE NOT AS YET EVEN TAPPED THE SURFACE.

Thermatron —heat without flame—can be extensively used in the setting of plastics. It heats and dries all types of non-metallic materials, including textiles, paper, powders, wools, ceramics, etc. It cures rubber and sets glues.

SUBMIT SAMPLES of your materials, along with details of your problem, to Radio Receptor engineers. We will be glad to make all necessary tests, and give you a full, unbiased and confidential report, including our opinion as to whether or not it will pay you to use this type of heat. There is no charge or obligation for this service.

Write, on your own letterhead, for our new **Thermatron** *folder to Dept. I-3.*

Standard sizes from 500 watts to 30 kilowatts output.
Units of special sizes and frequencies built to order.

Thermatron Division

RADIO RECEPTOR COMPANY, INC.

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

SINCE 1922 IN RADIO AND ELECTRONICS

KNOW-HOW BEGINS AT HOME

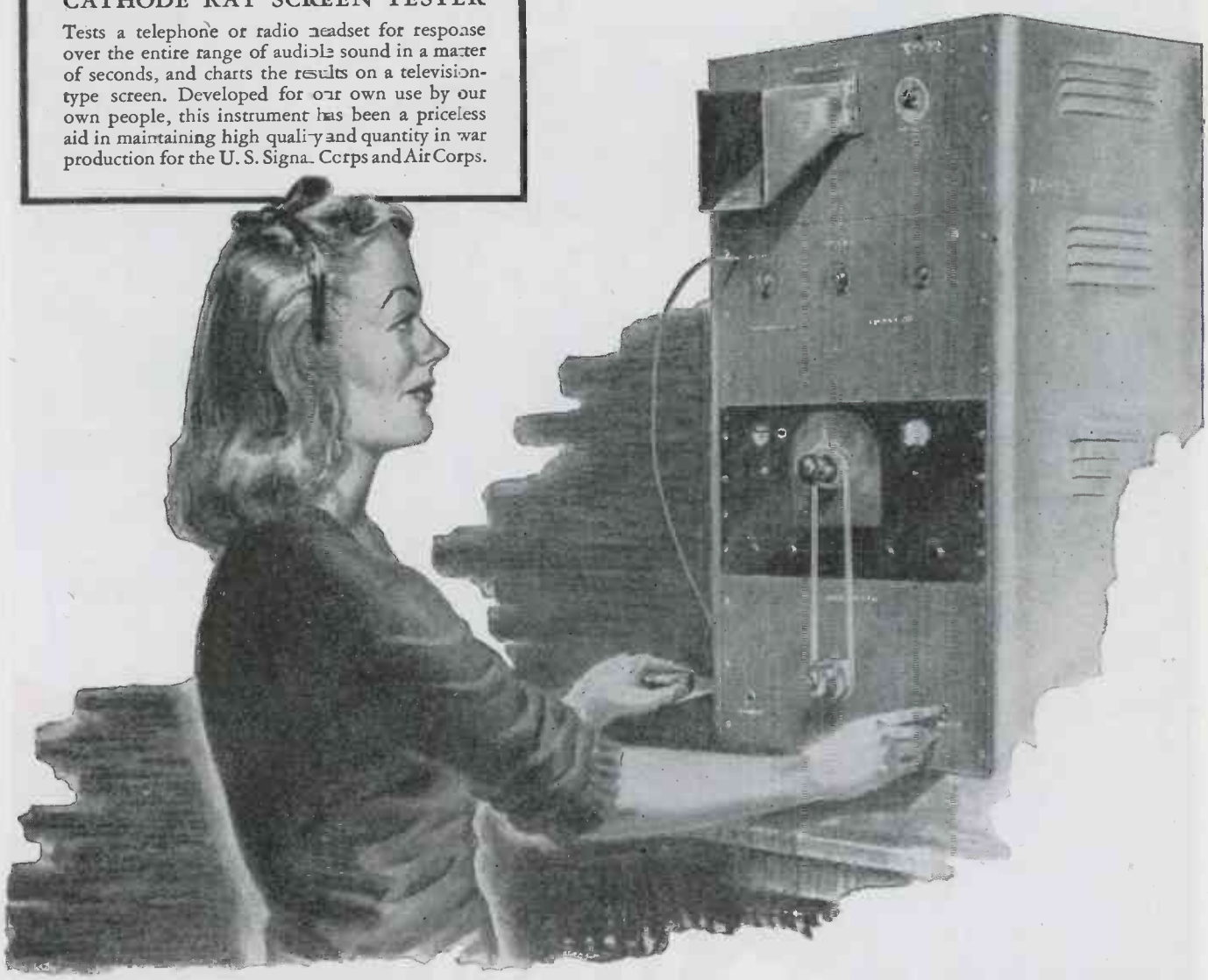
SPECIAL tools, ingenious manufacturing devices, and elaborate test equipment which makes delicate measurements almost as easy as telling the time . . . these things seem to interest our visitors particularly. We are always proud to point out that most of these aids to swift, precise production were developed by our own men and women.

There's a world of skill and experience at Connecticut Telephone & Electric Division . . born of nearly fifty years of practice and progress. This know-how isn't confined to our engineering departments, either. Some of our most useful suggestions come straight from the production lines.

Purchasers of C. T. & E. products benefit from this skill and ingenuity . . . in better, more advanced devices, produced faster, for less.

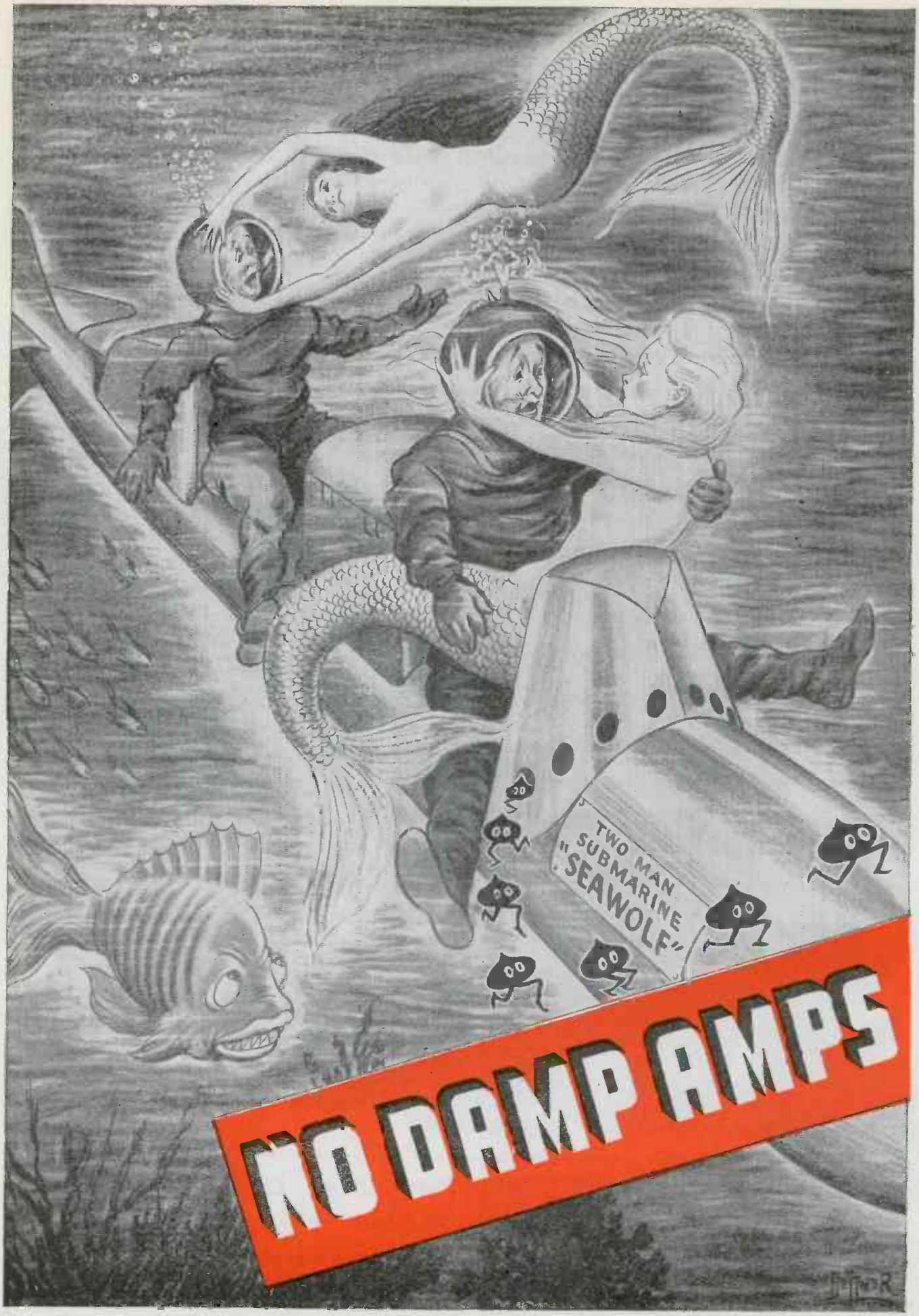
CATHODE RAY SCREEN TESTER

Tests a telephone or radio headset for response over the entire range of audible sound in a matter of seconds, and charts the results on a television-type screen. Developed for our own use by our own people, this instrument has been a priceless aid in maintaining high quality and quantity in war production for the U. S. Signal Corps and Air Corps.



CONNECTICUT TELEPHONE & ELECTRIC DIVISION
GREAT AMERICAN INDUSTRIES, INC. • MERIDEN, CONN.

TELEPHONIC SYSTEMS • SIGNALLING EQUIPMENT • ELECTRONIC DEVICES • ELECTRICAL EQUIPMENT
HOSPITAL AND SCHOOL COMMUNICATIONS AND SIGNALLING SYSTEMS • IGNITION SYSTEMS



Fusite terminal panel used as cover for container. A single sealing operation.

Hole punched and adapter socket formed to receive Fusite terminal panel.

700 SERIES 1" DIAMETER (.952)	900 SERIES 1¼" DIAMETER (1.235)
702	902
703	903
704	904
705	905
706	906
707	907
	908
	909

INTERFERENCE . . .

can spoil any pick-up. Electronic equipment can't operate satisfactorily with outside interference, either. The best transformer, coil or relay washes out when moisture wades in. That's the "why" for **FUSITE** hermetic seals. They keep out the wet outside by sealing in the dry inside. No damp amps are the positive result. In the lab, **FUSITES** pass the tough thermal shock test of dry ice to boiling water. In your plant, they can and do stand production handling . . . and later, on-the-job manhandling. **FUSITE** is the only glass-insulated, multi-terminal panel interfused within a reinforced metal shape, all in one piece. This means that one and only one sealing operation is required to provide a perfect hermetic seal. It all adds up to this . . . parts and labor saved, costs downed, production upped and performance guaranteed, regardless of time, place or temperature. Write for samples on your business letterhead. A four-page illustrated file-folder, telling all about **FUSITE** and its many applications, is also yours for the asking.

WITH FUSITE SEALS

I'M MISTER AMP,
THE 'LECTRIC SCAMP,
FOR WHOM DAMPNESS HAS THAT FEELING;
BUT WHEN I'M DRY,
I'M REALLY HIGH,
AND I GO FOR *FUSITE SEALING!*

GLASS TO METAL

FUSITE

HERMETIC TERMINALS

NO DAMP AMPS!

CINCINNATI ELECTRIC PRODUCTS COMPANY

CARTHAGE AT HANNAFORD, NORWOOD,
CINCINNATI 12, OHIO

STANDARD FREQUENCIES—*Octaves of them*

FREQUENCIES

10, 20, 40, 60, 80, 100, 120, 140, 160, 180, 190

Accuracy: 10 parts in 1,000,000
Output: 30 volts at 500,000 ohms
Input: 105-125V, 50-60c., 40 watts
Weight: 50 pounds

Impossible? Well, here it is—

This Multi-frequency generator furnishes the frequencies shown above at the turn of a switch. All frequencies are obtained from a temperature-compensated tuning fork and voltage-stabilized circuit.

With this unit it is possible to calibrate oscillators at many selected points without encountering complex oscilloscope patterns. One of the uncertainties involved in development work on tuned circuits, filters, reeds—and in time measurement can be minimized with the aid of this instrument.

Developed primarily to check frequency meters for precision war work, this Multi-frequency generator possesses a rugged durability and dependability in service that will prove an extra value to many laboratories.

Additional information available on request.

Manufacturer of the
Watch Master

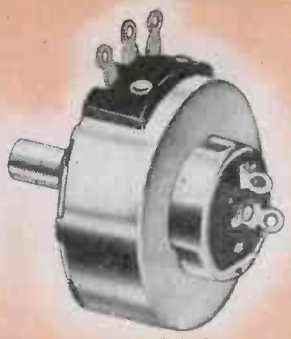
and distributor of
Western Electric
Watch-rate Recorders

American Time Products, INC.

580 Fifth Avenue New York 19, N. Y.

On your VARIABLE RESISTOR *problems...*

NO. 352



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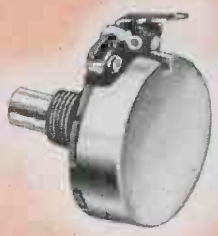

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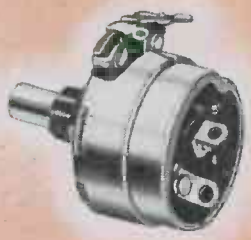

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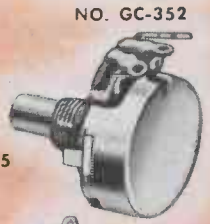

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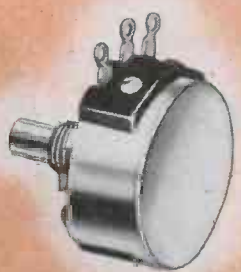
NO. GC-45



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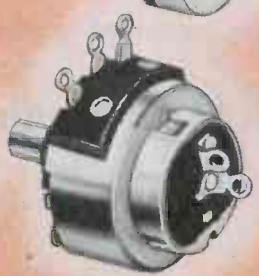

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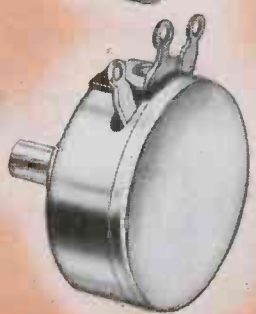

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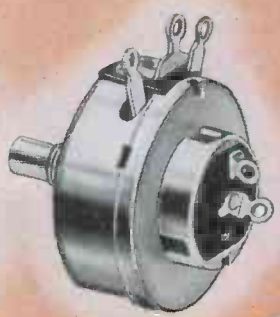

NO. GC-25

Perhaps you didn't realize that you *had* any "variable resistor problems." It frequently happens that way. That is why, years ago, Chicago Telephone Supply established the practice of submitting a sample whenever a customer orders variable resistors made to new specifications.

Before starting production on such an order, CTS just wants to make certain that no unforeseen problems exist. And in the course of many years' experience, the soundness of this practice has been demonstrated time and time again. It has saved many a manufacturer untold grief and very considerable sums of money.

Chicago Telephone Supply Company is a specialist in the field of variable resistors. As such, they feel obligated to do more than merely fill orders. They do their utmost to make sure that their variable resistors will do the job they are meant for.

Manufacturers of Quality Electro-Mechanical Components Since 1896

VARIABLE RESISTORS
PLUGS AND JACKS
SWITCHES, RINGERS
TELEPHONE GENERATORS

CHICAGO TELEPHONE SUPPLY
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IN CANADA

C. C. Meredith & Co.
Streetsville, Ontario

Centralab STANDARD, MIDGET AND ELF Radiohms

● For more than two decades the name CENTRALAB on a volume control has been a synonym for QUALITY.

The long wall-type resistance sector, the smooth performance and the satisfactory operation of these controls are in no small measure responsible for the fame of Centralab. Whether for original equipment or replacement always specify

CENTRALAB Radiohms

ARMY NAVY

Centralab

CRL

Division of GLOBE-UNION INC., Milwaukee

Producers of VARIABLE RESISTORS — SELECTOR SWITCHES — CERAMIC CAPACITORS, FIXED AND VARIABLE — STEATITE INSULATORS — SILVER MICA CAPACITORS

Here's 31 pounds of long range radio performance

FOR
- LIGHT AIRCRAFT
- PORTABLE GROUND STATIONS
- GENERAL MOBILE INSTALLATIONS

ALTAIR MODEL LY-1 COMMUNICATION SYSTEM — designed to give the highest performance with the least size and weight—has demonstrated its outstanding ability for use in light aircraft, in secondary equipment in large aircraft, portable ground stations and general mobile installations. Under the most severe operating conditions, Model LY-1 continues to give reliable communication in both the military and commercial fields.

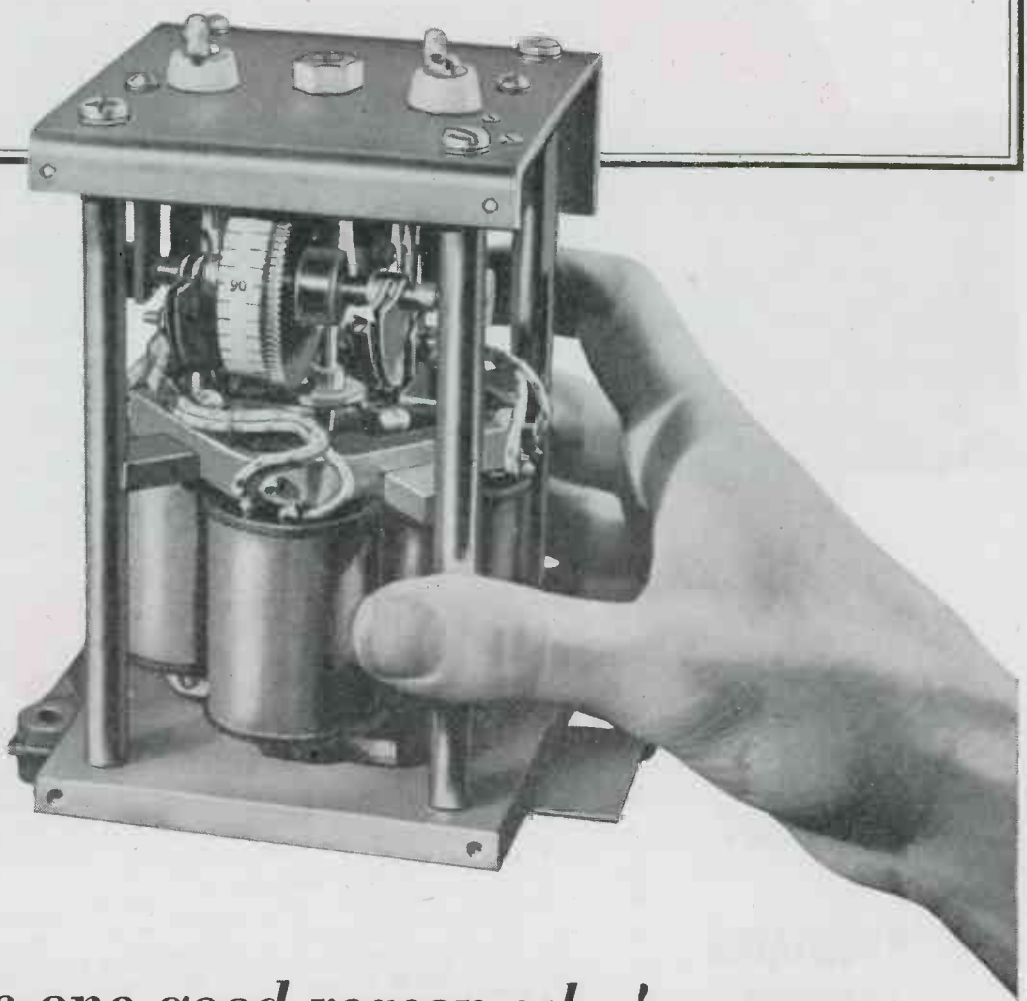
Besides three crystal controlled transmitter frequencies and two-band reception, the LY-1 provides interphone for two or more stations. For compactness and easy installation only the r-f components are built in with the transmitter-receiver; audio and intermediate frequency amplifiers being housed with the power supply which can be remotely located using only one interconnecting cable. For complete details write Pacific Division, Bendix Aviation Corporation, North Hollywood, California. Sales Engineering offices, New York and St. Louis.

Pacific Division
BENDIX AVIATION CORPORATION
NORTH HOLLYWOOD, CALIFORNIA

In FM Broadcasting

Western Electric

equipment leads the way



FM
Synchronized
Western Electric

...and here's one good reason why!

It's the Western Electric Synchronizer—announced in 1940 as a real contribution to FM—now proved outstandingly successful in years of operation.

In Western Electric Synchronized FM Transmitters, the mean carrier frequency is maintained continuously and precisely by a single low temperature coefficient crystal.

The Synchronizer compensates *immediately and automatically* for a change in the mean frequency of the modulated oscillator arising from any cause. It is uncannily accurate in keeping stations on frequency.

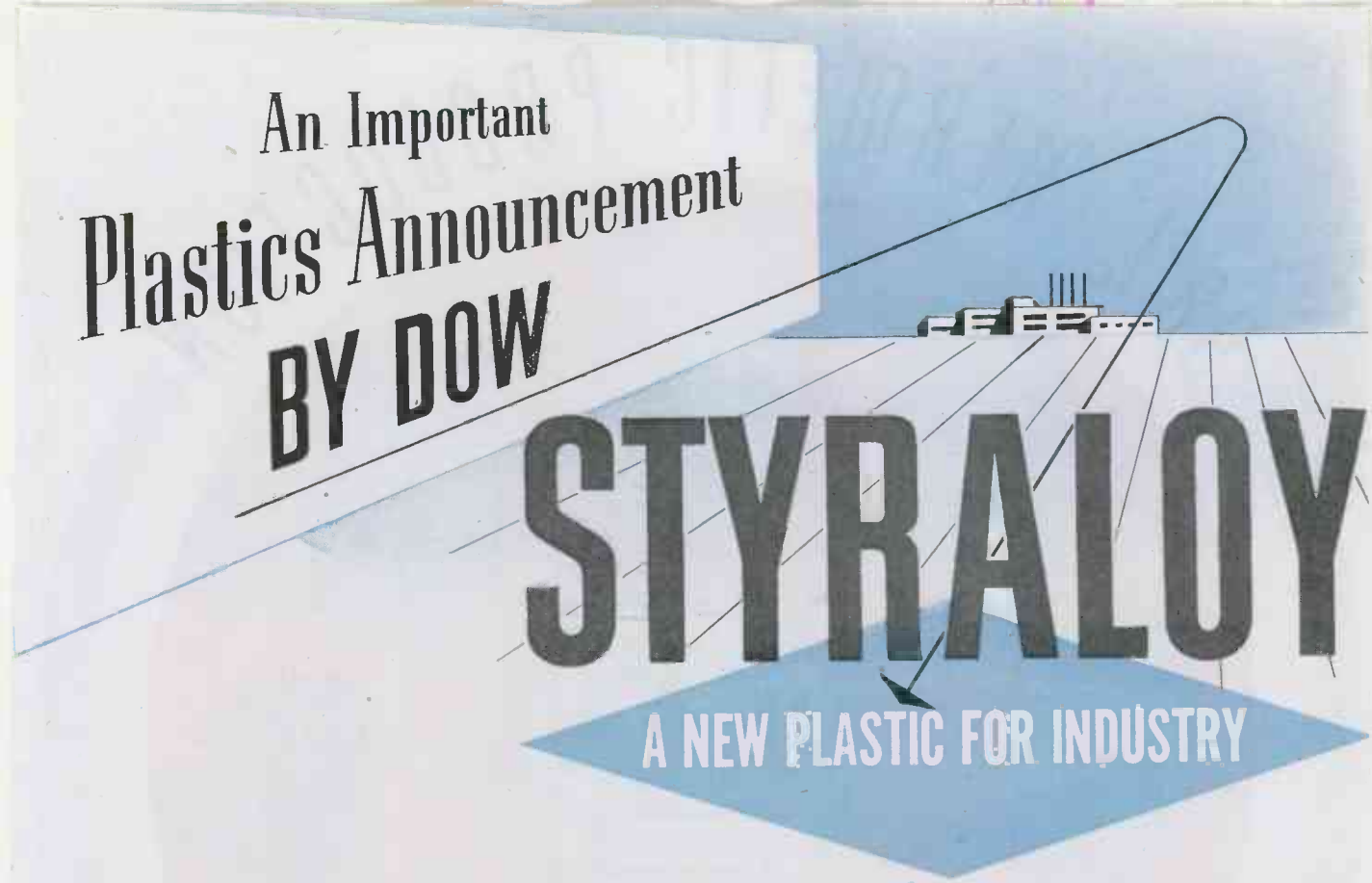
Developed by Bell Telephone Laboratories, the Synchronizer is a good example of the advanced design—and the leadership—you can count on in all equipment manufactured by Western Electric.

Western Electric

Distributed by GraybaR ELECTRIC COMPANY

Buy all the War Bonds you can...and keep all you buy!

An Important Plastics Announcement BY DOW



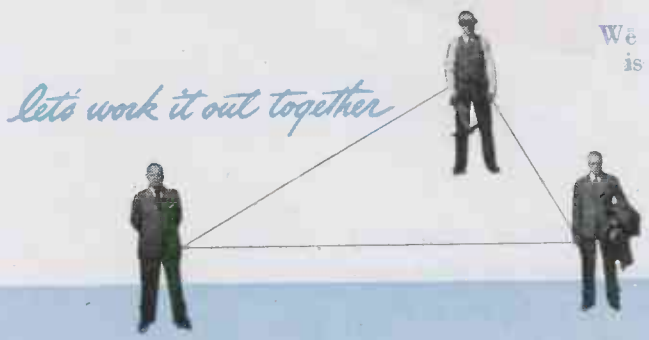
STYRALOY

A NEW PLASTIC FOR INDUSTRY

Highly significant among countless new materials developed for war requirements is Styraloy—trade-mark name for a remarkable group of plastics possessing properties intermediate between rubber-like materials and rigid thermoplastics.

"Working it out together" with the Armed Forces, Dow developed the first of this impressive new line——Styraloy 22—to provide a one-piece cable sheathing with a low power loss at high frequencies and possessing great durability and flexibility. These unique qualities—combined with others presented below in capsule form—point to its use in a broad range of products. As a result, unlike many war-born materials, Styraloy anticipates a peacetime career of great importance.

Now that Styraloy is available for commercial purposes, molders and manufacturers or designers will find Dow equally willing to cooperate with them in developing to the fullest extent the numerous applications indicated by the impressive list of Styraloy's properties. "Let's work it out together."



We at Dow know from experience that success in plastics is not a one-man nor even a one-industry job. It calls for the combined skill and cooperation of manufacturer or designer plus fabricator plus raw materials producer. Working together, this team saves time and money and puts plastics to work successfully. Call us—we'll do our part.

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ELECTRONIC INDUSTRIES
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Never in all history has a group of trained engineering specialists been handed such a huge responsibility as has been imposed on radio men in the last two or three years.

Think of this: In 1944 over five billion dollars' worth of radio equipment and service—five thousand million dollars—was produced, based on the technical discoveries and designs created by the members of the IRE and their fellow engineers. For each of the voting members of the IRE, this was nearly one and one-half million dollars per man, in 1944. Even more will be produced in 1945. And all of this five or six billion dollars of actual wealth per year has been created literally "out of thin air" by radio engineers and radio inventors.

When Radio Engineer Is Boss

Radio engineers must not be satisfied, we insist, to be merely employes and staff aids in the huge industries they have created. Radio engineers should themselves take business and industrial leadership. It is time for the radio engineer to be the "big boss" of his own concern and shape its general policies. Instead of avoiding and evading business responsibility in order to keep close to the design room and slide-rule, radio engineers should prepare to reach out, themselves, for the top management position—for independent proprietorships—for public service in fitting radio into broader usefulness to humanity.

All too often, some skillful lawyer, clever salesman or quick-minded accountant is chosen to fill the top place in a radio organization—a post which would have been far better served by a trained radio-minded man having the broad grasp necessary to relate our radio art to general business problems.

Perfectionists All!

Radio engineers are "perfectionists." And so they like to keep close to their technical work, improving detail parts into the highest possible efficiency.

But even from this aspect of perfectionism alone, radio men will admit that fullest perfection in radio cannot come unless the radio engineer has the greatest freedom in which to work. And this means that there must be radio engineers at the top who can give sympathetic encouragement to radio engineers throughout the organization.

Let Radio Man Collect, Too

That is why we look forward to the day when radio-electronic industries are officered by radio men—from top executive posts on down to the design rooms and production departments. This is absolutely necessary, for the good of the radio industries and the public they serve. Let radio men accept and even seek out these responsibilities of management and direction. And let us see that the radio man collects in full, for himself and his family, his share of the wealth he is producing!

Echo-Technique in Navigation

Echo-technique detection devices already are finding important navigation uses in thick foggy weather. Commanders today tell of the irreplaceable usefulness of these devices for locating buoys, lighthouses, and lightships, as well as for discovering oncoming vessels in a pea-soup fog. Even the impeccable gyro compass has been checked (and on occasion found wanting) by the ever-faithful radio echo, which in specific instances revealed that the gyro was erroneously steering the ship in a big circle! Through radio-echo-technique, the sea will be safer, postwar.

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In addition to regular contributors' rates paid to authors of technical articles appearing in these pages, the publishers offer extra Awards totaling $1,000 for the best three articles published during the remainder of 1945, as follows: 1st Award, $600; 2nd, $300; 3rd, $100. Selections will be made by a jury of competent engineers to be named later. Awards will be announced by January 31, 1946. **Further details on page 95.**

Authors are invited to submit articles in the usual way. All articles published in Electronic Industries during the remainder of 1945 will automatically be entered for these Caldwell-Clements $1,000 Awards. Address Editors, Electronic Industries, 480 Lexington Avenue, New York 17, N. Y.

DC SATURABLE REACTORS

By HARRY HOLUBOW
Electronic Engineering Co., and Holubow & Rehfeldt, Consulting Engineers, Chicago

Design factors covering core structure materials used in chokes engineered for optimum performance

● Although dc saturable reactors have been used as control devices for a number of years, their application did not become very extensive; the rapid development of the electron tube, and the limitation of magnetic materials are the main reasons for their retarded growth. Because of the improvements in existing silicon steels, and the development of new magnetic alloys within the past ten years, it became possible to obtain better results with saturable reactors, and therefore their use as control devices has been increasing. This is especially true if the amount of power to be controlled is not large.

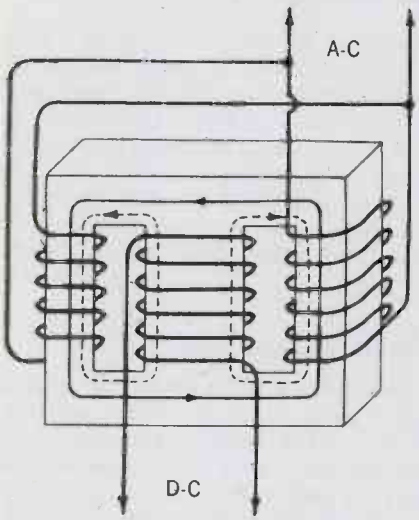


Fig. 1—Three-legged saturable reactor

Dc saturable reactors are often compared with the electron tube as a control device. Their similarities, however, are small. In the case of the electron tube, an instantaneous voltage applied to the control grid changes the plate resistance, and we are therefore able either to apply a direct voltage to the grid of the tube and get an increased continuous current through the plate, or we may apply a varying voltage to the grid and obtain a plate current that varies in the same manner as the grid voltage. In this case, the electron tube becomes a linear amplifier. In the saturable reactor a direct voltage applied to a control winding changes the ac impedance of another winding. Because of the characteristics of the magnetic material the change of the ac impedance is, in general, not proportional to the voltage applied to the control winding.

Core structure

The most commonly used core structure in the manufacture of saturable reactors is the shell type iron, or as it is usually known, the three-legged reactor, as shown in Fig. 1. The dc winding is placed on the center leg, and the ac windings are placed on the two outside legs. The ac windings may be connected either in parallel or in series. The dc flux shown on Fig. 1 in dotted line is present in all three legs while the ac flux shown in a solid line is present in the outside path of the core. In calculating the ac flux densities, inductance, and core losses, the center leg does not enter into consideration.

A number of different types of structures (1, 3), some requiring as many as five or six coils, have been used, but these have a curiosity interest only. Occasionally, however, it is necessary to use a construction differing from the three-legged reactors. This is true in instances where either an L-shaped lamination only is available, or when it is desired to use the several varieties of wound cores or grain-oriented steel.

In such cases a structure as shown in Fig. 2 may be used. Although the mechanical construction resembles that of the three-legged core, electrically it is different and inferior. As shown by the dotted line, the dc flux path in this type is the same as that of the core shown in Fig. 1. The ac flux path, however, is different from that of the shell type iron shown in Fig. 1. The whole core in Fig. 2 is subjected to the ac flux, and the iron losses are consequently larger. The ac windings are placed on the outside legs of the core assembly and may be connected either in series or parallel; electrically, however, they consist of two separate reactors connected either series or parallel. This results in a lower inductance for the same core size.

For example, if the two ac coils consisting of N-turns each in Fig. 1 are connected in series, the inductance in henries is

$$L_1 = \frac{0.4\pi N^2 \mu_a A}{10^8 l_1}$$

where μ_a is the apparent ac permeability, A is the cross-sectional area of the outside leg and l_1 is the effective length of the ac flux path. The inductance in henries of the structure in Fig. 2 is

$$L_2 = \frac{0.2\pi N^2 \mu_a A}{10^8 l_2}$$

where l_2 is the effective length of ac flux path of each core. If N, μ_a and A are the same in each case, the ratio $L_2/L_1 = l_1/2l_2$. For the average lamination size $l_2 = 0.75l_1$ and $L_2/L_1 = 0.67$. The inductance of the two separate cores in Fig. 2 is then only 67 per cent that of the core in Fig. 1. The iron losses,

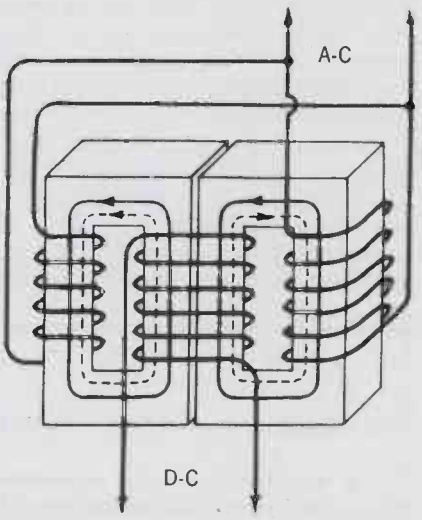


Fig. 2—Three-legged saturable reactor having two cores

however, will be about 50 per cent higher because of the larger amount of iron exposed to the ac flux.

FOR CONTROL PURPOSES

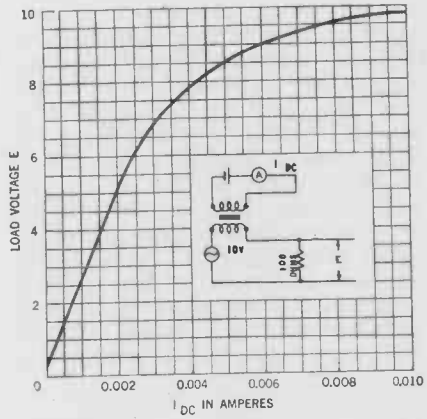


Fig. 3—Saturable reactor in series with R_L

In the construction of a saturable reactor core it is important to have as good a magnetic circuit as possible. Even a small air gap in the magnetic circuit will reduce the ac permeability greatly and waste a great deal of polarizing current, as may be seen from the following example: Let us assume that we have a magnetic circuit consisting of a magnetic path of 10 in. in the material and 0.001-in. air gap. The effective permeability may be obtained from the relation

$$\mu_e = \frac{\mu_a}{1 + a\mu_a/\ell}$$

where μ_e is the effective permeability of the complete circuit, neglecting the air gap, μ_a is the apparent permeability of the magnetic material, a is the length of air gap, l is the length of the magnetic circuit.

For such a magnetic circuit if the apparent permeability of the material varies from 20,000 to 200 as the polarizing current is applied, the actual variation of the effective permeability will be from 6,700 to 196. Thus, not only will the initial inductance be reduced, but the ratio of inductance change also will be reduced.

Effect of Air Gap

The effect of an air gap on the dc saturation may be shown as follows: Let us assume that it is desired to establish a polarizing flux density of 5,000 in the 10 in. core. If the dc permeability is 20,000, a polarizing magnetomotive force of $\frac{5{,}000}{20{,}000} = 0.25$ Gilbert/cm or 0.5 ampere-turn per inch will be required. For 10 in. a total of 5 ampere-turns will be needed. The ampere-turns to establish the same polarizing flux in the gap may be calculated from the following: $B = 0.4\pi NI/a$ where a is the length of the air gap. For B = 5,000 and a = 0.001 in. or 0.00254 cm., NI = 10. From this it may be seen that only about 33 per cent of the direct current is utilized to establish the polarizing flux in the core. A permeability of 20,000 and a 10 in. length of magnetic path was used in this illustration; as the length of the path becomes greater or if the permeabilities are lower, the effect of the gap will become smaller.

Reactor design

A dc saturable reactor to give the optimum performance in a given circuit should be properly designed for the application. In applications involving considerable amounts of power, the reactor is

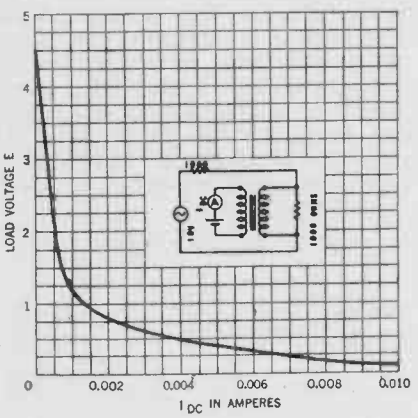


Fig. 4—Saturable reactor in shunt with R_L

usually placed in series with the load resistance, and the generator resistance is usually low. The load may be a pure resistance such as lamps. The control winding may operate either from zero dc or from a given low value of dc to a larger value to obtain the necessary saturation. The initial value of inductance is to be of a certain minimum, and the inductance at saturation is not to exceed a given maximum.

To illustrate, let us assume that we have a constant resistance of 50 ohms, and it is desired to have the voltage across the resistance 20 volts maximum without saturation, and 100 volts minimum with saturation from an initial line voltage of 115. Inasmuch as the load is a pure resistance, the voltage drop across the reactor $E_R = (115^2 - 20^2)^{1/2} = 113$ v when the voltage across the resistor is 20 v and $E_R = (115^2 - 100^2)^{1/2} = 56.5$ v at 100 v across the resistor. The alternating currents at these two

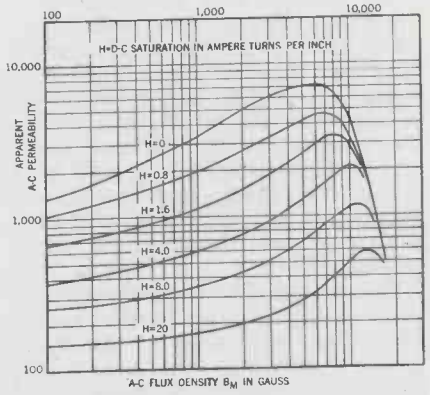


Fig. 5—Permeability curve for silicon steel with superimposed dc excitation

instances are 0.4 amperes and 5 amperes respectively. The values of the saturable reactor are then calculated from the voltage and currents in the reactor. At 113 v and 0.4 ampere the impedance of the reactor $\frac{113}{0.4} = 282$ ohms, representing an inductance of 0.75 henries at 60 cps. At 56.5 v and 2 amperes the impedance is $\frac{56.5}{2.0} =$ 28.25 ohms for an inductance of 0.075 henries.

The problem then consists of designing a reactor with a minimum inductance of 0.75 henries at either zero or low value of dc saturation, and a maximum inductance of 0.075 henries at full saturation. From the curves of apparent ac permeabilities (Fig. 5 to Fig. 8), the needed core size is determined and the design is carried out as in an ordinary reactor taking into consideration the ac flux densities and core losses. If the initial ac flux density at zero dc is selected at 10 kilogauss, at the maximum dc, it will drop to about 5 kilogauss. To obtain a 10 to 1 change in permeability for silicon steel core, a dc variation of magnetomotion force of from 0 to about 12 ampere-turns per inch will be required. (See Fig. 5.)

Low power reactors

The development of nickel-iron alloys having high permeabilities and low saturation values made it possible to design and build saturable reactors having a wide range of inductance from zero dc to comparatively low valve of dc excitation. The low saturation value of these alloys, however, limits their application to conditions where the amount of power handled is comparatively small; for applications where the dc power to be handled

is large, saturable reactors using nickel-iron alloys would be too large and expensive for economic use.

The growth and development of the small electron tube and phototubes capable of generating larger values of direct voltages played an important part in the development of small saturable reactors where the variation of inductance is larger than that obtainable with the silicon steels, and the use of nickel-iron alloys in saturable reactors is becoming more widespread.

The design of saturable reactors for small power applications does not differ from that of the large power application; in either case the reactor has to be designed to fit a given load application, whether it is expressed in terms of watts or load resistance. When the load to be handled is comparatively large, the generator impedance usually is very small and the reactor is generally placed in series with the load to get the necessary control; when the load is small and the generator resistance may be considerable, the saturable reactor may be placed either in series or parallel with the load as shown in Fig. 3 and Fig. 4. The voltage across the load resistance R_L in the series circuit is expressed as follows:

$$E_L = \frac{E_g R_L}{[(R_g + R_L)^2 + X^2]^{\frac{1}{2}}}$$

Where E_g = generator voltage
E_L = load voltage
R_g = generator resistance
R_L = load resistance
X = impedance of the reactor.

In the parallel circuit the voltage across the load resistance is as follows:

$$E_L = \frac{E_g R_L}{R_g + R_L} \cdot \frac{X}{[R_g^2 R_L^2/(R_g + R_L)^2 + X^2]^{\frac{1}{2}}}$$

The value of the reactor impedance for the desired load voltage may be obtained from the above equations and by means of the ac permeability curves the design may be carried out as in an ordinary reactor.

AC permeability curves

Graphical data on ac permeability curves are to be taken with a grain of salt. Besides the normal variation in performance which may be 10 per cent or even higher for supposedly the same grade of steel, there also are present the variations because of the different methods of measurement. The normal permeability of a magnetic material is defined as B/H, where

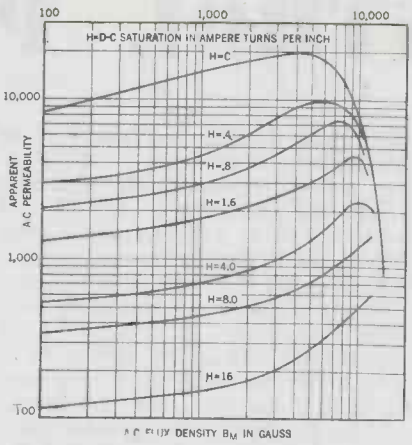


Fig. 6—Permeability curves for 45%-50% nickel iron alloy with superimposed dc excitation

H is the instantaneous magnetizing force and B is the resultant flux density. In ac measurements, B is a measurement of an emf and H is a measurement of current. If both the emf and the current varied sinusoidally, the expression B/H would give a true indication of permeability. However, the magnetizing current is not sinusoidal and may contain a very large component of third and fifth harmonic, and therefore the permeability is variable throughout the entire cycle. The data presented in these

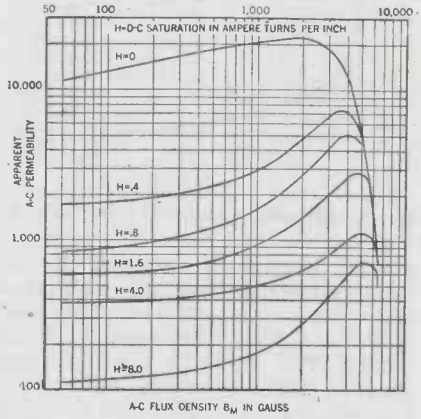


Fig. 7—Permeability curves for 78% nickel iron alloy with superimposed dc excitation

graphs is obtained from RMS values of emf and current, the voltage being maintained a sine wave and the values are therefore apparent permeabilities RMS ac.

As it has been seen from the previous discussion the apparent permeabilities and dc saturation will depend to a great extent upon the continuity of the magnetic circuit. For measurement purposes the ring sample is the ideal shape, but unfortunately samples of this shape are different and require special machines for winding. Besides, such shapes generally are not used in actual construction. The interlaced magnetic circuit usually presents an air gap equivalent to about 0.0001 in. The neglect of such an air gap will not seriously effect the calculated performance, unless the total length of the magnetic circuit is very small or the permeabilities are very high. A magnetic circuit of about 8 in. to 10 in. was used to obtain the data given in this paper. Unless the magnetic circuit is less than about 3 in., the result will be fairly accurate within the normal performance variation even for the high permeability nickel-iron alloys.

The most important factor affecting the accuracy of the calculation is the distorted wave shape of the magnetizing current. The dc saturable reactor is generally used

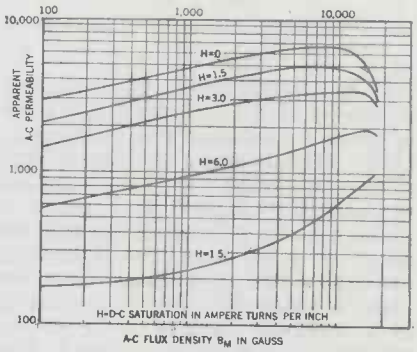


Fig. 8—Permeability curves for grain oriented steel

in series with a load which may be either a pure resistance or resistance and reactance. When a sinusoidal emf is applied to the system the drops across the load and across the saturable reactor are distorted and therefore the apparent ac permeability cannot be calculated with any degree of precision.

Calculating core loss

The departure is not bad at zero or at low values of dc excitation; first, because the harmonic content in the exciting current is not large, and secondly because the load impedance is comparatively much smaller than the impedance of the saturable reactor. At high values of dc excitation the harmonic content is very large and also the impedance of the load is greater than the impedance of the reactor, therefore the error in calculating the performance of a saturable reactor from the permeability curves at a high polarizing current is unusual.

The calculation of core losses from graphs is also subject to the same errors as is that of inductance. These calculations, however, are not always of much importance. In the larger reactors that are to handle a considerable amount of

power, only the maximum core loss is of interest. Subject to normal variations in iron data, curves in Figs. 9, 10, 11 will give fairly accurate results.

The most commonly used materials in the design of saturable reactors are the various grades of silicon. The maximum permeability of silicon steel occurs at about 5,000-6,000 gauss and it varies from about a permeability of 8,000 in the higher grades to about 2,000-3,000 in the lower grades. At high values of dc excitation the permeability is nearly the same for all the silicon grades.

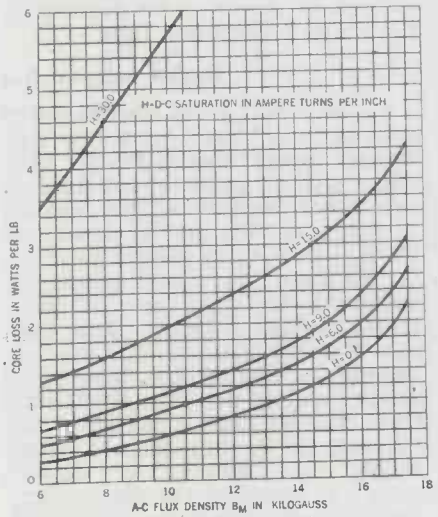
Silicon steels

The silicon steels are superior to the nickel-iron alloys in the respects that they saturate at much higher flux densities, and thus for the same volume of magnetic material they may be operated at a much higher power level. If the design is so made that the ac flux density is at the point of maximum permeability, an inductance change of about 20 to 1 easily may be obtained without using too much dc power. Such design, however, is not always practicable; the point of maximum permeability which occurs at about 6,000 gauss is nearly half the ac flux density commonly used in the design of small and medium transformers.

An inductance change of approximately 10 to 1 can be obtained using ac flux densities of 10,000-11,000 gauss. Such changes are usually satisfactory in most small or medium power applications.

The core loss of silicon steel increases considerably with the application of a polarizing current; fortunately in almost all applications involving dc saturable reactors, as the dc saturation increases, the ac saturation decreases.

Fig. 9—Core loss of .014 in. silicon steel with dc saturation



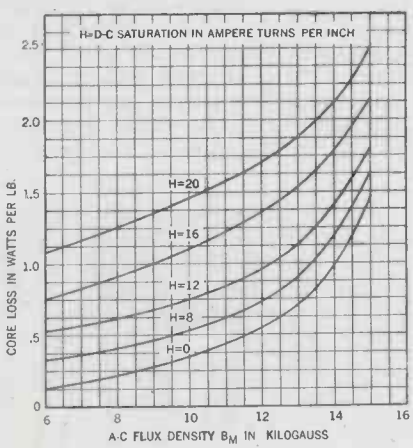
In the example previously shown, if at zero dc, the ac flux density was 10,000 gauss, then with full dc excitation, the flux density would be only 5,000 and from the graph on Fig. 9 the core loss per pound would vary from 0.6 to about 1.2 watts.

Of the nickel-iron alloys the 45-50 per cent alloy, commercially known as Hypernic or Electric metal, and the 78 per cent known as Permalloy or Mumetal are commonly used. The 45-50 per cent alloy has a higher saturation value than the Mumetal and therefore may be operated for higher power levels. The maximum permeability of the Electric metal occurs at about 5,000 gauss, and occurs as high as 20,000 for medium size cores. Although silicon steel may be operated at higher densities than Electric metal, the ac range in saturable reactors is about the same. Where the price of the product is not very important, a much greater range of inductance change and lower core losses may be obtained with this alloy.

Wound vs. cut cores

Permalloy or Mumetal definitely belong to the low power level group. The maximum permeability is 20,000 and it occurs at about 2,000 gauss. The material saturates at

Fig. 10—Core loss of .020 electric metal with changes in dc saturation level



6,500 gauss and therefore cannot be used at higher ac flux density. For applications where a very great change in inductance for a small change in dc excitation is required, the 78.0 per cent nickel-iron alloy is the best available.

Oriented, wound core silicon material is used in the construction of dc saturable reactors, but because of the difficulty in manufacturing, the use is limited. If a cut core is used, the inherent high permeability of oriented steel cannot be utilized because of air gap

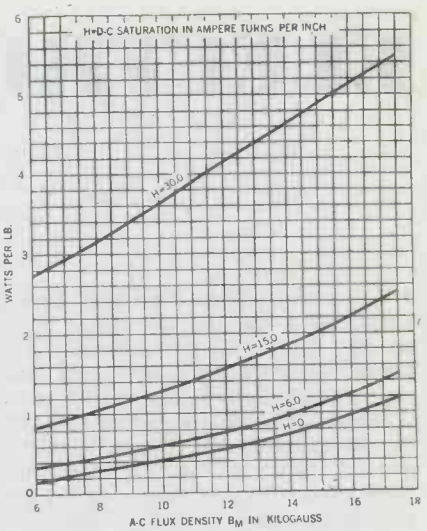


Fig. 11—Core loss of .013 in. grain oriented steel with dc saturation level changes

present, especially in the small sizes. When the size becomes large so that the effect of the gap is minimized, the oriented steel has a definite advantage over the silicon because of the lower core losses. The data shown in Figs. 8 and 11 have been obtained using a cut core having a length of the magnetic path of about 8 in.

The data shown in this article have been obtained at 60 cycles; at higher frequencies, the range of permeability variations decreases as the frequency increases. Even at 400 cycles the unsaturated permeabilities of the nickel-iron alloys become considerably smaller than at 60 cycles as shown in Fig. 12. At frequencies greater than 500 cps the permeability, even of silicon steel, begins to decrease considerably and therefore the use of saturable reactors at the higher frequencies is limited.

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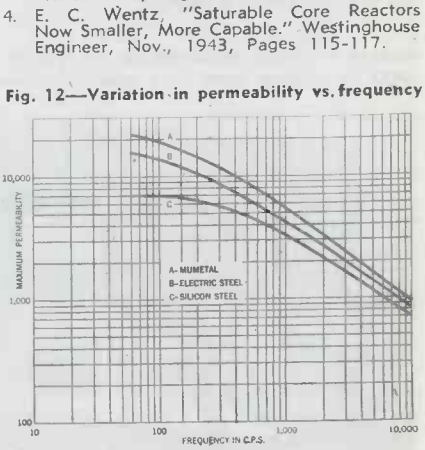
Fig. 12—Variation in permeability vs. frequency



ELECTRONIC TACHOMETER

Continuous record of instantaneous speed at high rotation eliminates fractional or multiple errors

• An arrangement that will give a continuous record of instaneous speed, that is not limited to comparison methods involving discreet steps (as is usual with a stroboscope) has an important role in the development of many industrial devices. A direct reading electronic tachometer recently developed avoids possible errors of multiple and fractional magnitudes that sometimes occur with a stroboscope. In this system a steady beam of light is interrupted by the movements of a reflecting surface on the rotating mechanism and picked up by a photocell. The resulting pulsating current is amplified and applied to a special visual frequency meter.

It provides a continuous record of the instantaneous speed, which can, if necessary, be transformed into a permanent record by connecting a recording milliammeter to the output of the instrument. It is capable of measuring very high speeds of rotating parts having small energy or which for other reasons cannot be mechanically connected to any measuring device.

The Model 505A Hewlett-Packard tachometer consists of two sections, a tachometer head assembly, and an electronic frequency meter. The tachometer head assembly contains a photocell pickup in combination with a light source. The light source is used to illuminate the moving part to be measured, which must be prepared by suitable means to have alternate reflecting and absorbing surfaces. The interrupted light reflected is picked up by the photocell, and the electrical impulses generated thereby are transmitted to the frequency meter.

In the pickup a 924 photocell is mounted in a shielding tube of the same size as the light source. It also is provided with a condensing lens to concentrate the available light on the moving part. To prevent restricting its use, and permitting its application to the study of a wide range of mechanisms, a cable is provided for connecting these units to the frequency meter, which allows the lamp and photocell to operate at any angle.

Operating principle

As shown in the photograph, the light source is mounted in a shielded tube. It is provided with a condensing lens to concentrate the light on the part being measured, adequate for most applications where good reflecting surfaces are available, especially if the light source and the pickup should be mounted within about six inches of the part being measured. A 15-cp 6-volt automotive bulb provides the light source.

This frequency meter operates by generating a square wave from the signal voltage, and applying it to a discriminating circuit, which produces a fixed current pulse at each half cycle. The pulses are rectified, and their average value indicated by a dc milliammeter. The reading of the meter is then proportional to the number of pulses per second, or the signal frequency.

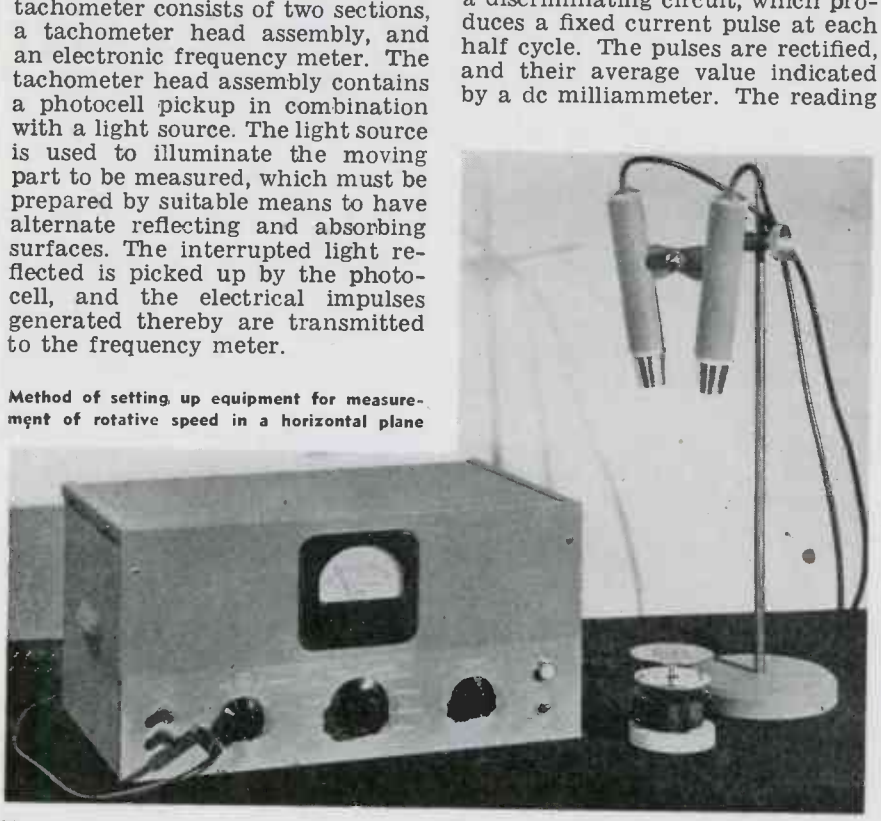
As will be noted in the circuit the photocell amplifier consists of three resistance-coupled stages, using 6SJ7 tubes. Voltage to drive the "switching" tubes is taken from the plates of the second and third stages. For normal signal voltages, overloading begins in either the first or second stage, hence the voltage applied to the switching tubes is nearly balanced. Any unbalance is unimportant because each switching tube is driven to cut off alternate half-cycles.

To produce the signal conversion to square waves, two 6V6 tubes, connected as triodes, are used to switch a constant current to alternate load resistors. The action is made very rapid by applying a large voltage to the grids of the switching tubes. This voltage is normally a square wave because of overloading in the voltage amplifier.

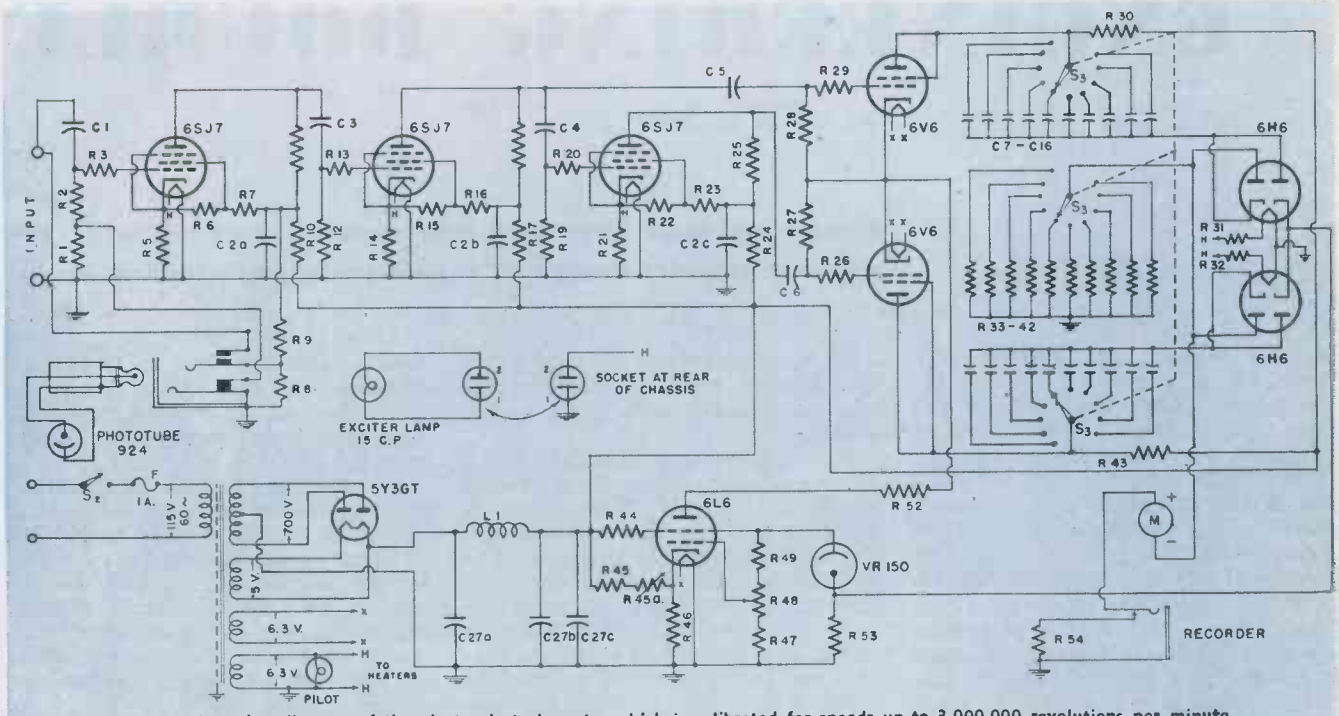
A dc current regulator is used to make the current applied to the load resistors independent of the characteristics of the switching tubes and the voltage applied to them. The regulator consists of a 6L6G tube, whose grid and screen grid voltages are obtained from a gas type voltage regulator (VR-150). A large amount of degeneration is used in the cathode, making the plate current practically independent of plate or filament voltages, or tube constants. The imperfect regulation of the VR tube is compensated for by feeding a small amount of current from the high voltage dc source to the cathode of the current regulator tube.

Pulse conversion

At each half cycle the regulated current is switched from one load resistor to the other (R30 and R43), and a current pulse is sent through the meter because of the change in charge on the pair of capacitors C7 and C26. Care should be taken to see that the signal voltage is sufficient—0.5 volts rms or more. If the signal voltage is less than the required amount, the reading depends on the voltage. The signal voltage should not exceed 200 volts rms. The design is such that the current pulse decreases to practically zero before the current source is switched (at the particular full scale frequency). The cur-



Method of setting up equipment for measurement of rotative speed in a horizontal plane



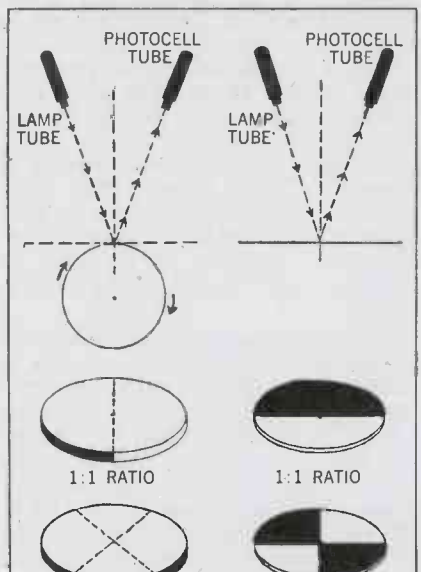
Schematic wiring diagram of the electronic tachometer which is calibrated for speeds up to 3,000,000 revolutions per minute

rent pulses are rectified by a diode bridge rectifier, and their average value read by a dc milliammeter. The reading is proportional to the number of pulses per second, hence proportional to the signal frequency. The value of each pulse depends upon the regulated current, and the capacitors and resistors in the discriminating circuit. Provision is made for checking the regulated current on the dc meter, so that the calibration is independent of tube constants and voltages, and dependent only upon the RC values of the discriminating circuit. The range switch selects the proper pair of capacitors for each frequency range, the load resistors being kept constant for all the ranges.

Zero emission current in the diode rectifiers is suppressed by applying a small negative voltage to the plates of the diodes. This voltage is obtained from the drop across resistor R53 in series with the VR tube. The bias voltage thus varies with line voltage, and is adjusted to compensate for changes in the emission velocity of the diodes over the line voltage range of 105 to 125 volts.

With measurements being made on a direct ratio (one light segment and one dark segment per revolution), the speed ranges will fall into ten divisions, having convenient and overlapping steps ranging from 3,000 to 3 million rpm full scale values.

Principle of operation showing alternative methods of preparing rotating part to present successive absorbing and reflecting surfaces



Measurable speeds

The lowest speed which can be measured conveniently on a one-to-one basis is about 600 rpm (10 rps) on range 1. However, slower speeds may be measured by blanking off the reflecting surface into a larger number of segments. If, for example, two reflecting and two absorbing segments are provided on this reflecting surface, the speed which can be measured is then reduced to 300 rpm (5 rps). Additional segments provided on the rotating part will allow much lower speeds to be measured.

While the instrument is calibrated up to 3,000,000 rpm, the highest speed it is practical to measure will depend upon several factors. First, the response of the 924 phototube, which is down approximately 3 db at 600,000 rpm. Second, the shunting capacities of the interconnecting cable, sockets, tubes, etc., of the photocell head will cut down the voltage applied to the frequency meter input at these higher speeds, so that a much more intense light source will be required for proper operation.

At 600,000 rpm the shunting effect of these capacities will cause the generated voltage to be approximately 16 db less than at the lower frequencies—making a total loss of 19 db, thus requiring the maximum light intensity to be nearly ten times as great as for the lower speeds. And third, the relative reflecting and absorbing abilities of the segments and the intensity of light shining on them will have a direct bearing on the amount of light reaching the phototube.

In order to obtain the proper interrupted light for this measurement, it is necessary that the rotating part have a light-reflecting surface, half of which can be blackened or otherwise treated so that the light beam is not reflected into the photocell during one part of each revolution.

There are several features incorporated in the instrument not shown in the basic diagram. One feature utilizes the fact that the

(*Continued on page* 208)

ENGINEERING DOUBLE

By JOHN D. REID, JR.
Manager of Research
The Crosley Corp., Cincinnati

Choice of high first and low second intermediate frequency permits design of set entirely push-button tuned

● This development started with the aim of providing a radio receiver in which the only tuning means was push-buttons, and in which the desired station frequency was punched out in a manner similar to the operation of a cash register. This tuning method was found feasible and practical by means of a double superheterodyne.

Fig. 1 shows in block form the basic circuit of a double superheterodyne which is tunable in steps of 10 kc from 500 to 1,590 kc. The first oscillator is switched in steps of 100 kc and simultaneously tunes the input in steps of 100 kc. The second oscillator is switched in steps of 10 kc and simultaneously tunes the input in steps of 10 kc. The first IF is made 100 kc wide and the second IF 10 kc wide.

The high frequency first IF enables excellent image response to be obtained and the low frequency second IF provides the required adjacent channel attenuation. The switches are shown in position for reception of the 850 kc channel. This simplified diagram shows rotary switches, but the actual receiver was constructed with push button switches.

Fig. 2 is a table illustrating the tuning of the range from 800 to 890 kc in steps of 10 kc, which is done by varying the frequency of the second oscillator in steps of 10 kc. It will be observed that the difference frequency is used for both conversions. The table is based on a first **IF** of approximately 4 mc and a second IF of 200 kc.

Fig. 3 is a table illustrating tuning from 500 to 1,500 kc in steps of 100 kc, which is done by varying the frequency of the first oscillator in steps of 100 kc.

Eliminating birdies

Interference points, or birdies, caused by beats between oscillator harmonics are minimized by the choice of the IF frequencies. It was found that by choosing a first IF frequency at least twice the highest frequency it was desired to receive, and a second **IF** frequency at least half the lowest frequency it is desired to receive, spurious responses were reduced to negligible amount.

An example of this form of interference can be seen by examining the table in Fig. 3. If the second **IF** were chosen as 250 kc then the second oscillator frequency would need to be 4,350 kc instead of 4,300 kc, which for reception of 500 kc would beat with the first oscillator at 4,600 kc, producing 250 kc the second **IF** frequency.

The image of the first oscillator, 8,600 to 9,700 kc, is greatly attenuated by the input circuit as it falls in the high frequency region. The direct IF response, which is very troublesome on a conventional superheterodyne, is also practically eliminated by the input selectivity which rejects 4 mc.

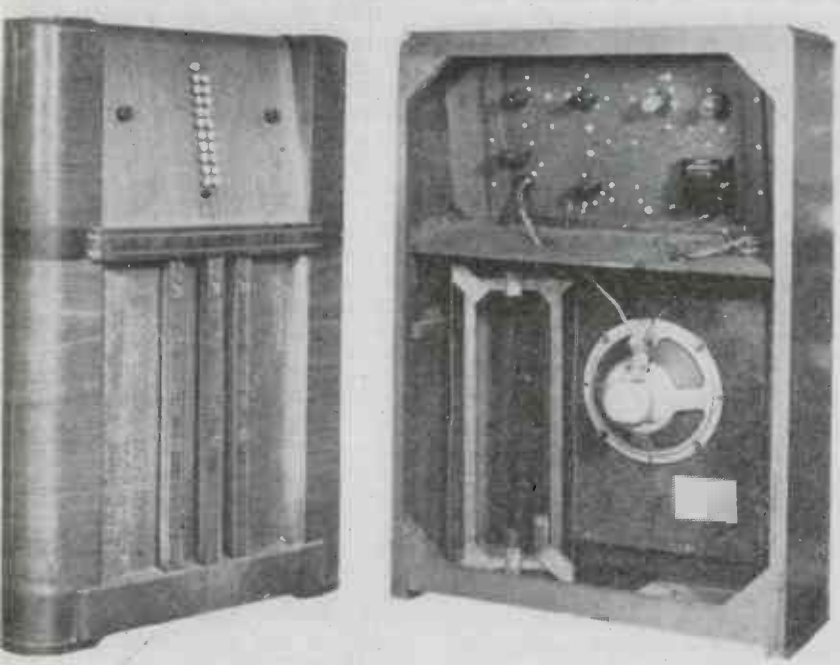
The image of the second oscillator is attenuated by the selectivity of both the first **IF** and the input circuit. This image ratio depends on the rejection of the first IF for frequencies 400 kc higher than resonance and the attenuation of the input circuit for frequencies 400 kc lower than the desired signal.

Fig. 4 shows the schematic diagram of the input tuning in simplified form, only three of the switch positions being shown. A low impedance loop was used due to its freedom from power line noise pickup. The 100 kc steps in tuning are obtained by varying the inductance, and the 10 kc steps in tuning result from a change in capacity.

The inductance values are chosen so as to be correct for the capacity across the circuit with the "50" switch closed; that is, the input circuit is exactly tuned for 550 kc, 650 kc, 750 kc, etc. The capacitor values are chosen so as to correctly tune over the range of 900 kc to 990 kc. This results in less than the desired change in input tuning with the "10's" steps for lower frequencies and more than the desired change for higher frequencies.

This mistuning is a maximum of approximately 15 kc for the low end of the band, 590 kc or 600 kc, and 25 kc for the high end of the band, 1,590 kc. This mistuning

Front view of the double superheterodyne receiver showing the decade tuning buttons, and a rear view showing the shallow chassis and cabinet, the loud speaker and the rotatable loop antenna



SUPERHET RECEIVERS

could be corrected by the use of combination inductance and capacity tuning for the "10's" steps, but the complication was thought unwarranted.

Physically, the variable inductance is made a large diameter solenoid with a series of taps brought out. The wire size and spacing between turns was made such that it was mechanically convenient to solder the tap wires where desired.

Fig. 5 shows the schematic diagram of the first oscillator in simplified form, only three of the eleven switch positions being shown. The 100 kc steps in oscillator tuning are ganged with the 100 kc steps in input tuning and obtained by shunting adjustable iron core inductances across the oscillator circuit. This is a Hartley type of oscillator with a relatively high shunt C and with the coil tap and grid condenser chosen for maximum stability.

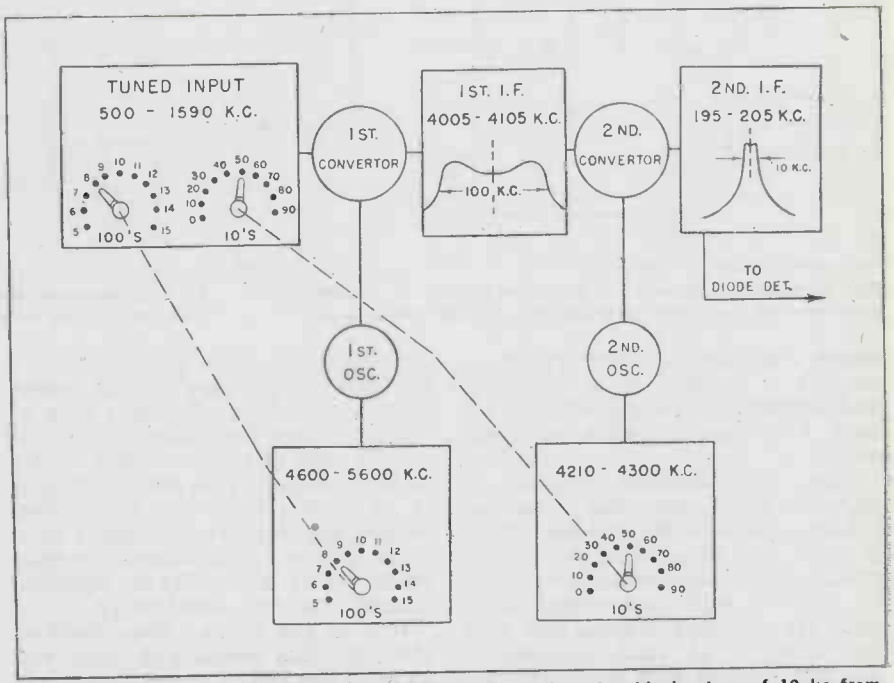


Fig. 1—Block diagram of the double superheterodyne receiver, tunable in steps of 10 kc from 500 to 1590 kc; first oscillator is tuned in steps of 100 kc, the second in steps of 10 kc

Frequency calibriation

The second oscillator, which is varied in steps of 10 kc, uses a similar circuit except that it was found convenient to make the variation consist of small series inductances. Fig. 6 shows the schematic diagram in simplified form, only three of the ten switch positions being shown. These series inductances take the physical form of self-supporting wires between switch points. The wiring is formed in the shape of a two-turn coil and line-up is accomplished by varying the spacing between the turns.

The frequency calibration of the receiver and its maintenance depend entirely upon the initial setting and stability of the two oscillators. Excellent stability is obtained with the circuits described. In addition, any changes in humidity which affect the two oscillator circuits equal amounts is largely balanced out. That is, if a large change in humidity should shift both oscillators .02 per cent, this would amount to a change of approximately 10 kc in the first oscillator and 8 kc in the second oscillator or a maximum net change in tuning of only 2 kc as represented by the difference between the shift in both oscillators.

The sample receiver, when checked after a period of three years, during which it was shunted from storeroom to storeroom, was found to be within 5 kc or better of calibration over the entire band.

A considerable line-up problem is entailed with the twenty-one oscillator adjustments which must be made accurately. This naturally suggests the elimination of this problem by the use of crystal controlled oscillators.

Fig. 7 shows an experimental circuit for crystal controlled oscillators. This circuit, which was suggested by A. A. Leonard of North American Philips Co., uses the

Fig. 2—Table illustrating tuning of the range from 800 to 890 kc in steps of 10 kc by varying frequency of second oscillator

ANT. TUNING (DESIRED SIGNAL)	1ST. OSC. TUNING (100'S BUTTONS) (NO. 8)	1ST. I.F. (100 KC BANDPASS) (4005 - 4105)	2ND. OSC. (10'S BUTTONS) (0 TO 9)	2ND I.F (10 KC BANDPASS) (195 - 205)
800	4900	4100	4300	200
810	4900	4090	4290	200
820	4900	4080	4280	200
830	4900	4070	4270	200
840	4900	4060	4260	200
850	4900	4050	4250	200
860	4900	4040	4240	200
870	4900	4030	4230	200
880	4900	4020	4220	200
890	4900	4010	4210	200

Fig. 3—Table illustrating tuning range from 500 to 1500 kc in steps of 100 kc by varying frequency of first oscillator

ANT. TUNING (DESIRED SIGNAL)	1ST OSC. TUNING ("100'S" BUTTONS) (5 TO 15)	1ST. I. F. (100 KC. BANDPASS) (4005 - 4105)	2ND OSC. TUNING ("10'S" BUTTONS) (NO. 0)	2ND. I. F. (10 KC. BANDPASS) (195 - 205)
500	4600	4100	4300	200
600	4700	4100	4300	200
700	4800	4100	4300	200
800	4900	4100	4300	200
900	5000	4100	4300	200
1000	5100	4100	4300	200
1100	5200	4100	4300	200
1200	5300	4100	4300	200
1300	5400	4100	4300	200
1400	5500	4100	4300	200
1500	5600	4100	4300	200

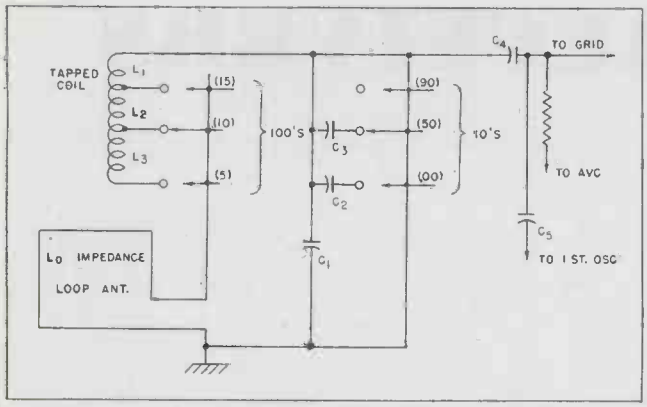


Fig. 4—Schematic diagram of the input tuning in simplified form, only three of the switch (push button) positions being shown

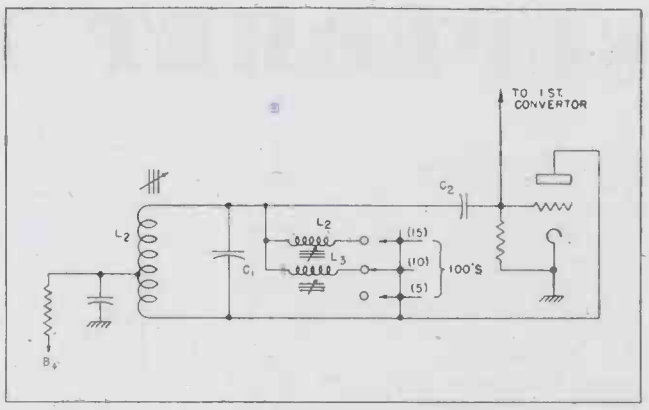


Fig. 5—Schematic diagram of the first oscillator in simplified form, only three of the switch (push button) positions being shown

series resonance of the crystal to control a Colpitts type oscillator, and requires no tuning adjustment over a frequency range as great as 2/1.

The experimental chassis is mounted in a conventional console cabinet. This model was completed prior to the war. The two rows of push buttons are arranged vertically, and the tone and volume controls are mounted at each side. The left row of 11 push buttons is marked 5 to 15 and tunes the receiver in 100 kc steps. The right row of 10 push buttons is marked 00 to 90 and tunes the receiver in steps of of 10 kc. Thus, a total of 10 times 11, or 110 channels, are available from the 21 buttons. The tuning range is therefore 500 to 1,590 kc.

Rotatable loop

To tune to the frequency of any broadcast station, two buttons must be pushed. For example: to tune to WLW, operating at 700 kc, the "7" button in the 100's row and the "00" button in the 10's row would be pushed. All that is necessary is to know the frequency of the station it is desired to receive.

The overall depth of the chassis behind the front panel is only 5½ in. and would allow a very shallow console to be used. It can be realized that many new styling possibilities are afforded by this type of design. The low impedance loop can be seen in the lower left corner of the console. This particular loop is of a size that can be rotated within the cabinet by means of a front control which allows an added factor of directivity in reducing shared channel interference.

One of the factors considered at the time this design was made was to keep the use of metal to a minimum. The chassis, therefore, was formed from a sheet of pressed composition board as shown in the close-up of the rear view.

The tapped antenna tuning coil and the shunt first oscillator coils are clearly visible on the transformer side of the switch in the front view of the chassis. The two small coils on the same side are the first and second oscillator coils. A type 6SN7-GT dual triode was used for each of the two oscillators.

The fixed mica condensers for the 10's step of input tuning and the small series coils for the second oscillator can be seen mounted directly on the switch. The two solenoids mounted alongside the switch constitute the first IF transformer, which resonates at approximately 4 mc. The two small universal wound coils form the second IF transformer, which is tuned to 200 kc. 6AC7's were used for both converter stages due to their high conversion conductance and low noise.

The first IF with circuit capacities of 35 $\mu\mu$f and 100 kc bandwidth at 90 per cent gives a conversion gain of 100. The second IF bandwidth of 10 kc at 50 per cent and circuit capacity of 200 $\mu\mu$f gives a conversion gain of 125. This affords a gain of over 10,000 from input to diode detector.

Shielding eliminated

The volume control is mounted on a bracket adjacent to the second IF transformer. The tone control and power switch is mounted on a bracket adjacent to the power transformer.

The remainder of the receiver is conventional in that a 6SQ7 is used as the diode detector, AVC and first audio stage. A 6V6-GT is used for the single-ended output stage and a 5Y3-GT serves as the high voltage rectifier.

The entire absence of shielding was made possible by the circuit used. The input and output of all high frequency stages are tuned to different frequencies, and there is no problem of regeneration. The choice of IF frequencies, as previ-

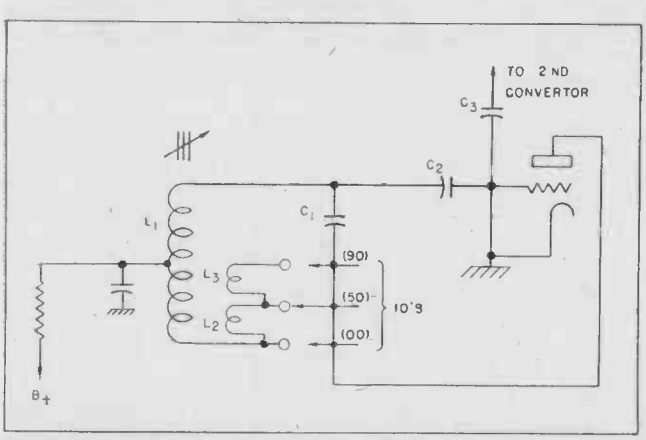


Fig. 6—Schematic diagram of the second oscillator in simplifled form, only three of the switch (push button) positions being shown

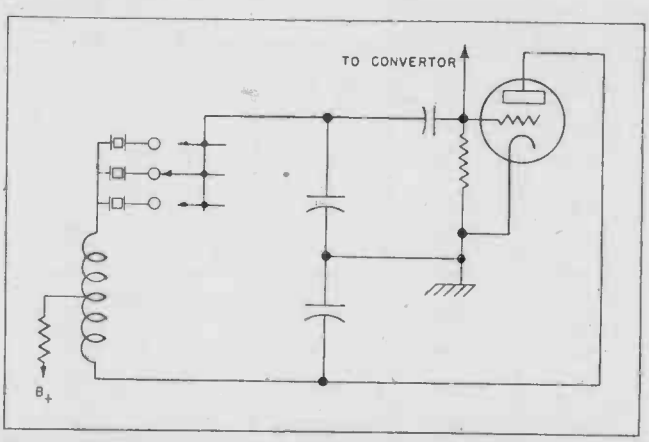


Fig. 7—Simplified schematic in which oscillator tuning is crystal controlled needing no adjustment over a range as much as 2 to 1

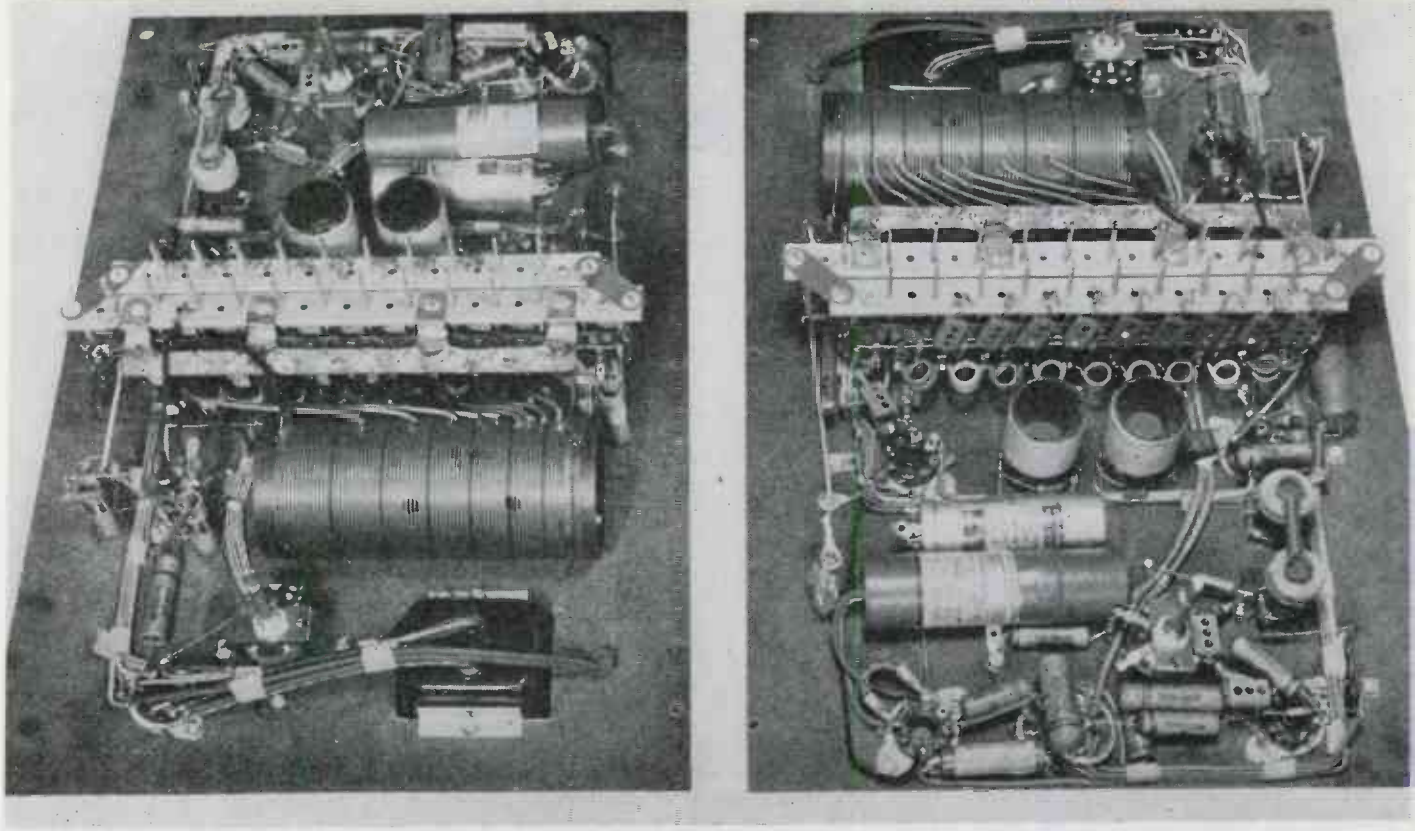


Fig. 8—Two views of the underside of the double superheterodyne chassis showing the tapped antenna coil, and shunt first oscillator coils. The fixed mica condensers for the 10's steps of the input tuning and the small series coils for the second oscillator mount directly on the switch

ously described, prevents spurious response due to beats between oscillators.

The overall performance of the receiver is excellent and equals that of a conventional superheterodyne with a tuned RF stage. In listening tests conducted in suburban Cincinnati locations, it was found possible during evening hours to receive interference-free signals on 40 of the 106 assigned channels.

NEW TYPE HIGH RATE DRY CELL

Portable Army and Navy radio equipment is currently using as replacement for dry cell power packs previously specified by the U.S. Signal Corps, an entirely new type of power pack built around a radically different type of dry cell which has been kept very much under wraps and about which no technical data have been permitted to become public. The new battery was invented by Samuel Ruben, a New Rochelle (N.Y.) inventor with substantial achievements to his credit in the field of electro-chemistry. It is being manufactured by the P. R. Mallory Co., with which Ruben has long been associated, in Indianapolis, and under license by the Ray-O-Vac Co., in Madison, Wis.; Magnavox Corp., and Sprague Electric Co. also have been licensed.

Greatly extended life

Compared with the battery which it replaces, the Mallory Tropical Dry Cell as now supplied to the armed forces provides four to six times the operating life, has greatly increased shelf life, its hermetically sealed individual cells will withstand high temperatures which seriously impair conventional batteries. The cells comprising the battery have what is known as a "flat discharge" characteristic, which maintains voltage practically constant up to the end of cell life, instead of dropping continually throughout operating life. Within its rated current range, the new cell provides the same ampere hours service life whether the battery is operated intermittently or continuously. Under normal conditions, no recovery time is required. At present entire production is going to the armed forces; commercial exploitation is indefinitely postponed.

AAF'S "HEROIC" TRANSMITTERS

Ten radio transmitters, transported over trackless wastes of China by truck and oxcart, and often operating from caves and temples, are credited with carrying the burden of American air force ground communications on that Asiatic battlefront from the arrival of the Flying Tigers in 1941 until the present. The outstanding performance of military radio equipment was revealed by Major Charles H. Whitaker, Communications Officer of General Chennault's 14th Air Force on his return to the United States after 25 months of service in the Orient.

The radio equipments described by Major Whitaker were manufactured by RCA Victor Co. of Canada, Ltd., for the Royal Canadian Air Force through whom it was made available to the Chungking Government.

The transmitters were obtained to serve the original AVG—or Flying Tigers—in 1941. They provided the eyes and ears of the American Volunteer Group until 1942 when the regular Army Air Force took over operations, and have continued to give reliable service ever since.

The sudden thrust of the Japanese at the Malay Peninsula and Burma changed original AVG plans with the result that the Flying Tigers became engaged in the retreat through Burma, successfully withdrawing their precious communications system with them into China.

"The transmitters were first unloaded at Rangoon in the Fall of 1941. The fighting started soon after their arrival," Major Whit-

(*Continued on page* 138)

IRE STAGES LARGEST

Lengthy program of engineering papers draws over 3000 registrations — FM allocation uppermost in interest

● Beyond question, the most interesting single feature of the Winter Technical Meeting staged by the Institute of Radio Engineers, January 24-27, in New York, was the highly controversial subject revolving about the frequency allocations proposed by the Federal Communications Commission and particularly those for FM. Two sessions devoted to the general subject, one, based on the paper by K. A. Norton, formerly FCC and now of the War Department, and D. W. Allen, Jr., FCC—"Very High Frequency and Ultra High Frequency Signal Ranges as Limited by Noise and Co-channel Interference"—and the other a session especially added to permit extended discussion of that paper, may well prove to be a pretty accurate preview of the public hearings which FCC has scheduled to let in more light on the whole subject, and that will open in Washington on February 28th, the original date of February 14th having been postponed two weeks.

In the broad, both sessions were essentially attempts on the part of FCC to justify its position in moving FM upstairs to an as yet untried spot in the spectrum and both drew fire from the FM contingent. Since, FM Broadcasters, Inc., has let it be known that the organization is planning a vigorous protest against the move "upstairs." It will participate in the oral arguments scheduled by FCC and file briefs setting up its contention that FM broadcasting has been operating satisfactorily for over five years in its present position in the spectrum and protesting any move to an unexplored region for which neither receiving sets nor transmitters have been designed. RTPB, which originally recommended that FM be left substantially "as is" has authorized its Panel Chairmen to consult with their memberships to determine whether they will file briefs and participate in the oral arguments.

At the time the proposed allocations were made public, FCC let it be known that the shift had been made entirely for engineering reasons and because studies which had been made by that body, and predictions which had been projected as a result of studies made by the Bureau of Standards, indicated continuing and probably increasing interference with FM signals in their present position in the spectrum. Both Norton and Allen reiterated those statements and amplified them. The FM people, on the other hand, are generally against going to higher frequencies and made no bones about saying so. The Norton and Allen paper included a series of charts based on measurements made at 46 and 73 mc and projected to 105 mc which indicated that continuing interference might be expected at the lower frequency but that at 105 mc little or no interference from sporadic E or other effects might be expected.

For better FM service

Allen pointed out that for broadcast service with a high antenna and a high power the service area increases with an increase in frequency. Norton added that there is no question but that there will be some interference at the higher frequencies but it will be for extremely short periods. In the meantime, FCC's studies indicate that it is logical to expect sky wave interference to FM reception amounting to 1 per cent of the time at 40 mc; 0.1 per cent at 60 mc and 0.01 per cent at 88 mc. This, then, is the basis upon which the proposed new allocation was made and according to Allen the shift is proposed purely in order that better FM service may be made possible for the listening public.

Against these theories the most important point made by the current FM contingent is that the proposed allocation is made entirely on predictions rather than on measurements and experience. Norton claimed that the facts on interference have never been refuted. Major Armstrong, on the other hand, pointed out that the service range presently predicted is something "which I do not know how to get," and added that in his judgment it is possible to furnish an interference-free service starting where we are now as well as we can by going up 30 mc as FCC proposes. He stated further that the present controversy appears to be "the age-old battle between theory and practice."

Time and again the statement was made that the time is not ripe for any change in frequencies for the reason that no one has had enough experience and that "know how" is conspicuously lacking. C. M. Jansky, Jr., chairman of FM Broadcasting Panel No. 5 of RTPB, echoed the feelings of many in the crowded room when he said, "whatever is done should be done on a basis of facts and not on some interpretation of those facts." "The question is," he said, "can we get more good out of going 'upstairs' with FM than there is harm in staying where we are?"

BRIEFING THE WINTER TECHNICAL MEETING PAPERS

SIGNAL RANGES

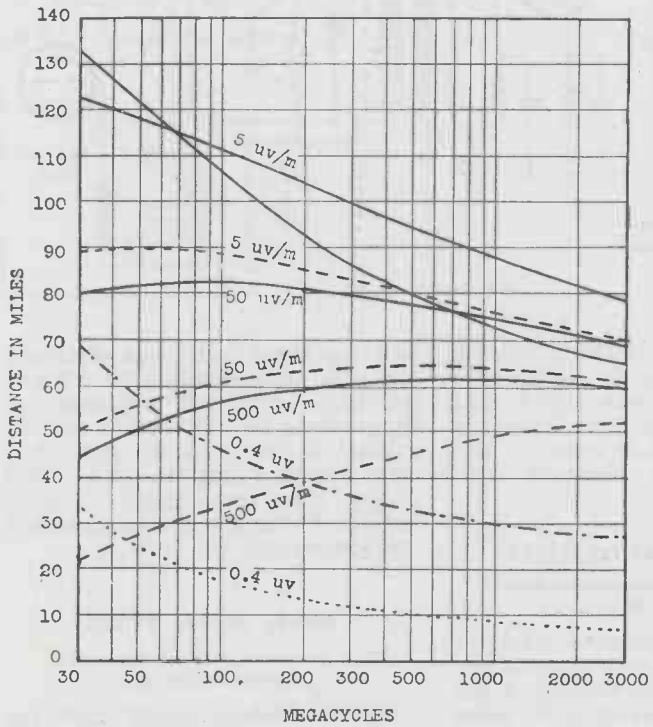
K. A. Norton, U. S. War Department, and E. W. Allen, Jr., Federal Communications Commission

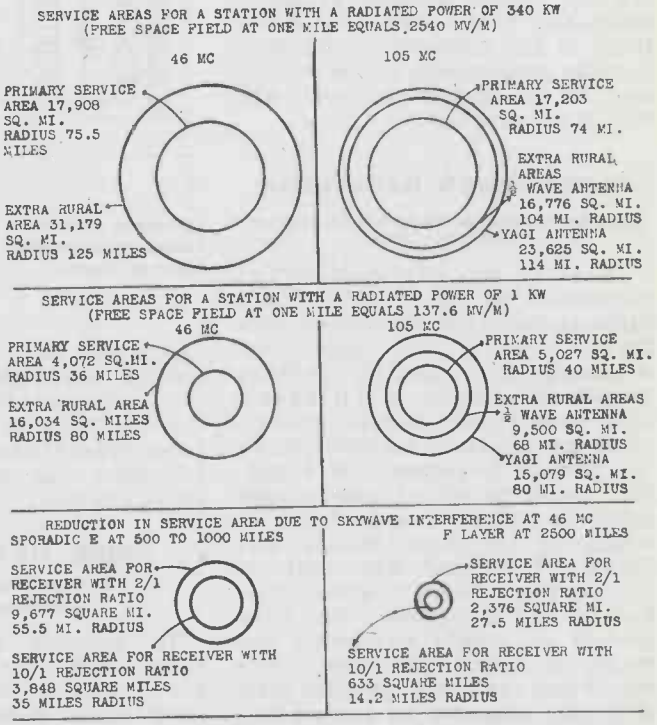
The paper first considered the theoretical ranges of ground wave signals for broadcast and land mobile services in the frequency band from 30 to 300 mc. It was shown that the distances to the theoretical broadcast contours which are to be protected from co-channel and adjacent channel interference increase with increasing frequency, whereas the broadcast interfering range and the extended rural broadcast range and mobile ranges, which are limited by receiver noise, decrease with increasing frequency. The possibilities of increasing the service ranges by the use of transmitting and receiving antennas with more antenna gain were discussed and the practical limits of their application indicated for both services.

Factors which may modify the theoretical ranges are: ambient noise levels, terrain, tropospheric propagation effects, long distance F layer and sporadic E layer interference.

A graphical illustration of the combined effects of such of the above factors as may be generalized is given by a comparison of the expected service areas of two FM

TECHNICAL MEETING





Left—Variation with frequency of ground wave service and interference range (Broadcast transmitter antenna horizontal ½-wave at 1000 ft., receiving at 30 ft. for 50 kw — — — and 1 kw — — —. For mobile service, land station antenna vertical ½-wave at 100 ft., vehicle antenna ¼-wave at 6 ft., for 250 watt —.—.— and 50 watt . . . . . Right—Comparison of FM service areas available on 46 mc and 105 mc, with transmitting and receiving antenna heights 500 ft. and 30 ft.; 6 db allowed for terrain irregularities

broadcast stations of equal power operating at 46 mc and 105 mc, when the service range is limited by (1) set noise, (2) the 50 uv/m protected contour, (3) F layer interference and (4) sporadic E layer interference.

It was shown that the noise-limited service range is greater at 46 mc than at 105 mc for stations of 1 kw and 340 kw effective radiated powers. For the large station the area within the 50 uv/m contour is greater at 46 mc than at 105 mc, while for the small station the 105 mc area is greater. Under conditions of interference via sporadic E from a station of equal power, the large station at 46 mc is expected to have a reduction in its protected area for 0.1 per cent of the time amounting to 46 per cent for a good receiver (2/1 rejection ratio) and to 78 per cent for an average receiver with a 10/1 rejection ratio. The 1 kw station at 46 mc will suffer a 5 per cent reduction in its protected area 0.1 per cent of the time for a poor receiver while for a good receiver reduction in area occurs for less than 0.1 per cent of the time.

For F layer interference, the area of the large station is estimated to be reduced for 5 per cent of the time by 86 per cent for a good receiver and by 96 per cent for the average receiver. The small station area for 5 per cent of the time will be reduced by 41 per cent for the good receiver and by 84 per cent for the average receiver. The time during which the reduction in area is effective is expected to increase materially with increase in the number of co-channel stations. In contrast to the serious interference situation at 46 mc, sporadic E and F layer interference is expected to be negligible at 105 mc.

MEETING HIGHLIGHTS

Setting an all-time record with over 3000 registrations, IRE wound up its largest gathering (Winter Technical Meeting) on Jan. 27 in New York after four days, with a program of some 42 engineering papers. The count at the annual banquet was 1260. Among newsworthy items: Presentation of the IRE Medal of Honor to RCA's Dr. H. H. Beverage, the Morris Liebmann Memorial Prize to Sperry's Dr. W. W. Hansen; award of Fellowships to H. H. Buttner, O. H. Caldwell, W. H. Doherty, A. W. Hull, A. L. Loomis, A. V. Loughren, F. X. Rettenmeyer, S. A. Schelkunoff, R. L. Smith-Rose, K. S. Van Dyke, Capt. E. M. Webster, P. D. Zottu.

HIGH FREQUENCY WATTMETER

Eugene Mittelmann,
Illinois Tool Works, Chicago

A new approach to the problem of measuring the useful power output of high frequency industrial and medical heating equipment resulted in an instrument that gives useful answers in all practical cases. A measurement of the power dissipation in the external load is possible by a method which uses the equivalent no-load loss conductance of the oscillator circuit as a standard of comparison. It was shown that the power absorption by the load is given by the expression

$$P = E^2 \cdot \frac{m}{R_o} \cdot \frac{(e_o - e_1)}{e_1}$$

in which E is the RMS value of the high frequency voltage across the tank circuit, R_o the equivalent parallel loss resistance of the oscillator circuit under no-load conditions, e_o and e_1 the resonant voltages across the tank circuit under no-load and load conditions, measured at any arbitrary level of the input power, and finally, m, a factor

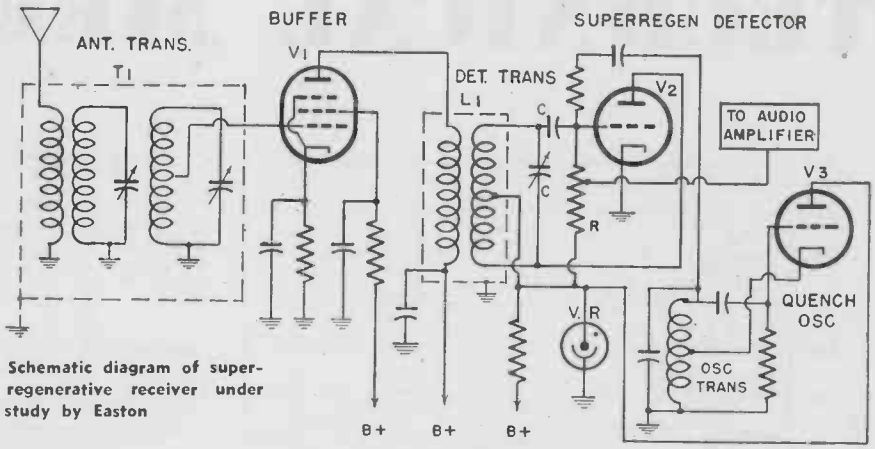
which is a function of the instrument constants.

Accordingly, any square law instrument capable of measuring high frequency voltages will measure the correct amount of power dissipation in the load if the sensitivity of the indicating instrument is made proportional to the expression in the bracket on the right side of the equation.

SUPERREGEN RECEIVERS

Allen Easton, Emerson Radio and Phonograph Corp., New York

To study the effects of circuit parameters on the selectivity of a super-regenerative receiver, a production receiver was constructed consisting of a selective antenna transformer, buffer amplifier, super-regenerative detector, quench oscillator and audio amplifier. Since the quench frequency and amplitude could be varied over a wide range of values, a dependence of selectivity on these factors was found. The total bandwidth is roughly proportional to quench frequency and amplitude. The data showed no simple correlation between sensitivity and quench constants but the signal to noise ratio is greatly improved as quench frequency and amplitude are reduced. The optimum conditions for 90 mc operation were 50 kc and 3 v rms amplitude. It is relatively easy to control bandwidth by simple circuit changes. It was found that the selectivity of a high frequency super-regenerative detector is better than can be obtained with tuned circuits.



Schematic diagram of super-regenerative receiver under study by Easton

NOISE MEASUREMENT

Jerry B. Minter, Measurements Corp., Boonton, N. J.

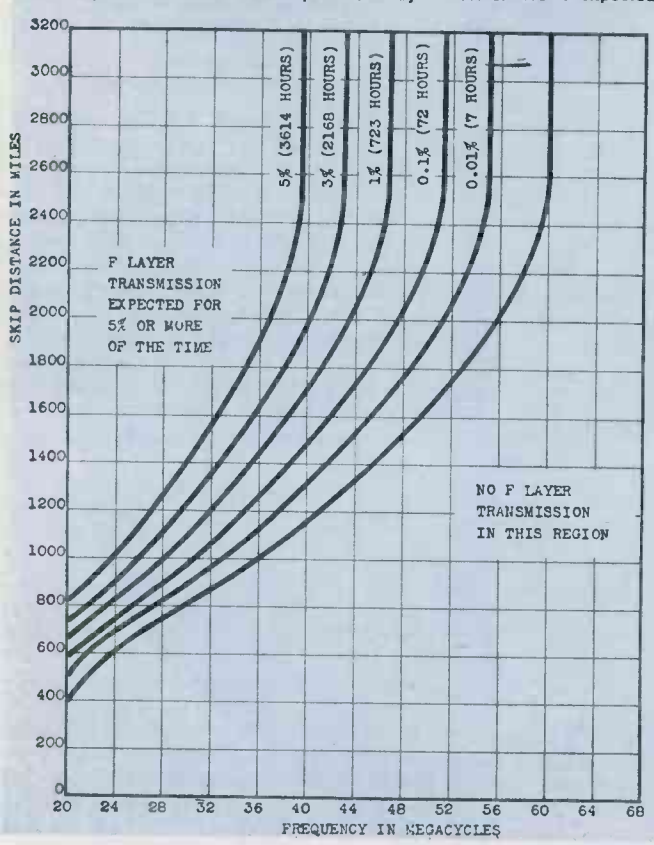
To properly measure receiver susceptibility, the simultaneous application of impulse noise and desired signal is necessary. A pulse modulated carrier is satisfactory as the synthetic noise source for most applications. Choice of pulse width and repetition rate was discussed and a suitable selection for FM and television suggested. Suitable arrangements for connecting the two sources to the receiver under test were shown. A peak to peak output meter was recomended. Typical data on FM and television receivers was presented.

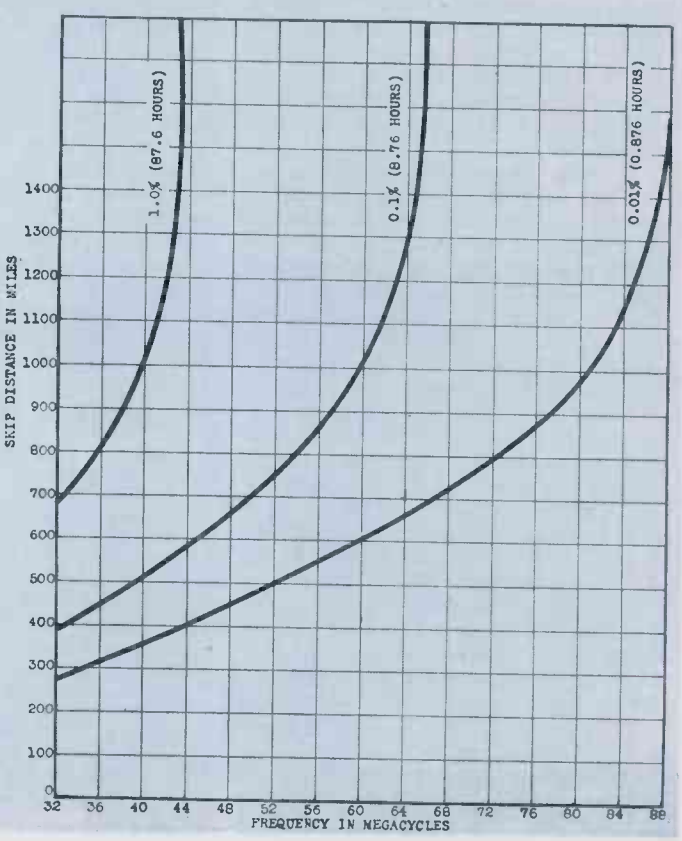
DISK SEAL TUBE

E. D. McArthur, Research Laboratory, General Electric Co.

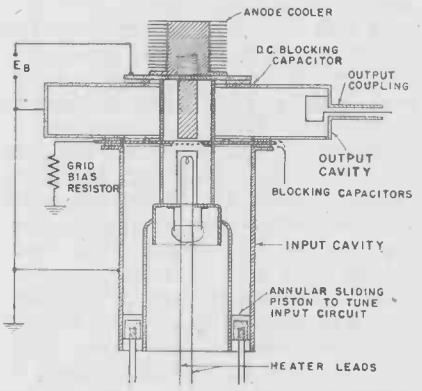
Several factors which limit the operation of grid-controlled tubes at ultra-high frequencies were discussed qualitatively. Starting with

Left—Percentage of the listening hours experiencing F-layer interference estimated from BuStan. ionosphere measurements at Washington. Right—Percentage of time for which sporadic E-layer interference is expected, estimated from BuStan. Ionosphere measurements.





these problems, certain new basic principles in tube design were developed and it was shown that ultra-high-frequency tube design and development must include detailed knowledge and consideration of the entire electro-magnetic system rather than just the evacuated bulb. The evolution of typical generalized cavity circuits was traced and from these units the grid-separation circuit developed. It was shown how the disk tubes used in conjunction with cavity resonators cooperate to alleviate many of the aforementioned problems so that very much higher operating frequencies can be attained. The detailed structure of several typical disk tubes was shown as was an example of the grid-separation type resonant cavity oscillator.

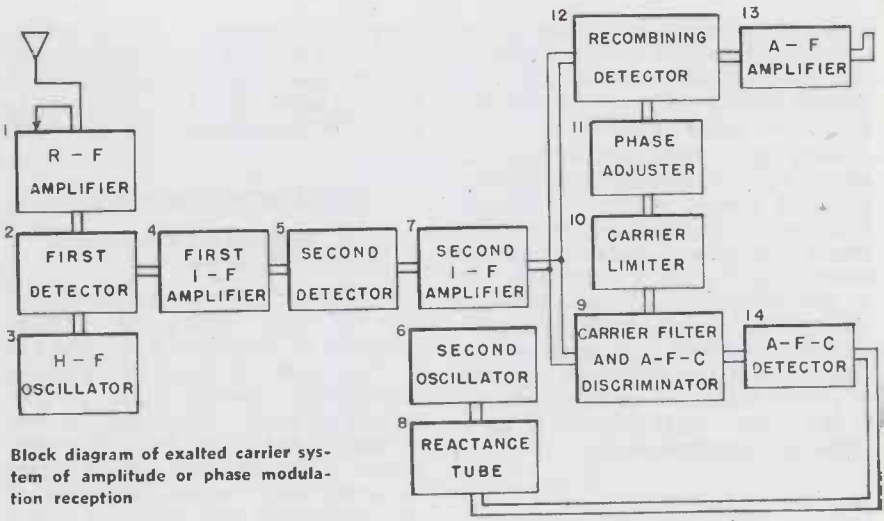


Diagrammatic section used by McArthur to show development of the disk seal tube

EXALTED CARRIER

Murray G. Crosby, Consulting Engineer, Formerly RCA Laboratories, Riverhead, L. I.

Carrier exaltation system of reception proves useful in improving radio communication reliability in cases where discrimination caused by cross interference between signals received over several paths produces a reduction in the carrier amplitude. Briefly, the system builds up the carrier by picking out the small carrier signal with highly selective filters, and amplifying and reinserting it at a later point. The circuit is readily convertible to either amplitude or phase modulation. As shown in the figure here, the various parts of such a receiver include the carrier filter, automatic - frequency - control discriminator, and the detecting system. An analysis was given of the selectivity effect produced by carrier exaltation with both diode and multigrid detection. The optimum degree of carrier exaltation and the effect of carrier limiting were discussed. Results of observations of reception on an exalted-carrier diversity receiving system were reported.



Block diagram of exalted carrier system of amplitude or phase modulation reception

HIGH FREQUENCY HEATING

Paul Zottu, Thermex Division, Girdler Corp., Louisville, Ky.

This paper described the process of generating electrical heat in non - conductors, semi - conductors and conductors. The variation of the electrical properties of the materials to be heated with temperature, moisture content, and other factors were listed. The general requirements of radio - frequency power generators as to frequency, power output, controls and circuits were discussed together with a description of a number of dielectric heating units and some commercial installations.

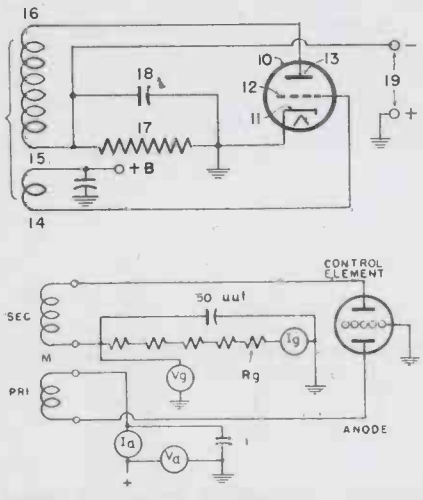
POWER SUPPLY

R. L. Freeman and R. C. Hergenrother, Hazeltine Corp., Little Neck, N. Y.

This paper, "High Voltage Rectified Power Supply Using Fractional-Mu Triode Radio-Frequency Oscillator," described an oscillator circuit using a special tube having an amplification factor less than unity, which proves useful in providing a negative high-voltage power source adapted for oscilloscopes and television, etc. The dc voltage across the grid leak of such an oscillator greatly exceeds the magnitude of the anode-supply voltage. Conventional triodes may be employed as inverted tubes, whereby the grid functions as an anode, and the plate as the control element. The μ of the inverted tube then becomes the reciprocal of the conventional μ. Such a connection does not satisfy all requirements for a dc high-voltage generator, since the large grid conductance and low limit of grid dissipation in most tubes limits the anode voltage to less than 100 volts and usual tubes are not capable of withstanding high voltage between elements.

A fractional μ oscillator tube to be used as a generator of dc voltage of the order of 6,000 volts from anode-supply voltages of 300 volts should have a μ of about 0.1, have a control element equipped to withstand a negative voltage of 12,000 volts with respect to all other elements and supports, and have a transconductance, with a small or zero bias on the control element, high enough to exceed the total circuit conductance.

A special tube was developed to obtain large anode conductance. Here the central element is the cathode composed of a directly-heated, w-shaped filament or a parallel array of indirectly heated cathodes. The anode and the control element are plates located on opposite sides of the cathode plane. In this tube the μ becomes less than unity when the control element is more distant from the cathode than the anode. The anode conductance and, in consequence, the transcon-



Top—Feedback oscillator with Inverted triode. Below—More effective circuit with tube utilizing repelling forces from special control electrode

ductance is increased by decreasing the cathode-anode distance. Coating the cathode on one side only greatly reduces the value of the uncontrolled anode current.

Tests on a tube, constructed as above, in an oscillator circuit using a tuned circuit with a by-passed grid leak connected in series between the control element and the cathode and with a feedback coil in the anode circuit gave the following: The voltage across the grid-leak was 16 times the anode-supply voltage, and the efficiency or ratio of power developed in the grid lead to the power input was 23 per cent. Other performance data:

E_a	E_g	I_a	I_g	R_g	$\frac{E_g}{E_a}$	$\frac{E_aI_a}{E_gI_g}$
Volts	Volts	ma	ma	Megohms		
220	3160	14.7	.134	23.6	14.4	.13
312	4900	21.5	.208	23.6	15.7	.152
362	5900	25.5	.250	23.6	16.3	.16
490	8400	35.2	.355	23.6	17.2	.171
300	4540	25.0	.360	12.6	12.	.217
485	7750	43.0	.617	12.6	12.6	.228

SERVO PROBLEMS

E. B. Ferrell, Bell Telephone Laboratories, New York

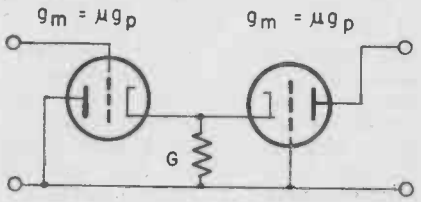
The servo mechanism system, used in many applications to reproduce a mechanical movement at a place or at a power level that is different from the original signal (but is under its control) was compared to electronic circuits such as a feedback. The servo uses negative feedback as do some of the others. Its circuit elements include motors, gears or thermostats. Its noise and distortion are called error. But the basic problems of stability, bandwidth and linearity are just the same, and it was shown that the same general rules found useful in feedback amplifier design could be applied to servo systems.

The methods of Nyquist and Bode are useful in the design of servo systems. They aid in the determination of the significant constants of the system by experimental means involving steady-state amplitude measurements of the loop transmission characteristics. These measurements lead to quick estimates of errors and stability and of the transmission changes required to give various degrees of performance.

SHIELDING PROBLEMS

G. W. Klingaman and G. H. Williams, RCA, Camden, N. J.

This paper reported an investigation of the effect of various amounts of shielding upon the radiation from a dielectric heating installation operating on a frequency of 9 mc. The radiation was measured with a field intensity meter. The relative effectiveness of single and double shielding of the applicator was reported. The most effective method for reducing the radiation from open work-access doors in the shielding was found in extending the door edges outward in the form of a "vestibule."



$$\mu' = \frac{-\mu}{1 + G/(g_m + g_p)}$$

$$g_m' = \frac{-g_m}{2 + G/(g_m + g_p)}$$

The double triode circuit with cathode intercoupling provides a non-reversing one-way voltage and current amplifier. Has lower transconductance but much less feedback coupling

TRIODE NETWORKS

Harold A. Wheeler, Hazeltine Corp., Little Neck, L. I., N. Y.

This paper analyzed the three ways of connecting a triode in a four-terminal network, (with the "common" or "grounded" electrode either the cathode, anode, or grid.) The grounded-cathode circuit is the usual form. The grounded-anode (cathode-follower) circuit is a non-reversing one-way repeater but amplifies only the current and, in a lesser degree, the power. The grounded-grid circuit has degenerative feedback by conductive coupling, in such a manner that it amplifies only the voltage and, in a still lesser degree, the power. It may be treated as a hypothetical "repeater-transformer" with an impedance ratio of μ plus one, which also multiplies the power in the same ratio. The equivalent network circuits developed for these alternate connections should prove valuable in circuit analysis.

MINUTE CURRENT TUBE

W. A. Hayes, Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

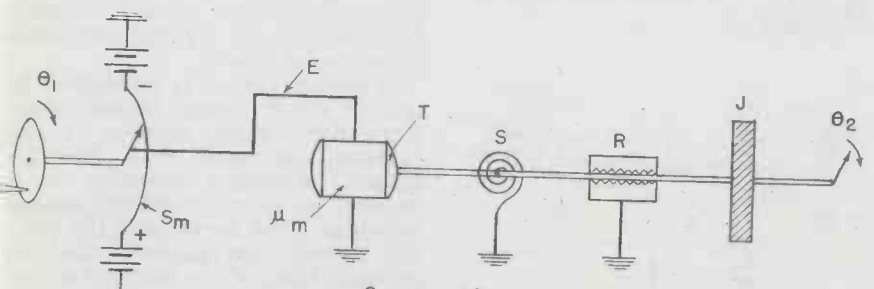
In this paper an electrometer tube is described which permits the measurement of minute currents and/or potentials down to 10^{-15} ampere and 10^{-4} volt, respectively. The sensitivity of the tube is made possible by an extremely low grid current and a high grid-to-cathode resistance. Technics involved in maintaining the standards required for sensitivity, stability and long life were given. Characteristics were included with data relative to linearity of output current as a function of grid bias. Zero control current is effected by proper selection of negative grid bias. This feature was described and data given. Stability of the tube with respect to random fluctuations internal and external to the tube was summarized relative to the accuracy of test results. Several special applications of the tube in the field of chemistry, metallurgy, and the medical professions were described.

REFLEX OSCILLATORS

J. R. Pierce, Bell Telephone Laboratories, N. Y.

The reflex oscillator is a form of high frequency long transit time tube which has distinct advantages as a low power source. It may be light in weight, need have no magnetic focusing field, and may be made to operate at comparatively low voltages. The reflex oscillator may serve as a beating oscillator in double detection receivers or as a frequency modulated oscillator in low power transmitters. So far the efficiencies which have been attained are quite low, but that need not be a severe handicap in some applications.

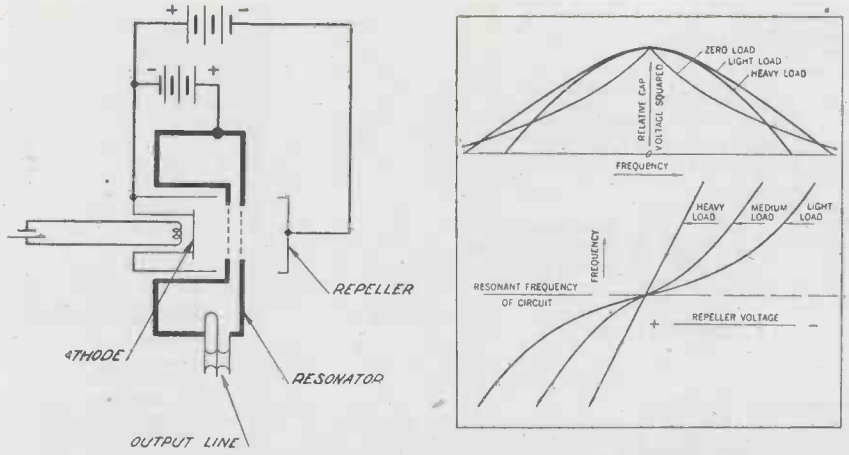
A reflex oscillator is illustrated. An electron stream from the cathode passes through the longitudinal radio frequency field in the "gap" between two grids, where the stream is "velocity modulated", then into a retarding field produced by a "repeller" electrode where the beam becomes "bunched." Finally the bunched stream returns across



$$\theta_2 = \frac{S_m \mu_m \theta_1}{S/j\omega + R + j\omega J}$$

$$\theta_2 = \frac{S_m \mu_m \theta_1}{S + pR + p^2 J}$$

Mechanical analog of a typical servo mechanism with its characteristics expressed in "amplifier" concept



Left—Basic circuit for reflex oscillator and (right) curves delineating frequency characteristic in relation to applied voltages. This illustrates a feature of reflex oscillators of this type—tuning by electronic means without physical manipulation of the cavity

the gap, exciting the resonant circuit or "resonator."

Bunching in a retarding field, may be, for example, the gravitational field of the earth. The "drift time" may be the time a ball thrown upward takes to return. If the ball is thrown upward with some medium speed v_o, it will return in some time T_o. If it is thrown upward with a low speed v smaller than v_o, the ball will return in some time T smaller than T_o. If the ball is thrown up with a speed v greater than v_o, it returns in some time T greater than T_o. Now imagine three balls thrown upward in succession, evenly spaced but with large, medium, and small velocities, respectively. As the ball first thrown up takes a longer time to return than the second, and the third takes a shorter time to return than the second, when the balls return they will be closer together than when they were thrown upward. Thus "bunching" occurs when the velocity with which a uniform stream of particles is projected into a retarding field is progressively decreased.

An important aspect of reflex oscillators is the electronic tuning which they exhibit. The frequency of oscillation can be changed by a substantial amount, usually several tens of megacycles, by varying the voltage of the repeller electrode.

It is well known that frequency of oscillation may be influenced by the load coupled to an oscillator. One sort of influence is obvious. A reactive load coupled to the resonant circuit changes the resonant frequency of that circuit and hence the frequency of oscillation. Another sort of frequency change with load is particularly important in the case of reflex oscillators which have a wide electronic tuning range. Imagine, for instance, that the oscillator is operating off circuit resonance by means of electronic tuning. Such operation is represented by a point away from the common intersection of the frequency vs. repeller voltage curves. Thus it may be seen that if the repeller voltage is kept constant and if the circuit conductance is changed, that is, the load is changed in purely resistive sense, not changing the resonant frequency of the resonant circuit, the frequency of oscillation will change in shifting to a new frequency vs. repeller voltage curve.

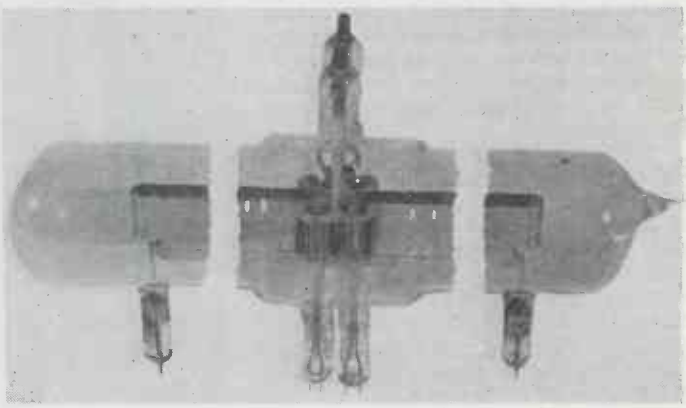
The nature of the load is important as well as its impedance at a given frequency. For instance, coupling a reflex oscillator tightly to a high Q resonant circuit makes the variation of frequency with repeller voltage less rapid and may result in other undesirable effects.

EVACUATED TRANSMITTER

Major H. A. Zahl, J. E. Gorham, G. F. Rouse, Signal Corps, Ground School Agency, Asbury Park, N. J.

A push pull triode transmitter type of construction was described in which the resonant circuits are contained inside the evacuated envelope to reduce lead effects and make it possible to use the resonant circuits to increase the anode dissipation. The internal resonant circuits consist of short circuited sheet tantalum parallel transmission lines attached directly to the tantalum plates and grids in such a way as to provide coupling between the plate and grid loops. Each side of the push pull circuit has two sets of plate, grid, and thoriated filament elements in parallel.

Although the tuning of the loop circuits inside the envelope cannot be changed, a limited control of the frequency is possible because of the tunable external filament line. The rf output circuit consists of a parallel transmission line, which is connected directly to the two pairs of plates. The combined tube, transmitter, and appropriate shielding occupy a much smaller volume than is required for external resonant circuits at frequencies of 200 to 700 megacycles and weigh only a few pounds.



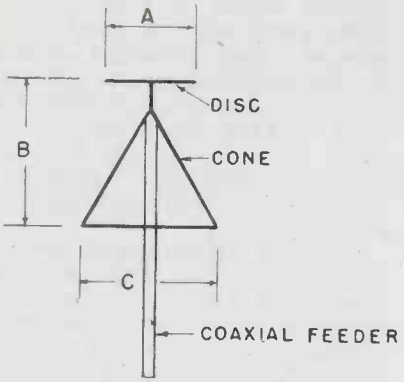
Type of evacuated transmitter in which the entire resonant circuit is enclosed within the tube envelope

NEW ANTENNA TYPES

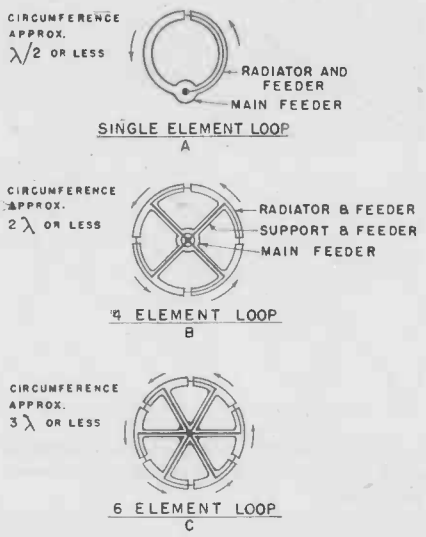
A. G. Kandoian, Federal Telephone & Radio Corp.

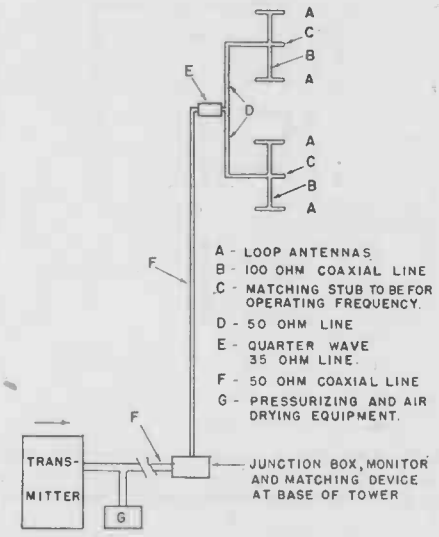
Three new types of antennas have been developed for use primarily in VHF and UHF spectrum. Type I, styled discone, is intended primarily for vertical polarization, giving an omni-directional pattern in the horizontal plane. A distinctive feature of this antenna is its extreme simplicity of construction and feeding. Its most important characteristic is that it operates satisfactorily, both as to radiation pattern and impedance, over an extremely wide band of frequencies — several octaves—without a substantial change of either input impedance or radiation pattern. This type of antenna has wide applications wherever extremely wide frequency ranges are encountered and simplicity of mechanical design and installation are required.

Type II antenna is intended primarily for horizontal polarization. It is a loop antenna with an omnidirectional radiation pattern in its own plane. The radiators forming the loop are metallically supported



CUTOFF FREQ	A	B	C
90 M.C.	18"	24"	20"
200 M.C.	9"	12½"	14"





Left—Fundamental construction of Discone antenna with dimensions for typical frequencies. Center—Loop antenna with circular radiation pattern useful for FM or television. Right—Combination antenna system having both vertical and horizontal polarization and useful directivity properties

from the mast or other supporting structure. Furthermore, both supports and radiators form part of the coaxial feeding circuit. No balanced lines are used anywhere in the circuit. The bandwidth is controllable, though in general much narrower than the type I antenna. No stubs are necessary to obtain a match to any common type of coaxial feeder of 50, 70 or 100 ohms. The most important feature of this antenna is its simplicity of mechanical design and construction and the ease with which a larger number of antennas may be "stacked" for high degree of directivity in the vertical plane, still retaining omni-directional radiation in the horizontal plane. Typical applications of this type of antenna are FM broadcast, television and general communication.

Type III antenna is similar to type II except that associated with the loop and perpendicular to it is a vertical dipole. As a result, though the radiation pattern of type III antenna is essentially the same as that of types I and II, the free space field at all points has both horizontal and vertical components in equal amounts.

The equality of amplitude of horizontal and vertical polarization is not necessary as any desired ratio of amplitude as well as phase relationship between the horizontally and vertically polarized fields may be obtained.

The most interesting application of this type of radiator is in high directivity arrays or in illuminating a highly directive parabolic reflector for general communication application. The presence of both vertical and horizontal components, it is felt, will be helpful in reducing fading. There is also a possible application of this type of antenna to VHF and UHF broadcast.

QUARTZ CRYSTALS

The crystal program was the subject of one entire technical session. Major Edward W. Johnson, Signal Corps, Office of the Chief Signal Officer, Washington, D. C. ("Quartz Crystal Supply Program"), detailed the industry's growth from 100,000 to 30,000,000 units per year in the face of many problems of manpower, facilities, and raw materials. "Crystal Quality," by I. E. Fair, Bell Telephone Labs., Inc., discussed the complexities of establishing performance criteria and measurements. A companion paper, "The Performance Index Meter," by C. W. Harrison, Bell Telephone Labs., Inc., explained the instrument which was designed to measure the anti-resonant impedance of the quartz crystal and associated circuit.

Clifford Frondel, Reeves Sound Labs., Inc., New York, presented the paper, "Frequency Adjustment of Quartz Oscillator Plates by X-Rays." The equipment used was described and illustrated by Charles Roddy, North American Philips Co., Inc., New York, N. Y. A paper titled, "Aging of Quartz Crystal Units," given by Virgil E. Bottom, Signal Corps Ground Signal Agency, Asbury Park, N. J., discussed the gradual drifting of finished crystals in terms of "powdering," or the accumulation of tiny particles on the crystal surfaces as a result of beneath-the-surface meeting of the many microscopic cracks left by the abrasive particles. Artificial aging by baking and other technics was found to be useless, acid-etching effecting the best solution to the stability problem.

Centrifugal drier used with UHF heating unit speeds up dehydration and concentration of materials

RF DEHYDRATION

George H. Brown, R. A. Bierwirth, and Cyril N. Hoyler, RCA Laboratories, Princeton

Methods have been worked out and equipment developed for using radio frequency in the dehydration of certain pharmaceuticals which are sensitive to high temperatures. As applied particularly to penicillin, the process has been divided into two discrete steps; bulk concentration and complete drying in the final container.

In the first step the dilute solution is drawn into a glass flask equipped with electrodes and maintained under a moderate vacuum. A radio-frequency current is passed through the solution to supply the energy of evaporation while the vacuum establishes a boiling point near room temperature. A standard 2-kilowatt oscillator operating at 28 megacycles will evaporate about 3 litres of water per hour. In the second step, a small measured quantity of the concentrated solution is placed in the final containers and then completely dried under

sterile conditions by radio-frequency power in vacuo.

Loss of the inherently foamy material from the bottles is prevented by rapidly spinning the bottles during treatment. Centrifugal force spreads the solution in a thin layer on the side of the bottle and at once the coupling problem is improved. At 3000 rpm the force is about 100 times gravity so that no solid material can be lost by foaming or frothing.

Each drying chamber now provides 34 plastic cups which are individually rotated between electrodes. There are six such chambers in an installation—three of which are being simultaneously treated by radio frequency at any one time. Under normal operation a 2-kilowatt oscillator can remove the moisture from 2000 bottles in an hour, which represent 200 million Oxford units of penicillin.

VHF TETRODE

Clayton E. Murdock, Eitel-McCullough, Inc., San Bruno, Cal.

The Eimac 4-125A, which is a medium-power transmitting tetrode is adapted to operate well into the vhf region. In a conventional push-pull arrangement a pair will deliver about 750 watts at frequencies as high as 120 mc., with low driving power, since less than five watts will satisfy the requirements of two 4-125A's under maximum output conditions. Interelectrode capacitances for a tube having such substantial power capabilities (C_{pg} = 0.03 $\mu\mu$fd), C_g = 10.5 $\mu\mu$fd) and C_p = 3.0 $\mu\mu$fd) respectively, are low.

Lead inductance has been kept to a minimum through the use of a "dish" type stem and short, heavy leads. To aid in holding the screen grid at ground rf potential, two screen leads have been provided. The tube has a seated height of only 4 ⅜ in.

The 4-125A has no internal insulator. The 32-watt thoriated tungsten filament, tantalum control grid and tantalum screen grid are supported by their leads from a dish-type stem. The tantalum plate is supported by a single lead from the top of the envelope. A large shield structure, which serves to join the screen grid to its supporting leads, separates the tube into two sections. Below this shield are those parts of the tube associated with the input circuit, while the output circuit is concentrated in the space above the shield. This shielding feature is carried into the external structure by allowing the metallic base shell to extend up to a point opposite the internal shield. When the base shell is grounded, the shielding between input and output circuits is nearly complete.

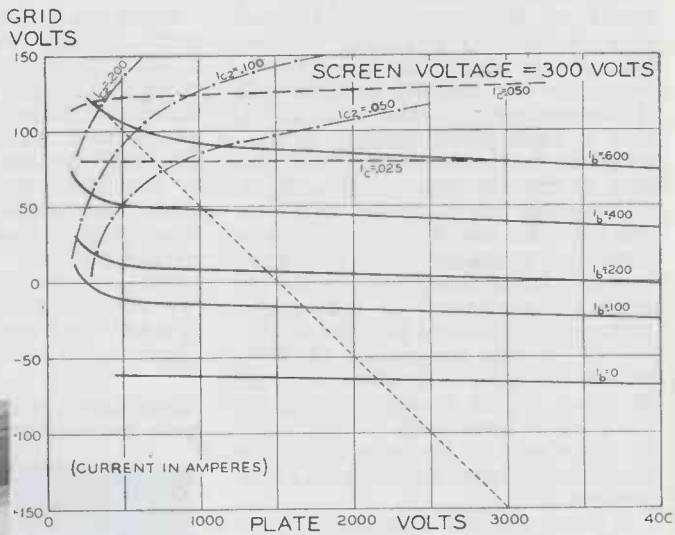
Two typical test rf amplifier units are illustrated. One which served for several relatively low frequency tests at 14 mc was completely contained in a cabinet measuring 15 by 11 by 9 in. This unit, which employed two tubes, was easily capable of handling an input power of 1000 watts at a plate efficiency of 75 per cent. On several occasions the low driving power requirements of the 4-125A were illustrated by driving the 14-mc. amplifier to its full rated 1000 watts input by means of an oscillator-doubler unit, with a 6L6 as the output-doubler stage.

For tests at 100 mc. and above, a unit utilizing linear grid and plate tank circuits was employed. There were no significant differences between the operation of the tubes at 14 mc. and 100 mc. The driving power at 100 mc. was found to be less than 5 watts per pair of 4-125A's, and there was no difficulty in obtaining a plate-circuit efficiency of 75 per cent.

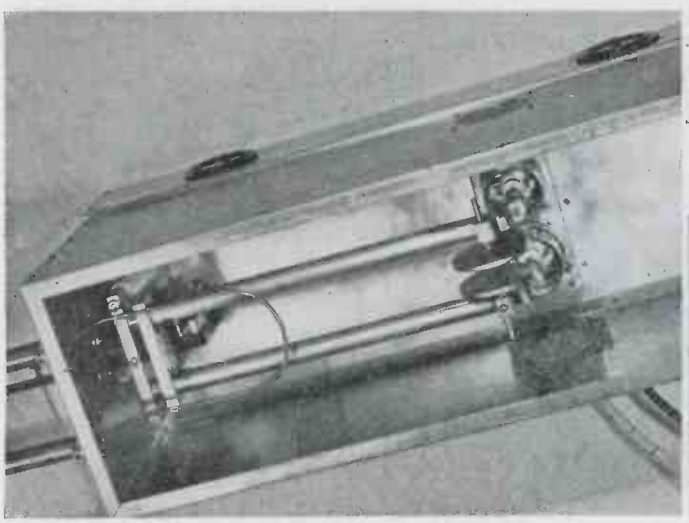
RADIO LINKS AND RELAYS

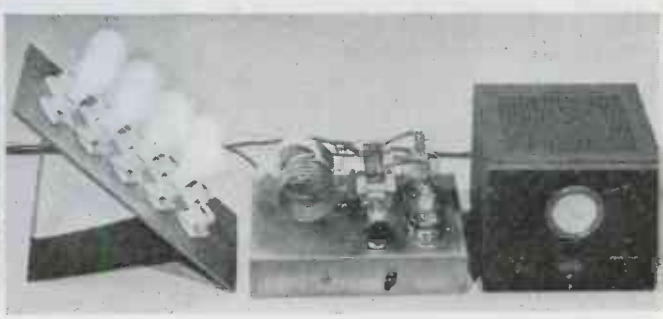
An interesting technical session was devoted almost entirely to a two-way, wide band radiotelephone relay across twenty-odd miles of water between Cape Charles and Norfolk, Virginia. A paper, titled "Cape Charles-Norfolk Ultra-Short-Wave Multiplex System," by N. F. Schlaack and A. C. Dickieson, of Bell Labs., described the general features of the 160-mc, 12-channel, 12 to 60 kc band equipment to handle radio transmission and reception of the standard type K cable-carrier signals.

"Ultra-Short-Wave Multiplex," by Charles R. Burrows, Bell Labs., Deal, N. J., and Alfred Decino, formerly of Bell Labs., New York, outlined the requirements of an ultra-short-wave multiplex system and de-



Constant current curves of new tetrode and (below) examples of two 1000-watt amplifier setups described by Murdock





scribed how they were met by employing a sufficient amount of envelope feedback.

The following three types of distortion that require consideration in this system are discussed:

(1) The non-linear distortion resulting from deviations of the overall input-output amplitude characteristic from a straight line.

(2) The distortion resulting from deviations of the gain-frequency characteristic from symmetry and the phase-frequency characteristic from skew-symmetry.

(3) The generation and detection of parasitic phase modulation.

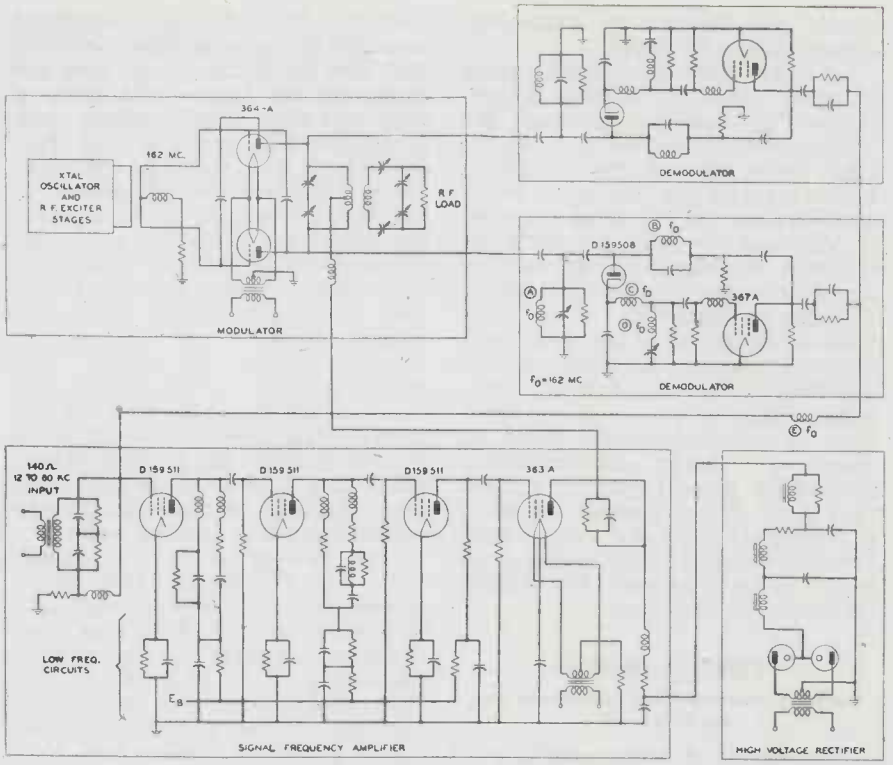
The signal of 12 speech channels in the type K frequency range from 12 to 60 kc is applied to the input of the signal frequency amplifier. The output of this amplifier is used to plate-modulate the 50 watt bridge-neutralized radio-frequency power amplifier. Part of the modulated output of this amplifier is picked up, demodulated, and fed back to the input of the signal frequency amplifier.

Since the demodulator is in the beta circuit, any distortion produced by it appears in the output of the transmitter. This is reduced to a satisfactory value by applying local feedback to the diode demodulator.

The main feedback amplifier is based on Bode's design. A fixed gain margin is provided at frequencies at which the phase is unfavorable and singing would result if the gain were greater than unity, and a fixed phase margin is provided at frequencies for which the gain is greater than unity and an unfavorable phase would result in singing. In the design of a commercial transmitter it is necessary to have these margins in order to allow for variations in the manufacture of tubes and the circuit elements. A gain margin of 10 db is provided. This will allow the use of tubes whose transconductances are greater than their design value by this amount. No decrease in the transconductance of the tubes can produce singing.

A phase margin of 30 deg. is provided to allow for variations in tube capacities and the electrical constants of the circuit elements. It is also desirable to provide more feedback than is necessary to limit the non-linear distortion to the desired value. In the transmitter under discussion 10 db of feedback is provided in addition to that necessary to meet distortion requirements. This allows the aging of the tubes to the point where their combined transconductance is less than the design value by this

(*Continued on page* 196)



Simplified schematic of the broadband radio relay transmitter

NAVY'S DOW SUGGESTS RADAR PATENT POOL

Advocating establishment of a radar patent pool, Captain Jennings B. Dow, Director of the Electronics Division of the Navy's Bureau of Ships, told the large audience that gathered for the engineering session sponsored jointly by the American Institute of Electrical Engineers and IRE, that something of the nature should be worked out.

On the basis of information from the industry, Captain Dow, who has directed the Navy's radio-electronic procurement program since before Pearl Harbor, estimated that for several years following the war there will be sales of radar equipment for government and commercial purposes amounting to $75,000,000 per year. The figure might be even larger, he noted, since the estimate does not take into account all equipment utilizing radar technique.

Captain Jennings B. Dow, Director of the Electronics Division of the Navy's Bureau of Ships

Stating that, except to a few government agencies, there is little information available about the number, nature and scope of radar patent applications now on file. Captain Dow urged that the electronics industry take appropriate steps to avoid undesirable conditions when the U. S. Patent Office sheds its secrecy after the war. He warned that a reasonable adjustment of the radar patent situation may require as long a time as 10 years.

Failure to arrive at a solution might result in the following conditions, Captain Dow felt: (1) manufacturers will not be able to supply the armed services and the public with the most suitable designs of radar equipment because of adversely held patents; (2) a pyramiding of royalty rates will contribute to excessive costs of equipment; and (3) a great amount of litigation will follow the issu-

(*Continued on page* 199)

$1000 EDITORIAL AWARD

Three Awards to be made by ELECTRONIC INDUSTRIES for engineering articles of outstanding value in advancing electronic principles

● ELECTRONIC INDUSTRIES, published by Caldwell-Clements, Inc., herewith announces Special Editorial Awards totaling $1,000 to be presented for outstanding articles or papers contributed for publication and conforming with editorial policies, dealing with timely subjects intimately related with the practical application of electronic principles.

The awards will go to the author, or authors, of those manuscripts, published in this magazine during the remainder of 1945, judged to be the best, taking into consideration originality of thought and the practical value of the particular application in advancing electronic engineering precepts.

The awards are three in number: A First Award of $600; a Second Award of $300, and a Third Award of $100. The simple conditions under which the Awards are to be made are given in an adjacent column.

Object of awards

The purpose of the Awards is to encourage the publication of original thinking, planning and achievement which may be of practical value. It is the belief of the Editors that there is a vast storehouse of engineering information locked up in the accomplishments of many engineers and that the publication of such material will be of immense value to a very large percentage of engineers who are directly responsible in shaping the destinies of their companies.

A principal object in making the Awards is to draw out such material so that it may be readily available; to put it on paper where it may do the greatest good to the greatest number; to stimulate engineering thinking; to help in the solution of engineering problems that must be solved in order that the already great and rapidly growing electronic industry may continue the upward curve of its successes.

Obviously there is a certain amount of engineering information that is buried under the veil of military secrecy and that for security reasons cannot emerge until after the war shall have been won. Such material may well have a profound effect on postwar developments and it is hoped that at least some of such information may be made available in time for consideration under the terms of the Award.

Type of articles

ELECTRONIC INDUSTRIES accordingly opens its pages to any and all engineers who have a story of real accomplishment to tell. The Awards will not be made on the basis of past reputation. The contest is not confined to any one class of engineers, but is open to all. The engineer of some small, almost unheard of company has exactly the same chance of winning an Award on the basis of originality of thinking and practical application as has the biggest engineer of the biggest company. Nor has the contest any geographical limitations. Manuscripts will be welcome, regardless of their source. The only proviso is that manuscripts must be printable in so far as the Armed Forces are concerned and must be properly cleared by the author's employers.

Manuscripts intended for consideration under the terms of the Awards must, in the judgment of the Editors, be suitable for publication in ELECTRONIC INDUSTRIES. If suitable for publication in ELECTRONIC INDUSTRIES they will be published and payment will be made for such manuscripts at the time of publication. They will, in addition, be considered for one of the Special Awards.

One thing more—to be eligible for consideration under the terms of the Awards, a manuscript must have been published in ELECTRONIC INDUSTRIES during the period between and including May, 1945, and December, 1945.

AWARD CONDITIONS

1—Manuscripts should be primarily engineering in nature and may include only original material not previously presented or published and must be of a nature suitable for publication in ELECTRONIC INDUSTRIES.

2—All manuscripts are to become the exclusive property of ELECTRONIC INDUSTRIES and may not be reproduced elsewhere in whole or in part.

3—All manuscripts must have Army, Navy and other clearance, as required, permitting publication.

4—Manuscripts may deal with any electronic engineering, research or scientific subject.

5—Manuscripts should be illustrated with photographs, diagrams, etc., as may be needed to supplement the text.

6—All manuscripts deemed suitable for publication in ELECTRONIC INDUSTRIES will be published and paid for at regular rates and will receive the consideration of the judges as to their suitability for one of the Awards.

7—The Award period shall start with the May issue of ELECTRONIC INDUSTRIES (closing date April 1, 1945) and conclude with the December issue (closing date November 1, 1945) and only manuscripts published during that period will be considered in making the Awards.

8—The Judges will be a Panel of engineers recognized in their respective fields and their judgment will be final.

9—In the case of more than one author collaborating in the preparation of a manuscript, any Award will be equally divided among the authors.

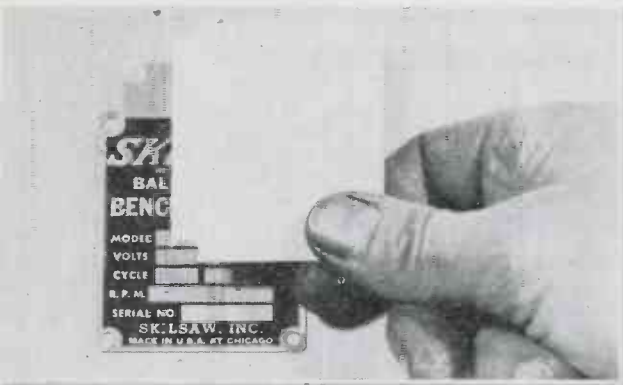
10—The basis of the Awards shall be originality of thought and the practical value of the manuscript in advancing the electronic arts.

11—The contest is open to all contributors except employees of Caldwell-Clements, Inc., their families or relatives.

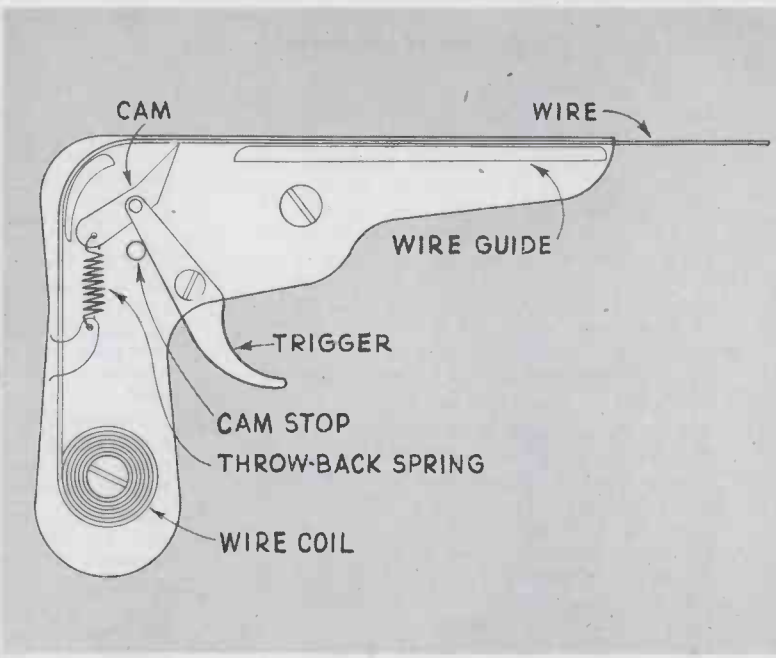
1 HIGH SPEED TESTING of 42-step resistor decade assemblies to 1 per cent tolerance is accomplished by Richardson-Allen Corp., New York, using electronic limit bridge and "standard" decade units arranged for mechanical ganging to assembly under test. Engraved panel identifies switch point being tested. Contacts to the assembly are automatic and front or rear decks of twin assembly may be selected by toggle switch

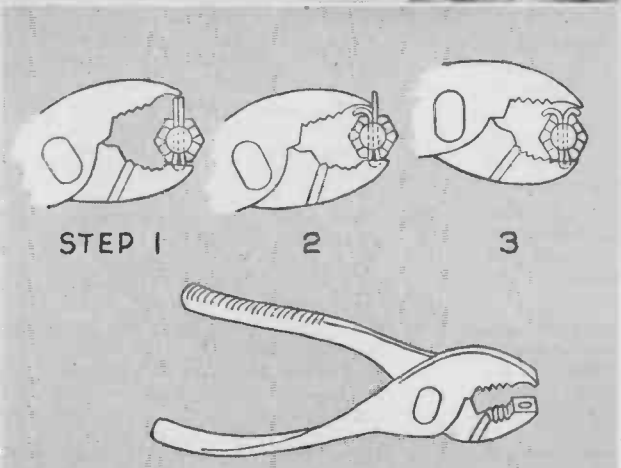
FACTORY SHORT CUTS

2 SAVING OF TIME results from use of pre-cut masking stickers over nameplates during finish-painting, instead of returning unit to production line after finishing, for name plates. Made by Avery Adhesives, Los Angeles



3 PISTOL-TYPE DISPENSER for silver solder originated at Portsmouth Navy Yard. Made of sheet metal, the handy tool unwinds solder ribbon from coil in handle in easy steps and provides a method of holding solder conveniently against the work. Diagram gives construction details





4 COTTER PIN PLIERS, at left, represent a short cut from the Flour City Ornamental Iron Co., Minneapolis. Modified pliers are used as shown in steps one to three. Efficiency increased 335 per cent in an operation involving castle nuts

Capacitor Plate Straightening Technic

1. Remove gear pin to allow operator to move rotor from 0-180°.

2. From back of condenser or end opposite gear:

A. Use centering screws to the right to adjust stator until all the rotor blade tips to the left of rotor shaft are in the exact center.

B. Using centering screws to the left; adjust until rotor and stator blades are in the exact center and parallel to each other.

3. Face gear of condenser and turn condenser so as to bring trimmer screws downward.

A. Move stator blades into the center by inserting blade straightener between the two right-hand tie straps and bend blades as close to the stator tie post as possible.

4. Face condenser end opposite gear—top up.

A. Open condenser until short rotor end is level with short stator end. Center blades by inserting straightening blade between rotor and stator blades on the right of condenser shaft. Straightener must be inserted until it hits the stator tie post. Do not bend tip of blades.

5. Face gear end of condenser from top

A. Straighten and center the short rotor end tips by inserting straightening blade until it hits the rotor shaft. Bend entire rotor blade.

B. Advance the condenser rotor to the end of the second segment of the tracking blade (approximately 30°). Center rotor plates in this position, insert straightening blade until it hits the shaft.

C. Advance condenser rotor to the end of the fifth segment of the tracking blade (approximately 60°). Center rotor blades in this position.

6. Face gear and back of condenser. Close condenser to 180°.

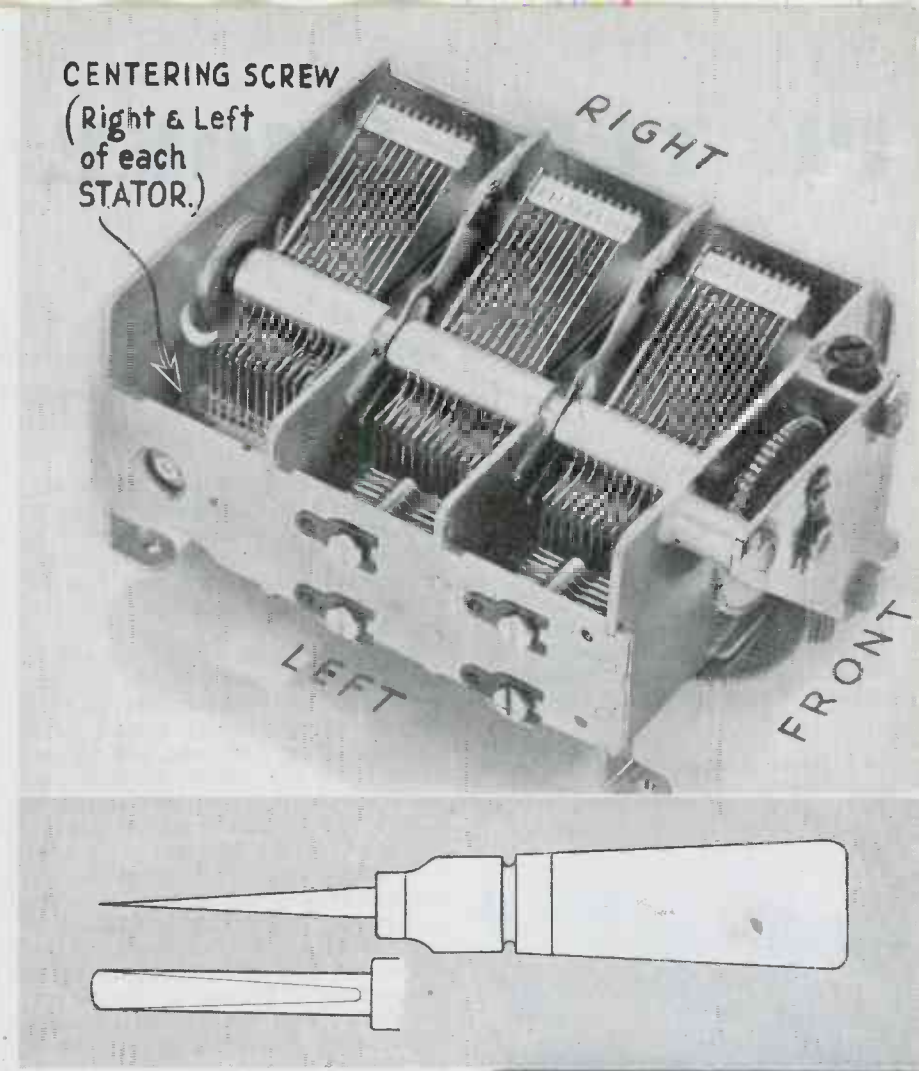
A. Center rotor blades to the right of bottom tie straps by opening condenser and moving the rotor blades near the third segment position until the blades are in the exact center position.

B. Close rotor. Center rotor blades at the left of bottom tie strap by opening condenser and moving the rotor blades near the fifth segment until all blades are in the exact center position.

7. Face back of condenser from end opposite gear.

A. Move rotor blade right-hand tips (see photo) into center position by inserting straightening blade between the two right-hand frame tie straps in such an angle downward, and deep enough so as to hit the rotor tie strap. Then bend rotor blades into the desired position.

8. Close condenser and inspect with .014" gauge for close blades in the usual manner.



5 CAPACITOR PLATE STRAIGHTENING technic developed by Dr. H. P. Eichler of Eastman Kodak Co. saves headaches. Complete story in column at left. Special tool must be highly polished, with rounded edges

6 PREVENTING EXPLOSIONS handling liquid air depends on keeping special cap on can at all times, according to Westinghouse, Bloomfield, N. J. If liquid is allowed to evaporate direct to the atmosphere, moisture condenses and freezes in neck, leading to disaster Illustrated

PE TUBE SMOKE SENSING

By GILBERT SONBERGH

Typical applications of photoelectric devices and associated tube circuits for protection and combustion control

● Many applications of photocells and phototubes are concerned with the determination of the presence of smoke, contaminants, or other foreign substances in liquids and gases. An instrument using ultra violet light of a critical wavelength for the detection of dangerous, although invisible, concentrations of carbon disulphide gas attendant upon certain chemical manufacturing operations was described in the March, 1944, issue of "Electronic Industries." The use of P-E flame-failure devices to stop fuel flow in oil and gas-burning furnaces is well known.

Simple barrier-layer photocell arrangements have been in use for some time as fire or smoke alarms. "Where there's smoke there's fire" may not always be true, but smoke alone can do costly damage to many varieties of merchandise. Where there's smoke there is certainly cause for alarm.

At any rate, where there is fire there is usually smoke, and in heating, ventilating, or air conditioning ducts or other more or less enclosed spaces, the use of reduction of light transmission through a sample of the local air provides a measurable variable for constant, 24-hour fire-protection supervision.

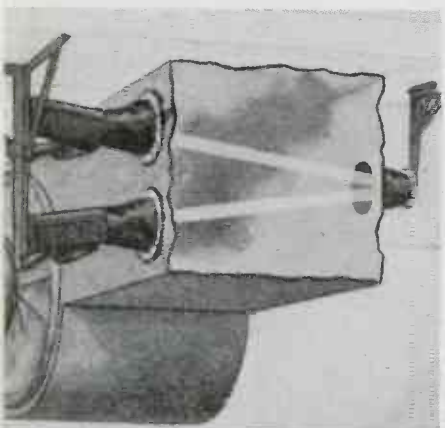
Air ducts with forced circulation are, unfortunately, excellent fire spreaders, and are natural flues for large scale blazes. Fires have been known to travel from basements to every floor of eight or ten story buildings within a matter of minutes. Outdoor fires, via sparks, frequently enter supposedly immune buildings through air intake ports. Safe, modern construction utilizes a simple photoelectric "watchman," near the intake and at other danger points in such duct systems, which sounds alarms, shuts down forced circulation systems, and closes duct dampers immediately, on the presence of even minute quantities of smoke in the circulating air.

Since such smoke is not often accompanied by heat in the early stages, ordinary fixed temperature or rate-of-change thermal fire detection sensing elements are not responsive. An ordinary self-generating photocell circuit is sensitive instantaneously to such contamination. Amounts of white or black smoke just barely susceptible to the eye cause a drop of about five per cent in the cell output in typical installations. Actually, any dangerous condition will usually involve much higher concentrations of smoke.

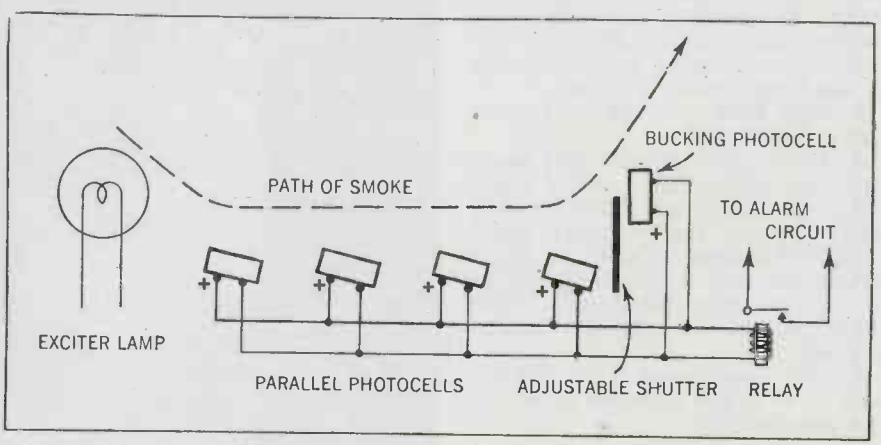
Duct protection

An artist's drawing of a smoke detector of the type used by American District Telegraph Co., New York, operators of Central Station protection systems of various kinds in all large cities, is shown. A three-inch beam from a prefocused six-volt lamp and condensing lens, mounted on one side of the duct in a heavy cast housing, is projected across the space to be protected. In this case, a mirror reflects the beam back to another housing containing another condensing lens and the photocell. Output of the cell under "safe"

A.D.T. smoke detector in ventilating duct, using mirror for two crossings



C. N. Cahusac, C-O-Two Fire Equipment Co., demonstrates the smoke detecting cabinet of the carbon dioxide shipboard fire extinguishing system. Heart of the unit is the photocell reflection detection method diagrammed below and described in the text



conditions keeps a sensitive, galvanometer-type normally-closed relay open. Of course, failure of the light source (usually good for 30,000 hours) or other trouble in the system itself sounds an alarm, making the equipment self-supervising. Means are provided for maintaining constant line voltage, aging of the light source, and slow fouling of the lenses and reflectors exposed to the circulated air.

Shipboard detection

Photocells of the barrier layer or tube type may be used to actuate an alarm on an increase of current output by causing light to be reflected from airborne smoke particles to cells located outside of the light beam itself. An interesting unit of this type is the carbon dioxide fire extinguishing system made by the C-O-Two Fire Equipment Co., Newark, N. J., for protecting holds and other enclosed spaces on ships.

In this system, air drawn continuously from each protected space through piping enters a cabinet located in the wheelhouse, passes through the smoke-detecting compartment of the photocell device housed in the cabinet, and is then exhausted to the atmosphere.

Should smoke from a fire in any of the spaces appear in this air, the detector gives warning by causing a red lamp to light and an alarm to sound in the wheelhouse of the ship. At the same time, the smoke stream becomes visible in one of a series of individually numbered observation windows of the smoke detecting cabinet and instantly identifies the space affected. This space is then flooded with carbon dioxide by manual control, to extinguish the fire.

A novel arrangement of photocells is employed. Two or more "operating" cells, connected in parallel to the input circuit of a sensitive relay, are mounted face upward in the lower part of the smoke-detecting compartment. Directed by a lens, a beam of light from an exciter lamp, mounted outside the compartment and operated on a 120-volt dc circuit, passes over these cells, so that they normally receive only stray illumination. This illumination is, however, sufficient to generate some current; and, when the cells are installed, their position with respect to the stray light falling on them is adjusted until their combined output to the relay is approximately 5 microamperes.

Another photocell, mounted in any convenient position where it is reached by direct rays from the exciter lamp, is also connected to the input circuit of the relay but with polarity opposed to that of the operating cells. Around this "bucking" photocell is an annular shutter, which can be raised or lowered by turning a control knob, thus varying the amount of light falling on the cell and also the electrical output of the cell.

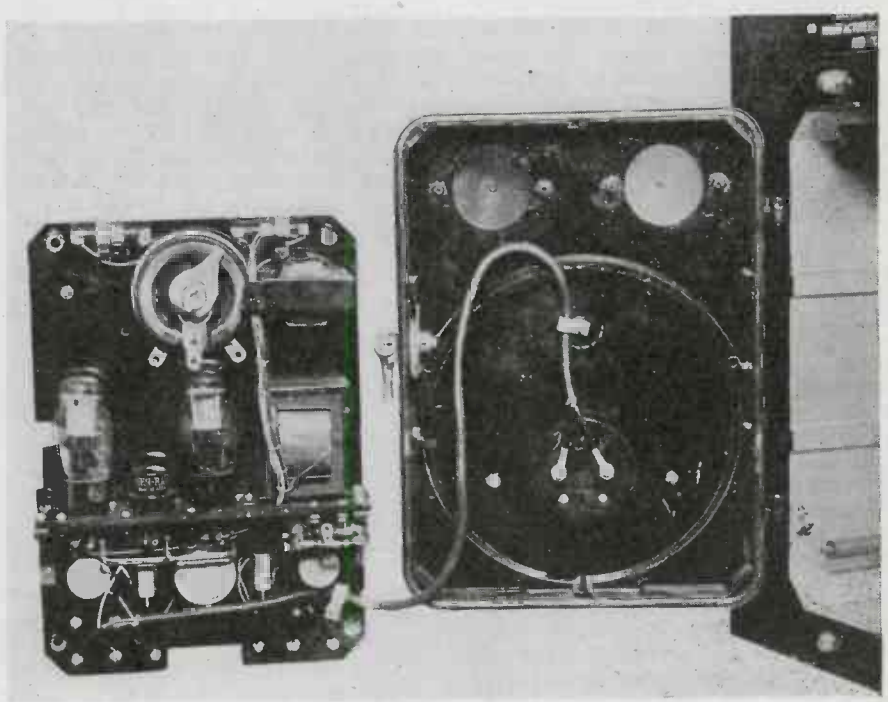
To set the detector for operation, the shutter of the balancing cell is adjusted until the output of this cell equals that of the operating cells and the current in the relay circuit becomes zero. This balance is attained when a needle attached to the relay points to a red arrow on its dial.

Operation

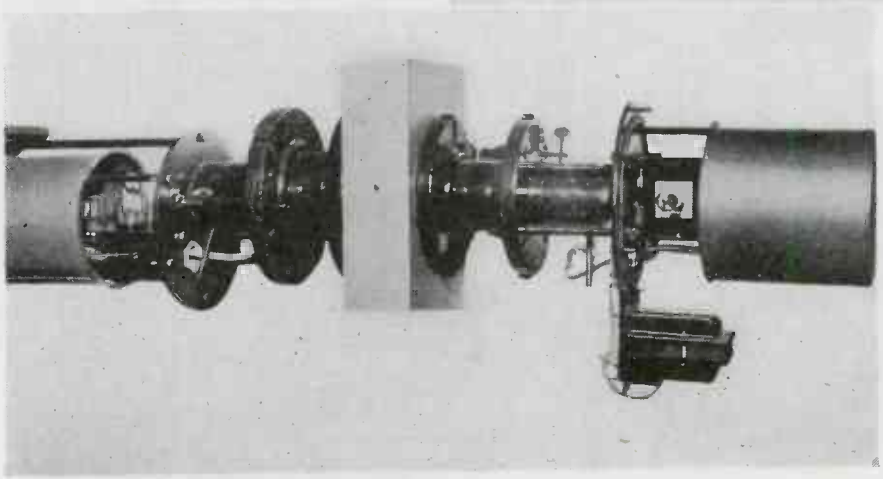
With this arrangement, smoke entering the smoke-detecting compartment is illuminated by the exciter-lamp beam and reflects light to the operating cells, while decreasing the direct illumination on the bucking cell. This upsets the balance in the relay circuit. The relay contacts close, actuating a power relay, which, in turn, closes the various circuits for an alarm, smoke indicating lamp, or other use. Temporary changes in the radiation from the exciter lamp, due to voltage variations and other operating causes, do not result in false alarms, because both the balancing cell and the operating cells are equally affected, the zero-current balance is maintained, and the relay is not operated.

The exciter lamp has a 500-watt rating but is operated at 400 watts input. In addition, it is burned at this wattage for only 4 seconds out of every minute, through the use of a motor-operated timing device. These safeguards, together with rugged mechanical construction, give this lamp a life of many years, minimizing replacements.

The brilliancy of the exciter lamp



Sensing element of the Brooke electronic relay. Left, P-E tubes; right, light source



Indicating unit removed from cabinet

is adjusted, occasionally, with the help of an auxiliary photocell, which is illuminated by the lamp (but plays no part in smoke detection) and is connected with a microammeter. By varying a resistor in series with the lamp until the needle of the microammeter points to a red arrow setting, the light output of the lamp is adjusted to the proper point.

Further protection from operating trouble is provided by a supervisory system, which lights a "trouble" lamp and sounds a buzzer when any lamp or other piece of equipment forming part of the smoke-detection system fails to function.

A simpler type of smoke detector, employing one operating cell and a balancing cell, with a continuously burning exciter lamp, has been developed for airplane applications.

Combustion control

If a photoelectric smoke detector is constructed with sufficient accuracy and installed in a flue or chimney, its varying output signal may be used as a visual indication of combustion efficiency in furnaces for heating or power generation. Coupled to suitable amplifying and control circuits, the principle may be utilized to regulate continuously the fuel-air ratio for maximum economy.

One such equipment is the Brooke electronic relay. Manufactured by the Brooke Engineering Co., Philadelphia, this device is used to convert impulses from a pair of phototubes into current to run a reversible motor. This motor, through the electronic relay, runs at a speed proportional to the signal and has full torque at all times. The electronic relay provides electrical compensation by means of a patented circuit varying the rate of condenser discharge. Such compensation is similar in results to mechanical throttling and reset types, but is accomplished all-electrically, without the use of electromagnetic relays. This throttling action and time delay are both readily adjustable.

Referring to the circuit diagram, bias to tubes J1 and J2 is supplied from one plate of rectifier tube Y. This dc output is filtered through group R5, C1 and C2 and then applied to voltage regulator tube B. From this regulated voltage the bias to tubes J1 and J2 is selected from resistors P4 and P3 respectively. With equal grid voltages, tubes J1 and J2 will have equal plate outputs through their respective half of the primary of transformer T2. Equal opposing currents through the two halves of the primary of transformer T2 will cause complete cancellation with resultant zero voltage across the secondary.

Any unbalance of plate currents will result in a secondary potential proportional to the degree of unbalance. The instantaneous secondary voltage sign is dependent on which half of the primary has the higher current. The entire operation of the electronic relay is based on the balance or unbalance of the currents in the two halves of the primary with the resultant secondary voltage changes. Assuming plate currents from J1 and J2 are equal, there is upon application of light to photo electric cell V2 an additional potential applied to the grid of J1 in proportion to the light intensity on V2. With a certain light intensity the bias to J1 and J2 is readjusted until both plate currents from J1 and J2 are again equal. From this point on, any change in light intensity will cause an unbalance in transformer T2.

Thyratrons G1 and G2 are biased just above their firing point from the dc potential off the other plate of rectifier tube Y through resistor P7 to center tap on secondary of T2 through P1 and P2 to grids of G1 and G2. Any plus potential applied to the grids of G1 and G2 from the secondary of T2 will cause one or the other of the thyratrons to fire, depending upon the direction of unbalance in the primary. The plate output of G1 and G2 are connected through a split series fractional horsepower motor so that firing of thyratron G1 will run the motor in one direction and thyratron G2 in the other direction.

Stepping action

The firing of either thyratron introduces a reversal of voltage to their grids by means of a feedback circuit from the plates of G1 and G2 through resistor R9 and P7 to center tap on secondary of transformer T2. This feedback voltage causes discharge of condenser C3 with subsequent change of voltage on grids of thyratrons G1 and G2 which causes them to stop firing. Condenser C3 then recharges and restores normal voltage to thyratron grids G1 and G2.

This results in a pulsating or stepping action which becomes increasingly effective as the induced voltage on the secondary of T2 approaches zero. The action prevents control mechanism from overriding the balance point. It should be noted that each firing step produces full power from the motor regardless of the nearness to balance point.

From this we have an electronic relay which will upon a certain light intensity on V2 cause a motor to stand still and with a slight increase or decrease of light cause the motor to run in one direction or the other. If this motor is then connected to a mechanism which will correct the conditions which caused the change in light intensity we have a control device.

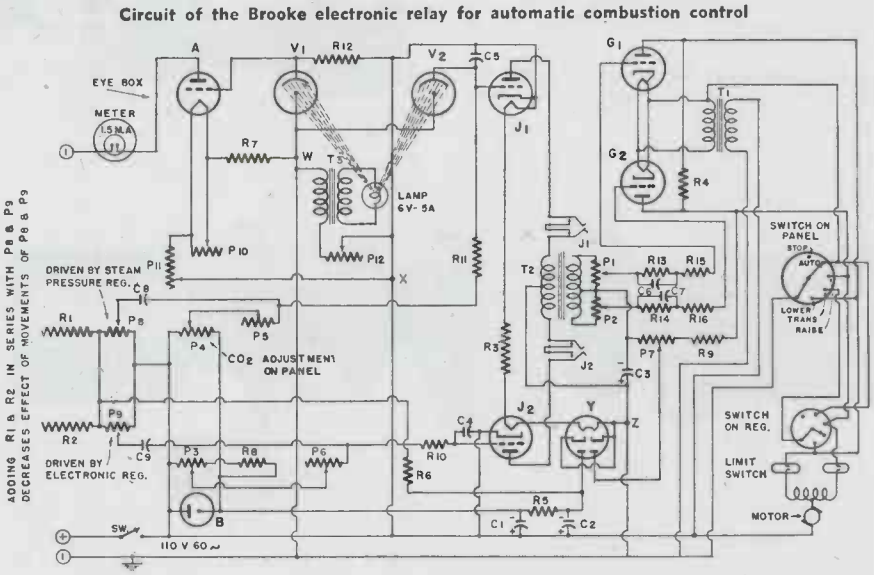
Time delay action

In combustion control the damper is moved to regulate the amount of air to the fire. In practice there is usually some degree of time lag between the time a correction movement is made and the time the correction actually occurs. This must be compensated for by introducing an adjustable time delaying action in the electronic relay over and above the compensation produced by the feedback circuit.

This action originates in variable resistor unit P9 which is driven through its entire range by being mechanically connected to the control mechanism. Across resistor P9 there is a dc potential from the

(*Continued on page* 194)

Circuit of the Brooke electronic relay for automatic combustion control



"TALKIES"

Engineering details of "Handies" and "Walkies"

● Since the Federal Communications Commission in its recently proposed frequency allocations included a spot in the spectrum between 460 and 470 mc for a "Citizens Radio-communication service," considerable interest has been aroused in the possibilities of equipment for the purpose. Now some additional details and pictures of currently used military types of "Handie Talkies" and "Walkie Talkies" that have played such a prominent part in the war effort have been revealed by the Signal Corps which has so extensively used the equipment.

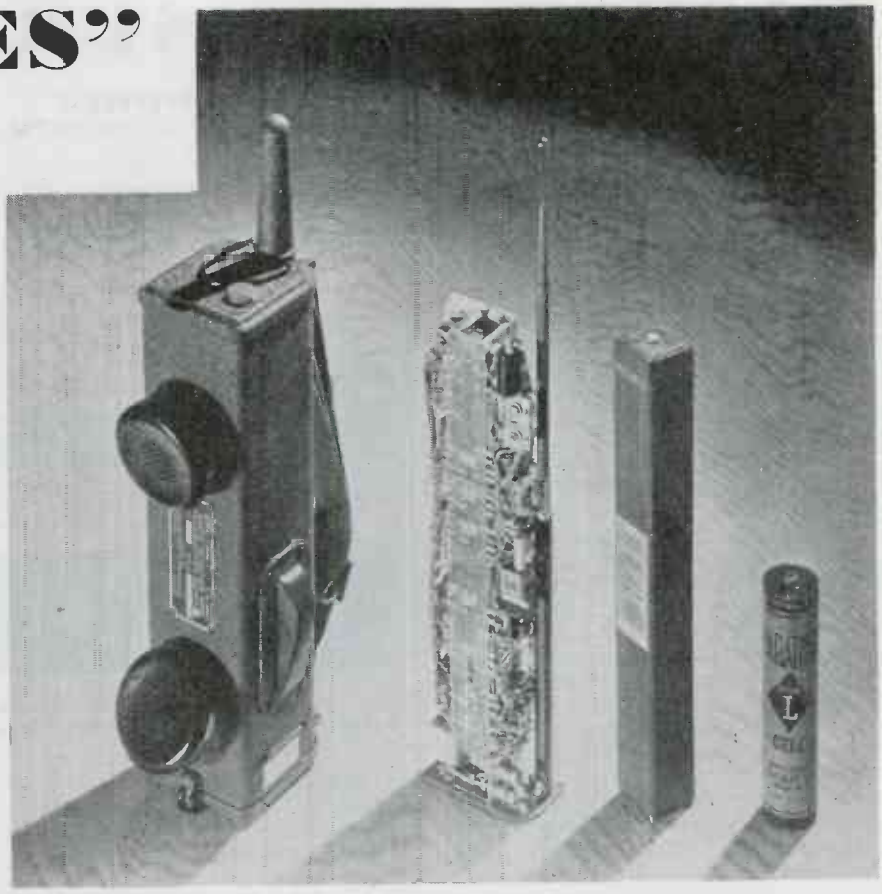
The "Handie Talkie" is about the size of a narrow cracker box, 3 x 3 x 12 in. long. The "Walkie Talkie" is about 17 in. high, 12 in. wide and about 7 in. thick. The smaller "Handie Talkie" weighs a little over 5 lb. and the larger "Walkie Talkie" about 35 lb. The "Handie Talkie" is carried in the hand, the "Walkie Talkie" on the back. Both are developments of the Galvin Mfg. Corp., Chicago.

The mouth and ear piece are attached to the "Handie Talkie" while the "Walkie Talkie" has connections into which are plugged the hand set (similar to a cradle type telephone set) and an earphone head set can also be attached. The range of the "Handie Talkie" is less than that of the more powerful "Walkie Talkie."

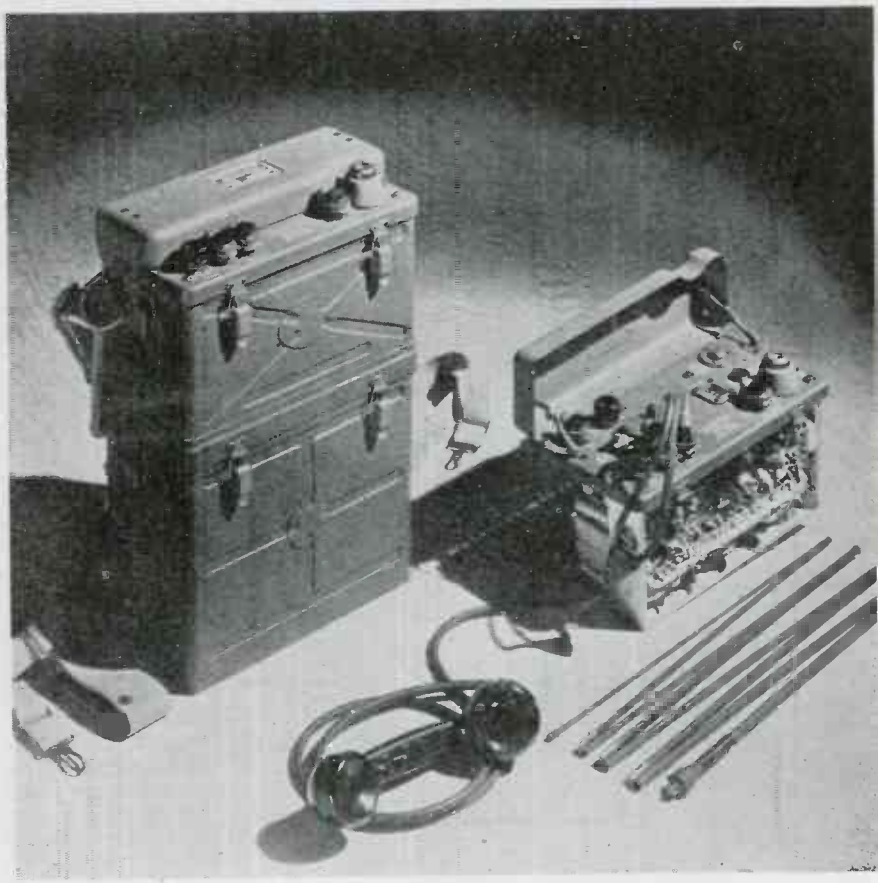
On the battlefield, the "Handie Talkie" and the "Walkie Talkie" are assigned different wavelengths. Each pair or more of the sets also have have their own wavelengths assigned for certain sections of the battle front so that the sets used by different companies or divisions will not interfere with each other. Wavelengths are changed frequently to avoid detection by the enemy.

Each "Handie Talkie" set operates on a fixed frequency, which can be quickly changed by simply changing a tube. The folding antenna attached to each unit is used for both receiving and sending.

When used for both sending and receiving messages the batteries have a life of 12½ hours. For receiving only, the batteries will last 50 to 60 hours. The range is limited to short distances and is used by troops to keep in contact with each other in landing operations and under battle conditions, as well as for other war communication purposes. Both sets are frequency modulated.



Inside and outside views of the famous Motorola "Handie Talkie" at the top showing types of batteries used, and the "Walkie Talkie" which weighs about 35 lb. ready for operation



GASKET PRESSURE METER

by GEORGE H. PFEFFERLE
Technical Director, Dresser Industries, Inc., Bradford, Pa.

Electronic "Sealometer" aids research and development of pipe couplings, clamps, and repair sleeves

● In many types of pipeline devices a thick rubber ring, compressed by bolting down iron clamps, is used to make a seal around the pipe. One type of joint is shown in cross-section in Fig. 1. The design of such mechanical joints is based on the principle that the unit pressure of this rubber gasket must exceed the pressure of the gas or liquid inside the line in order to prevent leakage. Obviously, if there is any variation of the gasket pressure, the minimum pressure is the one which determines the safeness of the joint. It therefore is important to determine accurately the distribution of the pressure which gaskets exert in order to design a successful joint.

An electronic device, the "Sealometer," was developed to cope with this problem. The device utilizes an audio howl as an aid to measuring pressures exerted by rubber gaskets in pipe couplings, clamps and repair sleeves.

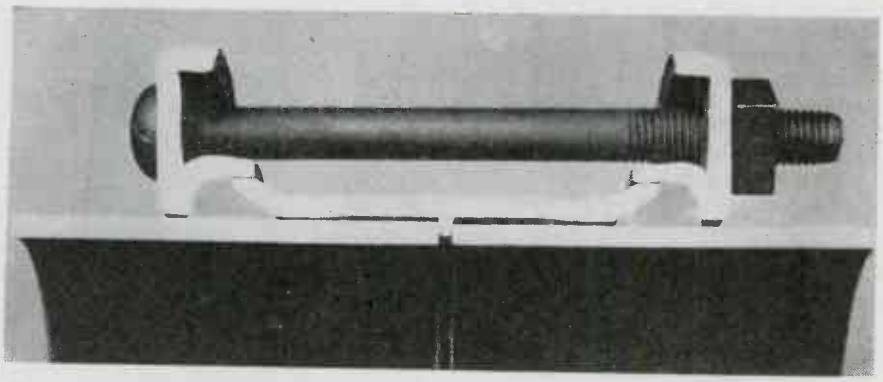
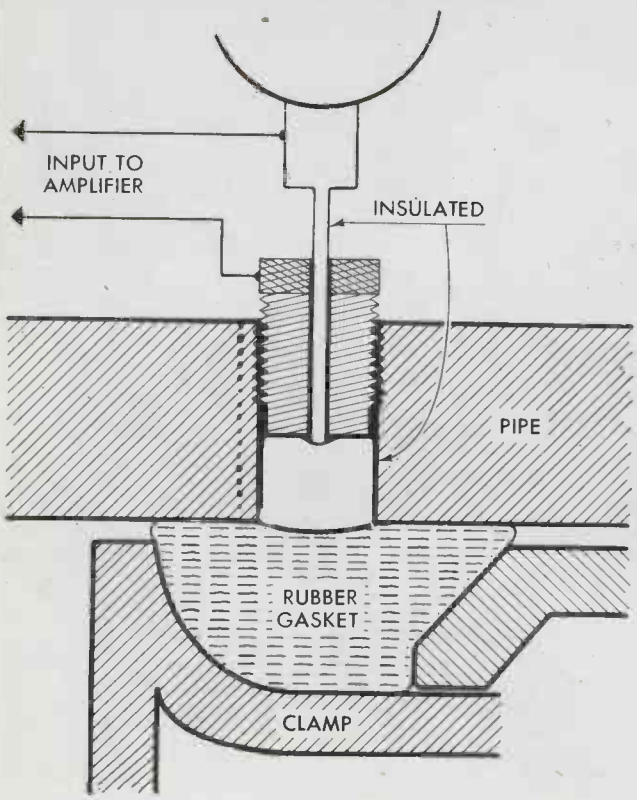


Fig. 1. One type of pipeline clamp, shown in cross-section, utilizes two rubber seals in which unit pressure greater than pipe's internal pressure must be evenly distributed to prevent leakage

Prior to development of the Sealometer, most tests were based on the assumption that the pressure was uniformly distributed and that the unit pressure was equal to the total load divided by the area of the gasket. There had been some attempts made to determine distribution of these pressures — observing impressions in a lead strip placed between the gasket and a grooved surface and studying through a glass-faced fixture the cross-hatched lines drawn on a gasket. However, each had limited value.

The problem of measuring the pressure which is exerted by an elastic solid such as rubber is much more complex than the measurement of fluid pressure. In the latter the displacement of fluid necessary to actuate a gage does not usually affect the applied pressure. When measuring rubber pressure, however, any appreciable displacement of the rubber will cause a considerable change in the pressure being measured, introducing an error of unknown proportions.

Fig. 2. Cross-section of the Sealometer's pickup head. Plunger of dial indicator is pressed through hollow screw against "pressure pin" (shown in white outline) forcing it into the compressed rubber. Contact between pressure pin and hollow screw is broken when manually applied pressure equals rubber pressure, setting up audio howl and allowing reading to be taken from indicator dial



Determining pressure

Two methods existed for determining force or pressure with very minute displacement. They were the piezoelectric method using a quartz crystal, and the McCollum-Peters telemeter using a sensitive carbon pile. However, both are such large instruments that readings could not be taken close enough together on a gasket to plot satisfactory pressure distribution curves. Also, each requires frequent calibration and the cost of the large number of units required would have been prohibitive for the problem at hand.

After extensive experimental work the Sealometer was developed. It was an entirely new, versatile and extremely accurate pressure gage free from the disadvantages of the previously existing devices. The principle of operation involves measuring the force exerted by the gasket upon the end of a "pressure pin" having an area of exactly 1/100 of an inch. Movement of the pin is limited to a few millionths of an inch—thus reducing the displacement error to a negligible value—by a special electronic circuit.

Each pressure pin is accurately fitted in a carefully reamed hole at any desired point in the test specimen and adjusted by means of a special screw (see Fig. 2) so that one end is flush with the surface contacting the gasket. A specimen thus prepared has packing surfaces substantially the same as those in a joint in actual use, and the behavior of the gasket is not altered. After the rubber ring in the test specimen is compressed, the pressure acting upon each pin is measured by applying an opposing force until a balance is obtained and the few millionths of an inch displacement of the pin occurs. This breaks the electronic circuit, setting up an audio howl. Fig. 3 is the circuit diagram.

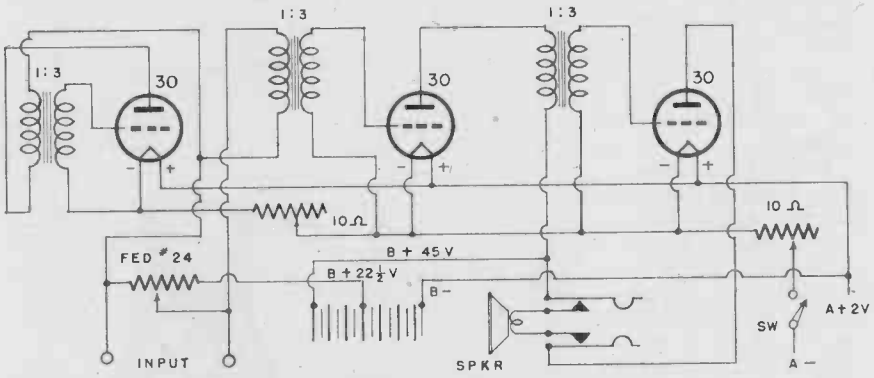


Fig. 3. Circuit diagram of audio howler to indicate equalized pressures. Primary of second transformer is normally shorted. Breaking contact in pickup head allows oscillator to excite amplifier stages

The opposing force applied on the pressure pins is exerted manually, as shown in Fig. 4. A stem of a dial indicator gage is fitted with a special needle-like plunger which can be inserted through the hollow adjusting screw to engage the pin. Mounted over the stem is a handle housing an accurately calibrated engine indicator spring that requires one pound of pressure for each .01 of an inch deflection. Any pressure exerted on the handle is transmitted to the pin through the plunger, the pressure being measured by the spring and recorded on the dial indicator. Since the area of the pin is 1/100 of an inch, each pound of pressure applied manually represents 100 psi.

Advantages of the Sealometer are numerous. The audio signal sounding when the balanced pressure condition is reached enables the operator to take readings without having to take his eyes from the gage. This simplicity of operation makes possible the reading and recording of pressures at the rate of about 150 per hour. Their accuracy has been checked at better than 98 per cent correct by independent methods, among them the use of a finely calibrated Bourdon-tube gage and the simulation of gasket pressures by means of fluid forced against a thin rubber diaphragm contacting the pressure pin. Since the actual diameter of these pins is only .1128 in. they can be spaced as closely as ⅛ in. apart on the test specimen.

Another advantage of the gage is that it permits pressure readings to be taken during assembly of a pipe joint as well as at any interval of time thereafter. It is also possible to take readings while the joint is under line pressure. The gage is not affected by such factors as condition of the pipe or bloom on the gaskets, which seriously distort the results obtained by internal pressure tests.

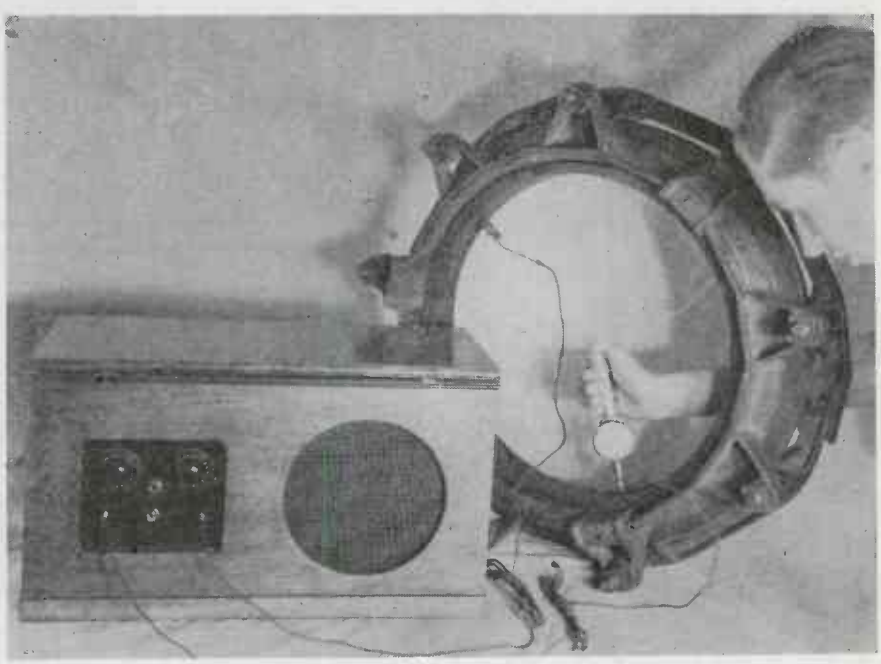
Three important factors influenced the design of the circuit of the Sealometer. Frequent opening and closing of the circuit in measuring the pressures would foul the contacts unless a very small current were used. Also, the limitation of movement on the pressure pin in order to avoid errors from distortion of the rubber gasket made it necessary to have a current that could not jump a gap of a few millionths of an inch.

A vacuum tube circuit carrying practically no current was selected. One wire from the front panel jack of the box housing the electrical apparatus leads to the stem of the indicator gage. The other wire from the panel jack is attached to the specimen being tested. Thus the current travels through the shoulder of the adjusting screw by way of the pressure pin to the plunger of the gage stem.

The circuit, of course, is broken when pressure on the plunger moves the pin away from contact with the shoulder of the adjusting screw. Insulation of the pin on all surfaces where it comes in contact with the reamed hole in which it moves prevents uncontrolled flow of the current. It was this insulating covering which proved one of the major difficulties. A coating of iron phosphate finally was selected. While not a superior insulation, it is sufficient to interrupt the slight current of the Sealometer circuit. At the same time it overcame the disadvantage of other types of insulation that were tried—a tendency to cause the pin to stick.

Results of tests of gasket pressures determined by the Sealometer were surprising. On one type of pipe joint—in spite of the fact that all bolts were tightened to exactly the same tension with a torque wrench—pressures ranging from 200 to 1000 lb. were recorded at various points around the gasket.

Fig. 4. Sealometer in use on a test specimen. Audio or visual indicating may be used



VHF HOMING DEVICE

Army develops simple system to locate lost planes and help pilots navigate safely to their fields

● High in the heavy overcast over Ohio one morning last summer, an Army fighter plane was lost. The pilot, Lt. Cecil Albright, well aware of the nearly exhausted gasoline supply, called frantically for help in locating Wright Field. Direction-finding equipment from the Signal Corps' radio laboratories on the field was called into service. A dozen planes near the field were picked up. There was no way to single out Albright's plane and guide him to safety. So he crashed. And, though the pilot escaped with only minor injuries, his plane didn't.

Over in the radio hangar, on the flight line, Virgil Faught, operator in charge of the Signal Corps radio station 09V, and radio operator Ed Spears had picked up. Lt. Albright's communications with the control tower and had themselves tried to help the flyer locate the field. When news of the crash came, they determined to do something about their inability to help.

Leads pilots home

A homing device to guide lost planes, especially fighter planes without a radio compass, had to be devised. The two men, with the full cooperation of their division officers, set to work to develop an instrument by which flyers, lost or unfamiliar with the area, could be picked up and guided by radio waves. Once over the field, the control tower could take over with landing instructions.

Beginning with a home-made antenna, Faught and Spears made many experiments and test flights. Today, the homing antenna is working successfully. Its value was proved dramatically in early May this year. Out of the heavy rain one dark day came a call for help. The pilot of a P-38, with only 60 gallons of gas left in his tanks, had become lost trying to locate Wright Field. If he were forced to land in a pasture, it would mean thousands of dollars in damage to his plane, and possible injury to himself.

Faught and Spears picked up the call and at once set their beam antenna into operation. Within 20 minutes the plane was over the field and receiving landing instructions from the control tower. Authorities have admitted that saving that one plane alone has amply paid for the cost of developing the antenna.

Fundamentally, this homing device is an application of a rotary beam antenna. It is a combination array consisting of a half wave dipole antenna with one director element and one reflector element. The construction of the antenna is shown in the drawing and photographs. The band of frequencies to be covered was the standard for AAF communications receivers. First consideration was the physical lengths of the director, antenna, and reflector. Length of each was figured for the

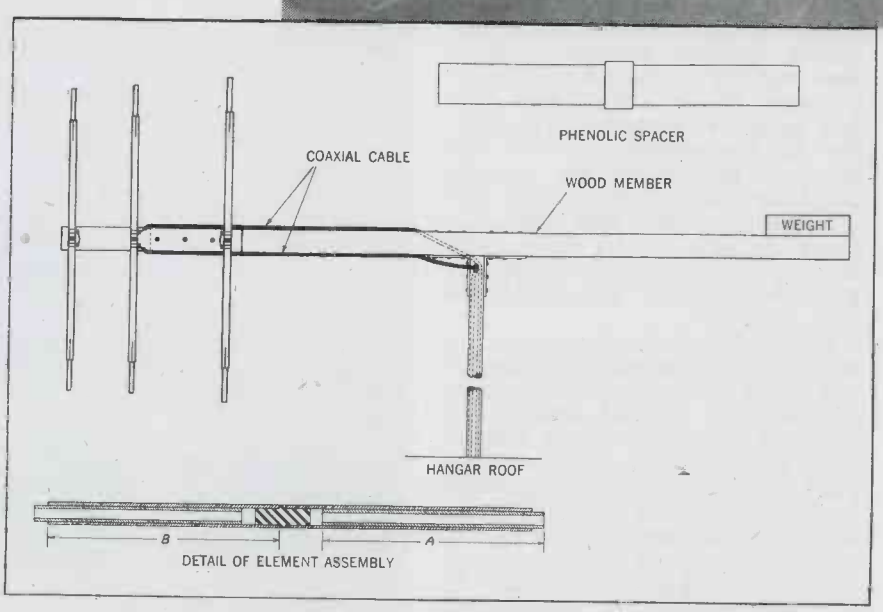
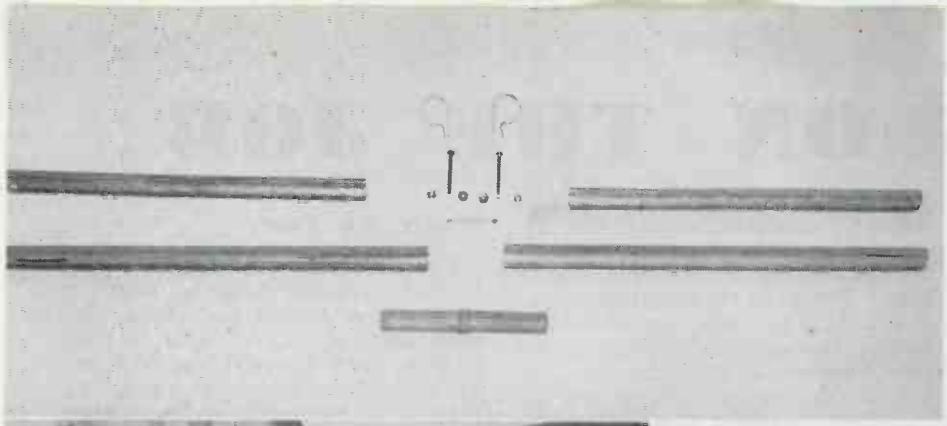
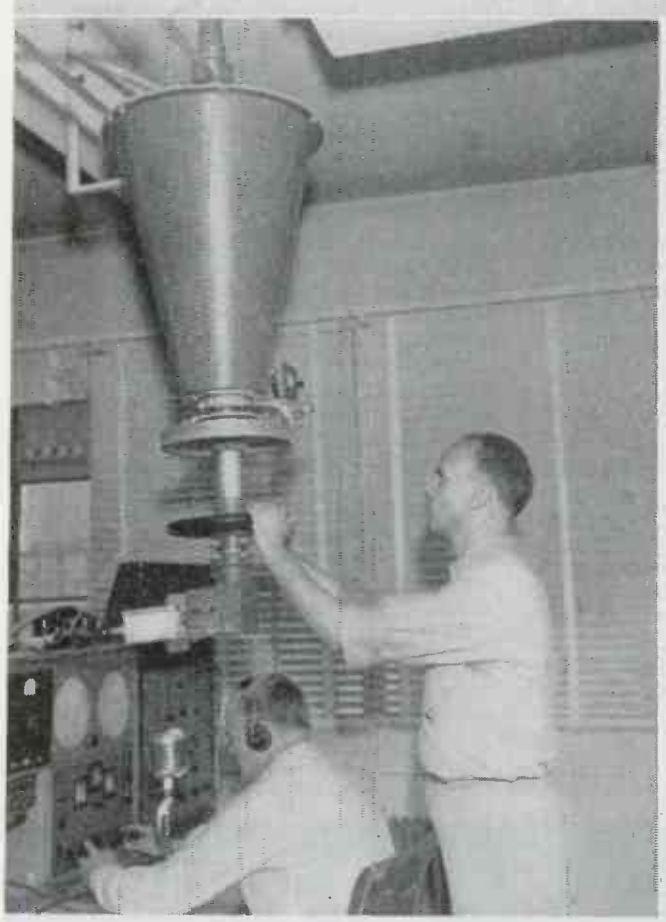


Photo above shows the rotable beam antenna mounted atop the Signal Corps Aircraft Radio Laboratory. Drawing shows essential features of the antenna construction





Left—Component parts of the three-element beam antenna used as a homing device at Wright Field. Below it is shown a photo made in the Laboratory where the antenna is rotated for best signal strength, locked in position and the pilot notified to fly a course based on meter readings shown on the antenna scale

shortest length necessary for the antenna to be tuned. Elements could then be extended by sliding sections for the antenna to be tuned at any frequency down to the lowest frequency of the band.

The director, antenna, and reflector each consist of two lengths of sidewall aluminum tubing which are held together with a piece of solid phenolic rod. The two lengths of tubing slip over the phenolic rod and are held apart by a shoulder on the phenolic rod. This is shown in the detail assembly drawing. Each of the antenna elements is secured to a piece of phenolic board with two metal cable clips, as shown in the photos. The director and antenna, and the antenna and reflector, are spaced on wavelengths based on the frequency near the middle of the band covered. The two lengths of tubing for the director and reflector are tied together with a jumper wire. Reason for this is explained later.

Lengths of sidewall aluminum tubing slide into each end of the director, antenna, and reflector. These are slid in and out when tuning the array. This is shown in detail assembly drawing.

Procedure followed in tuning the array is standard practice and, with one exception, needs no explanation. When tuning the director, the jumper between the two elements of the reflector is disconnected and the opposite is done when tuning the reflector. This action breaks up the element which is not being tuned so that the critical adjustments can be made. The phenolic board on which the antenna is mounted is bolted to a wood member which in turn is mounted on top of a pipe, being secured with two pieces of angle.

A weight is secured to the end opposite the antenna which acts as a counterbalance. The antenna feeders consist of two lengths of coaxial cable. Center conductors of the two cables are connected to the two antenna elements. Shieldings of the two cables are connected at the antenna and grounded at the other end. It will be noted that the antenna is "floating" with respect to ground. This has not affected the operation of the antenna and has proven very satisfactory.

When the antenna was first put into operation, it was mounted for horizontal polarization. Since this did not give the desired results, it was then mounted for vertical polarization which gave better results for this particular location. A simple rotating mechanism was designed for mounting the antenna, with a scale on which the operator reads the direction which the antenna points. As it was not desired to use sliding contacts for the feeder wires, the shaft was blocked from turning continuously, to keep from twisting and eventually breaking the feeders.

This rotating mechanism was used satisfactorily until it was possible to obtain an antenna equipment from a ground (mobile) direction finding set. This equipment provided an excellent calibrated control unit for the antenna. This unit was mounted immediately above the operator's table in the station with the shaft going through the roof of the hangar. This shaft was extended so that the antenna would be 30 ft. above the roof of the hangar. This antenna equipment uses inductive coupling for the feeders, gives excellent coupling between the transmitter and receiver equipment and the antenna, and also allows the antenna to be rotated continuously without sliding contacts.

Standard equipment

When the directive array was first installed, a standard VHF Radio Set SCR-522 was used for both transmitting and receiving. This is the same set used in airplanes and was satisfactory except that it did not have the output power desired. The transmitting equipment now used is a 50 watt VHF transmitter and the receiving equipment is another VHF receiver. The greatest signal strength reading is used for indication in operating the antenna. This is done because the radio station is mounted on the top floor of the hangar, which is a steel building, and is surrounded by nearby steel buildings, and, in addition, a large amount of noise is picked up from trucks and other machinery. Using a null reading, as is the normal case, would be unsatisfactory for these reasons. The output level meter of the receiver is used for the most accurate readings.

Very satisfactory results have been obtained over distances up to 150 miles from the station depending upon the altitude of the plane. When an airplane has been given the first bearing and is headed in the direction of the airport, bearings are repeated regularly until the airplane arrives over the field.

TUBES ON THE JOB

Mercury-Vapor Detector

A new electronic instrument for instantaneously detecting the presence of mercury-vapor concentrations in the atmosphere has been announced by the Special Products Division of the General Electric Company. The new detector is designed particularly for use in the glass, chemical, smelting, metal-mining, and electric apparatus manufacturing fields where mercury-vapor concentrations must be kept below the toxic limit—1.2 parts mercury vapor in 100,000,000 parts of air by volume for continual breathing—to safeguard the health of employees. The detector will measure directly mercury-vapor concentrations as high as one part in three million parts of air by volume and as low as one part in two hundred million parts, with an accuracy of approximately 5 per cent. Set at its highest point of sensitivity, the detector is also capable of measuring with reasonable accuracy concentrations as low as one part in a billion. In addition, it will detect mercury if it is carried by a gaseous medium whose spectral absorption band does not overlie the 2537 Angstrom wave length.

The detector samples air from the atmosphere at the rate of one-quarter to one-half a cubic foot per minute through a cylindrical absorption chamber within the instrument. This chamber contains an ultra-violet lamp and a phototube. Normally, the lighted ultraviolet lamp permits normal current to flow through the phototube, but the presence of mercury-vapor in the air drawn into the absorption chamber intercepts and scatters the ultraviolet light, thus reducing the phototube current. By means of a bridge circuit, this drop in the phototube current is translated into an upscale reading on the indicating instrument of the detector.

Small, light in weight, and easily operated, the detector is housed in an attractive, portable steel case on the front of which are conveniently mounted a line voltmeter, a microammeter, the adjusting knobs of the rheostats, and the requisite switches.

"Handie Talkie" in Combat

Many combat uses of the Motorola Handie Talkie are vividly demonstrated, under simulated battle conditions, by Errol Flynn in the new Warner Bros. movie, "Objective Burma." All through the movie Flynn uses the Handie Talkie to maintain communications with infantry and paratroopers and to direct and control combat operations.

Music by Fax

The first part of Dmitri Shostakovitch's latest musical score—a composition for piano, violin and cello entitled "Trio"—was flashed to New York directly from Moscow by radiophoto over the circuit of RCA Communications, Inc. Hurdling wartime communication obstacles, the transmission is the first of its kind involving a major musical work and presages the speeding of compositions by the world's great musicians from one continent to another by radiophoto as soon as completed.

In actual transmission time, it took twenty-four minutes for the first page of the musical score to come from Moscow over the RCA receiving radiophoto machine. To facilitate handling, the photograph of the composition was sent in four sections of six by eight inches each, and these were cut into a mosaic of standard musical page size for the positive print. A microfilm airmail transit of the Leningrad Symphony took nearly three days, and musical scores carried by ordinary mail often require several weeks to travel that distance.

The music was required here in a hurry to permit its broadcast from WEAF and over the NBC network.

Sampling air at rate of half a cubic foot a minute, electronic detector measures mercury vapor concentrations of one part in 3,000,000 parts of air

For first time score for symphony (reproduced) is sent by facsimile; time from Moscow to New York, 24 minutes

DIATHERMY PROBLEMS

Study of interference reduction indicates that additional band width on 27 mc would make FCC allocations serviceable

● For a number of years considerable discussion has been taking place on the problem of diathermy and industrial heating equipment interference in an effort to eliminate frequent disruptions of communication services. This discussion largely comprised a few "damns" and too little relating to actual solutions. The problem has been brought to a head by the FCC proposal to assign certain narrow bands to the operation of such equipment that is capable of causing interference. The importance of the high frequency heating application was not marked before the war, but there is every reason to believe that medical uses will increase, and the industrial uses are rapidly increasing to cover many new services, both as to number of installations and power.

These pages have been full of reports as to the unique applications of heat to hundreds of industrial uses, most of which have no alternate process that could be substituted. This is largely because of its unique ability of heating all parts of a non-conductive mass equally throughout, not only on the surface. New uses in different industries are discovered daily when all forms of gluing, drying, dehydrating, molding, tin flowing, soldering, fusing, tempering, annealing, sterilizing, cooking, etc., are considered.

Importance grows

In the medical field the uses are now becoming well known, and it is reliably estimated that some 200,000 outfits will be in use in a few years, more than double the 85,000 now in use, as reported by the FCC. The installations overshadow many times the high frequency power used in the radio broadcast art, no matter whether considered from the standpoint of total power, number of installations or the power levels found in individual installations.

These notable achievements are generally viewed with alarm by the television and UHF broadcasting industry (including FM). It is only by careful analysis of the problems found in both of these widely divergent electronic industries that a workable solution is to be found. Having spent many years working in both the television and the diathermy fields, it is our belief that the generalized solution of the whole interference problem (so often heard from communication engineers) "give them a frequency and make them put in crystal control" will do nothing toward a workable solution and the interference problem will always be with us. Similarly the alternate proposal "make them operate in shielded rooms" provides a nice sounding scheme. But this proposal also lacks knowledge of the conditions under which either the usual industrial unit operates, or which are necessary in a medical installation, when coupled with complete information as to the intricate and exacting details of what constitutes a complete shielding job, even one that only partially meets the FCC suggestion of the need for a 120 db attenuation.

The solution is one requiring engineering attention, with the same thoroughness that contributed so much toward advancing the communication art. This discussion will take up medical equipment in particular, since the problems in that field are quite different.

PANEL 12 PROPOSALS

Dominant frequency Mc	Wave length Meters	Band width %	Frequency limits Kc
0.225	1333	±0.45	224 226
0.450	666.7	±0.22	449 451
1.707	175.7	±0.1	1705.3 1708.7
3.415	87.85	±0.1	3411.6 3418.4
6.830	43.92	±0.1	6823.2 6836.8
13.660	21.96	±0.1	13646.3 13673.7
27.320	10.98	±7.3	25320.0 29320.0
			Megacycles
40.980	7.321	±0.5	40.755 41.185
81.960	3.660	±0.5	81.55 82.37
163.92	1.830	±0.5	163.10 164.70
491.76	0.610	±0.5	489.31 494.21
FUTURE EXPERIMENTAL Mc			
1050	—	—	1000 1100
2550	—	—	2500 2600
5100	—	—	5000 5200
10200	—	—	10000 10400
20400	—	—	20000 20800

Panel 12 of Radio Technical Planning Board has recommended these channels for high frequency heating and other non-communication applications

Pertinent questions

Starting from the beginning, the following questions come up:

(1) Have the presently-operated diathermy outfits been proved to be the culprits?

(2) Will operation on the proposed bands eliminate enough of the interference to be worth while?

(3) Are these frequencies satisfactory for medical applications?

(4) Will this proposed close regulation (0.05 per cent) increase the cost of treatments or prevent the purchase of needed equipment by prohibitive costs?

(5) Are there any other methods whereby such interference can be reduced? For example, how effective is shielding?

(6) Then there is the final question that has come up in some quarters: Does FCC have a right to control a non-communication service?

A study of this problem was underway some years back by a group representing the FCC, Bureau of Standards, the Council on Physical Therapy for the A.M.A. and certain manufacturers, to determine the extent of the interference and methods for its reduction, but this project was dropped at the outbreak of the war. Had it continued there would doubtless have been a

more complete answer to many of these questions.

An immediate result of this work, however, was the suggestion to use crystal control made by the Bureau of Standards, in their Specifications W-D-286 1/21/43. This proposal has been followed up by certain of the procurement agencies of the services and a great many outfits purchased during the past three years have had crystal control. The technical problems inherent with the use of crystals just to stabilize frequencies in such designs are easily solved, but the difficulties introduced thereby from the operating and servicing viewpoints are reported to be large although the whole answer here is still undetermined. Estimates vary among manufacturers but the opinion seems to support an admission to a doubled or tripled cost to the purchaser when crystal control is added.

Medical equipment usually runs to about 400 watts output so that a couple of buffer or frequency multiplier stages are needed between the crystal and the driver tubes ahead of the final amplifier. The equipment must be made foolproof so that loss of excitation or other troubles inherent with the more complicated system will not cause permanent damage, when used by those entirely unacquainted with technical equipment of this nature. It will be readily evident especially to transmitter engineers that the problem is not easy.

Safety precautions

In the usual self-excited oscillator circuit the excitation is dependent on the load current, being controlled by the feedback. In case the load changes or falls to zero the excitation also falls off and the plate current stays within reasonable limits. In a master oscillator rig, the final stage is nothing but an amplifier and if properly excited for good efficiency at full load will be grossly overexcited and will "run away" if the load is removed or is too low during the setup and adjustment period. This can be disastrous to the tubes —and a loss of a $50. pair of tubes would not be unusual. It is impossible for a doctor to estimate in advance what the load will be, and to set the load resonating circuit within the close limits demanded for tube safety, by "inspection" of the patient, and this is what he must do each time a treatment is started. It is not unusual to have the load change rapidly after treatment is started because small shifts in the location of the electrodes cause large variations. Safety features—circuit breakers or provision to do all tuning at lower power levels would help—but at the same time providing full safety is an expensive proposition. More frequent servicing would also be needed, an item of no small importance in many communities.

Standardization difficulties

There is also another effect noted by the writer some years ago in the design of such equipment, that from the medical viewpoint may be equally important. As in any medical treatment it is necessary to standardize the dosage in every particular case, so that any treatment prescription can be carried out exactly. Universal acceptance of any therapy system by the profession will not occur until this can be done. In use, either two insulated metallic pads or a loop of wire must be applied to the patient as required. This "load" must be maintained in resonance with the operating frequency (if any useful energy is to be transferred to the patient). If this frequency is fixed precisely with crystal control, as proposed, it does not take many tests to show that very small movements cause major shifts in the energy level applied when the whole load is made up of a moving human connected to loose electrodes by flexible leads. The effectiveness of the treatment may change over wide limits and even drop to zero.

A satisfactory way of getting a known and unvarying loading condition is to tightly couple the patient's applicator circuit, so that little reliance is placed on resonating the circuit. When this occurs the frequency shifts (over certain limits) automatically in accordance with load demands, a condition easily made possible with self excited oscillators. This feature simplifies and standardizes the procedure to be followed by the doctor and makes any treatment less affected by changes in position.

Does diathermy interfere?

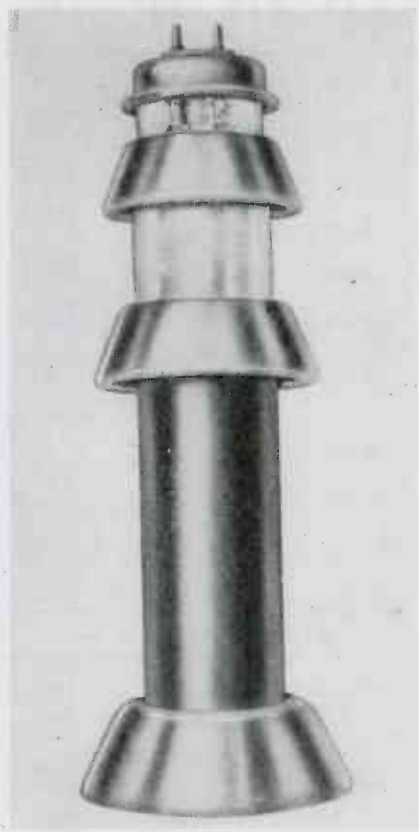
Any plan which would substitute a complicated outfit that is operated and serviced with difficulty for a simple affair that gives better satisfaction is not promoting a satisfactory or permanent solution.

That diathermy equipment causes interference is a well admitted fact. Keyed outfits have been heard for hundreds of miles in special tests. While it is admitted that a certain percentage of the trouble may be wrongly attributed to diathermy, as the matter stands something must be done to clear up the interference.

Reporting the other side of the story, it may be mentioned that some four years ago, when the question of interference was under discussion and restrictive legislation was contemplated, the manufacturers' group of the American Surgical Trade Association became alarmed at the implications. To evaluate the actual amount of interference created by diathermies as well as other instruments and equipment, a nationally known institute was engaged to study the matter. After broad and exhaustive studies and field tests as to various forms of interference and the level of such interference their report indicated that actual interference by the better designs of short wave diathermies was practically negligible and of such a low level that they were submerged by the radiations emitted by other commercial equipment. The report substantiated the idea that short wave diathermies were not the great offenders they were supposed to be. However, details as to the scope of these tests are not known and until they can be analyzed or repeated to the satisfaction of tele-

(*Continued on page* 223)

VOICE OF AMERICA



Tubes like this largest (200kw) high-power, high-frequency unit, developed by Federal Telephone and Radio Corp, will power OWI's West Coast short-wave international broadcasters, are used at Bethany on East Coast, as well. Tube weighs 350 lb., has 50 lb. of copper in the anode, is water cooled

ASSOCIATION NEWS

Happenings of the month concerning industry organizations

IRE Fund Organization

Powell Crosley, Jr., has been appointed chairman of the Campaign Executive Committee which is in charge of the work of supervising the raising of the Institute of Radio Engineers Building Fund; Dr. L. P. Wheeler is assistant chairman. The Initial Gifts Committee is headed by Dr. W. R. G. Baker; Austin Bailey of AT&T heads the Section Solicitation Committee; R. A. Hackbush of Stromberg-Carlson is chairman of the Canadian Council. The Building Fund Administrators are Melville Eastham (General Radio), L. C. F. Horle and E. A. Nicholas (Farnsworth).

RMA War Planning

For more effectual RMA action on the military program, a new RMA Industry War Planning Committee has been established by President Cosgrove. It succeeds the former Industry Reconversion Committee and has been given increased jurisdiction on military production problems. A. S. Wells, of Chicago, is chairman and Ernest Searing, of Philadelphia, vice-chairman of the new Industry War Planning Committee. Membership also is transferred from the former Industry Reconversion Committee, involving not only changing the name of the former committee but also more encompassing activities relating to the government radio-radar program.

AIEE Honors Alexanderson

Highest award of the American Institute of Electrical Engineers, the Edison medal, was conferred upon Dr. E. F. W. Alexanderson of the General Electric Co., at the annual meeting of AIEE, late in January. Another GE engineer, W. R. Wilson, was awarded the Alfred Noble Prize of $500 for an outstanding paper on electrical engineering.

Welding Education

In order to broaden the scope of its service to the metal working and fabricating industries, the Resistance Welding Manufacturers Association has inaugurated a program of cooperative educational activity on resistance welding. The main objective of the program is to encourage and to assist expanded use by making more widely available a knowledge of the advances in welding technic and in fabricating procedures which have been made during the war production period. Harold S. Card has been appointed educational director in charge of this program, with headquarters in the Citizens Building, Cleveland, Ohio.

Radio Club Elects

At the meeting of its directors on January 18, the Radio Club of America, Inc., re-elected for the 1945 term the same officers who served the previous year, as follows: President, F. A. Klingenschmitt; Vice-president, O. James Morelock; Treasurer, Joseph Stantley; Corresponding secretary, M. B. Sleeper; Recording secretary, John H. Bose; Publicity chairman, Austin C. Lescarboura. Mr. Morelock is also Chairman of the papers committee.

Conventions and Meetings Ahead

Electrochemical Society (Colin G. Fink, Columbia University, New York); Spring Convention, April 12-14, Hotel Claridge, Atlantic City.

Optical Society of America (A. C. Hardy, Massachusetts Institute of Technology); April 12-14, Cleveland, Ohio.

American Institute of Electrical Engineers (H. H. Henline, 29 West 39th Street, New York); North Eastern District Meeting, April 25-26, 1945, Buffalo, N. Y.; Summer Technical Meeting, June 25-29, Detroit, Mich.

Society for Experimental Stress Analysis (W. M. Murray, President, Central Square Station, Cambridge 39, Mass., Post Office Box 168); 1945 Spring Meeting, May, Buffalo, N. Y.

American Society for Testing Materials (260 S. Broad Street, Philadelphia, Pa.), June 18-22, Buffalo, N. Y.

Servo Mechanisms

The New York section of the Institute of Radio Engineers continued its series of supplementary meetings devoted to industrial electronics, January 17, with a paper by Dr. A. C. Hall, assistant professor in Electrical Engineering, Servomechanisms Laboratory, Massachusetts Institute of Technology, on "Application of Circuit Theory to the Design of Servo-mechanisms."

During the past few years engineering practice makes widespread use of automatic control devices or servo-mechanisms of which the most popular type in use where intricate control functions must be handled, uses the self-synchronizing motors, which are now available in so many styles. At one extreme these servo-mechanisms are large enough to be used in various types of steel mill controls. Smaller varieties are used to actuate automatic tuning devices in radio transmitters and receivers and in many remote control and indicating jobs associated with military equipment.

The major part of the paper pointed out the remarkable similarity between the action found in this field and that associated with feed-back amplifiers. Based on this analogy, useful basic automatic control design rules were formulated by which any desired stability, speed of response, over-shoot, and deviation limit can be designed into the system. By the use of a plot, which is equivalent to the Nyquist diagram for feed-back amplifiers the contribution of each component in the system, as it affects the overall characteristics, being a straightforward function, can be anticipated with satisfactory accuracy.

Descriptions were given of the two general types of systems: the open cycle controller consisting of a simple transmitting servo with its associated receivers or indicators with amplifiers when needed; and the closed cycle servos which involve a feed back of energy which provides a "follow-up" action. In one case, this action operates to drive the field structure of the transmitter servo around to follow any movements taken by the rotor. In other words, in this case

(*Continued on page* 210)

Array of some of induction and dielectric heating equipment of twelve manufacturers demonstrated at Chicago High Frequency Heating Conference. Brazing, heat treating, drying, preform softening, and similar practical jobs were performed for conference attendants during three-day sessions

STUDY ELECTRONIC HEAT

3,000 engineers, manufacturers and executives learn of practical applications and watch demonstrations

● Over 3,000 engineers, manufacturers and executives attended the three-day technical and demonstration sessions of the High Frequency Heating Conference held in Chicago late in January. The Conference was jointly sponsored and well managed by the Chicago Lighting Institute and the Great Lakes Power Club.

Dielectric and induction heating equipment from twelve leading manufacturers was on display, and typical heat treating, soldering, plastic preform heating, and plywood glue-setting applications were demonstrated at each session.

Technical papers by engineers of leading companies in HF heating covered a variety of topics. Papers entitled, Fundamentals of High Frequency Heating, were presented at successive sessions by J. P. Jordan, General Electric Co.; J. W. Cable, Induction Heating Corp.; S. Schneider, Westinghouse Electric & Mfg. Co.; Dr. H. B. Osborn, Jr., Ohio Crankshaft Co., and Dr. E. Mittelmann, Illinois Tool Works. These papers covered induction as well as dielectric heating theory in progressive degrees.

Special applications

In addition to papers on the fundamentals of the two main phases of the art, other speakers covered special applications; High Frequency Heating in Brazing and Low Temperature Soldering (H. U. Hjermstad, Federal Electric Co.); Heat Treatment of Metals (Otto Weitman, Lepel High Frequency Labs.); Application of Dielectric Heating to Wood Products (Paul D. Zottu, The Girdler Corp.); Use of Dielectric Heating for Sterilization, Pasteurization and Cooking (Wiley Wenger, Radio Corp. of America); Melting and Heat Treating Large Masses of Metal (F. T. Chestnut, Ajax Electrothermic Corp.); Forging of Metals (H. A. Strickland, Budd Wheel Co.); Use of Dielectric Heating for Plastics, Rubber and Rubber Substitutes (V. W. Sherman, Federal Tele. & Radio Corp.); A Mercury Arc Frequency Converter (S. R. Durand, Allis-Chalmers Mfg.

Mercury arc frequency changer units for 60/2000 cycle operation produce 250 kw and higher power for induction heating of large parts. High efficiency (90% or better) at even light loads is important feature

Co.); Uncommon Fields of Application for High Frequency (E. D. Tillson, Commonwealth Edison Co., Chicago); Function of Electric Utility in High Frequency Heating (W. M. Woll, Commonwealth Edison Co., Chicago).

A question and answer period followed each session with the answers being given by a panel of experts from the various equipment manufacturers. The problem of one user on soft soldering was the loss of the tin coating on copper when HF current was applied. H. U. Hjermstad, Federal Electric Co., recommended plating the work before soldering. In commenting on the flashing between turns of work coils on soldering jobs, Mr. Hjermstad said that the coil can be lined with a cylinder of glass cloth treated with silicone compound. V. W. Sherman, Federal Tele. & Radio Corp., reported good success in preventing arcs by treating work coils with glyptal.

Silver brazing

A question regarding the possibility of brazing rotor bars to end rings on an induction motor with HF equipment was answered by J. P. Jordon, General Electric Co. He suggested that with current designs of rotors, atomic welding was a better method.

Regarding silver brazing, H. A. Strickland, Budd Wheel Co., said that even heating up to alloying temperature is essential. He recommended processing more pieces at one time rather than applying high power concentrations to each piece in order to speed processing.

The possibilities of high frequency cooking were described as limited at this time. The experts described their experiments with cooking, particularly of meat, and explained that the results obtained on most types of meat would not be acceptable. The different electrical properties of the bone structure, fat and lean parts of a piece of meat result in very unequal heating and, consequently, those parts with the lowest specific heat reach a much higher temperature than the other parts, thus causing burning. An example was given in which a chicken was cooked whole, and while the meat was well done the bones were charred black. Homogenous mixtures, like hamburger, can be cooked satisfactorily.

Metal treating

Dehydration of shredded vegetables and similar food products was considered economically feasible if performed industrially. The process requires high vacuum systems.

The demonstrations by the various manufacturers of their products showed a great difference in the capabilities of the non-electronic equipment as compared with the electronic type particularly in the heavy metal industry. The largest standard electronic generator is limited for heat treating of gears approximately 3 in. in diameter while motor generator units are available for handling gears up to a number of feet in diameter. The simplicity and ease with which the non-electronic units function for treating metal made a spectacular showing. Another factor which points out the difference between the various basic equipment systems is the initial cost, which is about $50 per kw. for motor generator apparatus against $150 for vacuum tube equipment. Of course, in the dielectric field the electronic equipment has no competition.

In connection with high power, low frequency generation S. R. Durand, Allis-Chalmers Mfg. Co., described an electronic unit which fills the gap now served by motor-generator equipment.

Designed for the purpose of electronically changing power at commercial frequencies of 60 or 25 cycles into 1,000 to 2,000 cycle power, the mercury arc type of frequency changer, Durand revealed, is particularly suitable for supplying power for forging, melting and metal treating applications where large masses of metal or metal parts must be efficiently heated with this power at kilowatt capacities of 250, 500, 1,000 and higher. Two highly successful applications of the new converters have been made in the past year, one being a 300 kw unit in a forge plant, and the other a 250 kw unit in use in the melting section of a brass foundry.

Mercury arc converter

In months of operation, according to Durand, these mercury arc frequency changers have performed at higher full load and much higher partial load efficiencies than is possible with other types of converters for like frequencies; and operating and maintenance costs of mercury arc converters have proved to be much lower. The units are quiet in operation and require no ventilation or air-filtering, since they are water-cooled. In addition, high capacity mercury arc converters offer no vibration problems, making heavy and expensive foundations unnecessary. It was reported that the operating efficiency at half-load was over 90 per cent and still better at higher outputs.

In a paper not presented at the Chicago Conference, Carl J. Madsen, Electronic Engineer, Westinghouse Electric & Mfg. Co., has presented a number of the limitations of dielectric heating.

In considering these limitations, it must be understood that almost all of them are interlocked, to some degree with each other. Hence, in discussing each individually it is well to remember these inter-relations when considering an actual application.

High frequency energy is not a cheap source of heat. In terms of

(*Continued on page* 211)

Contour hardening technique of small gears is shown in this set-up. Automatically timed heating cycle is followed by water quench from spray ring surrounding work coil. Electronic generator has 15 kw capacity

SURVEY of WIDE READING

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

Effect of a Spherical Screen Upon an Inductor

C. F. Davidson and J. C. Simmonds (Wireless Engineer, London, January, 1945)

Expressions are developed for the decrease of inductance, δL, and for the increase of resistance, δR, caused by a spherical screen of radius a and surface conductivity R_s surrounding the conductor to shield it from external fields. The sphere may be regarded as a good approximation to screen shapes normally in use. The derivation is based on the assumption that the inductor may be replaced by N concentric circular loops of radius b. Further, the dimensions of the inductor and of the screen are assumed to be small compared with the operating wavelength.

The results are given by the following equations:

$$\delta R = \pi N^2 R_s \sum_{n=1}^{\infty} \left(\frac{b}{a}\right)^{2(n+1)} \frac{2n+1}{n(n+1)} \times \frac{P_n^1(0)^2}{\left\{1 + \frac{R_s^2(2n+1)^2}{(\mu a \omega)^2}\right\}},$$

$$\delta L = \pi \mu b N^2 \sum_{n=1}^{\infty} \left(\frac{b}{a}\right)^{2n+1} \frac{1}{n(n+1)} \times \frac{P_n^1(0)^2}{\left\{1 + \frac{R_s^2(2n+1)^2}{(\mu a \omega)^2}\right\}},$$

where $P_n^1(\omega)$ is the associated Legendre polynominal of order n.

For metal screens, at radio frequencies, and for b/a (the ratio of loop diameter to diameter of spherical screen) values smaller than 0.9, the expressions may be simplified to:

$$\delta R = \pi N^2 R_s \sum_{n=1}^{\infty} \left(\frac{b}{a}\right)^{2(n+1)} \frac{2n+1}{n(n+1)} \times P_n^1(0)^2 = \pi N^2 R_s \left(\frac{b}{a}\right)^4 F_1\left(\frac{b}{a}\right),$$

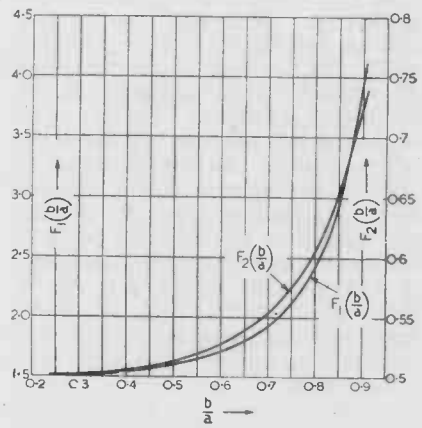
$$\delta L = \pi \mu b N^2 \sum_{n=1}^{\infty} \left(\frac{b}{a}\right)^{2n+1} \frac{P_n^1(0)^2}{n(n+1)} = \pi \mu b N^2 \left(\frac{b}{a}\right)^3 F_2\left(\frac{b}{a}\right).$$

Accuracy to within 0.1 per cent will be secured. The accompanying figure shows graphs of the functions F_1 and F_2 for values of (b/a) up to 0.9.

When the ratio b/a is smaller than about 0.5, the inductor may be replaced by a magnetic dipole and the equations reduce to:

$$\delta R = \frac{3\pi N^2 R_s}{2} \left(\frac{b}{a}\right)^4,$$

$$\delta L = \frac{\pi \mu b N^2}{2} \left(\frac{b}{a}\right)^3.$$



Graphs to assist in computing effect of spherical screen on inductor

Determining Young's Modulus of Elasticity (Using Ultrasonics)

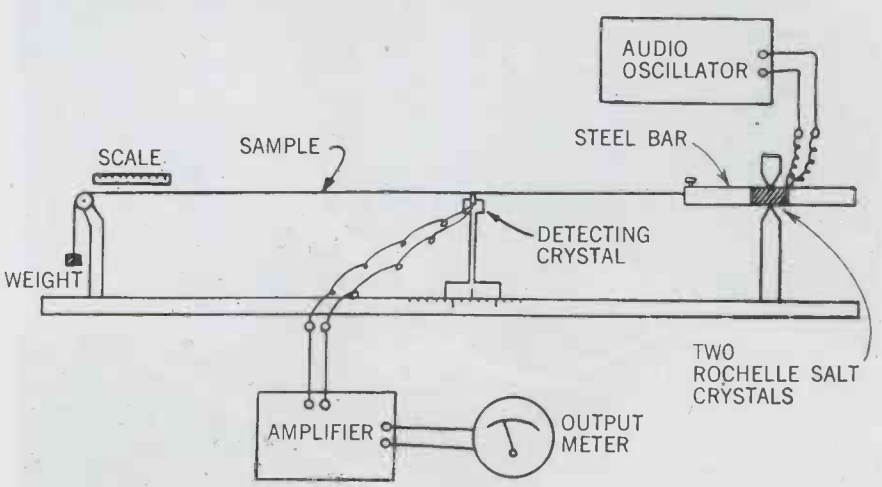
J. W. Ballou and S. Silverman (Journal of the Acoustical Society of America, October, 1944)

Young's modulus of elasticity, E, is the force in dynes required to stretch a piece of material of one square inch cross-section to double its original length, in other words, it is the stress required to produce unit strain. A method to determine Young's modulus was developed with a view to applying it to the study of the fundamental properties of fibers and narrow film strips of elastic materials, such as natural and synthetic rubber, plasticized resins, etc. The method is based on the equation $v = (E/d)^{\frac{1}{2}}$ for the propagation of sound waves in elastic media, where v is the velocity of sound and d the density of the medium.

Values for the density d could be found in the literature; the velocity of sound v was measured with the apparatus shown. The two Rochelle salt crystals mounted in the steel bar are excited by the audio oscillator at a frequency of 9.4 kc. Another thin Rochelle salt crystal attached to a slidable support acts both as a reflecting fret and detector of the amplitude of the standing waves set up in the sample. As this crystal is moved along the sample, successive peaks in sound intensity are noted, their distance giving the half-wavelength. The frequency being known, it was easy to compute the sound velocity, and, by substitution into the above formula, determine Young's modulus of elasticity. The small scale was

(*Continued on page 219*)

Electronic apparatus to determine elastic properties of fibers or narrow films



If you want the job done right —

A group of Hytron engineers decided in 1938 that to get those ideal tubes for "ham" radio — they must build them themselves. Combining years of experience in tube manufacture with exact knowledge of the tube characteristics desired, they went to work.

First they concentrated their efforts. Low and medium power types were most needed by the majority of hams. Hytron was equipped to make them. Gradually the engineers translated ideals into a comprehensive line—v-h-f triodes and pentodes, low and medium mu triodes, instant-heating r.f. beam tetrodes, and sub-miniatures.

Hams themselves, the engineers knew their brain children would be given the works. They built the tubes rugged; rated them conservatively. And did the amateur go for them! The v-h-f types — HY75, HY114B, HY615 — soon became accepted standards. Today's WERS operators use them almost exclusively.

Performance in the proving ground of amateur radio was the proof of the pudding. You will find Hytron transmitting and special purpose tubes in war and civilian jobs of all kinds. Like the BANTAM GT and BANTAM JR., they are popular because they are built right for the job.

OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

HYTRON CORPORATION ELECTRONIC AND RADIO TUBES

SALEM AND NEWBURYPORT, MASS.

ARMY NAVY

BUY ANOTHER WAR BOND

WHAT'S NEW

Devices, products and materials the manufacturers offer

Wide Range Amplifier

The Langevin Co., Inc., 37 West 65th St., New York, has developed a new type 101-A amplifier designed primarily to transmit excellent low frequency wave form at high output levels. This unit is mainly intended to feed groups of wide range loudspeakers where excellent music reproduction is required. Internal input impedance is 1,500 ohms, high gain, and 25,000 ohms bridging. Output impedance is adjustable to match loads from 1 to 1,000 ohms. The amplifier delivers 50 watts to a nominal load impedance with less than 3 per cent RMS harmonic distortion at 400 cycles.

Copper Plating Aluminum

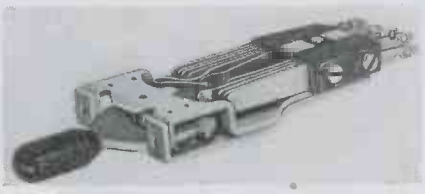
Adherent, uniform copper plating is now possible on aluminum and its alloys by means of a simple preparatory dip at room temperature. Practically any copper electrolyte can be used as the plating solution except the sulfate types or those having a high degree of acidity. High-speed, bright-copper can be deposited. The process developed by the Technical Processes Division of the Colonial Alloys Co., Philadelphia, consists of a specified means of aluminum cleaning and preparation, followed by a 10 to 30 second immersion in a simple dipping solution at room temperature and then plating from copper plating electrolytes.

New 813 Tube

Continuing its manufacture of beam power transmitting tubes under the RCA license, recently acquired, Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago, has started production on an 813 tube. This is a beam power tube of high sensitivity with a maximum plate dissipation of 100-watts. It requires less than 1-watt of driving power to produce about 260 watts when used for cw, need not be neutralized in circuits which provide adequate shielding. The tube utilizes low screen current and, when used as a frequency multiplier, is able to generate a high harmonic output at high efficiency. It can be operated at maximum ratings up to frequencies of 30 mc and with reduced ratings up to 60 mc. Maximum cw output is 360 watts, and plate modulated output is 240 watts, when operated in Class C.

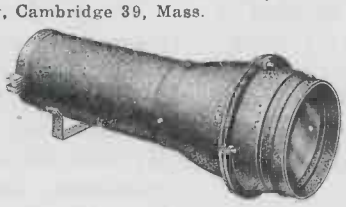
Narrow Lever Key

A new lever key only 7/16 in. wide, for control purposes in electronic and communications equipment where small size is important, is being produced by Federal Telephone and Radio Corp., Newark, N. J. The 18 spring capacity permits more than 500 possible switching combinations. Designed for one or two way, locking or non-locking operation with a positive action, the entire key assembly is held together by a single screw to facilitate disassembly. The spring pile-up mounts on one side of the two-piece pressed steel frame, with all front position springs in one group and all back position springs in another.



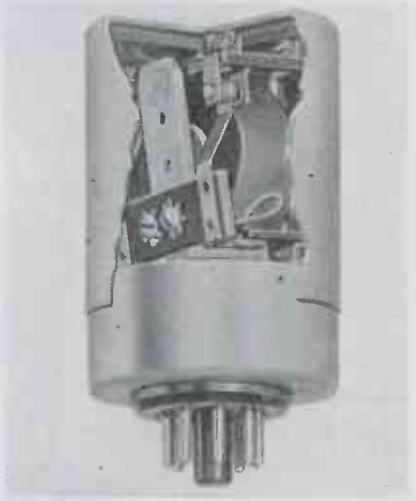
CR Tube Shield

Engineered for use with 3 in. cathode ray tubes, Model M-996h cathode ray tube shield combines shielding with both panel and chassis mounting. Protection against vibration and shock are afforded by a shock absorbing cushion built into the clamp ring and by gum rubber gasket around the tube face. Mechanical protection for the tube is provided by a transparent screen, available in either plain or colored Lucite. The shield body, formed of Mu-metal, is cadmium plated, with black baked wrinkle finish. Maker is Metallic Arts Co., 243 Broadway, Cambridge 39, Mass.



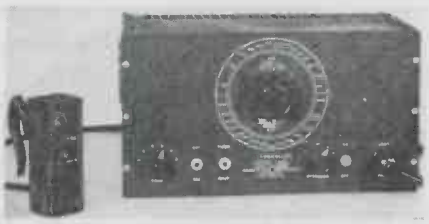
Aircraft Rheostats

Two new power rheostats for aircraft have been brought out by The Ohmite Mfg. Co., Chicago. The units are made in accordance with the latest Army-Navy Aeronautical Specifications AN-R-14a. (Drawing 3155). They meet the salt spray corrosion test and other critical tests—and operate satisfactorily in the temperature range from —55 deg. C. to +70 deg. C. Two sizes are Model "J" 50-watt and Model "H" 25-watt. Linear or taper wire-wound, in various resistances, with "off" position, as required. Totally enclosed in a compact, corrosion-resisting metal container.



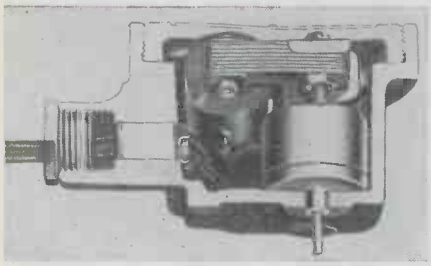
Plug-in Relay

A new relay of the plug-in type, enclosed in a metal can and fitted with a standard octal plug base, has been developed by Ward Leonard, Mt. Vernon, N. Y. The mechanism is encased in a cylindrical metal housing 2-1/16 in. in diameter and 3⅛ in. high. It is rigidly supported against shock by means of a key in the center of an insulating disc that fits snugly in the top of the case. The relay, made to operate on standard voltages up to 115 volts, ac or dc, is double pole, double throw; contacts are rated 4 amperes at 115 volts, 60 cycle ac, and at 24 volts, dc, ½ ampere from 25 to 115 volts, dc.



New Stroboscope

Based on a new principle, the recently developed CML model 1200 stroboscope increases the range through which moving objects may be examined. Now rotary speeds from 600 to 600,000 rpm or vibrations from 10 to 10,000 cps, can be "stopped" and studied. Since the light source is mounted in a small probe at the end of a 5-foot flexible cable, small objects may be easily viewed at close range. Provision is made to operate the unit from external tuning fork or crystal standards, where extreme accuracy is required. The motion of objects moving at irregular speeds may also be "stopped" with the Model 1200. An accurate repetitive pulse-rate is obtained, as the pulses are derived from a stable audio oscillator. This eliminates the necessity for constant readjustment of the repetitive rate, and also insures clearly defined images at high speeds. A light intensity control switch is provided for greater flexibility. The maker is Communication Measurements Laboratory, 120-24 Greenwich street, New York.



Explosion-Proof Motor

A new explosion-proof electric motor has been developed by Warren Telechron Co., Ashland, Mass., primarily for use in connection with automatic controls used in industrial processes where atmospheres containing ethyl ether vapor, gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors and natural gas are found. The motor is totally enclosed in a bronze casting with removable screw cover plate and adapted for explosion proof conduit mounting. It can be supplied for various shaft speeds, voltages and frequencies.

Fungicidal Tape

A new, fungicide treatment now is used in manufacturing Mystik self-stik cloth tape. The fungicide is applied to all components of the tape: the cloth, the adhesive and the backing which impregnates the tape against water, moisture, salt spray, gases and other damaging elements. The tape is used as a seal in packing and as a protective covering when applied directly to the product itself. Maker is Mystik Adhesive Products, 2635 N. Kildare, Chicago 39, Ill.

High Voltage Tester

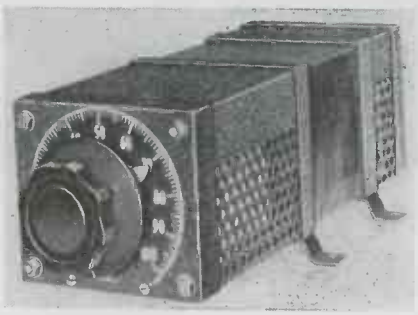
A light-weight, compact high voltage supply for testing corona effects, leakage and breakdown of all manner of dielectrics and assemblies has been made available by Northern Laboratories, Ltd., 3-01 27th Avenue, Long Island City, N. Y. Ranges are 0 to 5 kv, 0 to 10 kv and 10-0-10 kv (10 kv each side of ground or 20 kv between output terminals). Supplies from the increment of voltage from 0 to maximum rating indicated are by calibrated voltmeter. Milliammeter indicates commencement of leakage and also gives quantitative indication. A high voltage relay is operated by a micro-switch when the cover is lifted and extra ground connections are supplied for safety. Voltage is controlled by a Variac transformer which must be returned to 0 position to operate relay for cutting in high voltage. Accessories include three six-foot test leads with banana jacks and alligator clips. Model NL5-H5, illustrated, can be supplied with auxiliary capacitor network for momentary high current breakdown tests. Normal current range is 0 to 2½ milliamperes. Auxiliary capacitor network furnished in separate steel box with large porcelain standoff insulator for high voltage terminal.

Mildew Retardant

MerQree is described by its makers, Mer-Q-Ree, Inc., Bethesda, Md., as a mildewcide. The product is a clear liquid containing mercury compounds and other chemicals intended to prevent mildew. It is used in the proportion of one pint to five gallons of varnish or other coating material.

Variable Transformer

In the Gulow Vari-Former voltage is continuously variable without circuit interruption from zero to maximum values. A self-aligning solid silver contact, finger-tip controlled by a single knob switch, provides small increment voltage change throughout the range. No carbon brushes are used. Incremented increase is in the order of 0.75 volts or less. Standard units are auto-transformer type for high efficiency and good regulation. They are available wound for constant current or taper wound for current proportional to voltage. Units are supplied with auto-transformer winding or separate winding for isolation of circuits. Available for one or three phase use with single control. Made by the Gulow Corp., 26 Waverly Pl., New York.

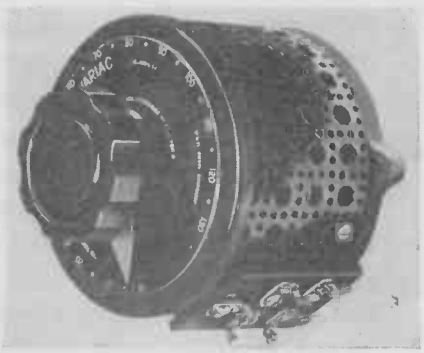


Stepping Relay

The Type 82 rotary relay stepping unit is a compact twelve position driving mechanism which operates a shaft extension through 360° in twelve progressive steps. The actuator can be furnished as a direct drive indexing the load with the current impulse, thus the switching operation is complete the moment the solenoid operates, or the actuator can be furnished as a spring drive, indexing the load following the current impulse. In this case, the switching operation is accomplished by spring action following each current impulse. The current required to operate this unit will depend upon the torque required for a particular application. For a twelve ounce-inch load a twelve ohm coil drawing two amperes from a 24 volt dc supply would be required. Manufactured by Price Brothers Co., Frederick, Md.

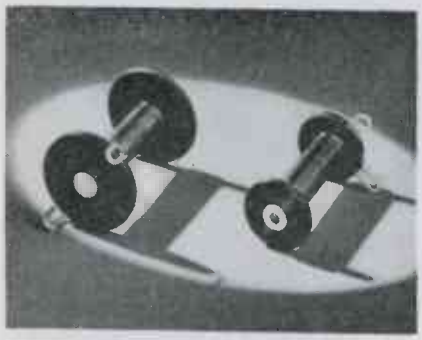
50-kw Electronic Heater

A new 50-kw electronic heater for surface and localized hardening of gears, rods, and other parts and for annealing, brazing, and soldering operations has been developed by the Industrial Heating Division of the General Electric Co., Schenectady. The new heater incorporates all of the features of the 5-kw and 15-kw models and, in addition, is capable of heat-treating much larger parts or the same size parts in less time. This heater is readily applicable for many different heating jobs by changing the induction-coil fixture. Available in models rated either 230 or 460 volts, 3 phase, 60 cycles, this heater is easy to operate. Automatic controls regulate heating and quenching cycles. An attached work table provides two heating positions. Completely enclosed in grounded steel, which minimizes radiation and affords protection for the operator, the entire unit weighs approximately 6,000 lb. and is 84 in. wide, 94 in. deep, and 82 in. high over-all. The electronic heater cabinet is composed of two compartments, one of which contains an air-cooled transformer to step-up power supply voltage to the six rectifier tubes, and such accessory items as a contactor, a tap-changing switch, and filament transformers. The other compartment contains the high frequency components—a single water-cooled oscillator tube and a bank of water-cooled capacitors. Meters and controls are mounted on the front.



400-Cycle Variac

The latest addition to the General Radio line of Variacs is the Type 60-A, a 400-cycle 5-ampere model for 115-volt use. Rated nominally at 400 cycles, it can be used at any frequency between 400 and 2600 cycles. The rating is 860 volt-amperes. Output voltages up to 135 volts are obtainable with 115-volt input. A new type of brush and radiator construction is used so that brushes, when necessary, can be changed in a few seconds. Available either with or without case. The overall height is 4⅛ in., the overall diameter 5½ in. Net weight is 3½ lb. cased, 3 lb., 2 ozs. without case. Maker is General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.



Bakelite Molding

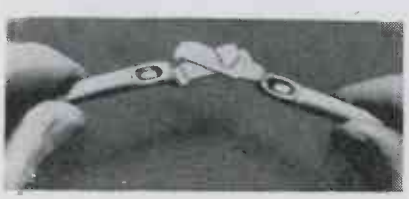
A method of molding bakelite to provide sealed barriers between the coil windings and cores of its relays has been originated by the R-B-M Mfg. Co., division of Essex Wire Corporation, Logansport, Ind. With this technic, high impact bakelite is molded directly to electro magnet cores without deforming them. Finished bobbin assemblies can be subjected to extreme limits of temperature without failure. The same method is also used to mold coil terminals directly in the bobbins, thus assuring adequate insulation and secure anchoring of the terminals.

Loudspeakers

A complete new line of loudspeakers engineered to cover the entire size range from 2 to 15 in. has been developed by Permoflux Corp., 4900 West Grand Avenue, Chicago. Speakers are true dimensioned and diaphragms are graduated in ½ in. steps up to and including 7½ in. with other standard sizes up to 15 in. The line will provide power handling capacities from 1 to 20 watts and is designed to give acoustical output in 2 db steps. A new magnetic alloy which provides an actual magnetic efficiency of at least three times that of pre-war type magnets, results in considerable weight savings. All speakers are completely dustproof with metal parts rust-proof finished.

Quick-Disconnect

A new self-locking quick-disconnect electrical connector, known as the Burndy Clasp, designed espeially for small wires and approved by the U. S. Army Air Forces, is now available from Burndy Engineering Co., Inc., New York. Composed of two identical halves, this new quick-disconnect slides together in jack-knife fashion and locks in a positive position with a slight pull. This exclusive locking feature prevents loosening or pulling-apart in service, even though someone should inadvertently pull or jerk on the cables.

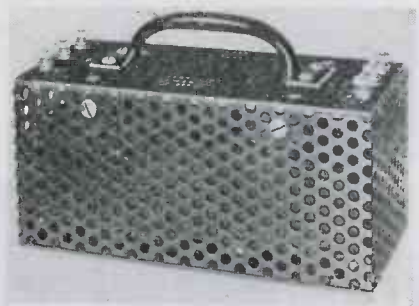


Panel Instruments

A new line of 1½ in. electrical indicating instruments has been developed by Roller-Smith, Bethlehem, Pa., designed to withstand the extreme conditions of temperature, humidity, vibration and shock in aircraft service and to withstand hydrostatic pressures up to 14.7 psi without case leakage. The instruments are available in dc voltmeters, in all practical ranges above 50 millivolts and in dc ammeters in all practical ranges above 500 microamperes.

Radiohms Improved

Another Centralab product to revert to prewar construction is the split knurl midget radiohm. The difference is in shaft specifications. Present construction specifies an extruded brass rod that allows immediate cutting to desired length as well as slotting the fin to the exact depth of the original control without removal of the tip. Radiohms effected by the revived construction process are CRL part numbers NK-136 to NK-144 inclusive and NK-172 to NK-174 inclusive. Both old and new specifications call for a 3-in. shaft from end of bushing. A slight spread of the shaft portion is essential to provide tension for the knob in both cases. Manufacturer is Centralab, Division of Globe-Union, Inc., Milwaukee, Wis.



Isolating Transformer

A new type of isolating transformer wound for three-phase current but usable on single phase has been developed for laboratory and testing purposes by New York Transformer Co., 26 Waverly Pl., New York. The unit is portable and rated at 250 VA, 115 V, 1 to 1 ratio, three phase with a frequency range of from 60 to 400 cycles. The housing is well ventilated and the unit weighs 16½ lbs.

Delay Relay

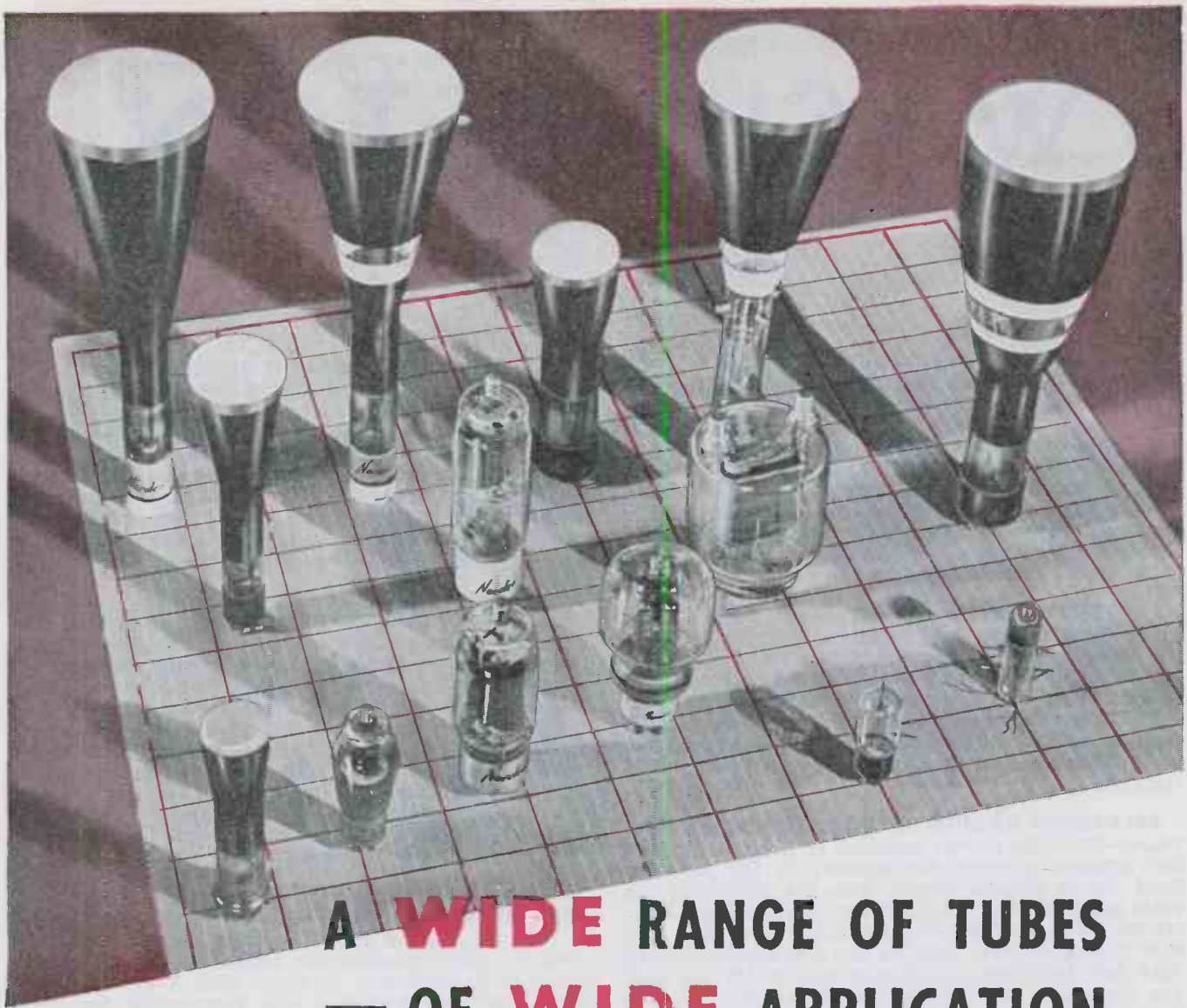
A new type Amperite thermostatic delay relay incorporates a porcelain heater and provides for operating delays ranging from 1 to 120 seconds. The unit is hermetically sealed, has an octal radio base and is made in two types: SPST normally open, and SPST normally closed. The unit is explosion proof and designed to operate under temperature changes from —40° to 110° F. The maker is Amperite Co., 561 Broadway, New York 12, N. Y.

Audio Chanalyst

A new and advanced RCA Audio Chanalyst, which provides complete sound system testing equipment in a single unit, has been developed by the RCA Victor Division of the Radio Corp. of America. Type 170A is comprised of several self-contained testing sections or "channels" and can be used to test any point of any sound system from microphone to speaker, serving in emergencies as a bridging unit to substitute for the defective section of an inoperative amplifier. It contains a calibrated high gain amplifier, supplies its own test signal from a built-in beat frequency oscillator, which can be operated by an internal auxiliary sweep circuit for checking multiple speaker installations. The Volt-Ohmyst is included as one of the channels and has been modified for flat, linear measurement of audio frequencies. An impedance tester and a high-speed electronic indicator add to the unique testing facilities of the Audio Chanalyst, as various combinations of its channels can be used for audible and visual testing.

Pre-heater Unit

Designed and built especially as a production unit for the plastics molding industry, the new model X875 Thermex high frequency heating unit has an output of 400 watts, automatically controlled, and is made by the Girdler Corp., Louisville, Ky. The unit weighs 250 lbs. and is 15 in. wide, 23 in. high and 29 in. deep. Ordinary 230 volt, 60 cycle single phase current is used. The built-in heating cabinet and removable 7 x 10 in. tray make this Girdler machine a flexible piece of equipment. The upper electrode can be adjusted to a height of 2¼ in. above the tray. There are no dials, no tuning, nor even a push button. Closing the preform drawer all the way in automatically turns on the high frequency power and timer. At the end of the prescribed time the red indicating light goes out and the operator transfers the heated preforms to the mold cavities in the press.



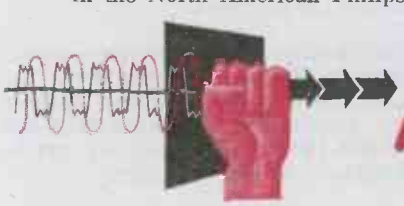
A WIDE RANGE OF TUBES — OF WIDE APPLICATION

THE enviable engineering tradition on which the foundation of the North American Philips Company, Inc., rests, is reflected in the superior quality and performance of electronic tubes bearing the NORELCO stamp. Contributing to the long life and uniform characteristics of these tubes are many exclusive manufacturing techniques and inspection methods developed over a long period.

Among the types we now manufacture—some of which are illustrated—are a number of special-purpose, cathode-ray and transmitting tubes for high and ultra-high frequency applications, r-f and a-f power amplifier tubes, and low- and high-power rectifiers. Although all the tubes we produce now go to the armed forces, we invite inquiries from prospective users. A list of the tube types we are especially equipped to produce will be sent on request.

In the North American Philips Company, there is gathered together a team of outstanding electronic engineers, coached by a group with world-wide experience resulting from fifty years of research and development in the electrical field. This new combination of technical talent has at its command many exclusive processes that insure electronic devices of the highest precision and quality. Today, North American Philips works for a United Nations Victory; tomorrow, its aim will be to serve industry.

OTHER PRODUCTS: In addition to the electronic tubes mentioned above we make Quartz Oscillator Plates; Searchray (X-ray) Apparatus, X-ray Diffraction Apparatus; Medical X-ray Equipment, Tubes and Accessories; Tungsten and Molybdenum products; Fine Wire; Diamond Dies.



Norelco
Reg. U. S. Pat. Off.

When in New York, be sure to visit our Industrial Electronics Showroom.

ELECTRONIC PRODUCTS by

NORTH AMERICAN PHILIPS COMPANY, INC.

Dept. D-3, 100 East 42nd Street, New York 17, N. Y.

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

WASHINGTON

Latest Electronic News Developments Summarized by *Electronic Industries'* Washington Bureau

ORAL ALLOCATIONS ARGUMENTS—The FCC expected to gather much valuable information from the respective segments of the radio industry—FM broadcasting, television, communications, mobile services and manufacturers—at the oral arguments on its Proposed Allocations Plan from 25,000 kc to 30,000,000 kc, which commenced Feb. 28 and continued for several days. The main problem was the settlement of the controversy over the placement of FM broadcasting in the spectrum with the FM group opposing the projected shift of its bands from 42-50 mc to 84-102 mc.

PROTEST FM SHIFT—The FM position was presented by FM Broadcasters, Inc., its manufacturing members, the Yankee Network and the Milwaukee Journal station of FMBI President Walter Damm. The U. S. Office of Education was understood to have joined hands with FM broadcasters in protesting the "upstairs" shift for this service on the ground that several educational institutions have already invested public funds in FM stations.

TELEVISION GROUPS SUPPORT FCC PLAN—Television—the radio service heralded as likely to produce the greatest postwar development in the art—was lined up in general accord with the FCC proposed video assignments. The Television Broadcasters Association, Allen B. DuMont Laboratories, Inc., RCA and NBC presented their views at the oral arguments and TBA had indicated in advance that it did not seek any change in the proposed assignments. Columbia Broadcasting System again contended that the move "upstairs" for higher-definition and color television should be effected at the earliest possible moment and that it was ready to start its television service in the higher bands within a year or 18 months. The aviation group and amateurs likewise supported the FCC allocations plan.

WANT DEFNITE ALLOCATIONS—The telephone industry as represented by AT&T and Independent telephone industry sought "earmarked" allocations instead of the plan for considerable sharing. Mobile and new radio services, including the motor truck, bus and taxicab groups, were prepared to emphasize a similar stand for definite exclusive bands as necessary for full development of their projected postwar use of radio.

NAVY PRODUCTION ORDERS TO BE STABILIZED—Beginning in May, the placement of new Navy electronic, radio and radar equipment orders will be stabilized at a level of $67,000,000 a month and this rate of production and deliveries is slated to be maintained for a good many months. The $67,000,000 a month contracting requirements, it was emphasized by most authoritative Navy sources, will not be affected by the termination of hostilities in Europe.

TO MINIMIZE TRANSITION AFTER V-E DAY—By setting the Navy's sights at a stabilized production level of $67,000,000 a month, Captain Jennings B. Dow, Director of Navy Electronics, is trying to minimize any shocks for the radio-electronic manufacturing industry in the transition period after the victory in Europe. The industry had been disturbed over the sharp reduction in Navy orders during the last six months of 1944, when the contracts dropped from $100,000,000 a month to $50,000,000. Because of the backlog of previous orders, manufacturers have just recently commenced to experience the reaction of the reduced requirements of the latter half of last year. However, during 1944 the rate of deliveries to the Navy had been maintained at an average of virtually $100,000,000 a month.

WINTER TOUGHEST OBSTACLE—The severest winter in 25 years for sections east of the Mississippi River and its accompanying fuel shortages and transportation difficulties have proved an even stiffer obstacle than lack of manpower in critical labor areas to the radio-electronic industry in maintaining production schedules for the Army Signal Corps. But despite these hurdles of the winter hardships and manpower shortages, the Signal Corps leadership has been highly laudatory of how the industry has been meeting in excellent fashion the Army's sharply increased demands in deliveries during the past month or two.

PREPARING FOR RECONVERSION—In order to be set for a "full speed ahead" start in handling settlement of the cutbacks and cancellations of Army Signal Corps contracts to come after V-E Day, the Signal Corps Procurement and Distribution Service through Major General William H. Harrison, its Chief, has established a new Division—the Contract Adjustment Division. Brigadier General Edgar L. Clewell, Assistant Chief of the Service and next ranking to General Harrison, has been designated as Acting Director of the new Division and is now engaged in starting its functioning with top efficiency so as to be prepared for the quickest sort of analysis and adjustment of cancelled contracts. (So far the Signal Corps has only had one major cutback.)

SOME MANPOWER SHORTAGES—So long as the War Manpower Commission keeps its high priorities on employment in the radio-electronic industry, it is felt that manpower troubles will not be too serious, although WMC Chairman McNutt recently reported that the radar industry required 8,711 new workers and dry cell batteries 1,359. There are still some shortages in combat areas of certain critical items, such as radio equipment parts, field wire and some types of batteries, but by and large the industry has met the Army's huge requirements 100 per cent.

MISCELLANY—Contribution of American radio manufacturing industry to Russian victory drive towards Berlin included 12,000 radio-equipped fighter and bomber airplanes, and radio apparatus on 3,300 armored scout cars, 6,000 tanks, 5,500 artillery prime movers and 1,700 ordnance service vehicles.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington Editor

GUARDIAN Series 345 RELAY

a "Basic Design" with many variations

meets special applications

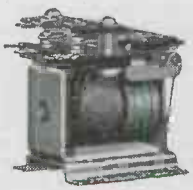
saves time . . . saves tooling . . . speeds delivery!

If your application requires a specially designed relay Guardian engineers can be of great help to you. But, as a result of their wide experience in designing "specials" they have evolved a standard design so flexible that it is now specified in numerous applications that would ordinarily require a specially designed unit. Perhaps you can use it in your "special" application . . . with a saving in money and delivery time. This unusually flexible relay is the SERIES 345. Its chief features are the large coil winding area, numerous contact combinations, the non-binding pin type armature hinge pin, its resistance to shock and vibration, and an ability to operate in extremes of temperature. It is now being used in aircraft, radio, and other exacting applications to insure dependable performance.

STANDARD SERIES 345—The ample coil winding area of the SERIES 345 gives you a wide range of windings for various voltages and currents. Coil winding area is approximately .75 cubic inches. Average power required is 3.56 watts with three pole, double throw contacts of 12½ amp. capacity. Coils are available for either A.C. or D.C. operation.

The maximum switch capacity of the Standard Series 345 is three pole, double throw. Contacts are rated at 12½ amperes at 110 volts, 60 cycles, non-inductive A.C. Moving contacts are attached to but insulated from the armature by a bakelite plate. Terminals are solder lugs. Weight is 6½ ounces.

VARIATIONS OF THE SERIES 345 RELAY



TIME DELAY

WINDING—Multi-wound coils are available for operation on two or more circuits. Or coil may be wound to operate on the discharge of a 3 mfd. condenser.

CONTACTS—Normal switch capacity is three pole, double throw; maximum switch capacity may be up to six pole double throw with 12½ amp. contacts, or any variation of contact combinations within this range, including the operation of contacts in sequence. The flexibility of the contact springs may be increased through the use of coil spring rivets.

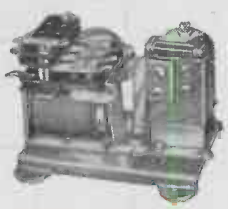
TIME DELAY—On D.C. coils a time delay of 0.25 seconds on release or 0.06 second on attract may be achieved through the use of copper slugs which require these time intervals for saturation or de-energizing depending on whether they are used on the heel or head of the coil.

DUST COVER—For applications where this relay may be subject to injury or in atmosphere where dust may be present in sufficient quantity to impede operation, the SERIES 345 may be equipped with a metal dustproof cover.

SCREW TERMINALS—Screw type terminals are optional for applications where terminals must be disconnected occasionally or where solder lug terminals are not otherwise practical.

DUST COVER

INTERLOCKING—The SERIES 345 may be used in combination with various coils to achieve a mechanical interlock. One of the most recent developments is the use of the SERIES 345 in an overload application. Excessive current energizes the SERIES 345 coil. The armature is then mechanically locked in the energized position by an arm attached to a Series 405 coil and is held in the locked position until the Series 405 coil is energized by a push-button arrangement. If current through the Series 345 is still excessive, relay remains in locked position even though released by push-button confrol.



INTERLOCKING UNIT

SERIES 345 RELAY DATA

Normal Volts	Minimum Volts	Normal M.A.	Minimum M.A.	Coil Resist.	Normal Wattage
6	4.8	600	480	10	3.56
12	9.8	300	245	40	3.56
24	18	148	111	162	3.56
32	25.6	112	89	287	3 56
115	92	31	25	3720	3.56

Minimum operating wattage.....2.3

If you will write us about your relay problems our engineers will be glad to make recommendations which may save you time and money. Should you desire a quotation, please mention quantity.

GUARDIAN ELECTRIC

1622-C W. WALNUT STREET CHICAGO 12, ILLINOIS

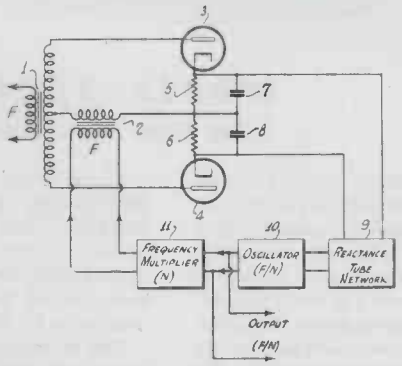
A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY

NEW PATENTS ISSUED

Frequency Divider

Automatic phase control is used to synchronize oscillator 10 to the Nth subharmonic of the input frequency F. The ratio of frequency division N may be increased to any desired value by merely increasing the degree of frequency multiplication in the multiplier 11, and by adjusting the tuning elements of oscillator 10 to the corresponding subharmonic frequency for zero output voltage across resistors 5 plus 6. If the input frequency is frequency-modulated, the frequency deviation ratio is proportionately reduced.

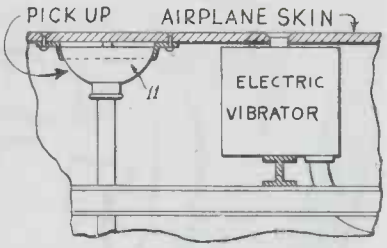
The conventional phase comparison network 1,2,3,4,5,6,7, and 8 provides a voltage across resistors 5 plus 6 which is a function of the phase difference between the voltages across the secondaries of transformers 1 and 2, the output being zero for a 90 deg. phase difference. This output voltage is applied to reactance tube 9 and controls the frequency of oscillator 10 to follow the desired subharmonic of the input frequency. Any deviation in phase, and consequently in frequency, will result in a voltage across resistors 5 plus 6 which will effect the required adjustment.



M. G. Crosby, R.C.A., (F) July 4, 1942, (I) October 31, 1944, No. 2,361,606.

Vibration Dampening

To dampen the detrimental mechanical vibration, for example of an airplane skin, it is proposed to use a displacement type of pick-up 11 to transform these vibrations into electrical oscillations, which in turn are made to generate mechanical vibrations applied to the airplane skin and intended to dampen the original vibrations. The electrical impulses generated by the displacement type pick up are amplified, heterodyned to result in oscillations above or below the critical range of mechanical vibrations, and applied to the vibrator.



A. Vang, Jordan & Harrison, Inc., (F) September 23, 1942, (I) October 24, 1944, No. 2,361,071.

Velocity-Modulation Tube

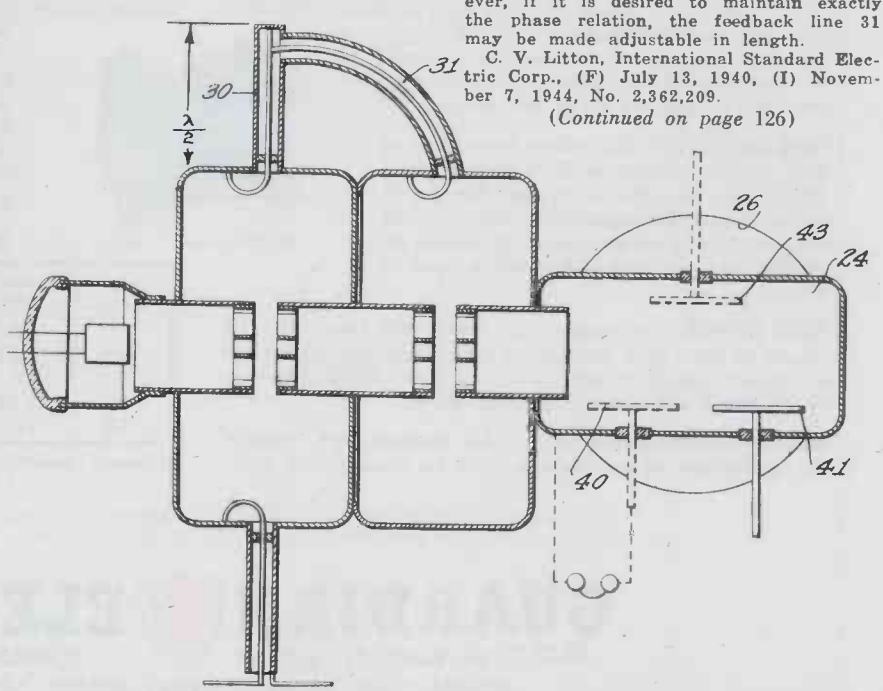
The tube constitutes a combination of velocity modulation and beam deflection principles. The velocity-modulated electron beam is deflected downwardly by a magnetic field generated by a current through coil 26 and/or by an electrostatic field applied to electrodes 40, 41, or 43. This deflection causes separation of the electrons according to their velocity. The slow electrons will be deflected downwardly into contact with the walls of chamber 24 (or electrode 40), the higher speed electrons will reach output 41, and a detected output may be obtained between this electrode and the casing of chamber 24.

Alternatively, electrode 41 may be provided and the slow electrons used as the detected output. Furthermore, by coupling an amplifier in push-pull to electrodes 40, 41, and connecting the mid-point of the input to the casing of chamber 24, push-pull output of the detected waves may be had.

The arrangement provides a high frequency amplifier and detector. Feedback may be provided over transmission lines 30 and 31. Line 31 consists of a flexible concentric conductor and is coupled to line 30 at an adjustable point so that the amount of feedback can be controlled by adjusting the coupling point. For small adjustments the phase difference due to the change in length of the total feedback line will be relatively unimportant. However, if it is desired to maintain exactly the phase relation, the feedback line 31 may be made adjustable in length.

C. V. Litton, International Standard Electric Corp., (F) July 13, 1940, (I) November 7, 1944, No. 2,362,209.

(*Continued on page* 126)



RADIO EQUIPMENT ON PANAGRA'S PASSENGER PLANES WILL BE ALL BENDIX

With the installation of Bendix Radio Type MN-31 Dual Automatic Radio Compasses and RA-2C Receivers, *all* of PANAGRA'S scheduled planes for passenger service will be 100% Bendix Radio equipped.

Bendix Radio Type TA-2J Transmitters have already flown many millions of miles over PANAGRA'S Route between Balboa in the Canal Zone and Buenos Aires, Argentina.

Thus Bendix joins with PANAGRA in building ever closer and friendlier relations with the republics of the Americas; and in contributing to the safety, comfort, and dependability of air transportation in South America.

MN-37
Automatic Compass Bearing Indicator

MN-26
Automatic Compass Receiver

MN-28
Automatic Compass Remote Control

RA-2—Receiver

BENDIX IS A TRADE-MARK OF THE BENDIX AVIATION CORPORATION

Bendix RADIO DIVISION

BENDIX AVIATION CORPORATION, BALTIMORE 4, MARYLAND

STANDARD FOR THE AVIATION INDUSTRY

TELEVISION TODAY*

New Developments in the Video Field

Bingley Vice-President of Television Broadcasters

Frank J. Bingley, chief television engineer of the Philco Radio and Television Corp., has been elected vice president of the Television Broadcasters Association, Inc. He succeeds Robert L. Gibson of the General Electric Co., who tendered his resignation as an officer and Director of TBA. Mr. Gibson was recently appointed advertising and sales promotion manager of the Chemical department of the General Electric Company and his new post will take him out of direct television activity, it was stated.

British Plan Color Television Development

A large-scale television-in-color technical development planned for the film industry of the British Empire to be carried out over a period of ten years anticipates full development of the color film within the first four years, according to a report of the Department of Commerce. According to the plan, the practical realization of commercial high-definition large-screen television together with the means of providing and distributing television programs of special events will be reached in about six years. Provision of large screen television in color will be developed in the eighth year and a practical solution of stereoscopic projection is expected to be realized before the end of the ten year program.

Subscription Television

Subscription radio, proposed first for FM, may have some application in television. Scophony Corp. of America, 50 per cent owned by Paramount Pictures, Inc., and 20th Century Fox, is surveying the possibility of utilizing a "scrambling" device. Subscribers would pay a fee of $2.25 a week for the use of equipment that would permit them to unscramble the pictures.

Live Acting with Canned Sound

Recorded sound for television programming, including dialogue, background music and sound effects, was tested experimentally with live actors on the program, "WOR Presents," heard and seen over DuMont Television Station WABD. By piping sound into the studio, the type-cast AFRA actors have no difficulty synchronizing their action and lip movement with the records.

This technic, considerably less expensive than motion picture films, frees the studio of a microphone and permits more complicated and pre-tested use of sound in the programs.

Transmitter for Detrola

International Detrola Corp., Detroit, reveals in its annual report that the corporation is making ready to enter the television field. An order has been placed for a transmitter, and studio and transmitter space are being readied. It is planned to serve an extensive Michigan-Ontario area.

Films Want Tele

To the two television stations now broadcasting in California—one by Don Lee and the other by Television Productions, Inc., Paramount subsidiary—four more may be added. FCC now has applications from Warner Bros., Metro and Howard Hughes who want channels out of Hollywood; Hughes also wants to plant a station in San Mateo county. FCC also has applications for 26 commercial FM stations in California.

Marconi Plaque to Television Broadcasters

Representatives of one of the oldest arts of radio communication —wireless—saluted one of the newest of the broadcasting arts—television, on Saturday, February 17, 1945, when the Veteran Wireless Operators Association, Inc., presented the Marconi Memorial Plaque to the Television Broadcasters Association, Inc., at a dinner at the Hotel Astor in New York. The award was made to TBA, VWOA president McGonigle stated, "for the initiative it has shown in banding together the television interests of the United States in order to insure American pre-eminence in television."

J. R. Poppele, President of the Television Broadcasters Association, Inc., received the plaque for TBA. The dinner cruise at which the award was made marks the 20th anniversary of the Veteran Wireless Operators Association.

French 1000-Line

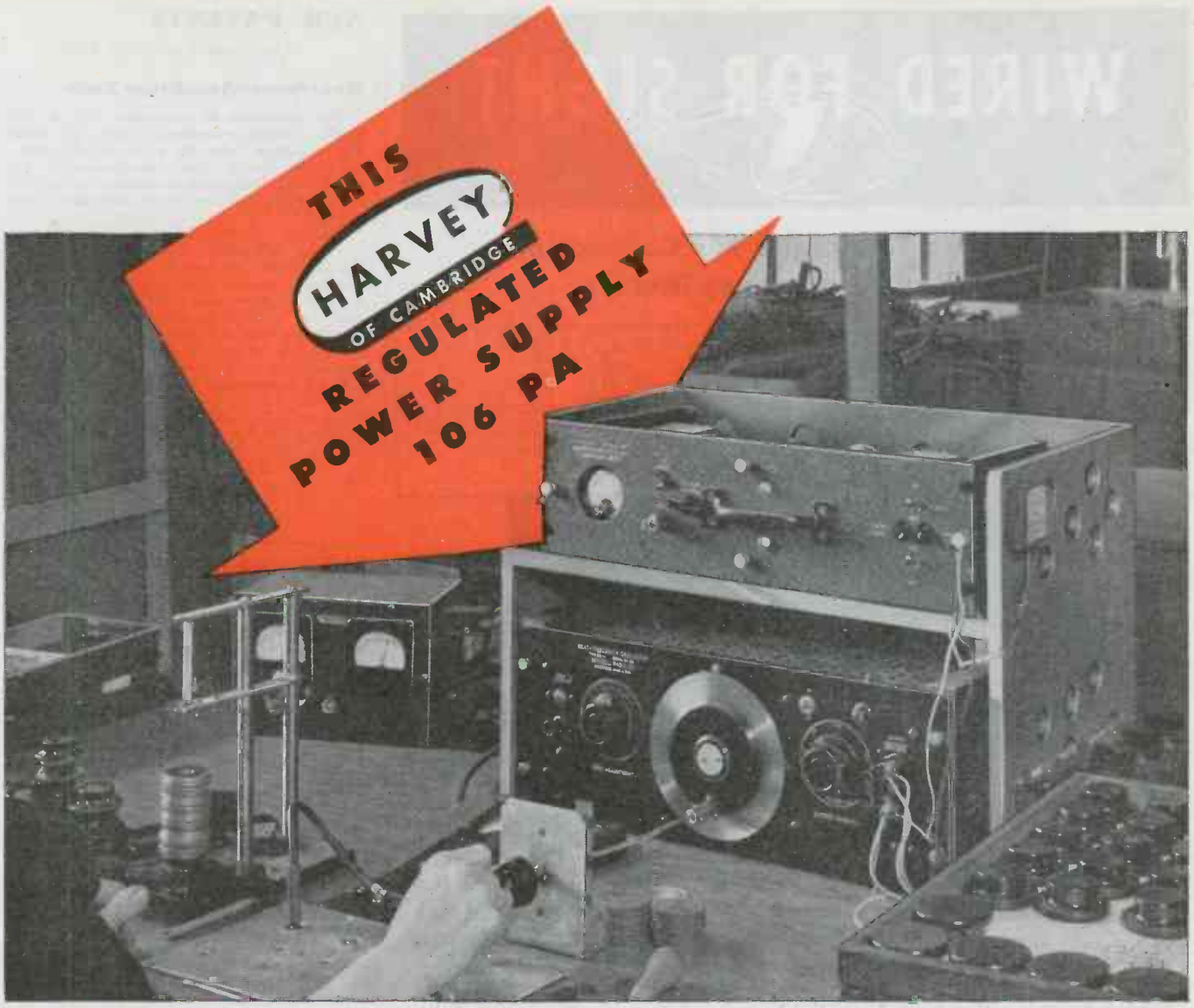
Setting at rest controversies that have waged in the public prints as to whether the French have or have not developed thousand line television, and making plain the manner in which that achievement has been reached, R. Morris Pearce, who is chief engineer of radio station WGAR, and who has spent consid-

(*Continued on page* 204)

RCA READIES 300-MC TELE TRANSMITTER FOR TESTS

Early field tests are planned for this 300-mc television transmitter developed experimentally in RCA laboratories and still in the development stage. Engineers R. D. Kell and T. L. Gottier

*Title registered U. S. Patent Office.



Helps Check The Quality of MURDOCK-Made Head Sets

The *W. J. Murdock Company* of Chelsea, Massachusetts, relies on a HARVEY Regulated Power Supply 106 PA to determine that head sets manufactured by them for the Armed Services meet Signal Corps and Navy Department Specifications.

The HARVEY 106 PA, teamed with a wide range beat frequency oscillator, supplies a constant D.C. voltage for an amplifier testing the output of Murdock type R14 head sets. Input is three volts. Earphones are tested at four frequencies within the range of 500 to 2500 kc., to check various decibel readings within that range.

The HARVEY Regulated Power Supply 106 PA is operating successfully with constant frequency oscillators, amplifiers, pulse generators, measurement equipment and other apparatus requiring a constant source of D.C. current. It operates on 115 volts, 50–60 cycles A.C., and has a D.C. output variable from between 200 to 300 volts that is regulated to within one per cent.

If you need a constant, thoroughly dependable source of D.C. power, better look into the HARVEY Regulated Power Supply 106 PA. The whole story is contained in a new bulletin. We'd be pleased to send it.

HARVEY
OF CAMBRIDGE

HARVEY RADIO LABORATORIES, INC.

441 CONCORD AVENUE • CAMBRIDGE 38, MASSACHUSETTS

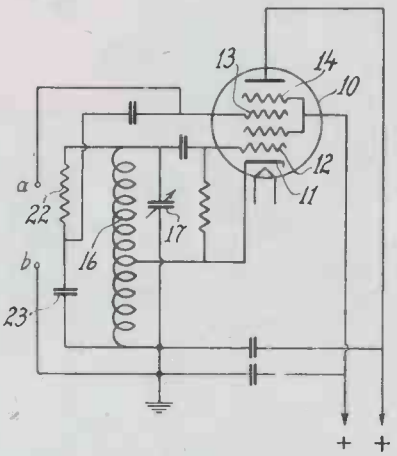
NEW PATENTS

(*Continued from page* 122)

Reactance-Amplifier Tube

The invention is concerned with a composite oscillator-reactance tube or amplifier-reactance tube, in other words with a one tube circuit that simultaneously generates and frequency-modulates oscillations, or amplifies and frequency-modulates oscillations.

Cathode 11, control grid 12, screen grid 14, and oscillator circuit 16,17 form a conventional oscillator. The a.c. voltage developed across the inductance 16 is impressed upon a phase shifting network 22,23 and the quadrature voltage derived from this phase-shifting network is applied to the second control grid 13. This quadrature control grid voltage will cause a quadrature current component in the plate circuit of tube 10. Due to the tapping of the cathode 12 from the inductance 16 of the oscillatory tank circuit, this quadrature term of the plate current will have the effect



of a reactance shunted across the tank circuit. By varying the d.c. bias on the grid 13 according to a modulating potential applied to terminals a, b, the quadrature plate current component, and hence the effective reactance across the tank circuit, will be varied, resulting in frequency modulation of the generated oscillation.

The same principle may be applied to control the tuning or aligning of an amplifier. By using several tubes in cascade, tuning may be effected by a single control voltage simultaneously biasing the reactance-controlling screen grids of all tubes. Mechanical ganging of the tank circuits will then be superfluous.

Other embodiments using pentodes or hexodes and different type oscillators are shown. The functions of the two control grids 12 and 13 may be interchanged; electron stream coupling instead of the physical coupling through the tank circuit is feasible. It is also proposed to use the voltage induced in a control grid by a virtual cathode which induced voltage will be in quadrature with the current regulating the space charge density in the virtual cathode.

H. M. Bach, Patents Research Corp., (F) December 12, 1940, (I) October 31, 1944, No. 2,361,731.

Gain-Control Circuit

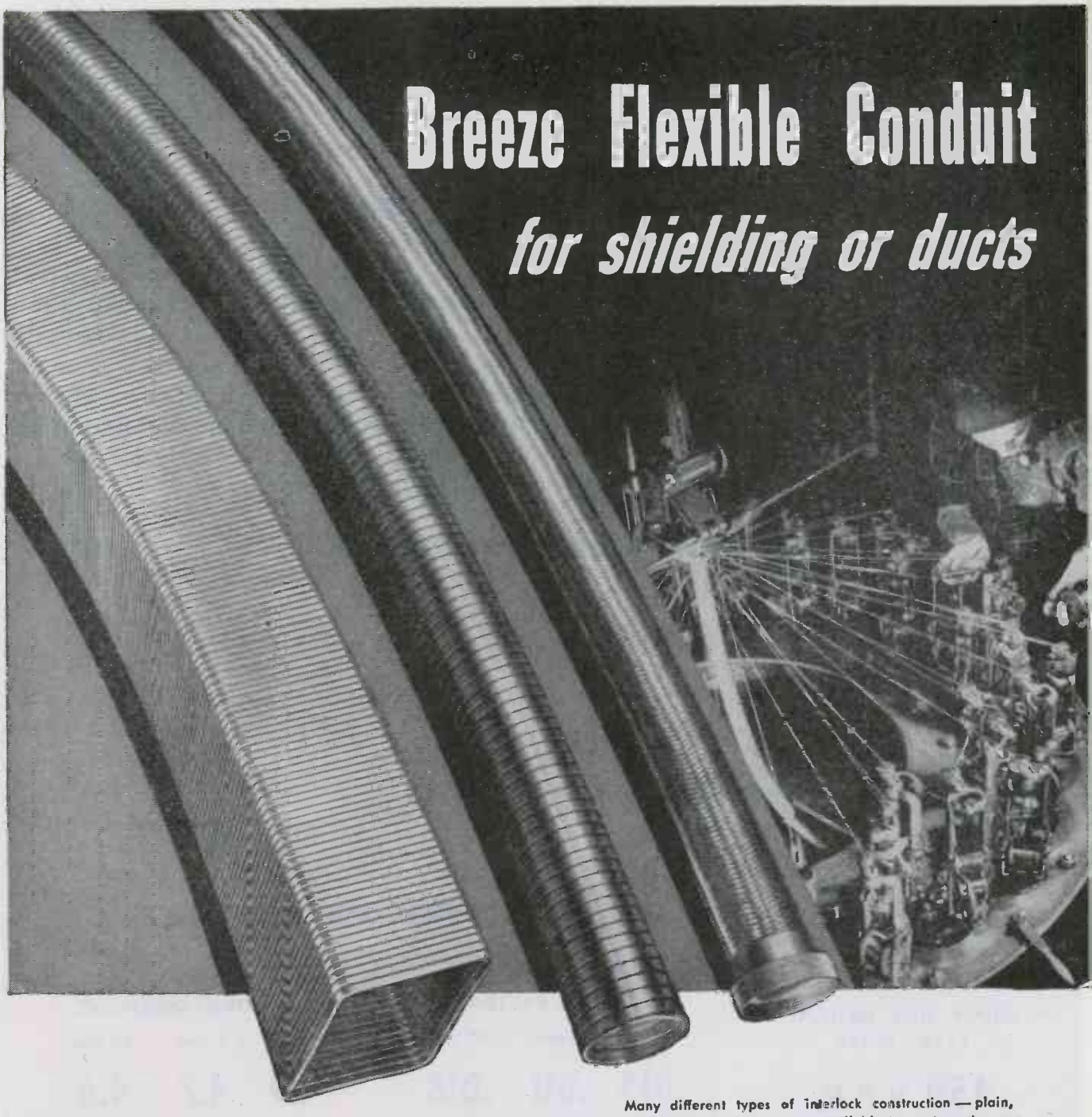
It is intended to control the gain of an amplifier independently of the direct-current component of the output. Essentially, the screen grid current of V_2 is substituted for the loss in the direct current output of V_1, upon the application of a negative gain control voltage to the suppressor grids.

The two pentodes V_1 and V_2 have identical characteristics and, if the direct current component is to be maintained constant during changes in the gain, they are connected in identical circuits. When it is desired to quash abruptly, either wholly or partly, the amplifier gain, a negative potential is applied abruptly to the suppressor

(*Continued on page* 130)

Breeze Flexible Conduit

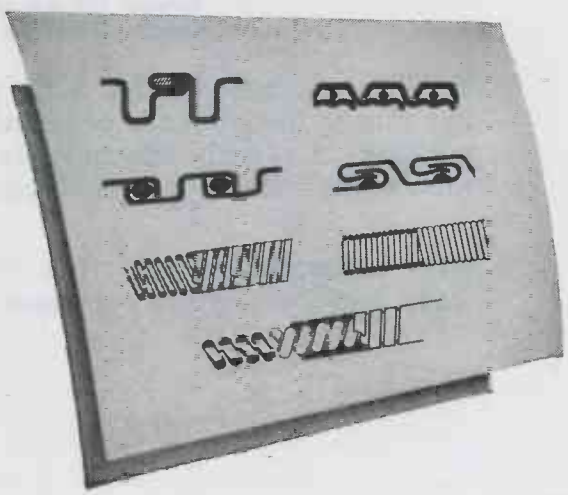
for shielding or ducts



Breeze Flexible Tubing, manufactured in many diameters from a wide variety of metals, is used as ventilation and exhaust ducting in industrial, aircraft, marine and automotive applications. The same basic tubing, with the addition of a braided metal covering, becomes light-weight shielding conduit, used extensively for shielding ignition systems and any electrical circuit to insure dependable radio communication.

Manufactured from a continuous strip of metal, Breeze Flexible Tubing and Conduit can be furnished cut to length, with necessary end-fittings for any conduit installation.

Many different types of interlock construction — plain, packed, and soldered—are available to meet varying use requirements. A few of these are illustrated below.



Breeze BREEZE MARK

CORPORATIONS, INC.

Newark, New Jersey

MF-66 Glass base material is ready! Material, facilities and techniques are at last available for the production in quantity of the new Formica grade which is superior to all other grades in low losses at high frequencies. This material, created to extend the useful working range of laminated plastics, is ready for prompt shipment to high priority customers.

THESE ARE ITS CHARACTERISTICS:

MECHANICAL STRENGTH
(average values)

TENSILE (non-directional)	FLEXURAL (flatwise)	COMPRESSIVE (flatwise)
10,000 P.S.I.	14,000 P.S.I.	42,000 P.S.I.

WATER ABSORPTION
(average values)

24 HRS. IMMERSION AT 25°C
SAMPLE: 3" x 1" x 1/8"

0.15%

DIELECTRIC STRENGTH
(average values)

SHORT TIME METHOD
1/16" SHEET

450 V.P.M.

DIELECTRIC PROPERTIES
(average values)

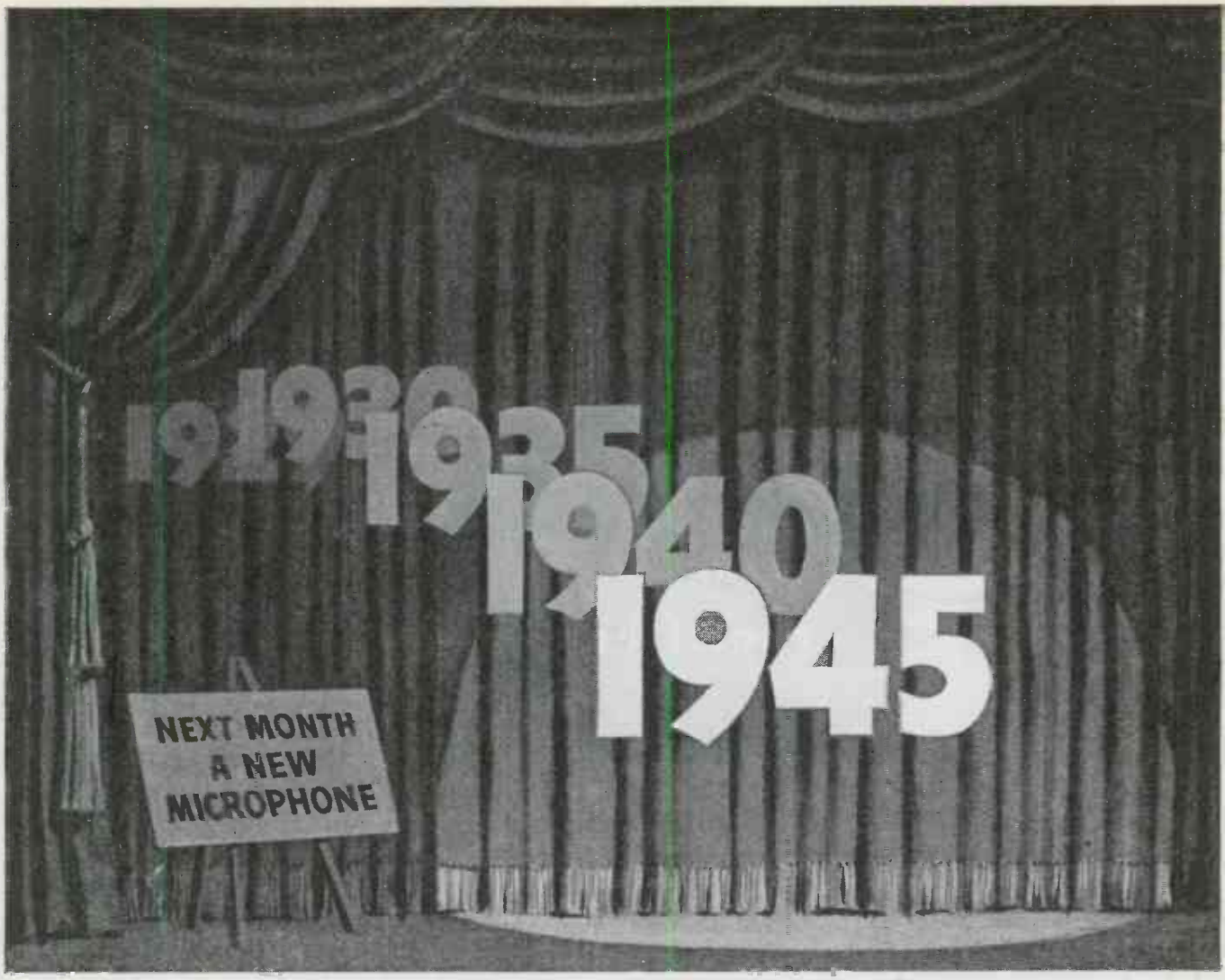
POWER FACTOR			DIELECTRIC CONSTANT		
1 kc.	1 mc.	30 mc.	1 kc.	1 mc.	30 mc.
.015	.011	.018	4.9	4.7	4.6

Grade MF-66 is recommended for radio and radar coil forms, antenna bases, terminal strips and molded parts.

Fungus resistance of MF-66 is outstanding due to the absence of cellulose. The material is readily machinable to close tolerances into strong, shock-resisting insulating parts. Its low water absorption insures high electrical and dimensional stability in humid climates. Ask for quotations!

THE FORMICA INSULATION COMPANY
4647 Spring Grove Ave., Cincinnati 32, Ohio

FORMICA



A NEW STAR IN THE ELECTRONIC FIELD

The stage is set for something new in Universal's line of products. Next month will bring the appearance of a new microphone to meet markets made by present and postwar demands. This will be the first microphone of its kind offered by Universal since the War. Universal has, since before Pearl Harbor, been manufacturing microphones and electronic voice communication components for the U. S. Army Signal Corps.

We are still pleased to manufacture all the microphones our fighting men require and we are pleased to make a new microphone to fill their and essential home front needs.

← **Emblems of quality in war production**

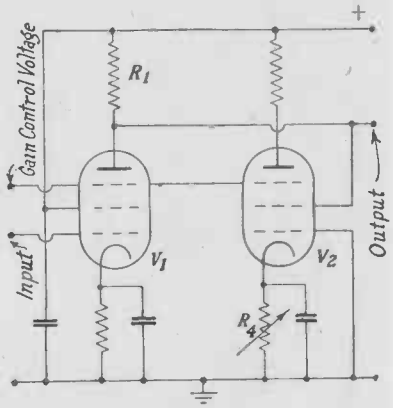
UNIVERSAL MICROPHONE COMPANY
INGLEWOOD, CALIFORNIA

FOREIGN DIVISION: 301 CLAY STREET, SAN FRANCISCO 11, CALIFORNIA – CANADIAN DIVISION: 560 KING STREET WEST, TORONTO 1, ONTARIO, CANADA

NEW PATENTS

(*Continued from page* 126)

grids, changing the proportion in which the cathode currents of both tubes are divided between plates and screen grids. The increase of screen current of tube V_2, for a given reduction of the suppressor grid



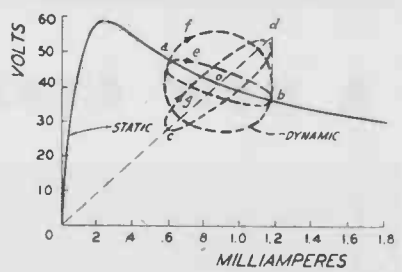
potentials, is, therefore, equal to the corresponding decrease of mean plate current of tube V_1. It follows that the direct current component through plate load R_1 is independent of the alternating current amplification factor.

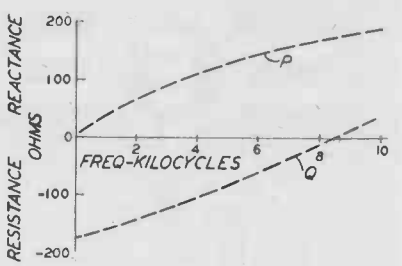
The invention may be used to insert the synchronizing signals in television systems. For this purpose, resistor R_4 may be adjusted so that the current changes in the two tubes will be different to a desired degree. The circuit is also applicable to the production of polar diagrams on the screen of a cathode ray tube.

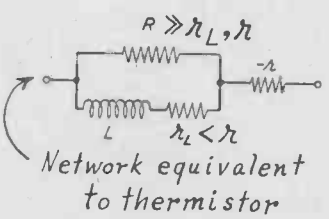
L. H. Bedford and W. H. Stevens, A. C. Cossor Ltd., (F) August 20, 1941, (I) October 17, 1944, No. 2,360,466.

Negative-Resistance Loading

It is proposed to use the negative-resistance characteristic of a thermistor to compensate for the attenuation in a trans-







mission line. Thin thermistor elements, capable of following temperature variations at a frequency exceeding the highest signal

(*Continued on page* 134)

ORIGINAL AWARD JULY 27. 1942

SECOND AWARD FEB. 13, 1943

THIRD AWARD SEPT. 25, 1943

FOURTH AWARD MAY 27, 1944

FIFTH AWARD DEC. 2, 1944

For the fifth consecutive time, the men and women of American Lava have earned the Army-Navy "E" Award "for continued excellence in quantity and quality of essential war production." All of us are very thankful that the necessary knowledge, experience and skill were available at American Lava *to maintain the high standard of quality* of ALSIMAG products, while meeting production schedules that once seemed incredible.

AMERICAN LAVA CORPORATION • *Chattanooga 5, Tennessee*

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ALSIMAG

TRADE MARK REG. U. S. PAT. OFFICE

CERAMIC INSULATORS

For Use in:

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- Electrical Circuits and Appliances
- Gas and Oil Heating
- Automotive Equipment
- Chemical Processes

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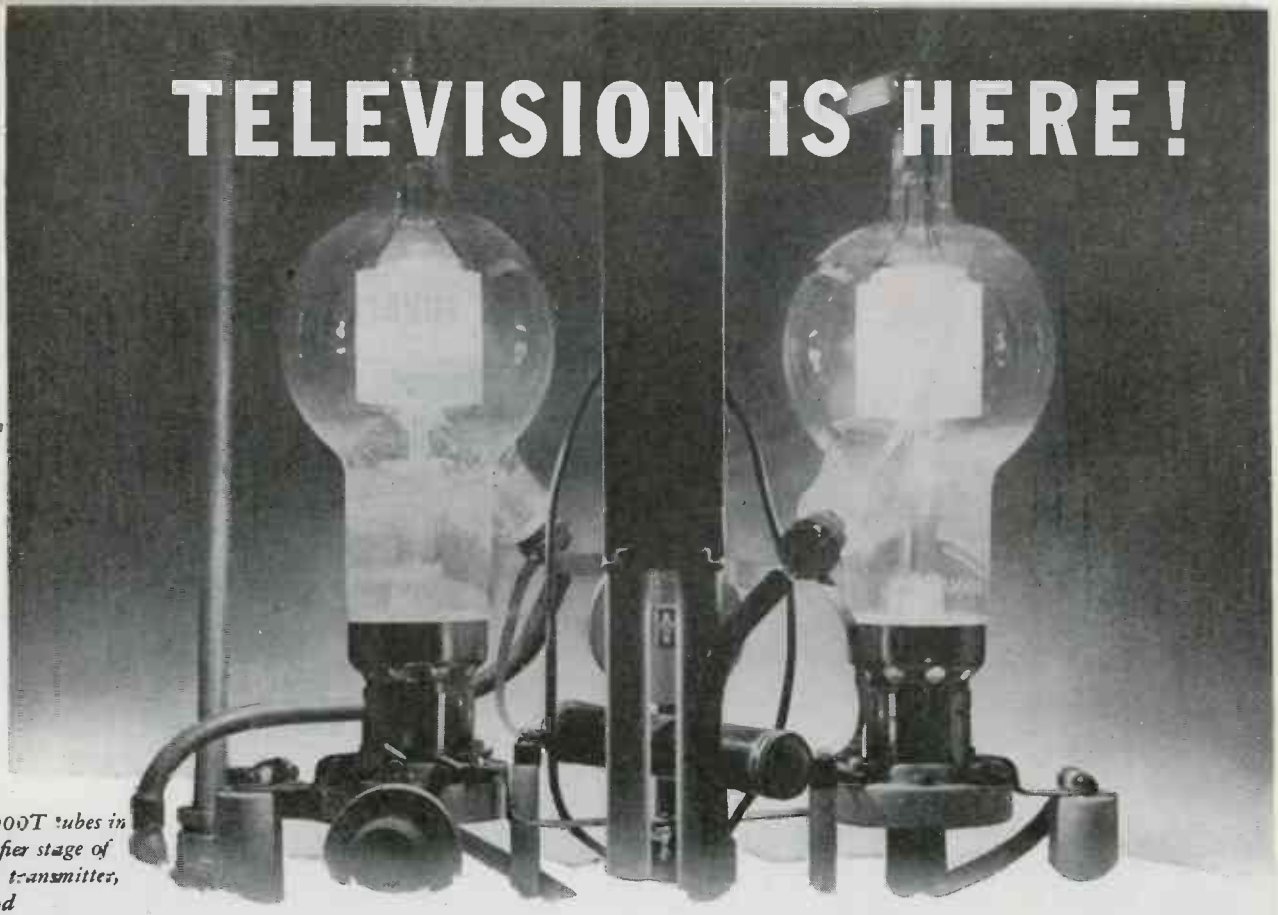

Eimac 1000T tubes in an amplifier stage of W6XAO transmitter, Hollywood

At Don Lee Hollywood... Station KTSL using EIMAC TUBES *since* 1938

Julia Lee Wright, noted Home Economics Director of "The Family Circle" magazine being interviewed, and telecast revealing tricks of her trade.

Two young comedians, Robert Sweeny and Hal March, currently on transcontinental radio show, give a preview of their talents for television broadcast over W6XAO.

Work on television station W6XAO (Commercial station KTSL) began in November 1930; and thirteen months later, Dec. 23, 1931, it was on the air on the ultra high frequencies, the first present day television to operate on schedule. Today the station occupies elaborate copper sheathed studios which stand 1700 feet above Hollywood with an antenna on a 300-foot tower.

The program log shows almost every type of presentation. Highest in interest and achievement are the remote pick-ups and special event broadcasts made simultaneously or recorded on film for release later. Studio presentations, especially those directed to war activities, have become a duration standard.

Under the direction of Harry R. Lubcke, television station KTSL will be in daily schedule immediately after the war. Mr. Lubcke says: "We have been using Eimac tubes in our television transmitter since about 1938... We have found them good and reliable performers... their design is such that a favorable ratio of power output to tube and circuit capacitance is obtained... we look forward to using new Eimac tubes which may be forthcoming."

Here again is a statement from a leader in the field, which offers clear evidence that Eimac tubes are first choice of leading electronic engineers throughout the world.

Write for your copy of Electronic Telesis—a 64 page booklet fully illustrated—covering the fundamentals of Electronics and many of its important applications. In layman's language.

Follow the leaders to

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Plants located at: San Bruno, California and Salt Lake City, Utah
Export Agents: Frazar & Hansen, 301 Clay St., San Francisco 11, Calif., U. S. A.

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MALLORY "FP" CAPACITORS

TOP chassis mounting for Mallory "FP" Capacitors . . . plus the "twisted-ear" feature that eliminates other hardware . . . can save plenty of man-minutes on your assembly lines.

Mallory "FP's" make designing easier, too, if you want to save chassis space, for they are the smallest capacitors available for a given electrical rating. Capacities range from 3,000 mfd. at 10 volts to 80 mfd. at 450 volts.

Long life and uniformly high quality are built into every "FP" capacitor by Mallory precision workmanship. You'll eliminate many engineering and production problems if you specify Mallory "FP" Capacitors for any electronic equipment you plan to produce in volume.

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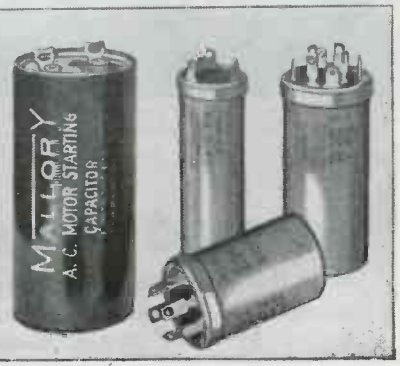
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

P.R. MALLORY & CO. Inc.

MALLORY

Electrolytic, Film and Paper CAPACITORS



NEW PATENTS

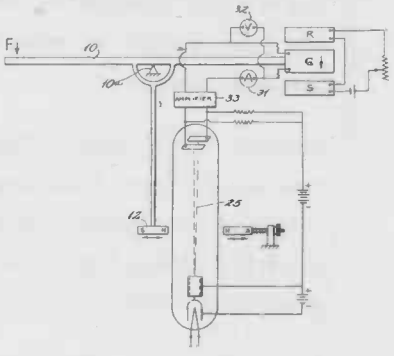
(*Continued from page* 130)

frequency to be transmitted, are inserted at intervals in a transmission line to provide negative resistance loading. A suitable bias current is applied to the thermistor to secure the desired negative-temperature coefficient of resistance.

The type of thermistors recommended for the purpose of negative-resistance loading has a static voltage-current characteristic as shown in the diagram. If a direct current greater than about 0.3 milliamperes be applied to the thermistor, a superposed alternating current of very low frequency will trace out a curve aob approximating the negative resistance static characteristic. If the superposed current has a very high frequency, the thermal lag of the thermistor will prevent any change in temperature, and hence in resistance, from taking place. The voltage-current trace therefore will be along the ohmic resistance line cod. At intermediate frequencies the superposed current will produce traces as shown at e, f, and g in the order of increasing frequency; for some critical frequency, the resistance becomes zero. The reactance and resistance curves P and Q, respectively, are shown as functions of the frequency. Careful study will reveal that a similar dependence on frequency will be found by the equivalent network shown.

By the insertion of a thermistor, the loss in a line may be considerably reduced and the frequency characteristic flattened. The fact that thermistors lose their negative resistance property and become positive resistances at high frequencies is of great advantage in preventing the development of self-sustained oscillations. Coil and thermistor loading may be favorably combined. To compensate for ambient temperature variations, another slow-acting thermistor unit may be added.

P. G. Edwards, Bell Telephone Laboratories, (F) April 25, 1942, (I) October 24, 1944, No. 2,360,940.



Balance

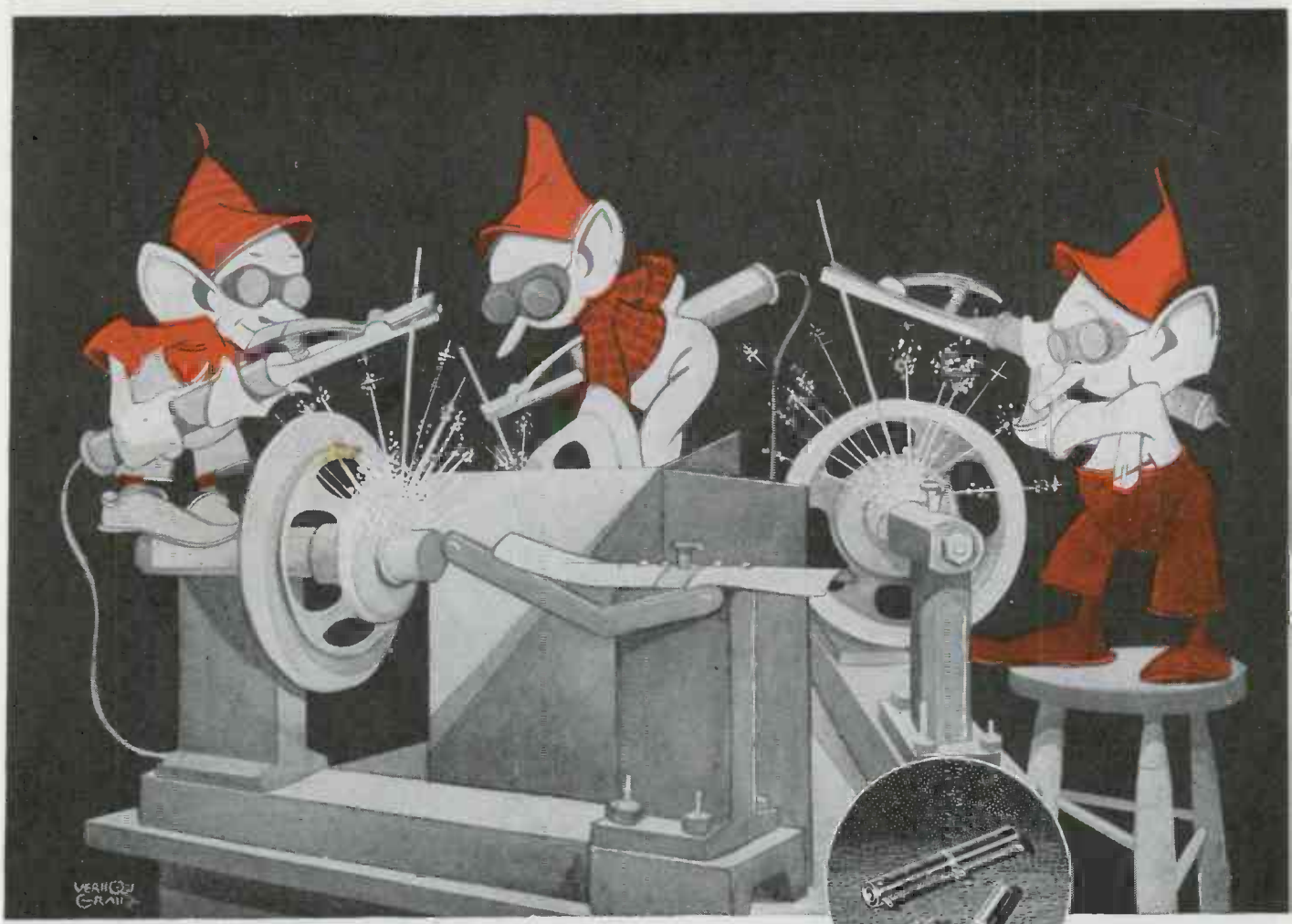
The negative-feedback, deflection beam tube (see "Deflection Beam Tube" by Paul Glass, "Electronic Industries," August, 1944) is used in a balance to measure or meter any quantity that can be made to depress the lever of balance 10, such as electric current, variable flow of fluids, temperature variations, etc.

Balance 10 is pivoted at 10a.

The mechanical force F exerted on the left-hand lever of balance 10 will bring magnet 12 closer to the electron beam 25 in the cathode-ray tube. The field of magnets 12 and 36 will no longer balance out and consequently the electron beam will be deflected, current will flow through amplifier 33, ammeter 31 and coil G. The interaction of constant currents through coils R and S and the variable current through coil G will cause coil G to move in such a direction as to restore lever 10 to its balanced position. The reading on ammeter 31 or voltmeter 32 will be directly proportional to the force F.

Electrostatic deflection may be used instead of electromagnetic deflection; several

(*Continued on page* 138)



Vitreous enamel resistors, plugs, switches, and other component parts for electronic applications.

UTAH'S "PRECISION PLUS" MANUFACTURE ... SPEAKS FOR ITSELF!

Utalins* at work . . . welding . . . and proud as punch at the technique they've developed. They know welding is just one of several steps in the production of Utah's radio parts and electronic devices. But they give it that "precision plus" accuracy that Utah demands all the way.

Every phase of manufacture that is produced in Utah's own factory is to perfection standards.

First comes the careful purchase of quality raw materials. Then Utalins make the tools that make the Utah products. The modern methods of production, the testing, the supervision, even the infinite care in shipping all add up to Utah's comprehensive process—an infallible system of manufacture that enables Utah—and you—to be proud of the finished products.

Utah products finally become hidden parts of your radio, and the world listens—with pleasure—as Utah performance speaks for itself!

*Utalins—Utah's helpers

utah
RADIO PRODUCTS COMPANY
CHICAGO, ILLINOIS

Utah Radio Products Co., 820 Orleans St., Chicago 10, Ill.
Utah Products (Canada) Ltd., 300 Chambly Rd., Longueuil, Montreal (23) P. Q.

Using Strength, Lightness, Wearing Quality

STRENGTH, light weight and wear-resistance make Synthane laminated highly desirable for retainers in high speed ball bearings . . . and an excellent example of putting plastics where plastics belong.

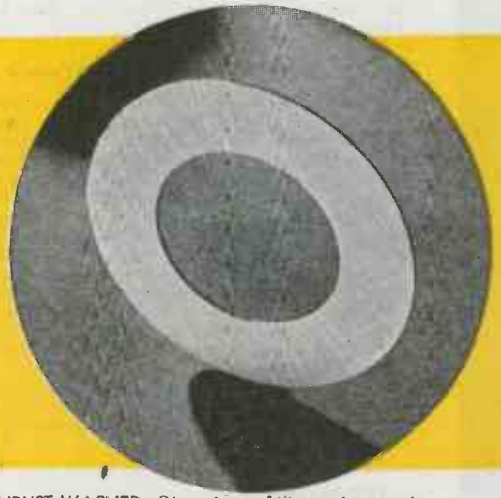
If you haven't used plastics at all or to the fullest extent, if you are not certain *which* of the many plastics fits into your plans . . . or where . . . or why . . . or what the cost will be . . . ask us to help you, preferably *before* you design.

This way, if Synthane is the answer to your needs, you can be sure of design and material not only right for the application but right for fabrication. Should you, in addition, want us to take over fabrication, you can be sure your parts will be produced by men who know machining of plastics, working on machines fitted especially for plastics. For your whole job or any part of it—design, materials or fabrication—remember Synthane. It will give you a real sense of satisfaction to know whether the job can be done, how it can be done, how long it will take to produce and how much it will cost. Synthane Corporation, Oaks, Pennsylvania.

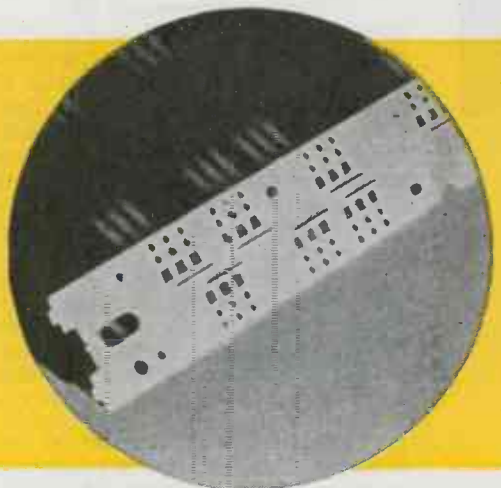
SYNTHANE TECHNICAL PLASTICS ARMY NAVY **DESIGN • MATERIALS • FABRICATION**

SYNTHANE

Plastics is a Word . . . like Metals



THRUST WASHER—Dimension stability, moisture resistance, compressive strength and immunity to oil are factors in the selection of Grade C (fabric reinforced) Synthane.



RADIO TERMINAL STRIP—Low power factor, low water absorption, low dielectric losses and stability of these properties led to the use of Synthane Grade XXXP.

BREAKER ARM—Synthane molded-laminated with a fabric filler is notable for its high impact strength, excellent wearing qualities and good electrical properties.

● **IT IS IMPORTANT TO AVOID** using the word "plastics" loosely or generically. It is as imperative to distinguish between plastics as between metals, say as between steel and bronze—and then to distinguish further between types of the same general plastics as you would between various steels and various bronzes.

● **SYNTHANE IS OUR NAME** for one type of plastics, made from phenol formaldehyde resins and various fillers. This type is thermosetting, that is, it does not soften under a reapplication of heat as do thermoplastic materials. The phenol formaldehydes, including Synthane laminated, are newsworthy among plastics for their *combination* of high tensile strength, high compressive strength, high flexural strength, high impact strength and high dielectric strength. Synthane has, of course, many other desirable properties in combination such as light weight, hardness, low thermal expansion, low moisture absorption, and resistance to corrosion.

● **THERE ARE, HOWEVER,** various grades of Synthane, just as there are various kinds of bronze, steel, aluminum, and other metals. Naturally, you will not find the optimum values of all properties combined in any one grade. For instance, one grade, reinforced with a paper filler is most suitable for its mechanical characteristics, another for its dielectric qualities. In addition to paper grades there are grades reinforced with fabric, asbestos, and glass fillers and impregnated with a diversity of resins.

● **THE SELECTION OF A GRADE** of Synthane is influenced not only by its inherent physical, electrical, mechanical or chemical properties but often by processes of machining required to produce from Synthane the finished parts you require.

● **AS AN ILLUSTRATION,** production of the parts you have in mind may only be economical by punching. Depending on your requirements, paper base grades as XP, XXP or XXXP (the "P" denotes a punching or plasticized grade) may be amply adequate for your purpose.

● **USUALLY ONE OF THE MANY** standard grades of Synthane can be found to meet satisfactorily all your specifications, both in properties and in machinability. If not, we may have already developed, or have to develop, a special grade which will.

● **REMEMBER THAT SYNTHANE** is as adjustable within its combination of properties as an alloy of a metal, and that if you are not sure there's a grade of Synthane to fill the bill for you, just ask us. If possible, let us help you before you design and, in so doing, give us the opportunity to assist you in selecting the right Synthane material for your application and for ease in fabrication.

SYNTHANE

SYNTHANE CORPORATION, OAKS, PENNSYLVANIA
Representatives in All Principal Cities

NEW PATENTS

(*Continued from page* 134)

other modifications are also suggested. If an arrangement similar to the coils R, G, S is used on the other arm of balance 10, the mechanical force indicated by the instrument may be originated by an electric current.

H. Ziebolz, Electrobeam, Ltd., (F) March 11, 1942, (I) October 17, 1944, No. 2,360,751.

Protecting Electrode Surfaces

Roughened cathode or plate surfaces which are covered with relatively loose material may cause electrostatic sparking and disintegration of the electrode. To prevent this, additional grid electrodes are mounted in close proximity to the electrode to be protected and held at the same potential as that electrode. This additional grid electrodes provide electrostatic shielding; they are made of highly refractory material, such as tungsten, tantalum or molybdenum. The shielding electrodes are particularly recommended for plates either surfaced with carbon or comprised of carbon (graphite), as well as for oxide coated cathodes.

I. E. Mouromtseff and G. M. Dinnick, Westinghouse Electric & Manufacturing Co., (F) February 14, 1942, (I) October 17, 1944, No. 2,360,707.

"HEROIC" TRANSMITTERS

(*Continued from page* 85)

aker said. "The AVG's clung tenaciously to them all during the fighting retreat up the Burma Road. In this ordeal they covered more than 2,000 miles of the world's roughest travel. Trucks banged them over that winding, heavily bombed road and when the road changed to a miry jungle track they were carried by oxcart."

Arriving in the China war theater, the equipment became "stations" linking up the air bases. One AT-3 and one or more AR-77's comprised a "station" with a National 100 battery receiver as a backstop.

When Jap penetration endangered the safety of the station and it had to be shifted, the communications officer declared, the operator and his two Chinese assistants merely tossed the equipment on a truck and started across country to a new spot designated by headquarters. The only insulation provided on these rough journeys was that of a mattress covering the truck-body's floor.

The AT-3 is powered 300 watts for phone and 400 watts for cw. Their normal operating distance was from 700 to 800 miles. However, one of the AT-3's, according to an AVG operator, kept contact with Corregidor about 2,000 miles away in the last hours before the Philippine fortress' capitulation and the AR-77 received the operator's final message from the beleaguered station.

Crowe Now Croname

Crowe Nameplate and Mfg. Co., 3701 Ravenswood Avenue, Chicago, henceforth is to be known as Croname, Inc. The new name has been adopted to better indicate the manifold electronic and mechanical operations of the company.

MEC-RAD

ELECTRONIC COMPONENTS

help bring them back safely

Official U. S. Navy Photograph

A giant four-motor bomber, its mission completed, settles down for a safe landing atop one of the "miracle" steel runways, set up at breathtaking speed by Navy Seabees at a Pacific base.

Electronics has made a note-worthy contribution to the effectiveness and safety of our fighting planes. Mec-Rad's part in this program is to supply certain vital, highly precise mechanical and electro-mechanical components for electronic units. Today —and as long as they are needed,— our services will be given over 100% to this work.

Our work includes "fancy brass plumbing" of all types involving soft and hard soldering, close tolerances, precision machining, careful assembly and finishes ranging from lacquer to silver and rhodium plating.

After the war our specialized facilities will be available to the electronic industry for peacetime needs. Our engineering "know-how" is at your disposal now to help you with your post-war plans.

MEC-RAD

DIVISION-BLACK INDUSTRIES

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FERRIS INSTRUMENTS

ANOTHER NEW FERRIS PRODUCT

MODEL 24-A

For speedy spot checking in the range from 20 to 160 Mcs. the Model 24-A MICROVOLTER provides 15 selected frequencies. Ideal for receiver production and quick field checks.

Ferris instruments have provided the standards of radio measurements for the past twelve years. New instruments are extending these standards into new fields of application. Prompt service to maintain instruments in the field has contributed toward making the purchase of Ferris instruments a sound and lasting investment.

FERRIS

FERRIS INSTRUMENT COMPANY

110 CORNELIA STREET, BOONTON, N. J.

A newcomer in the ballast tube field..

E-E TYPE 3-16

A direct result of large-scale engineering and research in the electronic tube design and manufacture, this E-E Ballast Tube type 3-16 embodies the ruggedness and quality characteristics associated with this specialized vacuum tube line.

Especially suited for use in series with a string of 300 M.A. filament tubes fed from a fluctuating voltage supply. Satisfactory operation is assured under voltage variations normally causing faulty operation.

E-E engineers are available for collaboration in ballast tube problems. Inquiries are invited—no obligation is incurred.

WRITE FOR DATA BOOK

A complete volume, describing E-E power and transmitting tubes—mercury and high vacuum rectifiers, power and amplifiers, modulators, oscillators, grid control rectifiers, etc. Maximum ratings, characteristics, mechanical dimensions, circuit information are included.

ELECTRONIC e ENTERPRISES

ELECTRONIC ENTERPRISES · INC

GENERAL OFFICES 65-67 SEVENTH AVENUE, NEWARK, 4, N. J. — EXPORT DEPT. 25 WARREN STREET, NEW YORK CITY, N. Y., CABLE ADDRESS: SIMONTRICE, N. Y.

NEW BOOKS

Ordinary Differential Equations

By E. L. Ince, Professor of Pure Mathematics in the Egyptian University, published by Dover Publications, New York, 1944, 558 pages, $3.75.

The first American edition of a standard English book on ordinary differential equations, the text is an unusually extensive and thorough study of the subject. It will be essential to anybody seriously interested in this field, and can be highly recommended as a guidance to further literature in a special branch.

"For some time," the author states in the preface, "I have felt the need for a treatise on Differential Equations whose scope would embrace not merely that body of theory which may now be regarded as classical, but which would cover, in some aspects at least, the main developments which have taken place in the last quarter of a century." Therefore, the author, who has an outstanding knowledge of this intricate but essential subject, covers material not found in conventional textbooks.

Physical Foundations of Radiology

By Glasser, Quimby, Taylor, and Weatherwax, published by Paul B. Hoeber, Inc., Medical Book Dept. of Harper Bros., New York, 1944, 426 pages with many illustrations and references, $5.00.

In the early days of X-ray applications there was so much nonuniformity in the characteristics of the apparatus that standardization of operating technic was impossible, and "rule of thumb" methods were developed for each installation. Present day precision in design has taken the vagueness from radiology and made it a science. Here is a book acceptable to a physicist in its presentation of the concepts of X-ray and radium, and to the radiologist for practical information, as to operating technic. While the book is largely nonmathematical, a substantial amount of the physical and electrical concepts are included with an easily readable style. The chapters devoted to the production of X-rays, and those on the measurements of both X-ray and radium exposures will be of special interest to engineers.

RWMA Elects Eisler

The Resistance Welder Manufacturers Association has elected Chas. Eisler its president. He is owner and director of the Eisler Engineering Co., Newark, N. J., New vice-presidents of RWMA are: David Sciaky, Sciaky Bros., Chicago, and H. V. Beronius, Welding Machines Mfg. Co., Detroit.

Faradon Condensers for Industrial Oscillators

Faradon Power Condenser used in Industrial Oscillators

RCA 15,000-Watt Electronic Generator for electronic heating

For 25 years Faradon Condensers have been used in outstanding communication and broadcasting equipment built by RCA and other well-known manufacturers.

Today these condensers are finding new uses in electronic power generators, which are serving industry in many ways.

The reliability of Faradon Condensers, the wide range of sizes available, and the facility with which they can be adapted to design requirements, makes them a natural choice for all such applications.

For information on Faradon Condensers, for any purpose, write to Engineering Products Department, RCA Victor Division, Camden, N. J.

BUY MORE WAR BONDS

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION · CAMDEN, N. J.

In Canada, RCA VICTOR COMPANY LIMITED, Montreal

ALDEN

for Graphic Recording of any kind

OUR YEARS OF EXPERIENCE, and cumulative skills, in the designing and production of RADIO COMPONENTS, are now being used in making equipment which covers *the entire field of FACSIMILE.*

Actual service, as found in war and communication work under all conditions, has given a PRACTICAL quality to our equipment which, under ordinary conditions, would not have been obtained in years of engineering with limited application.

ALDEN PRODUCTS COMPANY is manufacturing practically ALL TYPES AND SIZES of facsimile and impulse recording equipment—using all the varied recording mediums: Photographic Paper, Film, Electrolytic Paper, Teledeltos, and Ink.

ALFAX IMPULSE RECORDING PAPER

●

By "COVERING THE ENTIRE FIELD," we mean . . .

1. Some of our equipment has been used for the transmitting and receiving of photographic pictures of reasonably high resolution (such as the war pictures now appearing in the news).

2. Continuous Recorders—of the type whose value has been proven on National and International news service circuits—are now on their way to the Orient, to be used for the receiving of the so-called "picture" languages. They use ALFAX paper.

3. Also, through the use of ALFAX (the first high-speed black and white permanent recording paper), HIGH-SPEED Signal Analysis Equipment has been made possible for various laboratories and Government Departments. Other equipments have employed Teledeltos Paper for message work and other purposes.

4. For outlying posts, where servicing equipment is an impossibility, or, where radio or wire links are of poor quality and power, ALDEN Tape Recorders (recording medium, ink)—have been designed to operate with a minimum of trouble and adjustments, and have PROVED MOST SATISFACTORY.

5. The ability of ALFAX Paper and ALDEN Machines to record impulses *as they occur*, without the inertia problems of many previous methods, has made possible other recorders at various speeds (including slow). They will record a whole day's history of related phenomena, with time indicated, and often—with self-calibrated linear reference marks for ready interpretation.

ALDEN PRODUCTS COMPANY

117 North Main Street

BROCKTON 64G, MASSACHUSETTS

PERSONNEL

Kaufman Joins Lewis

Jack Kaufman, long known for his connection with the South San Francisco firm of Heintz and Kaufman, producers of Gammatron tubes, has joined Lewis Electronics in Los Gatos, California, and become a vice-president of the company. Mr. Kaufman was for 15 years executive vice-president of Globe Wireless, Ltd. Mason Shaw is president of Lewis Electronics.

Dr. Frederick E. Terman has been appointed Dean of the Stanford University School of Engineering, Palo Alto, Calif. He is now head of the government's Radio Research Laboratory at Cambridge, Mass.

Dunford Kelley, recently a staff engineer with the El Monte, Cal., plant of Littelfuse, Inc., has joined the staff of the Universal Microphone Co., Inglewood, Cal., as electro-mechanical engineer. He has been assigned to duties in conjunction with Army and Navy and postwar production of microphones.

L. V. Bedell, assistant manager of the Sperry Gyroscope Co.'s Nassau plant at Great Neck, L. I., has been appointed manager of Sperry's electronic plant at Garden City, L. I., **G. J. Parker,** chief industrial engineer, succeeds Bedell as assistant Nassau plant manager.

Jack Davis has been appointed chief engineer of the auto radio division of Galvin Mfg. Co., Chicago; **Gus L. Mydlil** has been made assistant chief engineer.

Frank V. Webb has been appointed general manager of the broadcasting division of the Farnsworth Television and Radio Corp., Fort Wayne, Ind., and has assumed charge of station WGL. Coincidentally, **Howard J. Beck** has been made chief engineer of the broadcasting division. Beck has been with Farnsworth since 1939. Latterly, Webb has been sales manager for KDKA.

Howard L. Beck Frank V. Webb

This "big gun of electronics" is a symbol of Machlett's ability as a tube manufacturer.

In this unique tube is found the highest development of the basic requirements common to all electron tubes for whatever purposes. These are:

The tube must be structurally sturdy, compact, and completely vacuum-tight.

It must embody means for the accurate, effective and stable control of an electron stream.

It must have adequate heat-dissipating properties.

The difficulties of meeting these requirements are multiplied many times by each increase in size, design-complexity, and voltage. They reach an all-time high in this 2,000,000-volt d-c X-ray tube.

When buying electron tubes, whether X-ray, oscillators, amplifiers or rectifiers, look for the Machlett name as evidence of high technical achievement protecting your purchase. For information about available types of Machlett tubes write Machlett Laboratories, Inc., Springdale, Conn.

The ML 880 is a radio oscillator tube for use in transmitters, and has a maximum output of 60KW.

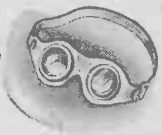
MACHLETT

APPLIES TO RADIO ITS 46 YEARS OF X RAY TUBE EXPERIENCE

SUN GLASSES

SKIING GLASSES

SWIMMING GOGGLES



WELDING GOGGLES

IN METALS TOO
It all depends on what you want to do

SELECTION GUIDE TO INCO NICKEL ALLOYS

PROPERTY:	MONEL	"R" MONEL	"K" MONEL	"KR" MONEL	"S" MONEL	NICKEL	"Z" NICKEL	INCONEL
CORROSION RESISTANCE	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
STRENGTH	GOOD	GOOD	HIGH	HIGH	GOOD	GOOD	HIGH	GOOD
TOUGHNESS	GOOD	GOOD	HIGH	GOOD	GOOD	HIGH	HIGH	HIGH
HARDNESS	GOOD	GOOD	GOOD	GOOD	HIGH	FAIR	HIGH	GOOD
MACHINABILITY	GOOD	HIGH	GOOD	HIGH	GOOD	GOOD	GOOD	GOOD
NON-GALLING	NO	NO	NO	NO	HIGH	NO	NO	NO
SPRING PROPERTIES	GOOD	NO	HIGH	NO	NO	GOOD	HIGH	HIGH
ELEC. CONDUCTIVITY	POOR	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR
HEAT RESISTANCE	GOOD	GOOD	GOOD	GOOD	HIGH	GOOD	GOOD	HIGH
HEAT TREATABLE	NO	NO	YES	YES	YES	NO	YES	NO
NON MAGNETIC	NO	NO	YES	YES	YES	NO	NO	YES

When it's a question of finding a metal for some tough job you have in mind there is a quick way to look for a ready answer...

Take a look at the family of Inco Nickel Alloys—strong, hard, corrosion-resisting and absolutely free from rusting, every one of them. Those are the family characteristics of the eight Inco Nickel Alloys.

Which one should you choose for your particular job?

It all depends on what you want to do.

From this "Selection Guide" you can see how each one provides a different combination of advantages for different types of work.

Then write for a copy of our List "B-100" which lists more than 100 technical bulletins and publications that explain the properties, corrosion-resisting characteristics and practical applications of these INCO Nickel Alloys. It is yours for the asking.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

Photo credits (left to right): Ewing Galloway, N. Y.—American Spectacle Co., N. Y.
American Spectacle Co., N. Y.—Black Star, N. Y.

NICKEL (INCO) ALLOYS

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL • Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings . . . Welding Rods (Gas & Electric)

LUMARITH* C.A. provides a "Safety Curtain"

against the BLACK HAND OF CORROSION

LUMARITH C.A. (cellulose acetate) insulation is effective protection against electro-chemical corrosion, the greatest cause of electrical failure. It is another example of how synthetic materials can frequently do a better job than natural materials, because they can be created from the start to meet definite objectives.

Lumarith C.A. is not subject to the built-in hazard of organic decomposition. It resists moisture and contains no substances which combine with moisture to form free acids. Applications involving fine wire, humidity and direct current are particularly well served by Lumarith C.A. insulation.

Lumarith C.A. films' and foils' high dielectric strength (2800-3300 volts/mil.) and high softening point (146-177° C. depending on formulation) recommend them for many types of coil insulation. Available also in sheets, rods, tubing, and molding materials. Films and foils are furnished plain or with special mat finish that's easy to see and slip resistant. Write for the reference booklet "Lumarith for the Electrical Industry." Celanese Plastics Corporation, *a division of Celanese Corporation of America*, 180 Madison Avenue, New York 16, N. Y.

A Celanese Plastic*

*Reg. U. S. Pat. Off.

Lt. Commander de Mars who has joined consulting engineer Raymond M. Wilmotte

Lt. Commander Paul de Mars has become associated with Consulting Engineer Raymond M. Wilmotte, Washington, D.C., who has added a department for industrial electronics. Lt. Cmdr. de Mars has been vice-president and chief engineer of the Yankee network.

Thos. A. White has been made president and general manager of Jensen Radio Mfg. Co., 6601 So. Laramie Ave., Chicago. Tom White joined Jensen in 1928 in the capacity of sales manager after acquiring an interest in the company. He was made vice-president in charge of sales and advertising in 1940. Mr. White assumes entire direction of the company, replacing W. E. Maxon who retired at his own request.

Dr. Bennett S. Ellefson has been appointed assistant to the vice president in charge of engineering, Sylvania Electric Products Inc. His office is located at Sylvania Center, Bayside, Long Island. Associated with the company since 1937, Dr. Ellefson has specialized in research on fluorescent screens, special uses of glass, fluorescent powders for cathode ray tubes and specialized war products.

Dr. Bennett S. Ellefson, who takes charge of engineering for Sylvania Electric Products

most hours for your tube dollars

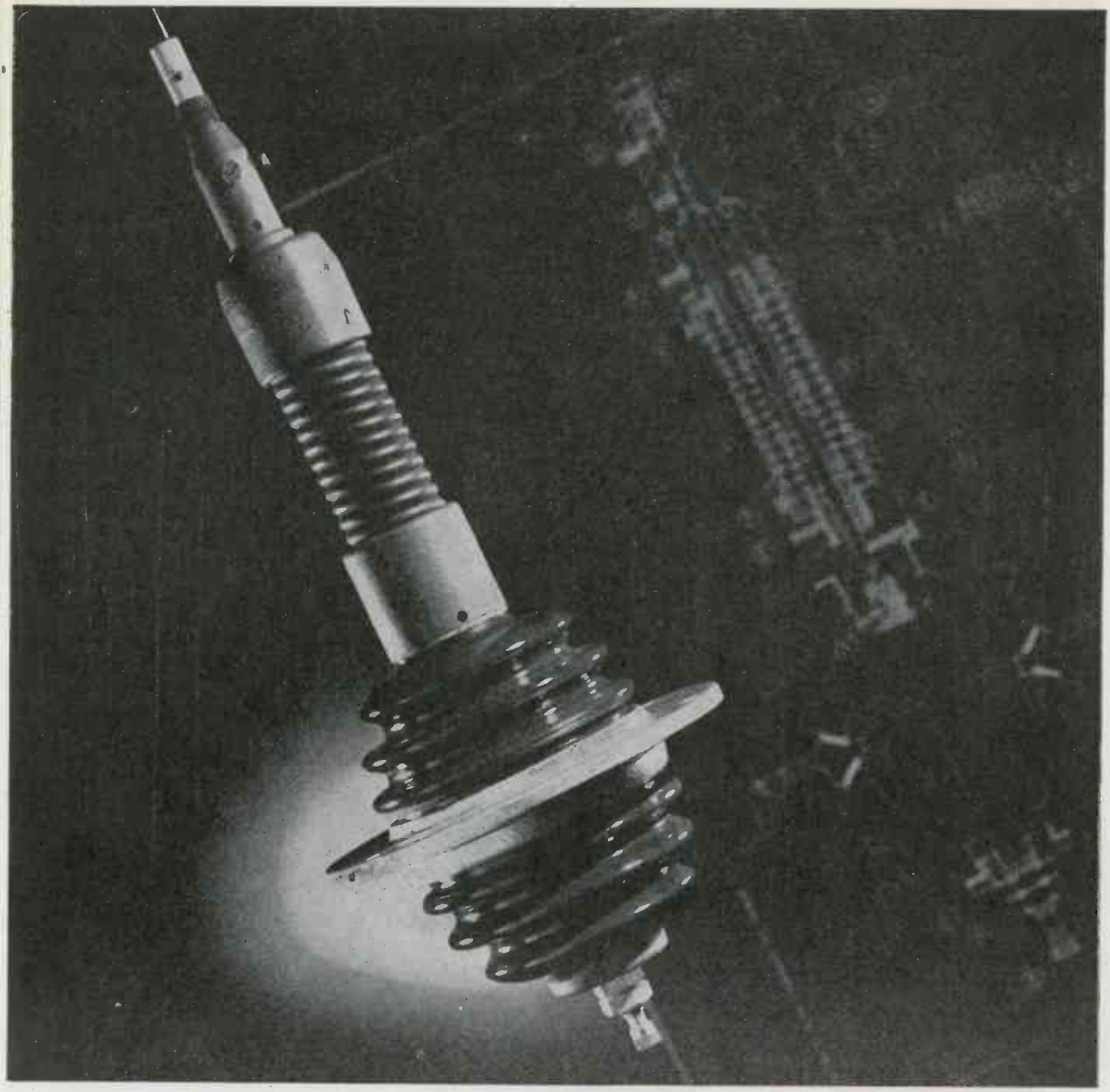
In short-wave broadcasting, diathermy and induction heating, the nine General Electronics' tubes illustrated here have become favorites with users who keep close tab on tube life as well as on performance.

The extra-long life of General Electronics' tubes is the *planned* result of the designing and manufacturing background of one of America's pioneer, leading vacuum tube engineers. Combine such advantageous experience with a young and virile organization equipped with the most advanced production facilities and methods—and you have the reason for the steadily increasing demand for General Electronics' tubes... the reason why they give "Most Hours For Your Tube Dollars."

The handsome new General Electronics catalog is ready! Photographs, description and complete operating data on every tube we sell. Designed for your ready reference. Write for it today.

GENERAL ELECTRONICS INC.

SALES: 1819 BROADWAY, NEW YORK 23, N. Y.



LAPP-DESIGNED, LAPP-BUILT—TO DO A SPECIFIC JOB

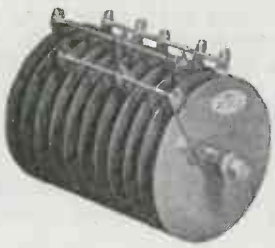
This is an antenna base insulator for use on a communications center transmitter. It is one of several Lapp designs for transmitter and receiver mast bases for military vehicular radio—on jeeps, halftracks, tanks and other rolling equipment.

Whether or not this special-purpose gadget has application to anything you build or propose to build, there's a moral in it for you. In this case, as in hundreds of others, an original and impractical design was modified by Lapp engineers—to provide a part that meets all electrical and mechanical requirements, and that Lapp can build economically and efficiently.

Lapp engineering talent and Lapp production methods are such that we can say, "If it's an assembly that can be made of porcelain or steatite and metal parts, tell us what the requirements are and how you think it might be made; Lapp will tell you how it can best be made—and will make it." Our right to that claim has been proved over and over in military electronic production; it's going to be a competitive advantage to smart post-war electronic producers. *Lapp Insulator Co., Inc., LeRoy, N. Y.*

Lapp

An example of B-L Battery Charger designed to meet specific needs.



B-L Selenium Rectifier converts AC to DC.

Specially designed B-L Transformer delivers 12 volts from the 115 volt output of the power supply.

This B-L Battery Charger meets special requirements of the Signal Corps

The problem of designing and manufacturing a charger for Signal Corps equipment which would meet the needs of increased loads was submitted to B-L engineers. The result is a Battery Charger producing *three times* the rate originally employed. It charges the batteries, and *keeps them charged*, in the Signal Corps equipment shown at the right.

The alternating current power supply is converted to direct current by sturdy, specially built B-L Selenium Rectifiers which meet the demands of this unit for charging the 6-cell 12-volt batteries. . . . The Charger itself is built to withstand rough usage and the severe moisture of the tropics.

A switch controls rate of delivery—5 amperes or 15 amperes . . . The built-in Thermal Circuit Breaker protects against overloads — the push button resets . . . The cut-out relay provides against any discharge of batteries in the event of power failure . . . Four fasteners permit handy removal from or installation to the base.

Mobile Unit, with Trailer, made for the U. S. Signal Corps by The Hallicrafters Co., Chicago.

Have You a Conversion Problem?

Twenty-five years of B-L specialized skill in AC-DC conversion problems is available to you. We are designers of Selenium and Copper Sulphide Rectifiers, Battery Chargers, and DC Power Supplies for practically every requirement. We invite your inquiries — without obligation.

SELENIUM **B L ELECTRICAL RECTIFIERS** **COPPER SULPHIDE**

THE BENWOOD LINZE COMPANY

1815 Locust Street • • • St. Louis 3, Mo.

DESIGNERS AND MANUFACTURERS OF COPPER SULPHIDE AND SELENIUM RECTIFIERS, BATTERY CHARGERS, AND D. C. POWER SUPPLIES FOR PRACTICALLY EVERY REQUIREMENT.

John Hutchins has been advanced from chief engineer of the Continental Electric Co., Geneva, Ill., to vice-president in charge of engineering. He joined Continental in 1942, was previously an engineer in the vacuum tube division of General Electric.

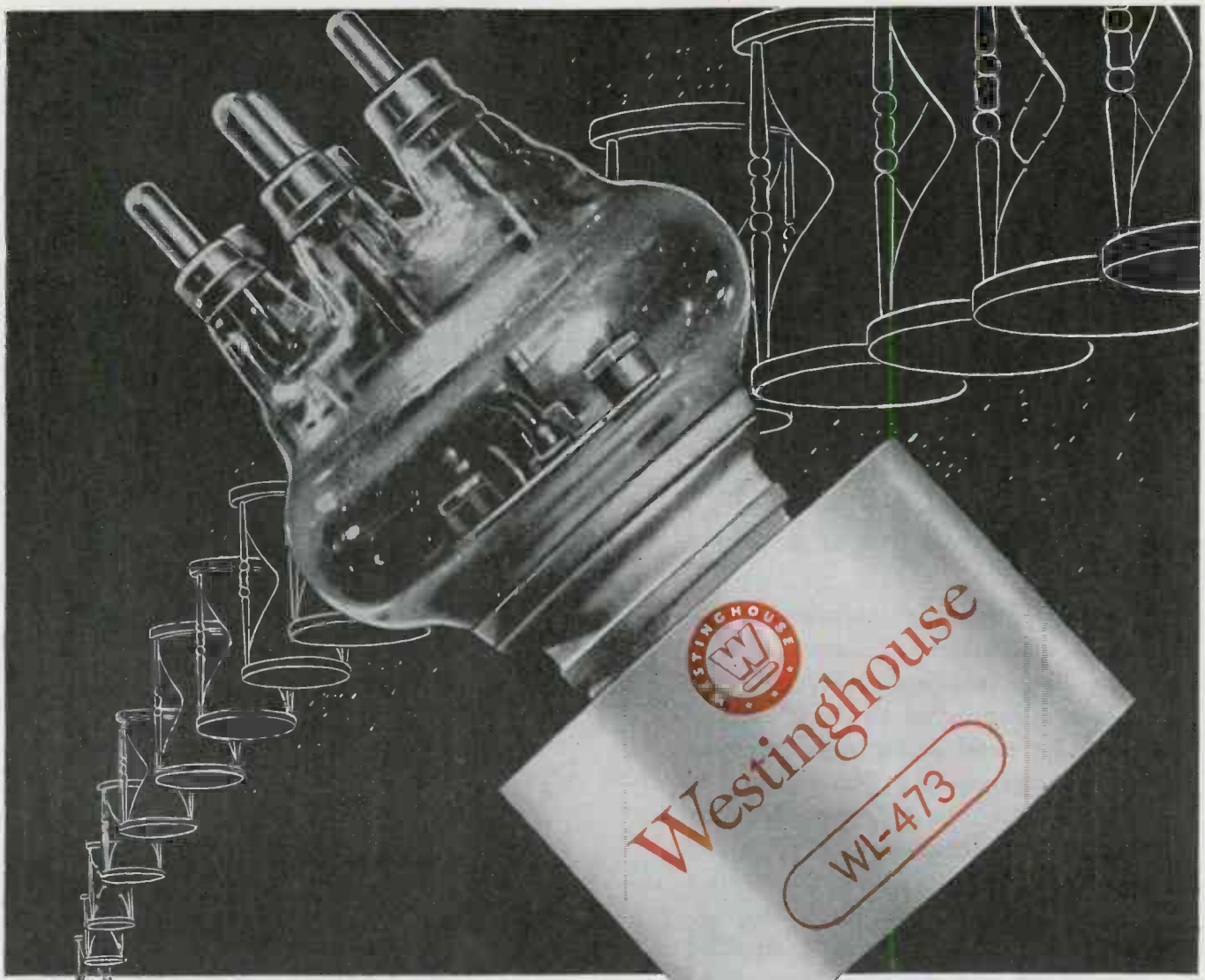
Clinton R. Hanna, inventor of the tank-gun stabilizer, has been appointed an associate director of the Westinghouse Research Laboratories. Mr. Hanna, who is also manager of the electro-mechanical department of the Research Laboratories, has been associated with Westinghouse since 1922. His work includes the design of the Silverstat, an automatic voltage regulator first used for the control of generators. He directed the development of the Westinghouse Photophone, one of the first successful methods of producing talking-movies.

Walter R. Jones has been appointed general engineering manager for receiving tubes by Sylvania Electric Products, Inc. He has been manager of commercial engineering.

Walter R. Jones who is now Sylvania's receiving tube engineering manager

Capacitron's Electrolytics

Production will soon be started on several lines of electrolytic capacitors in the new plant of the Capacitron Co., 849 North Kedzie Avenue, Chicago 51, In addition to standard lines of electrolytic capacitors, the new plant will turn out capacitors of a high life expectancy for use under severe service and temperature conditions. Several types of fluorescent ballast capacitors of this type as well as a complete line of heavy duty motor starting capacitors will be produced.



RUGGED-DEPENDABLE

. . . HOUR AFTER HOUR!

You can tell just by looking at it—this tube is built to l-a-s-t.

This new air-cooled Westinghouse Pliotron No. WL473 is small, compact and designed especially for dielectric and induction heating. It is extremely economical in operation, having the lowest cost per R.F. kilowatt hour of any tube in its class on the market today.

For technical data or any other information on the Pliotron No. WL473 or any Westinghouse Electronic Tube, consult your nearest Westinghouse Office or write to Westinghouse Electric & Manufacturing Company, Electronic Tube Division, Bloomfield, New Jersey.

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Quality Controlled Electronic Tubes

Only GE Offers All Three

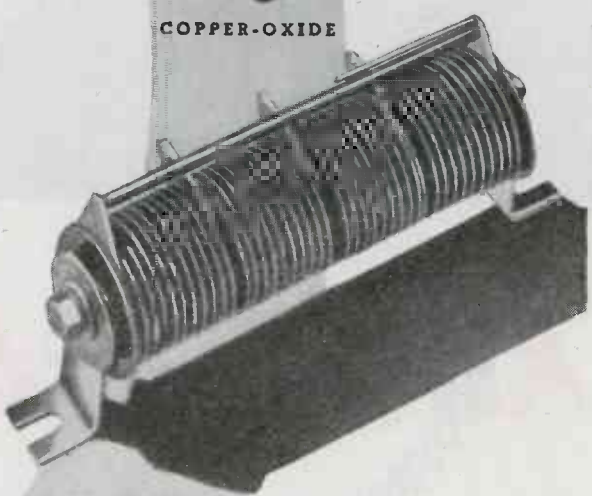
Low-voltage Rectifiers

Where other manufacturers offer one or two of the three standard types of low-voltage rectifiers, General Electric is alone in supplying all three—an important fact to remember when next you need a rectifying unit. The reason: The most efficient type in one application may be least efficient on the very next application. It is in determining which type to use in each instance that G.E. can help you most—having all three types it can give impartial engineering advice on which one you should use. Full details from Section A-356-124, Tungar & Metallic Rectifier Division, General Electric Co., Bridgeport, Conn.

Hear the G-E radio programs: "The G-E All-Girl Orchestra," Sunday 10 P.M. EWT, NBC; "The World Today" news, Monday through Friday 6:45 P.M. EWT, CBS; "The G-E House Party," Monday through Friday 4:00 P.M. EWT, CBS.

GENERAL ELECTRIC

COPPER-OXIDE



SELENIUM

TUNGAR

SCOVILL charted a new "course" for radio compass terminals and made them faster and better for less

Scovill Electrōnents may give you the same competitive advantages*

Electric terminals for radio compasses were needed faster than screw machines could turn them out of rod stock. Asked to suggest a speedier method, Scovill recommended stamping them out of sheet metal. Given the job, Scovill produced many more terminals per day at a much lower cost . . . and paid an extra dividend in the form of better electrical properties. That was because the sheet brass used had a higher copper content and higher conductivity than the brass rod necessary in the former method.

With the same kind of ingenuity applied to your small electronic components or complete assemblies, the chances are that Scovill can save you time and money. Investigate the designing service, manufacturing ability in all metals, and wide range of metal-working facilities that have won for Scovill the title of "Masters of Metal". Fill in coupon below and mail today.

*Electrōnents = Electronic Components

Scovill
Masters of Metal
MANUFACTURING COMPANY
WATERBURY, CONN.

Please send me a free copy of "Masters of Metal" booklet describing your facilities. I am interested in the ELECTRONENT* applications checked.

☐ Batteries	☐ Dials	☐ Panels
☐ Record Changers	☐ Escutcheons	☐ Sockets
☐ Clips	☐ Jacks	☐ Stampings (misc.)
☐ Condensers	☐ Lugs	☐ Tubes

Other applications.....

SCOVILL MANUFACTURING COMPANY
Electronic Division
23 Mill Street, Waterbury 91, Connecticut

Name .....

Company .....

Address.....

Bailey Joins IRE As Executive Secretary

George W. Bailey, Chief of the Scientific Personnel Office of the Office of Scientific Research and Development for the last four years, and President of the American Radio Relay League and of the International Amateur Radio Union since May, 1940, has been elected executive secretary of the Institute of Radio Engineers.

Mr. Bailey plans to continue his present work with Dr. Vannevar Bush in the OSRD for the duration of the war, gradually assuming his new responsibilities with IRE. The maintenance of these responsibilities will enable him to continue through the postwar period of readjustment his association and contacts with professional electronic and radio engineers, most of whom started in the field as amateurs. He is slated to retain his presidency of the ARRL, together with his IRE post.

A retired industrialist, Mr. Bailey volunteered for war service in Washington during the period of national defense preparedness in May, 1941, and has continued in this work during the entire war. During the defense preparedness period he rendered valuable service to the Army Signal Corps and Navy Communications in enrolling qualified technical personnel particularly for radar specialists, including a group of 500 officers who trained with the radar systems in England during the Battle of Britain. He then originated the plan of establishing intensive courses in ultra-high frequency and electronic training specialized for military requirements for Army and Navy reserve officers in 40 colleges and universities, including the Massachusetts Institute of Technology. During this time up until August, 1942, he was working with the National Academy of Sciences and then continued in the same field with the OSRD.

Tagliabue Sells Out

Portable Products Corp., Pittsburgh, has bought the assets of the C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., long known for its production of industrial and laboratory instruments. The business will be continued as a separate division of Portable Products Corp., which operates plants in Newburgh, N. Y., and Philadelphia as well as in Pittsburgh.

CORRECTION

The illustrations, Fig. 13 and Fig. 14, in "Measuring Klystron Amplifier Features" by Coleman Dodd (January, "Electronic Industries," p. 79), were inadvertently reversed. The diagram at the right on p. 79 is Fig. 13 and the one at the left is Fig. 14.

DO YOU NEED A CRYSTAL BALL?

THERE are times in the lives of all good engineers when a crystal ball would come in mighty handy. We know because we've had many a problem where it looked like aid from the occult was the only solution. Instead, we found that sound engineering plus the outstanding physical properties of Corning's electrical glasses usually supplied the answers.

These same glass qualities are ready to help *you* produce better postwar electronic products. Which do you need?

1. High dielectric strength—high resistivity—low power factor—wide range of dielectric constants—low losses at all frequencies.

2. Permanent hermetic seals against gas, oil and water between glass and metal or glass and glass.

3. Commercial fabrication to the fine tolerances of precision metal working.

4. Corning's metallizing process produces metal areas of fixed and exact specification, permanently bonded to glass.

* * *

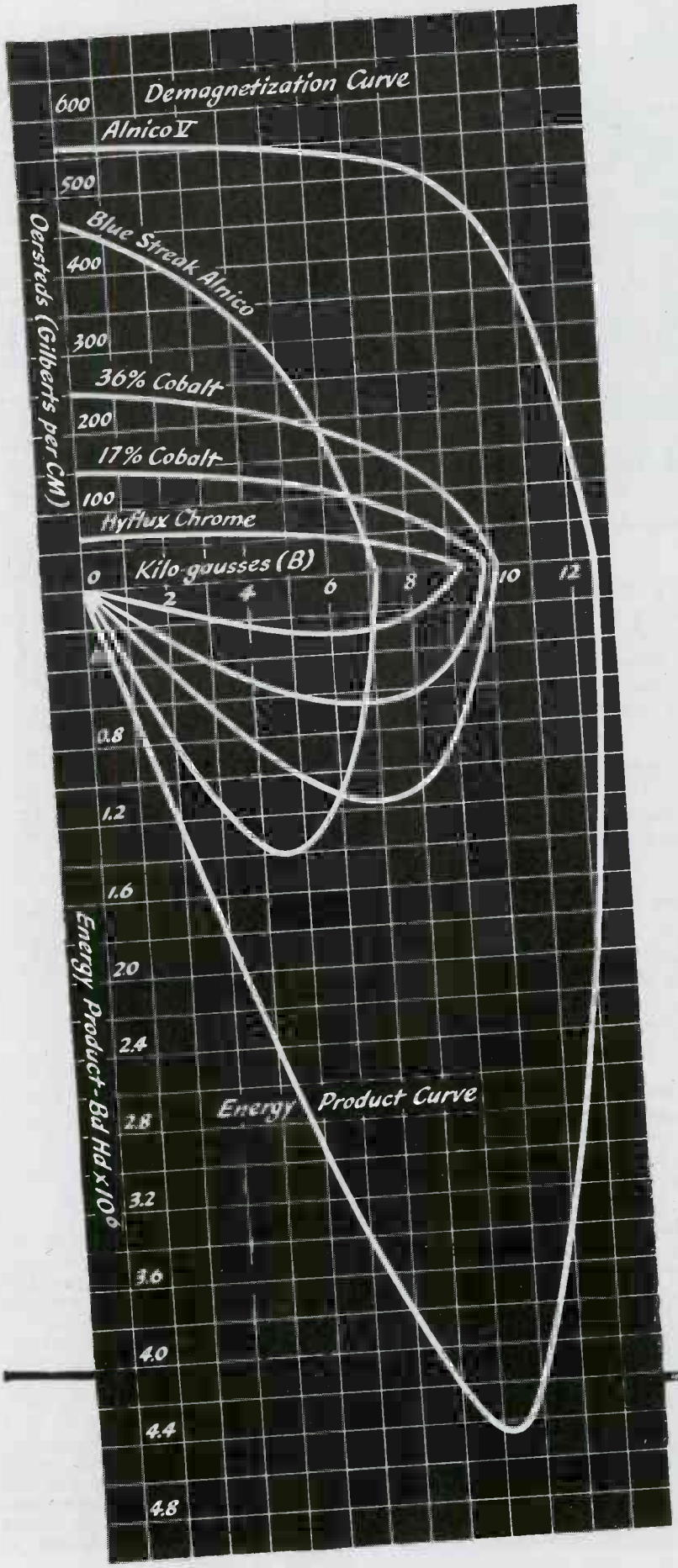
Write us about your problems. We'd be interested in seeing if glass can help you. Address Electronic Sales Dept., I-3, Bulb and Tubing Division, Corning Glass Works, Corning, N. Y.

CORNING *means* Research in Glass

Electronic Glassware

TRADE MARK VYCOR REG. U.S. PAT. OFF. CORNING REG. U.S. PAT. OFF. PYREX REG. U.S. PAT. OFF.

"PYREX", "VYCOR" and "CORNING" are registered trade-marks and indicate manufacture by Corning Glass Works, Corning, N. Y.



Magnetic Material Improvements

Metallurgical research is constantly expanding the productivity of permanent magnets, through the discovery of new magnetic materials and alloys. The permanent magnet of today is capable of *three times* the output of magnetic energy of that of 1939, and *nine times* that of 1917.

The proper utilization of materials in permanent magnets produces a specified ability to maintain the required magnetic field after the magnet has been magnetized—often despite severe external demagnetizing forces.

The development of permanent magnet materials of higher coercive force opens up many new applications of larger scope. Our research is facilitating these applications by employing an experience of more than a third of a century in the exclusive manufacture of permanent magnets. Our engineers are available for consultation to help solve your problems in the use of permanent magnets. Write for specific information; ask for free copy of pamphlet *"Permanent Magnets Have Four Major Jobs."*

THE INDIANA STEEL PRODUCTS COMPANY

6 NORTH MICHIGAN AVENUE • CHICAGO 2, ILLINOIS

A Star was Added ARMY NAVY E *in January, 1945*

Specialists in Permanent Magnets Since 1910

Radio Stocks Show Spectacular Increases

Radio stocks, as compiled by J. Cosin of "Electronic Industries" Readers' Service Dept., have in many cases spurted to amazing new highs under the stimulus of the war efforts.

The whole list as published here, has increased by something over two and one-half times in value, considering the low point of '41 and the current high for which the stocks are selling. In by far the majority of cases, though, gains have been far more spectacular and run from a conservative doubling to the case, for example, of Raytheon which increased in value no less than fifty-eight times. It is unlikely that any other industry can point to such gains. Following are figures as reported for February 9, 1945.

Firm Name	Price—2/9/'45	High-Low 1941
Admiral	10⅞-11	*
Aireon Mfg.	7⅜-7¼	2⅛-1½
Amer Tel & Tel.	162⅞-162⅛	168¾-115¼
Amer Type Fndrs.	15⅝-15⅜	7-3⅜
Argus, Inc.	9-8⅞	2½-⅞
Belmont Radio	17-17½	6-2½
Bendix Aviation	53½-53	41⅛-32⅜
Callite Tungsten	7⅞-7¾	2⅛-1⅜
Cornell-Dubilier	20⅝-20½	9½-7¼
Crosley Corp	38⅜-37¾	9-4⅜
Davega Stores	13¾-13¾	5¼-2⅞
Decca Records	35¾-35½	9¼-5⅛
Dumont Labs, A B	8⅜-8⅝	*
Emerson	20⅝-21⅛	*
Fairchild Camera	12⅝-12¼	12⅛-7½
Farnsworth	15⅝-15¼	*
General Electric	39½-39⅛	35⅛-24¾
Hazeltine	32¾-32½	26⅞-14
Int Detrola	17¾-18¼	*
Int Tel & Tel.	24¼-23½	3⅜-1¼
Ken-Rad	30½-30½	5½-3
Kingston Products	4¼-4⅛	1⅜-1
Magnavox	12¾-13	$1.20-$0.80
Maguire Industries	5-5⅜	*
P R Mallory Co.	31-31½	*
Natl Union Radio	6⅛-6	¾-⅛
Noblitt-Sparks	38½-38½	32¾-19
Philco Corp	35¼-35¼	12½-8½
RCA	12¼-12	4⅞-2¼
Raytheon Mfg.	58-57	4⅞-15/16
Sangamo Electric	23¾-24¼	22½-13½
Solar Mfg.	8¼-8	1-½
Sonotone	3⅝-3½	2¼-1⅝
Sparks-Withington	8-7⅝	* 2-1
Sperry Corp	28¾-28⅝	39¾-27⅛
Stewart-Warner	17¾-17½	8¾-4½
Sylvania	31½-31⅜	19¾-13¼
Tung-Sol	7⅞-7⅞	2⅜-1
Utah Radio	10¼-9⅞	1⅛-1¼
Westinghouse	120¼-119⅝	105-71
Weston	34⅝-34⅝	34½-27½
Zenith Radio	40⅞-40⅜	15⅞-8

*Not available

Sound Meter Standard

A new American Standard for sound level meters used for measuring the intensities of noise and other sounds in order to evaluate their relative effect on the ear has been approved by the American Standards Association. The new standard supersedes a tentative standard originally issued in 1936. This has been brought up to date in accordance with developments in acoustical practice in the sound measurment field. Work on the new standard was carried out by a committee of technical experts under the direction of the Acoustical Society of America.

This specialist is giving our Type 59 a thorough physical. Here he is checking voltage and capacity. Type 59 will also be checked for current rating, temperature rise and insulation resistance.

Capacitors may look alike. When new, they may be comparable in physical and electrical properties. The difference—that you don't see—shows up later after long hard service.

The difference is due to the men who make them . . . and their methods.

Through 35 years of capacitor specialization, Cornell-Dubilier has built a tradition of quality . . . has originated many basic innovations in capacitor design, engineering and manufacture.

In its six large plants, C-D has every facility to insure product perfection. These facilities are at your service. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey. Other Plants: New Bedford, Brookline, Worcester, Massachusetts, and Providence, Rhode Island.

CORNELL-DUBILIER CAPACITORS

1910 1945

MICA · DYKANOL · PAPER · WET AND DRY ELECTROLYTICS

TYPE 59 TRANSMITTING CAPACITOR. *Improved design, extremely adaptable under severe operating conditions. In low-loss white glazed ceramic cases. Low-resistance, wide-path end terminals. For grid, plate blocking, coupling and by-pass applications.*

To Release Radar

It is understood that both the Army and the Navy are preparing shortly to release particulars of the American development of radar equipment. The data will be given concurrently to all newspapers and magazines and will be dated for release two weeks after receipt. The British already have permitted certain details of their equipment to be made public through publication of an article in the February issue of "Wireless World," by R. L. Smith-Rose, of the British National Physical Laboratory, entitled "Radio Location."

RCA International

A new RCA International Division has been formed by the Radio Corp. of America to supervise foreign sales and other activities of the company and its subsidiaries outside of the United States. Headquarters of the Division will be in New York. John G. MacKenty, vice president and general manager of Radiomarine Corp. of America, has been appointed managing director of the division. He has been associated with the company for more than twenty-three years and has held important posts at home and abroad. The International Division will have charge of the export of all products manufactured and sold by RCA companies and divisions, and will supervise RCA interests abroad.

Zenith Doubles Production

Zenith Radio Corp.'s production of war equipment in 1944 was almost double that of 1943, according to Commander E. F. McDonald, Jr., president, as the company was awarded for the fifth time the Army-Navy "E" production award for outstanding services in production. "Cutbacks and completion of contracts prior to the German break-through last month caused some tapering off of production in the latter part of 1944," he said. "Since then new orders for vital electronic equipment have been placed with us by the Government, and schedules on some existing contracts have been sharply increased."

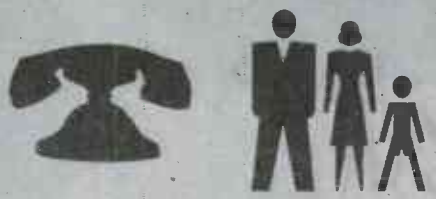
Sperti in New York

Sperti, Inc., which has headquarters, laboratories and manufacturing plant in Cincinnati, has opened a New York office at 714 Fifth Avenue. George Stevens comes from the parent organization to manage the new office which will represent all the company's various divisions.

A MODERN SYLLOGISM

MAJOR PREMISE:

Bell Telephone System serves the American Public.



MINOR PREMISE:

Bell Telephone Laboratories develop the facilities of the Bell System.

CONCLUSION:

Therefore, Bell Laboratories serve the American Public.

And that is the *raison d'être* of the Laboratories. For the Bell Telephone System, the Laboratories carry on research studies in all the sciences and development work in all the engineering arts that relate to electrical communication.

For the Western Electric Company, the manufacturing unit of the System, the Laboratories develop equipment, prepare specifications for its construction, and engage in various engineering activities.

For the Armed Forces of the United States, under contracts of the Western Electric, the Laboratories have undertaken more than a thousand development projects — many with spectacular effect upon our enemies.

BELL TELEPHONE LABORATORIES ***explore and invent, devise and perfect for our Armed Forces at war and for continued improvements and economies in telephone service.***

OHMITE Rheostats

INSURE PERMANENTLY SMOOTH

CLOSE CONTROL

10 Wattage Sizes

. . . in a variety of types to meet every need

There's an Ohmite Rheostat to assure the best unit for each control need . . . from the 1000 watt, 12″ diameter, Model "U" to the 25 watt, 1 9/16″ diameter, Model "H". Made in single or tandem units, with uniform or tapered windings, in stock or special resistance values. And large or small—each Ohmite Rheostat is designed to give smooth, close control—long life—and trouble-free service. In Resistance Control, Ohmite Experience Makes a Difference.

Write on company letterhead for Catalog and Engineering Manual No. 40.

OHMITE MANUFACTURING CO.
4983 Flournoy St., Chicago 44

Be Right with OHMITE

RHEOSTATS • RESISTORS • TAP SWITCHES

86 Pieces Gaged Per Minute

EACH CHECKED FOR 7 DIMENSIONS

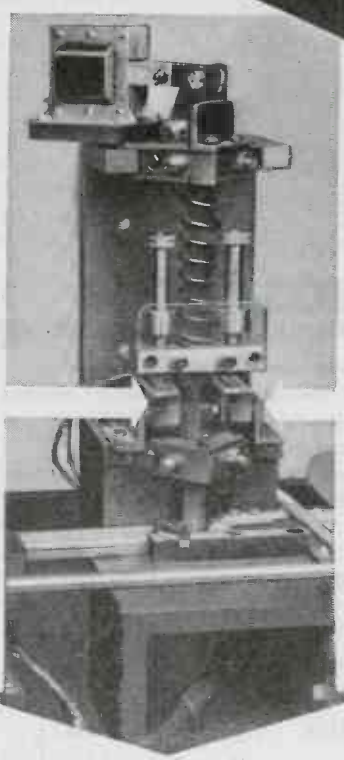
Thanks to MICRO SWITCH

Automatic checking of small parts to assure that they are within allowable tolerances is accomplished by this "Gage-O-Matic" precision gaging machine through the use of Micro Switch products.

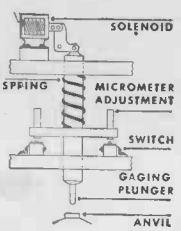
Built by the General Control Company for the use of Hamilton Standard Propellers, the "Gage-O-Matic" permits high speed checking of seven accurate dimensions at the rate of 86 pieces per minute.

This is accomplished by pairs of plastic enclosed switches which monitor each gaging operation. They are actuated by micrometer heads mounted on a sliding bar. If the part being tested is in tolerance, *one* switch is actuated . . . if under tolerance, *both* are actuated . . . if over tolerance, neither is actuated.

If the part is over or under tolerance, it drops through a tube into the proper rejection drawer, automatically segregating rejected parts for their particular defect.



Here's How it Works



The small parts are fed through a chute by a rotating hopper. As the part slides down the chute, it is stopped at different intervals by solenoid controlled levers. The part is positioned between the gaging plunger and anvil, then the solenoid on the gaging head is released. The spring drives the gaging plunger assembly down and in contact with the part.

The gaging assembly is then pulled up by the solenoid and the part, if acceptable, is permitted to move to the next state.

1,001 Jobs For Micro Switch Products

In wartime production and after victory, there are 1,001 important jobs for Micro Switch products in every branch of industry. They control temperature, help package products, limit machine operations and serve as sensitive and efficient controls for a limitless number of electrical and electronic devices.

Production and design engineers, planning new products or seeking ways to improve present products, should be thoroughly familiar with the many advantages of these rugged, compact, sensitive snap-action switches. Write today for Handbook-Catalog No 50 which gives complete details on electrical characteristics, housings and actuators.

LET'S ALL BACK THE ATTACK — *BUY EXTRA WAR BONDS*

MICRO MS TRADE MARK SWITCH

A DIVISION OF FIRST INDUSTRIAL CORPORATION

Freeport, Illinois, U. S. A., Sales Offices in Principal Cities

This is the basic switch—a thumb-size, feather-light, plastic enclosed, precision, snap-action switch, Underwriters' listed and rated at 1200 V. A., at 125 to 460 volts a-c. Capacity on d-c depends on load characteristics. Accurate reproducibility of performance is maintained over millions of operations. Basic switches of different characteristics are combined with various actuators and metal housings to meet a wide range of requirements.

Electronic Vulcanizing

Basic patents covering electronic vulcanization of rubber and other materials have been purchased by The B. F. Goodrich Co. and The Firestone Tire & Rubber Co., Akron. The patents were originally granted on discoveries made by R. A. Dufour and H. A. Leduc of France, and by E. E. W. Kassner of Switzerland. The patents will be made available both to the rubber and plastics industries on a reasonable basis.

Adds Electronic Lab

The York Research Corp., 63 Park Row, New York, has added an electronic laboratory to better serve its clients. The laboratory will be under the supervision of J. Knox Tillotson, formerly supervisor of the electronics and vibration laboratory for the Elastic Stop Nut Co.

Universal Enlarges Service

Universal Microphone Co., Inglewood, Cal., has enlarged its service department. Formerly a part of the commercial division, it will now be a separate department devoted to the repair of microphones, stands and accessories. In charge will be Robert Ramsey.

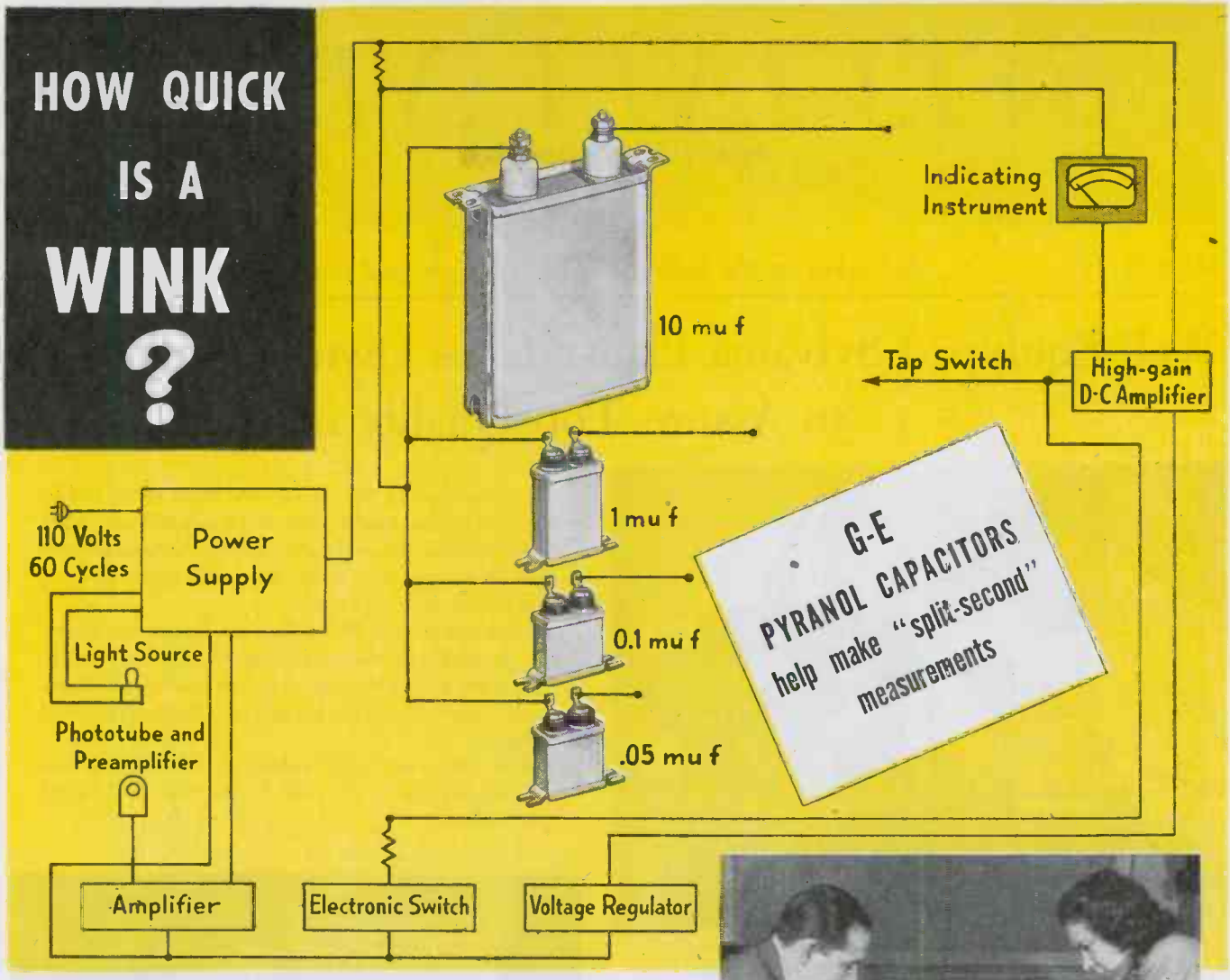
Bell Broad-band Net

An emphatic "Yes" came from the American Telephone and Telegraph Co. in answer to the question of whether the Bell System can provide program transmission channels which will meet the present and future needs of FM broadcasters with respect to high fidelity and freedom from noise and distortion.

The statement is contained in a 12-page brochure which points out that the Bell System already is furnishing studio-transmitter links to the majority of FM stations now in operation. These links transmit a frequency band of 15,000 cycles as specified by the Federal Communications Commission. It was stated that present broad band "carrier" telephone facilities can readily be adapted for 15,000-cycle program circuits, if desired, by adding special terminal equipment.

For many years, the announcement says, wide frequency bands have been transmitted over these carrier systems which make it possible to send many telephone and telegraph messages over a single pair of conductors. This network of wide-band channels, blanketing the entire country, already is capable of transmitting frequencies of 15,000 cycles or more for telephone purposes. There are thousands of miles of intermediary telephone routes which can be similarly equipped for wide-band transmission.

HOW QUICK IS A WINK ?



Another new job for capacitors

WHILE we have not yet measured the quickness of a wink with the time-interval meter, we know that it will do more practical jobs like measuring the time required for a camera shutter to open, or the time that it remains open. This meter is also being used to synchronize flash-bulb contacts on camera shutters, test relay performance, and measure the velocity of moving bodies.

Here's how Pyranol* capacitors are used in its circuit: An external contact or a phototube, working through the amplifier, causes the electronic switch to close during the time period to be measured. While the electronic switch is closed, one of the Pyranol capacitors is charged at a constant rate through a precision resistor. Thus, the voltage developed across the Pyranol capacitor is a direct measure of the required time interval.

Four Pyranol capacitors and several charging resistors are used to obtain eight full-scale ranges (0.001, 0.003, 0.01, 0.03, 0.1, 0.3, 1, and 3 seconds). A tap switch on the instrument panel is used to select the correct Pyranol capacitor and resistor for the desired scale range.

An inverse feed-back arrangement holds the charging rate constant while the Pyranol capacitor is charging, and also corrects for leakage in several elements. The feed-back principle also enables the use of a direct indicating instrument to measure the capacitor charge, without discharging the capacitor.

The way Pyranol capacitors are used in this circuit may suggest a better way to do some job in one of your circuits. Remember that the high capacitance per cubic inch of Pyranol capacitors, their compact, space-saving shapes, and long life make them ideal for a wide variety of built-in applications.

This sensitive electronic instrument accurately measures time intervals as short as 1/10,000 second. It is being used here to measure the time the man takes to react and turn off the lamp after it has been turned on by the girl. (Reaction time on this test: 175–200 milliseconds.)

Booklets on our various lines—h-f paper dielectric, h-f parallel plate, Lectrofilm, as well as Pyranol units—are yours for the asking. General Electric, Schenectady 5, N. Y.

*Trade-mark Reg. U.S. Pat. Off.

GENERAL ELECTRIC

40"-85-5700

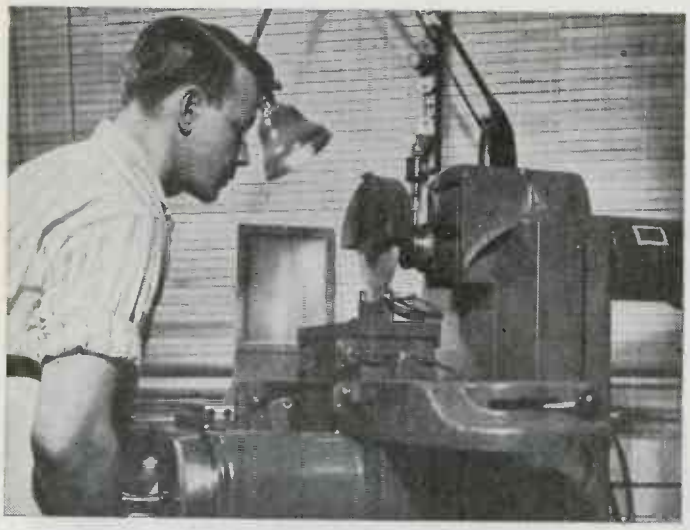
BUY WAR BONDS

SYLVANIA NEWS

ELECTRONIC EQUIPMENT EDITION

MARCH *Published in the Interests of Better Sight and Sound* 1945

Well-Equipped Sylvania Plant Makes Own Small Parts to Assure Top Quality in Radio Tubes



Many of the special tools required for turning out small tube parts are tailor-made right at Sylvania's Emporium plant.

To insure that all Sylvania-made radio tubes will be of the very best quality, the well equipped tube plant in Emporium, Pennsylvania, provides extensive facilities for making over 8500 of the delicate small parts that go into Sylvania tubes.

Each month over 600 million small parts are turned out. In making these intricate parts, Sylvania craftsmen work with a variety of metals such as tungsten, steel, copper, phosphor bronze, beryllium copper and tantalum.

The Emporium staff includes highly skilled production engineers, tool and design men, and expert tube makers.

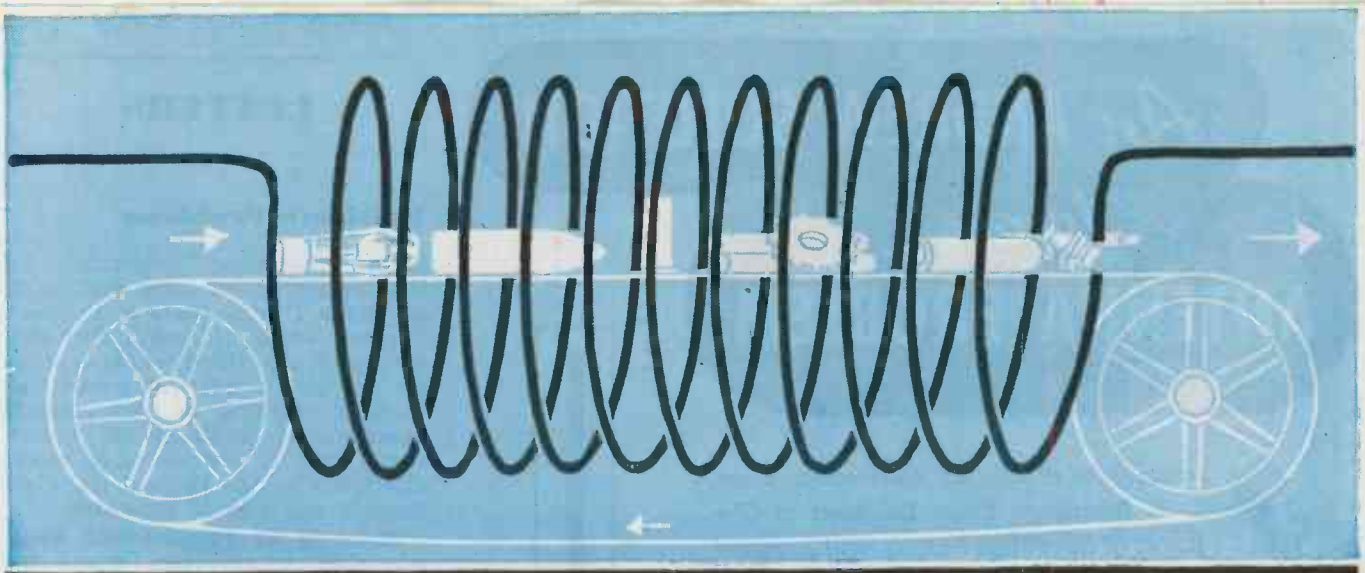
Tiny tube parts are magnified and their outlines superimposed on scale drawings to insure meeting the extremely close dimensional tolerances required.

By a sampling method, watchful Sylvania inspectors carefully study each batch of small parts for detailed perfection.

SYLVANIA ELECTRIC

SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa.

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, ACCESSORIES; INCANDESCENT LAMPS



HIGH FREQUENCY HEATING

is on the move!

In hundreds of new applications it's improving product quality at higher-than-ever speeds and lower heating costs. Here's what Ajax-Northrup users say about high frequency for

FORGING, UPSETTING: Faster, automatic. Lower unit heating cost. Less scale, hence greater dimensional accuracy and longer die life. Compact, dependable equipment takes little space.

Example: A hot 75mm. billet every 28 seconds with a 5-heater set-up for forging. Accurately timed green lights set the pace for the operator. In one 8-hour shift, one upsetter turned out 960 perfect shells!

BRAZING: Perfect joints — almost no rejects. Less warping, scale, or residue. Easy to handle. No fumes or excessive heat.

Example: 24 perfect brazed fuse seat liners per minute with battery of four Ajax-Northrup brazing units. Loading is easy and no clean-up is needed.

HARDENING: Fast, precise control needed for jobs ranging from self-quench to through hardening. Can achieve any heat pattern.

Example: The noses of nearly 6,000 armor-piercing shells are hardened in one day with a single 6-kw. Ajax Northrup unit.

BUILT-IN induction heating is on the horizon for higher-production machines of tomorrow. Already Ajax-Northrup equipment is one of industry's best, most dependable tools. Bring your plans to us and let us engineer your high frequency heating.

POST-WAR SUGGESTIONS

Equipment bought for one war purpose can easily be converted to your peace-time heating. In most cases all you'll have to do is change a coil on the heaters, or connect up new brazing or hardening coils.

For example, you may be able to do a large part of your future forging, melting, and heat-treating (or any of hundreds of other jobs that are now being done by high-frequency) with equipment you install for shell forging.

66

AJAX-NORTHRUP HIGH-FREQUENCY HEATING MELTING

SINCE 1916

AJAX ELECTROTHERMIC CORPORATION • Ajax Park TRENTON 5, N. J.

ASSOCIATE COMPANIES . . . THE AJAX METAL COMPANY. Non-Ferrous Ingot Metals.
AJAX ELECTRIC FURNACE CORPORATION. Ajax-Wyatt Induction Furnaces.
AJAX ELECTRIC COMPANY, INC. Ajax-Hultgren Salt Bath Furnaces.
AJAX ENGINEERING CORPORATION. Aluminum Melting Furnaces.

LETTERS

Multipath Problems

Editor, Electronic Industries: In the matter of reducing multipath problems, I think there is no question but what it is sound that elevation of the television transmitter antenna height will reduce the troubles. I think we have enough experimental evidence to prove that. Further, the use of as much directivity in the vertical plane as possible will give it assistance.

There is no question but what television transmitters with the antennas on the same level with tall buildings and other obstructions will have trouble from reflections to a greater degree than those antennas which are located more in the clear. One of television's major technical problems is that of getting rid of images arriving by several different paths and accomplishing this end without destroying the ability to look in on several different transmitters. J. E. Brown, Assistant Vice-President, Zenith Radio Corp., Chicago.

Tele Lower

Editor, Electronic Industries: This is in response to the proposal by Mr. Batcher in the February issue of Electronic Industries, in dealing with the idea of using a high tower for all television transmitters to overcome multipath problems.

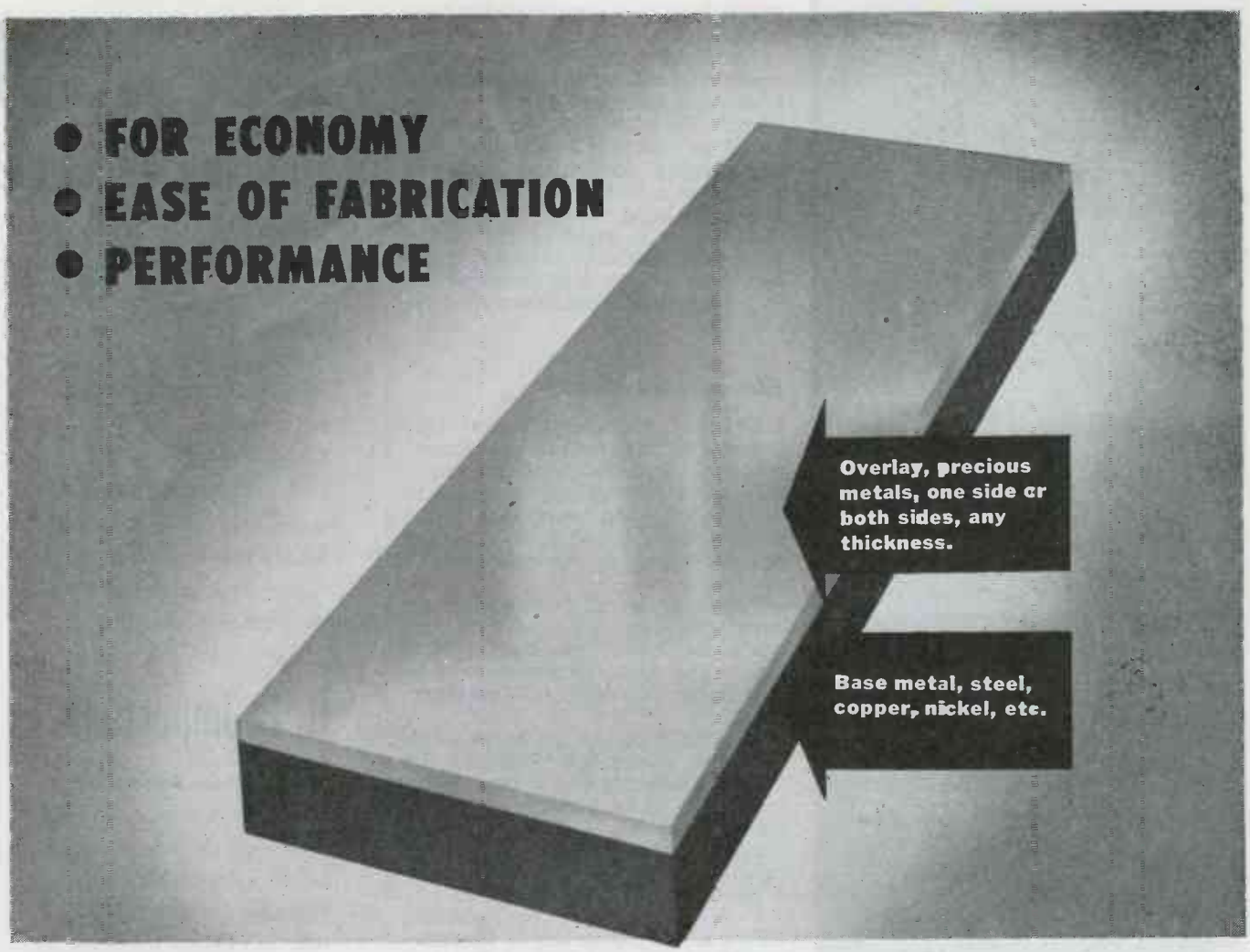
I agree that the only way to solve the multipath problem is by means of highly directional antennas at the receivers.

Transmitting towers as high as suggested in the article would increase the coverage of a transmitter to a point where interference would reduce the number of possible stations on the Eastern seaboard. By reducing the power, the signal strength at the horizon could not be adequate to operate the receiver, yet sufficient to cause interference.

On the present 6 mc channels, with the allocation suggested by the FCC, it seems unlikely that a single receiving antenna could cover the entire frequency band from 44 to 220 mc (ratio of 5:1). In addition, an antenna which is to receive a signal at 44 mc could not be sufficiently directive to reduce appreciably multipath reception and still remain a structure of reasonable size.

It looks to me as if the ultra high frequency channels, which cover a band less than 2:1 in ratio,

(*Continued on page* 175)



INVESTIGATE *General Plate Laminated Metals*

For your Peace Products

No matter what your contemplated peacetime products . . . from peanut radar tubes to giant turbines, . . . General Plate Laminated Metals can offer you many worthwhile advantages from economy to better performance.

Made by permanently bonding precious metals such as silver, gold, platinum to inexpensive base metals, they are more economical because they give precious metal performance at a fraction of solid precious metal cost. The laminating process makes the precious metal harder assuring long life, while the base metal adds strength and workability.

Many base to base metal combinations which provide performance characteristics not found in solid base metals are also available.

Now, while your products are still in the design stages, is the time to investigate General Plate Laminated Metals. They are available in rawstock, inlaid or wholly covered or as fabricated assemblies. Write specifying your problems, and our engineers will make recommendations.

GENERAL PLATE DIVISION

OF METALS & CONTROLS CORPORATION

Metals and Controls Corporation Divisions manufacture the following products: Laminated & Solid Precious Metals, Electrical Contacts, Rolled Plated Precious Metals to Base Metals in all forms — Truflex Thermostat Metals.

ATTLEBORO, MASSACHUSETTS

50 Church St., New York, N. Y.; 205 W. Wacker Drive, Chicago, Ill.; 181 E. Main St., Centerbury, Ohio; 2625 Page Drive, Altadena, California; Grant Bldg., Pittsburgh, Pa.

would furnish a simple and radical answer to the problem. Using a single tower for all transmitters would be an advantage. However, I believe a structure as high as the Empire State or Chrysler Building would be just right. Fairly simple and highly directional antenna structures covering the entire UHF television band would be provided then at each receiver location.—Peter R. Goldmark, Director, Engineering Research and Development Dept., Columbia Broadcasting System, Inc.

Electrified Snow

Editor, Electronic Industries. Regarding "Electrified Snow" ("Electronic Industries," February, 1945, p. 73). I read the reference to this subject with more than usual interest since I had seen a similar demonstration on two previous occasions.

The first time was while using an early "battery radio set" in the winter of 1925. This was in Missouri. The second instance was in Gunnison, Colorado in December, 1937.

In each case the static was discharging across the plates of the tuning condenser and severe shocks were felt while trying to disconnect the aerial. I do not remember the first case too well, but recall that the second coincided with a light but very dry snow fall.

I discussed this phenomenon with physics instructors at the University of Missouri and at Western State College of Colorado. In each case it was decided that it was "snow static" but considerable doubt was expressed regarding the potential that must have been present.

This must be a rather rare thing. I have been tinkering with radio as a hobby for over 20 years and have seen it only twice.—Edwin M. Legg, Meteorologist, U. S. Weather Bureau, Box 263, Pomona, Calif.

Enhanced Thermionic Emission

The following letter to the editor by J. B. Johnson of Bell Telephone Laboratories was published in the December 1944 issue of the Physical Review:

"A new type of electron emission from oxide-coated thermionic cathodes is disclosed by a method of measuring simultaneous thermionic and secondary emission. In this method the heated oxide target is bombarded by the primary electrons from a gun in which the high voltage electron stream can be turned on by a small auxiliary voltage. The steady collector voltage is first applied so that before the bombardment starts the circuit is in electrical equilibrium. The

Questions and Answers

ABOUT THE

1945 ENGINEERING DIRECTORY

TO BE PUBLISHED *in May* AS A SECTION OF

ELECTRONIC INDUSTRIES

q. What is the 1945 outlook for radio-radar work?

a. The program of the Signal Corps and Navy Bureau of Ships is now at an all-time peak. Even though some manufacturers finish present contracts or get cutbacks, it is more than likely that most of the contractors and their suppliers will be kept busy for months by the constantly changing needs of the war.

q. What is the outlook for reconversion to radio, combinations, television, and allied units?

a. The present state of the war makes it quite possible that the production of radio consumer goods may come suddenly—much earlier than was anticipated in December and January during the Nazi "bulge".

q. What should be done immediately by manufacturers who have run out of war work?

a. Get ready for the possibility of a sudden and quick reconversion.

q. Will the demand be greater than prewar?

a. It will surpass anything ever known in peacetime. Millions are waiting for improved postwar models of radio receivers, phonograph combinations, FM and television receivers as well as new things to come out of the war.

q. Can you build postwar business by advertising in this Engineering Directory?

a. Yes, if you now have, or will have, a product that can be used to advantage by radio-electronic manufacturers, industrial electronic users, communications services, etc. Remember, this directory will have a year-long life.

q. Must you advertise in the directory in order to get a free listing?

a. No. The listings are a 100% editorial service. But you have the opportunity to use advertising space to amplify your listings or catalog your products.

q. How are the free listings obtained?

a. By filling out and returning promptly the questionnaires we have mailed to all producers and their advertising agencies. It is of the utmost importance to you and to us, that full information be given in these questionnaires.

q. WHO publishes ELECTRONIC INDUSTRIES?

a. Caldwell-Clements, Inc. (Orestes H. Caldwell and M. Clements, editor and publisher respectively, the pioneers and present-day leaders in radio-electronic publishing.)

q. What is the closing date for advertising in the May directory issue?

a. April 1, for advertisers requiring composition and proofs. April 10, for complete plates, ready to print.

14,000 PAID CIRCULATION of ELECTRONIC INDUSTRIES and its Engineering Directory includes a complete coverage of the top-ranking design and production engineers and purchasing agents of all radio manufacturers and fabricators of peacetime radio equipment and television.

ALSO the men who initiate and authorize radio-electronic activity in war plants, communications systems and industrial plants. 14,000 paid.— the most effective buying power of circulation in the four billion dollar electronic industries.

LISTING MANUFACTURERS OF finished products, raw materials, parts and components, equipment and accessories, associated apparatus, laboratory equipment, production equipment.

COMPLETE, CLASSIFIED, CROSS-INDEXED to include not only a product directory, but the only alphabetical directory interfiled for all manufacturers.

A COMPREHENSIVE CATALOG of the products of the radio-television-electronic industries.

Caldwell-Clements, Inc.

480 Lexington Avenue New York 17, New York Telephone PLaza 3-1340

(201 N. Wells Street, Chicago 6, Illinois Randolph 9225)

thermionic current is then read by a d.c. meter. Short-time changes in the current to or from the target are observed on an oscilloscope with an intervening amplifier from which d.c. is excluded. Time as short as 2×10^{-7} sec. can be resolved."

"When now the primary bombardment is started the oscilloscope shows at first an abruptly rising flow of electrons from the target, followed by a gradual rise to an equilibrium value many microseconds later. When the bombardment is stopped, the electron current drops abruptly by the same amount as the initial rise, and there then follows a more slowly decreasing current. The bombarding primary current shows none of this behavior but begins and ends sharply."

"The initial rise or final drop of current is interpreted as the beginning or end of normal secondary emission of the target. It changes little with temperatures and varies in the usual way with the primary voltage. At a primary voltage of 1200 to 1500 volts, the ratio of the maximum value of the secondary current to primary current varies from 3 to 5. The emission which persists after the end of the bombardment can hardly be secondary emission but must be of thermionic origin, and presumably the equal rise of emission during the bombardment is of the same kind. This emission varies with the temperature of the target in about the same way as the steady emission, thus following roughly the Richardson law. It increases with bombarding voltage and current density, and may exceed the steady thermionic current in value. It is undoubtedly an enhanced thermionic emission excited by the electron bombardment."

"A natural assumption is that the increased emission is caused by a rise in target temperature caused by the bombardment. The temperature rise of the surface of the target may be calculated, and is far too small to explain the effect. One must conclude instead that the bombardment temporarily changes the thermionic activity of the oxide target."

"This effect no doubt explains the exponential rise with temperature that has been reported for the secondary emission factor of oxide cathodes.[1]"

Frank W. Phelan has retired as president of All America Cables and Radio, Inc., an affiliate of International Telephone and Telegraph Corp. after fifty years of service.

A cable operator at the age of 14, Mr. Phelan has devoted practically his entire life to telegraphy.

THERE'S NOTHING ELSE LIKE IT!

THE AMP PRE-INSULATED TERMINAL

For easy identification insulation is colored for each range of wire sizes:

Red — 22-18
Blue — 16-14
Yellow — 12-10

Press dies and hand tools are similarly marked.

THE FACTS

1. The insulation is permanently bonded to the barrel of the terminal — will not distort, slip, crack or peel off — its dielectric qualities are equal to or exceed any conventional crimped terminal with loose sleeving.

2. The production cost of applying separate tubing to the terminal is approximately the same as the cost of applying the terminal itself to the wire. By using the Pre-insulated Terminal you eliminate such costly operations as buying, expediting, stocking, cutting and installing insulation sleeving of the proper size.

3. The AMP Pre-insulated Terminal is delivered to you ready to install with AMP precision hand, foot or power installation tools.

4. In addition to Pre-Insulation, you get all of the features of the famous AMP "Diamond Grip" Insulation Support terminal — two crimps on the barrel and one on the insulation sleeve — all performed in one operation.

TEST DATA

on insulation used in AMP Pre-insulated solderless terminals:

- The pre-insulation takes the exact contour of the crimp without distortion or cracking. It will not dry out or come loose.
- Dry dielectric strength 750 VPM.
- Wet dielectric strength 350 VPM.
- Tensile strength pounds per square inch 2150.
- Life at 220° F. over 400 hours.
- Does not shatter when pinched with pliers at minus 40° F.
- Does not support combustion when tested in accordance with ASTM D350-40T.

Write today for Bulletin 29 describing in detail the AMP Pre-Insulated Terminal

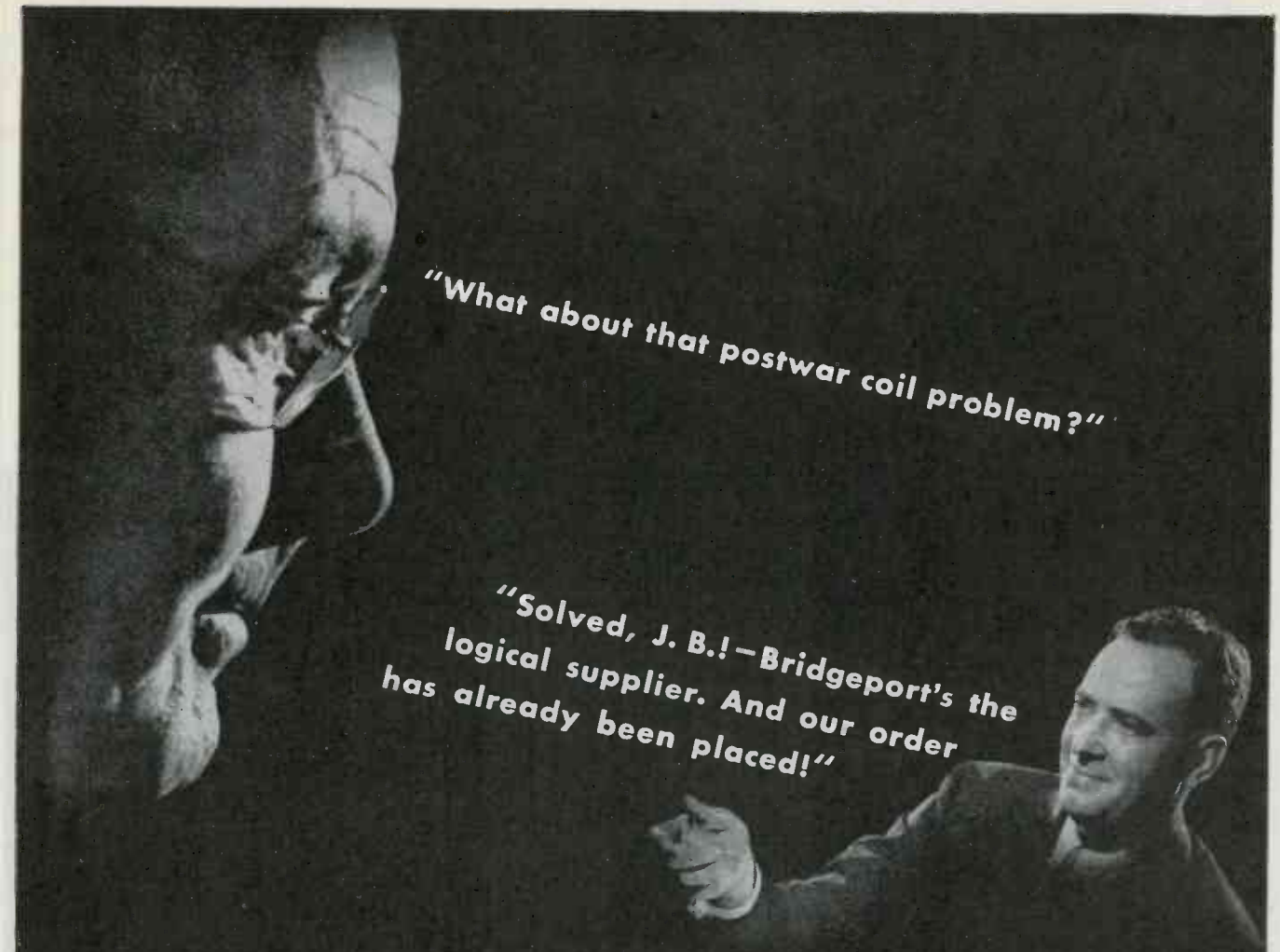
"Precision Engineering Applied to the End of a Wire"

AIRCRAFT-MARINE PRODUCTS INC. AMP SOLDERLESS WIRING DEVICES

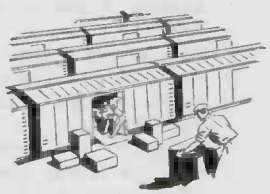
Trade Mark Reg. U. S. Pat. Off.

AIRCRAFT-MARINE PRODUCTS INC.

1521-34 N. 4th ST. HARRISBURG, PENNA. • TELEPHONE: HARRISBURG 4-0101
S. F. BOWSER CO. LTD., 183 GEORGE ST., TORONTO, ONTARIO



INCLUDE BRIDGEPORT IN YOUR POSTWAR PLANS!



Bridgeport Manufacturing Company is your logical supplier for R. F. coils and chokes, I. F. transformers and transmitting coils and chokes. Right now we're turning out search coils and variometers *by the carload for the Armed Forces.* After V-day, the same facilities now devoted to this big job and the same personnel that are meeting the most rigid military specifications will be available for your job.

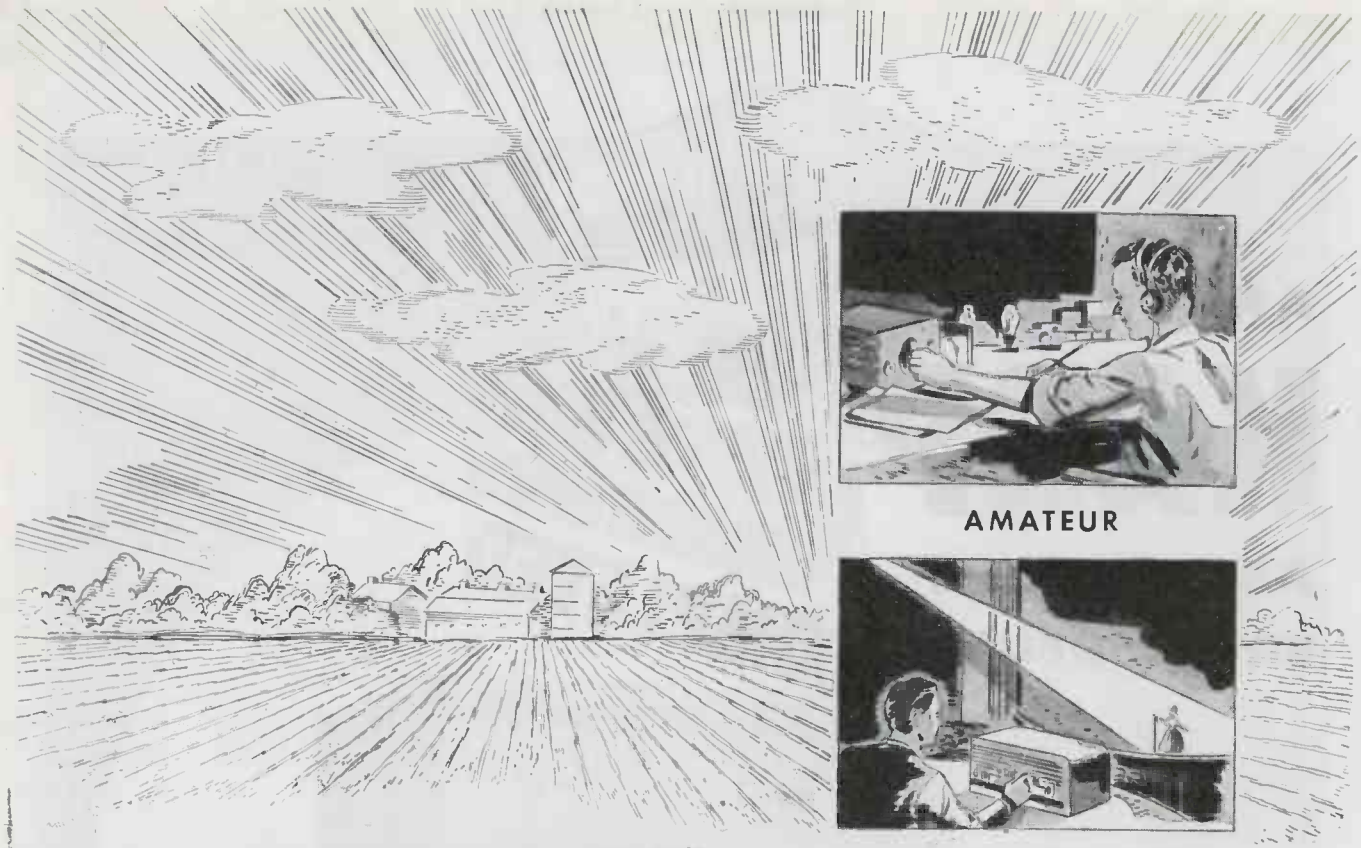
Bridgeport's location, near the population center of America, assures you fast, trunk line service to any of your plants. Write to us NOW to insure early postwar delivery.

BRIDGEPORT

MANUFACTURING COMPANY

Bridgeport, Illinois

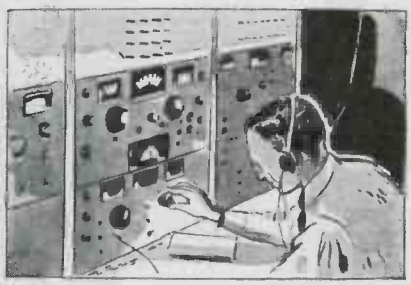
R. F. Coils • R. F. Chokes • I. F. Transformers
Transmitting Coils • Transmitting Chokes



AMATEUR

SOUND AMPLIFIER

FIELDS OF TOMORROW



COMMUNICATIONS

will be developed more efficiently because of Thordarson Transformers being designed TODAY!

Our 50 years of general experience, plus the many new results of war-time research are a guarantee that Thordarson will have the right transformer for every need, when civilian orders may again be accepted.

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TRANSFORMER DIVISION
THORDARSON ELECTRIC MFG. CO.
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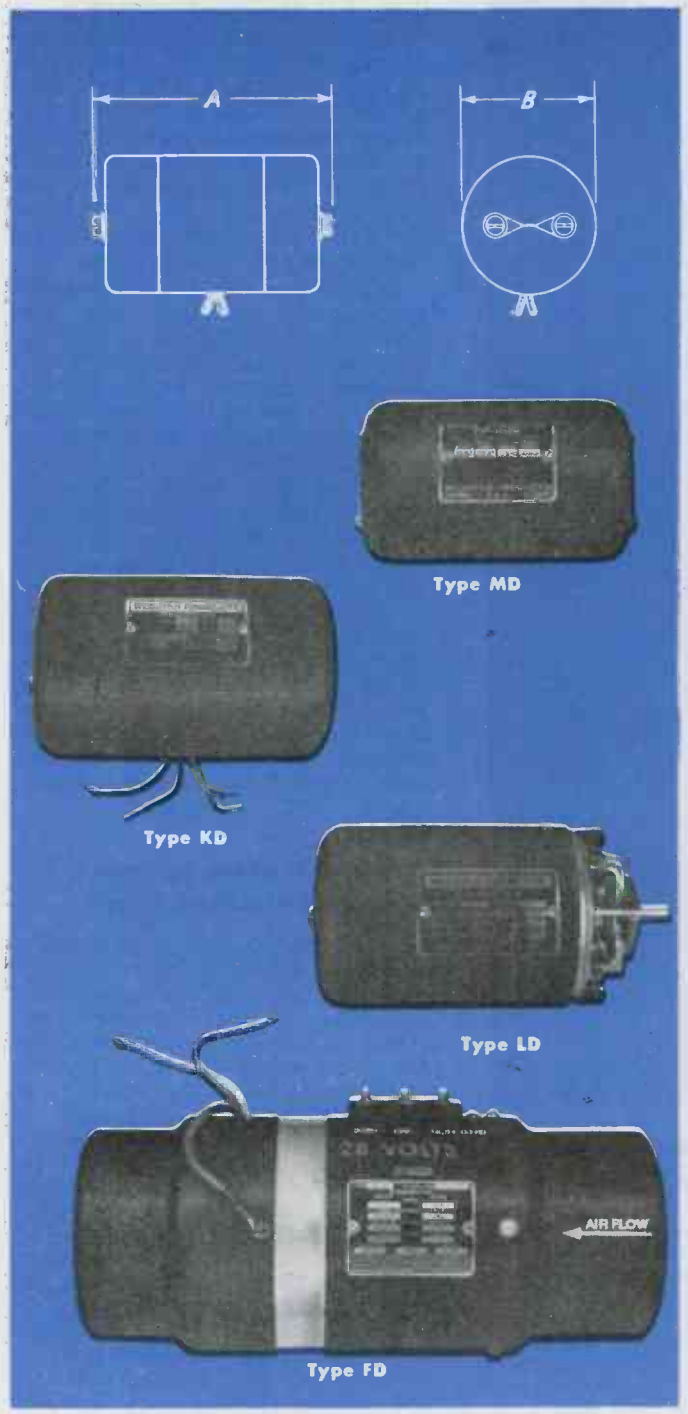
Transformer Specialists Since 1895
. . ORIGINATORS OF TRU-FIDELITY AMPLIFIERS

WEBSTER DYNAMOTORS



have a reputation for outstanding performance

. . . and the Webster organization meets schedules.

Webster Dynomotors have shown in actual service that the *extra quality* built into them pays out. They reflect the care with which parts are fabricated and inspected before assembly to assure good balance, freedom from minimum vibration and maximum durability. If you need dynamotors in production quantities for the war program, Webster can serve you. Just write us about your problem.

The Webster Dynamotors listed here are our basic, standard, large-scale production models.

Wattage	Webster Model Number	Input		Output*		Net Wt. Lbs.	Dimensions	
		Volts	Max. Amp.	Volts	Amp.		A	B
10 to 15	MD-1020	14	2.4	250	.060	2 9/16	4 13/16	2 3/4
	MD-1021	28	1.15	250	.060	2 9/16	4 13/16	2 3/4
	MD-1024	27	1.15	250	.060	2 9/16	4 13/16	2 3/4
	MD-1025	24	1.6	190	.100	2 9/16	4 13/16	2 3/4
	MD-1026	13.7	2.8	230	.080	2 9/16	4 13/16	2 3/4
	MD-1027	27.9	1.4	230	.080	2 9/16	4 13/16	2 3/4
	MD-1028	27	1.75	300	.075	2 9/16	4 13/16	2 3/4
15 to 20	KD-1000	14	2.8	220	.080	5	5 5/8	3 7/16
	KD-1001	12	3.8	220	.100	5 1/4	5 5/8	3 7/16
	KD-1002	13.8	2.5	230	.070	4 7/16	5 5/8	3 7/16
	KD-1004	27.9	1.25	230	.070	4 7/16	5 5/8	3 7/16
20 to 30	LD-1010	12.2	3.3	230	.090	5 3/8	5 29/32	3 7/16
	LD-1011	28	1.6	230	.100	5	5 29/32	3 7/16
	LD-1012	9	6.4	450	.060	5 3/4	6 7/16	3 7/16
	LD-1013	18	3.3	450	.060	5 3/4	6 7/16	3 7/16
	LD-1014	18.5	3.3	400	.080	5 3/4	6 7/16	3 7/16
	LD-1015	8.9	7.5	425	.095	5 3/4	6 7/16	3 7/16
	LD-1016	19	3.8	425	.095	5 3/4	6 7/16	3 7/16
165	FD-1060	28	10.5	High 300 Med. 150 Low 14.5	.260 .010 4.9	21	12 1/16	5 11/32

*Ratings shown are for continuous duty with temperature rise and secondary ripple voltage well within the limits of Government Specifications. Mounting brackets or filters are available when required.

LOOK TO WEBSTER PRODUCTS

TODAY

Dynamotors and Voltage Regulators

TOMORROW

Webster Record Changers

Keep on Buying
WAR BONDS
. . . and Keep Them

WEBSTER PRODUCTS

3825 W. ARMITAGE AVE. CHICAGO 47, ILLINOIS

DuMont Television Course

Samuel H. Cuff, general manager of DuMont television station WABD, is conducting a laboratory course at New York University on "The Technique of Television," started February 19. Twenty-five regular students of NYU have been admitted to what is the first academic television course offered in any college in which university credit is given toward graduation. The instruction will be given through NYU's Washington Square College of Arts and Science.

This is also the first time a lectureship on television has been awarded on the regular college faculty, according to Professor Robert Gessner, Chairman of the Department of Motion Pictures, under whose department the instruction is being offered.

A third "first" which will accrue to this course is from its being the pioneer laboratory class in television. Most of the class sessions will take place at station WABD to help familiarize the students with actual operation of television equipment, make-up, programming, script writing and production technique. "The Technique of Television" will be offered for a single semester, three hours a week (Mondays, from 7 to 10 P.M.) for 15 weeks.

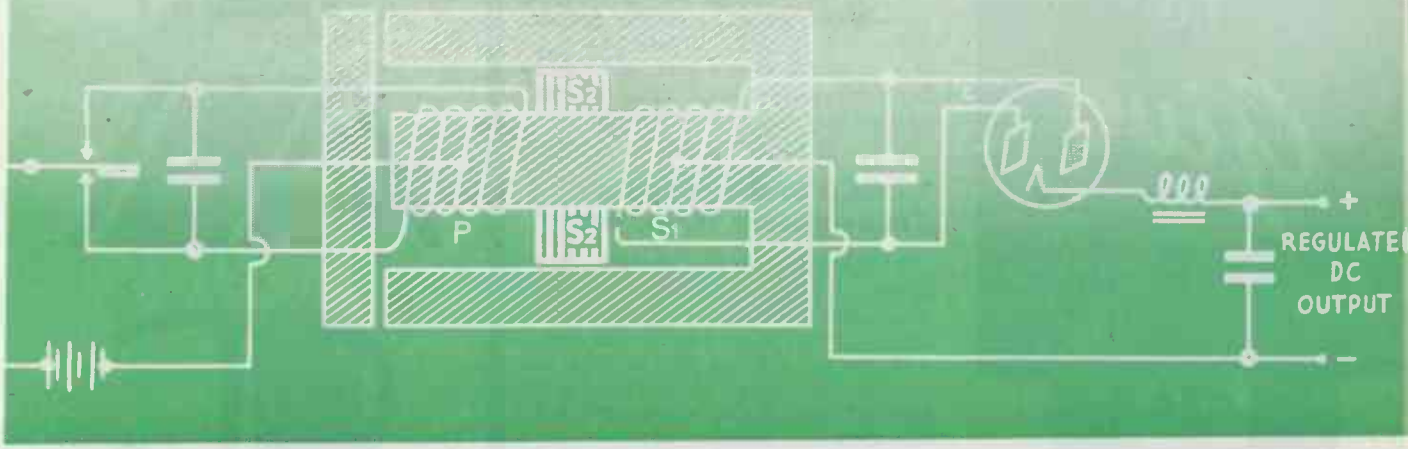
Press Wireless Speeds Manila Invasion News

The Army Communications Service of the Signal Corps is expected to handle the radio messages to and from the liberated American prisoners in the Philippines. Probably the communications of the civilian internees who have been freed coincidentally with the fall of Manila will under arrangements now being perfected by the State Department and Red Cross flow over the circuits of the commercial radiotelegraph companies. So far, only a few messages from either the liberated prisoners or the internees have come through. In the case of the freed American prisoners, their messages will be handled under the supervision of the Casualty Branch of the Adjutant General Office.

Press Wireless handled 25,000 words of newspaper copy during the first 12 hours after the entrance into Manila, Director of Communications J. W. Chaplin announced. The dispatches moved via the Press Wireless station on Leyte and were delivered directly to the Western terminal of the company in Los Angeles for distribution to news agencies throughout the United States.

The first announcement of the entry was released by General MacArthur at 5:30 p.m. (EWT) Sunday and in little more than half an

E-L DEVELOPS HIGH DEGREE OF VOLTAGE REGULATION IN VIBRATOR POWER SUPPLIES



One of the most serious and annoying problems faced by radio and electrical engineers has been fluctuating output voltages due to varying input voltages. Now, Electronic Laboratories has solved this problem by using a high-efficiency, regulated type transformer system applied to vibrator operation for DC systems.

This type of transformer, as shown above, consists of primary and secondary windings having a linear magnetic leakage path between them. The tank condenser, C, is connected across the secondary winding.

The equivalent circuit diagram is shown at the right (see Fig. 1). L_k represents the leakage inductance provided by the magnetic shunts. L_p and L_s are primary and secondary inductances respectively, L_s working at the saturated portion of its curve.

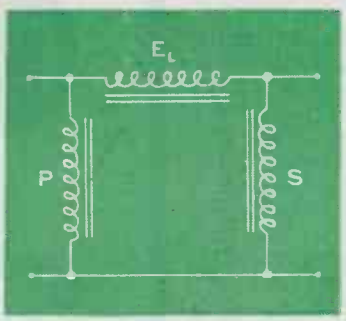


FIGURE 1

The net voltage across the output terminals is the vectorial sum of the equivalent voltage input and the drop across the reactance L_k. This drop is due to the condenser current (addative) and the inductive current drawn by the saturable reactor L_s (subtractive). In operation, when the input voltage rises, there is a proportional increase in condenser current. Also, due to the non-linear characteristics of L_s, there is a more than proportional increase in the inductive current. The next effect is an increase in the inductive (subtractive) drop in the reactor L_k. Thus, the voltage across the output terminals tends to remain substantially the same. When the input voltage goes down, the inductive drop on L_k will fall at a faster rate than the capacative drop due to C, for reasons explained above. This results in a net gain in capacitance or addative drop which prevents the output voltage from decreasing with the input voltage.

To insure absolutely flat regulation, coils wound on the primary are connected to buck at small percentage of the voltage of the secondary as shown by the accompanying schematic (see Fig. 2). The bucking voltage, being a linear quantity, can be made to compensate exactly for the small rise in voltage across L_s as it swings through its saturation curve.

An important feature of this system is its excellent load regulation. The output will tend to remain constant with load, since the reactive energy stored in the secondary circuit can be made large compared to the actual energy delivered at the output. This method of regulation is particularly suited to battery-operated power supplies, because it is a *high-efficiency* regulator and not a losser, as available heretofore. In addition, the output wave form approaches a sine wave, which is especially desirable in certain applications. Also, any number of output voltages and currents, both AC and DC, can be obtained from the secondary circuit of a single transformer.

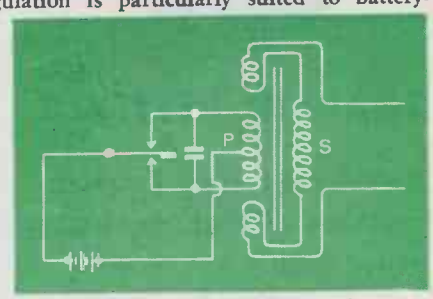


FIGURE 2

* * * * *

E-L Vibrator Power Supplies have wide application in many fields: radio, electrical, electronic, marine, aviation and railroad. Their high efficiency and versatility with multiple inputs and outputs, enable them to meet many power supply needs. They may be designed to provide any wave form required for specific equipment. . . . Economy is assured because of long, efficient service with minimum maintenance. E-L Engineering Service is available to discuss your power supply problem and to design a vibrator power supply to meet specific voltage, power, size and weight requirements.

E-L STANDARD POWER SUPPLY
Model 1566

This typical E-L unit, with voltage regulation, is used to supply the necessary voltages for the Signal Corps Model BC-100 Walkie Talkie Transmitter-Receiver, from a 6, 12, or 24 volt storage battery.

Input Voltages: 6, 12 and 24 volts DC

Output Voltages: 140 volts DC at 0-55 ma.
90 volts DC at 30 ma.
45 volts DC at 250-550 ma.

Regulation: Output voltages are held constant within 5% over the entire range of load changes listed above, as well as over input voltage variations, as for example, 5.7 volts to 7.5 volts.

Electronic
LABORATORIES INC.
INDIANAPOLIS

hour from filing time in the Philippines the dispatches were being received in the New York press association offices (6:02 p.m.) As newspaper correspondents found time to prepare their stories and go to transmission points in Manila, the volume of news traffic speedily increased. The 25,000 word total for the first 12 hours was considered high in view of conditions incident to the first arrival in Manila.

23 RCA Shortwave Transmitters Wage War

The radio war against Nazi Germany and her remaining satellites will grow in intensity as several additional RCA shortwave radio transmitters go into action during the next few months. RCA Victor Division of the Radio Corporation of America has shipped the last of a total of 23 such transmitters to be supplied during the past two years. Three additional RCA transmitters of this type have been completed and will be shipped within the next thirty days.

Among the RCA transmitters now on the air are seven operated for the Office of War Information, including five on the East Coast of the United States, one on the West Coast and one in North Africa. Three of the East Coast stations are being operated for OWI by NBC, the other two by CBS. The West Coast station is being operated for OWI by Associated Broadcasters.

First of the list of 23 to be installed was a transmitter purchased by the Brazilian government for Radio Nacional, government-operated station at Rio de Janeiro, which went on the air during the winter of 1942-43. Next came Radiodiffusion Nationale Belge (the "Voice of Free Belgium"), at Leopoldville, in the Belgian Congo, and Radio Brazzaville, operated by the French National Committee for Liberation, in Brazzaville, French Equatorial Africa. These transmitters went on the air in the spring of 1943, Leopoldville preceding the Free French station by about a month.

Expect Wide Use of "Walkie Talkies"

The FCC's projected "Citizens Radio Communications Service" which may use walkie-talkie radio equipment, aroused considerable interest among the members of the House Independent Offices Appropriations Subcommittee, when Commissioner E. K. Jett described its aims and general postwar extension.

Commissioner Jett pointed out that this new service will result in a tremendous amount of clerical work on the part of the FCC to keep it in hand but without much antici-

One of a series of Electro-Voice advertisements explaining in detail the applications and specifications of Electro-Voice microphones

A Popular Favorite

WHEREVER . . . WHENEVER . . .

. . . a general-purpose dynamic microphone with an exceptionally wide and flat frequency response—for both indoor and outdoor speech and music pick-up —is required . . .

Electro-Voice MODEL 630

This versatile, moderately priced microphone is excellent for public address, all types of dispatching and call systems, paging systems, churches, auditoriums, hotels, recording studios and broadcast remote pick-ups. Though somewhat lighter in weight, it is a sturdy microphone, built with typical Electro-Voice care to serve satisfactorily over a long period of time. Attractively styled, it is finished in lustrous chromium The Model 630 is unusually flat through lower and middle register, rising 5 db on upper frequencies for added crispness of speech. Operates efficiently in salt air and humidity.

OUTPUT LEVEL: Power ratings: 54 db below 6 milliwatts for 10 bar pressure. Voltage rating (high impedance) 7 db above .001 volt/bar, open circuit. Voltage developed by normal speech (10 bars) .0224 volt.

FREQUENCY RESPONSE: 40-8000 c.p.s., with slightly rising characteristics.

WEIGHT: 1½ pounds.

TILTABLE HEAD: 90° tiltable head for directional or non-directional operation.

CABLE CONNECTOR: Built-in cable connector permits movement of head without moving the cable.

CASE: Built of highest quality, high impact pressure cast metal.

TRANSFORMER CORE: Nickel alloy; hydrogen annealed, low capacity windings

DIAPHRAGM: Fine quality, heat-treated duralumin, corrosion-inhibited for use in salt air and humidity.

CONDUCTOR CABLE: 20-ft well shielded cable and connector; low impedance balanced to ground

HI-Z (DIRECT TO GRID) or 50, 200, 250 and 500 ohms.

SCIENTIFICALLY DESIGNED GRILLE: Reduces wind noise

ON-OFF SWITCH: Standard ⅝"—27 stand coupler

MAGNETIC CIRCUIT: Employs Alnico V and Armco magnetic iron.

List Price, $30.00

Contact your nearest radio parts distributor today His knowledge of Electro-Voice microphones may aid you in selecting the appropriate type for your individual need He may also be an important factor in speeding your order

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pated difficulty in licensing and regulating. This type of equipment can be provided for every person in the United States desiring it—farmers, industrial plants, laundries, department stores and sportsmen being examples, but he stressed no charge may be made for the messages. The FCC proposes to issue a five-year license to be printed on pocket book size cards and the only qualification for an operator's license will be American citizenship and an understanding of the FCC rules and regulations. The transmitter may include electrical impulses to actuate other devices, such as opening the garage door automatically. Mr. Jett added that it might be very helpful to the large ranches in the West. The FCC is hopeful that citizens radio leagues will be organized in each community to agree on local operating frequencies.

In reply to a question as to the attitude of the telephone companies, Commissioner Jett stated that one of the big companies had told him they thought it was one of the finest things to come out of the allocations hearings and there would be a terrific demand for this service. Commissioner Jett did not think it will ever take the place of local telephones because of the maintenance cost which will be more than wire telephone service. There are many places in the United States without telephone service where the only means of communication with a mobile unit is by radio. Mr. Jett pointed out that walkie-talkies might be designed to be plugged into light sockets to save batteries.

Future Aircraft Radio Control

The most important problems for the United States in postwar aviation radio communications will be the solving of potential difficulties in intercontinental flying and the provision of radio navigation facilities for the use of the several hundreds of thousands of private pilots expected to be flying rather constantly within the first decade after peace comes. These were the highlight forecasts of Charles I. Stanton, Deputy Administrator of the Civil Aeronautics Administration, in his address on future aviation communications problems at the first general meeting of the Radio Technical Commission for Aeronautics since the start of the war, held Jan. 11.

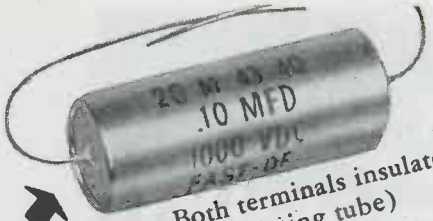
Deputy Administrator Stanton told the RTCA that the CAA expects to install a complete new Very High Frequency system of ranges along the Federal Airways and that this equipment may be available before this summer. Mr. Stanton brought out that money was allotted for this work in the CAA appropriations before Pearl

Harbor but military requirements had necessitated the diversion of the projected equipment until now. Eventually, VHF radio ranges will replace the present low frequencies entirely.

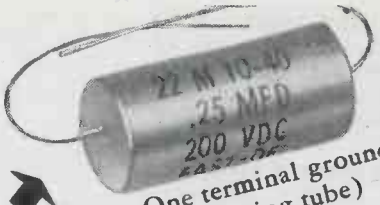
In the case of postwar intercontinental flying, Deputy Administrator Stanton, who before he assumed that post and the Administratorship had for a number of years been the Director of the Federal Airways, foresaw several problems which must be solved immediately in order to avoid serious difficulties. Among these he mentioned the exchange of many thousands of daily messages concerning weather, flight movements, special messages and emergency procedures which will cause an impossible "jamming" or overload of the aviation radio frequencies and will have to be transmitted as much as possible by cable and other landlines; and that further "jamming" or overloading of radio air-to-ground transmission may require a separate frequency for different types of flying, with certain wavelengths assigned to military, airline, private and instructional flying. He also broached the intriguing problem of language difficulties which will inevitably arise from intercontinental air traffic and expressed the hope that a code system of signals intelligible to all nationalities will meet the problem. Private pilots, Mr. Stanton believed, will demand an inexpensive radio set capable of receiving weather information and traffic control instructions.

Basic needs

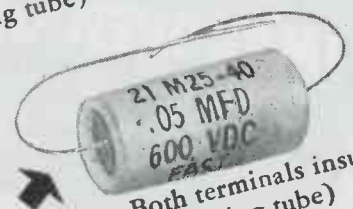
The basic navigational facility for domestic airway flying in the postwar future will be the omnidirectional visual VHF radio range, Mr. Gilbert stated. These ranges will form an airway system which will be quite similar to that in existence today, except in many instances more direct routing will be provided by the elimination of "dog legs." He declared the omnidirectional characteristics of these ranges will provide much greater flexibility in air traffic control by making possible the establishment of variable routing of aircraft over and above the established traffic channels. The airway ranges will be laid out so as to serve directly principal airports and avoid, insofar as possible, interference between "through" airway traffic and local traffic using the instrument landing systems at the various airports. He cited that on the runway localizer of each instrument system, it is planned to install a fan marker approximately eight to ten miles from the airport for the stacking of aircraft under the approach control plan. The need of



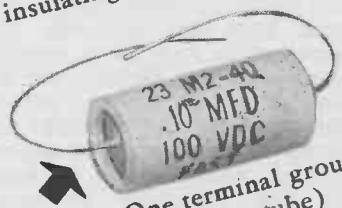
Class 20M—Both terminals insulated (without insulating tube)



Class 22M—One terminal grounded (without insulating tube)



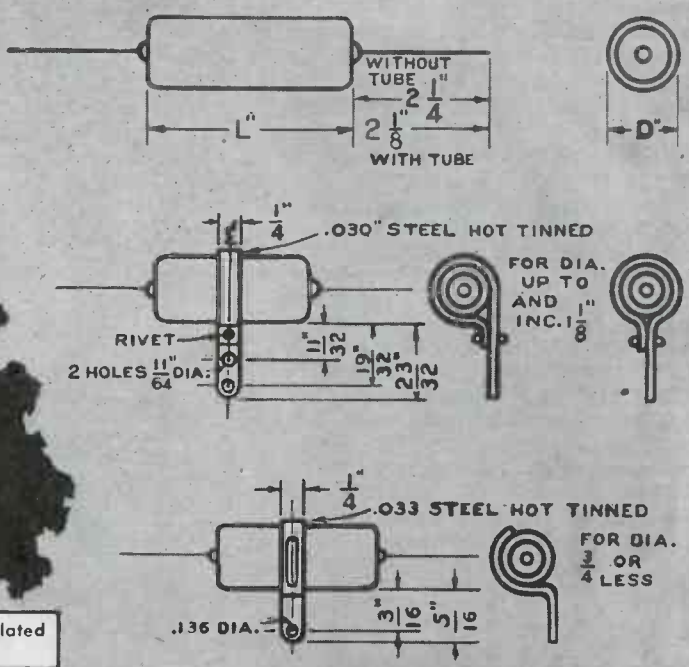
Class 21M—Both terminals insulated (with insulating tube)



Class 23M—One terminal grounded (with insulating tube)

MEMO:

To Designers, Engineers and Manufacturers of Electronic, Radionic and Electrical Devices, thinking in terms of quality for POST WAR production . . . Here is a convenient "abbreviated listing" of METAL-CASED TUBULAR OIL-PAPER CAPACITORS — hermetically sealed to meet unusual operating conditions.



Class 20M—Both terminals insulated (without insulating tube)			
CAP. MFDS.	VOLTS D. C.	SIZE (inches) D.	L.
.001	1000	1/2	1-3/16
.0025	1000	1/2	1-3/16
.005	1000	1/2	1-3/16
.005	600	3/8	15/16
.01	600	3/8	1-3/16
.02	600	1/2	1-1/16
.05	600	9/16	1-5/16
.1	200	9/16	1-13/16
.25	200	3/4	1-7/8
.5	200	1	1-13/16

Class 21M—Both terminals insulated (with insulating tube)			
CAP. MFDS.	VOLTS D. C.	SIZE (inches) D.	L.
.05	800	11/16	1-5/8
.1	800	13/16	1-7/8
.1	600	11/16	1-3/4
.25	600	13/16	2-5/16
.25	400	13/16	2-5/16
.5	400	1-1/16	2-5/16
1.	400	1-1/16	3-15/16
1.	200	1-1/16	3-3/16
1.5	100	1-1/16	3-3/16
2.	100	1-5/16	2-11/16

Class 22M—One terminal grounded (without insulating tube)			
.0075	1000	1/2	1-1/16
.01	1000	1/2	1-1/16
.05	1000	5/8	1-13/16
.5	600	1	2
1.	600	1	3-5/8

Class 23M—One terminal grounded (with insulating tube)			
.1	1000	13/16	2-1/16
.25	1000	1-1/16	2-1/2
.5	1000	1-7/16	2-13/16
.5	800	1-1/16	3-1/16
1.	800	1-7/16	3-1/4

(Standard Capacity Tolerance on the above units is ± 20%. Closer or wider tolerances may be obtained if required.)

Standard or Special Units to Meet Every Need

FAST Capacitors are produced in many types and sizes in standard or special designs. We can supply paper capacitors—oil or wax impregnated—rectangular or tubular—in sizes from the smallest to the largest.

This line of FAST Capacitors have containers made of brass with a heavy tin dip. The terminals are made with bushings of NEOPRENE and BAKELITE and are coated with "fungus-resistant" insulating varnish. They have excellent stability over a wide range of temperatures and frequencies—will pass recognized thermal and salt water immersion tests.

Inquiries are particularly invited from organizations planning to build that *better* equipment for the new day ahead. Please feel free to call us on any capacitor problems.

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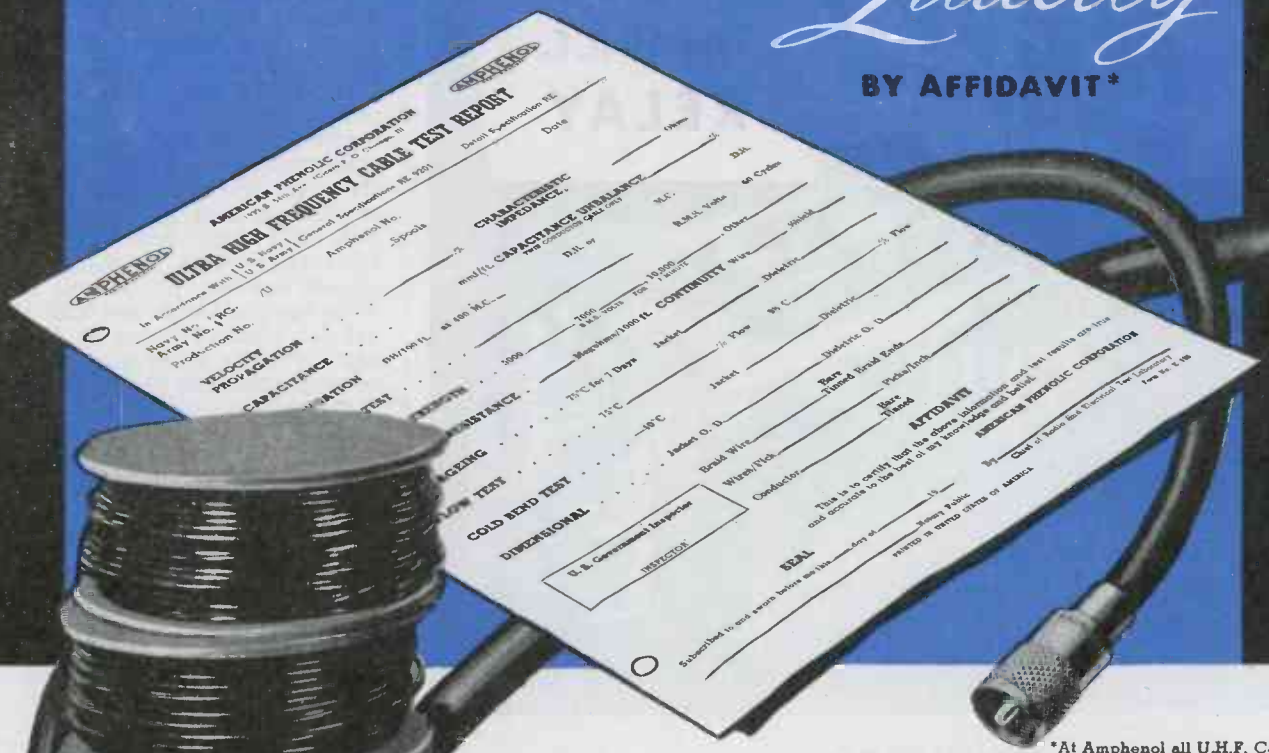
AMPHENOL confirms *Quality* BY AFFIDAVIT*



*At Amphenol all U.H.F. Cable is thoroly inspected and must bear affidavit of test approval before shipment.

Extra significance is attached to the whole idea of *Quality* when it applies to electronic equipment. High-frequency currents make special demands of a technical nature that go far beyond the standards of good material and high quality workmanship.

Such requirements are a familiar story to Amphenol, one of the pioneers and leaders in the low-loss transmission equipment field. Amphenol makes the most complete line of both solid dielectric flexible U.H.F. Cables and U.H.F. Connectors and they are now being produced in tremendous volume.

Actually Amphenol's own tests and inspections go beyond required performance and tolerances. Amphenol tests for *outstanding quality* assure dependable performance under the most difficult of conditions.

Depend upon AMPHENOL *Quality*

U.H.F. Cables and Connectors
Conduit Fittings
Connectors (A-N, U.H.F., British)
Cable Assemblies
Radio Parts
Plastics for Industry

AMERICAN PHENOLIC CORPORATION
Chicago 50, Illinois
In Canada, Amphenol Limited, Toronto

Amphenol U.H.F. Coax Cables with Amphenol Low-Loss Connectors.

this marker later may be eliminated by the use of a visual distance-indicating device. Scanning screens will be used in control towers to monitor the approaches of aircraft using the instrument landing system and holding on the runway localizer so as to provide a further safeguard against collision of planes.

In regard to air-ground communications which consist of two basic types—one for traffic control and the other for transmission of weather reports and forecasts, winds aloft, notice to airmen and related communications, Mr. Gilbert pointed to the plan to provide multiple VHF voice channels for traffic control and meteorological communications along the airways. He cited that for traffic control it is planned that the runway localizers will have one simultaneous voice channel to be used for approach control; all control towers to be equipped with one VHF channel for aircraft flying in the airport's vicinity other than those receiving approach instructions over the localizers' voice channel; and an additional radio channel to be provided in the control tower for communications with aircraft on the airport.

Receiver specs

For aircraft, Mr. Gilbert declared that the proposed arrangement of ground facilities contemplates one aircraft receiver will be sufficient for minimum navigation and air traffic control requirements. This receiver should be capable of receiving navigational guidance along the airway with VHF ranges and the runway localizers of the instrument landing system and also for receiving the communications voice channels along the airways and the simultaneous voice channel on the runway localizers as well as the control towers' radio channels for air and ground traffic. In addition to this minimum service, pilots could have a second receiver for the VHF markers and on the instrument landing system; a third receiver, if desired, would be required for the glide path; a fourth receiver would be required if the pilot desired to use the visual distance-indicating facilities; and a fifth receiver would be necessary if ADF navigation was to be used.

Probably the most important device for installation in postwar aircraft is the collision warning apparatus. Mr. Gilbert stated that the CAA is of the opinion that planning for air traffic control should have as one of its basic concepts the delegation of more responsibility for the avoidance of collision to the individual pilot rather than placing added responsibility on a ground control agency.

RESISTORS

The wire-wound resistor you need is made by Ward Leonard

Ward Leonard resistors include a full range of types, sizes, ratings, terminals, mountings and enclosures. They are built to withstand heat, moisture, vibration and other adverse conditions.

The electrical and electronic industries depend on Ward Leonard—pioneers in the commercial production of vitreous wire-wound resistors—for resistance units to meet each new development. Ward Leonard engineers are always glad to assist in working out special applications.

RHEOSTATS AND RELAYS — Ward Leonard is headquarters for electrical controls of all kinds. A comprehensive line of rheostats and relays has been developed hand in hand with the development of vitreous wire-wound resistors.

Rear view of a modulator unit showing Ward Leonard Resistors in Station WABC, Columbia Island, New York

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ELECTRIC CONTROL DEVICES SINCE 1892

TREADMILL LIGHT

When Chicago inaugurated its "brownout," Hallicrafter's Michigan boulevard headquarters was not too hard hit. A treadmill was installed and relays of students kept it going

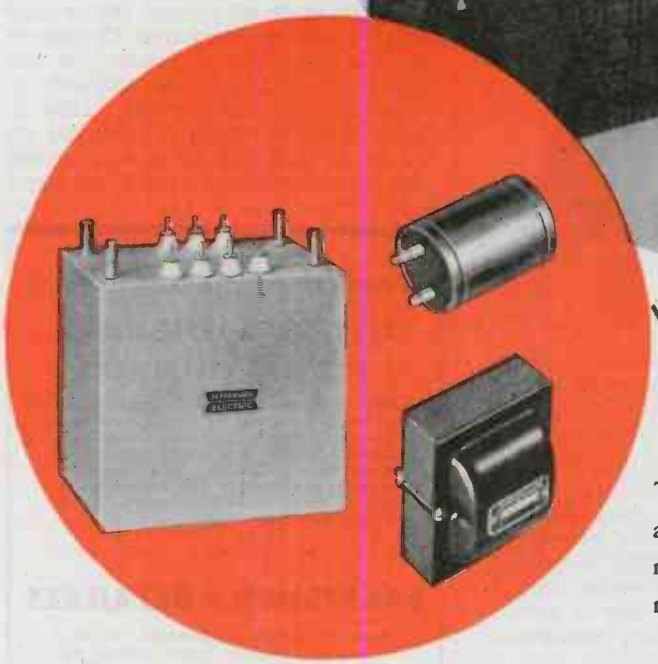
Industrial Electronics

"Fundamentals of Industrial Electronics," 40-page Bulletin GEA-4309 of the General Electric Company, Schenectady, N. Y., is a reprint of eight articles on that subject written by G. M. Chute and published in the magazine "Steel," April 3 to May 22, 1944. The articles cover conventional tube applications as rectifiers, amplifiers, relays, photoelectric controls, motor control, electronic heating, and other industrial uses.

"Housing" Project

This is reported to be the longest molded plastic product ever manufactured. Five-foot-two Jane Harrington of General Electric's plastics divisions, Pittsfield, Mass., is dwarfed by the 17-foot radar housing manufactured for the Douglas Aircraft Co. The housing, low-pressure molded, consists of a glass-fabric filler

IN READINESS TO START POST-WAR DELIVERIES



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JEFFERSON ELECTRIC

TRANSFORMERS

SMOKE SENSING

(*Continued from page* 100)

plate of rectifier tube Y. From P9 there exists a closed circuit through condenser C9, resistors P6, P3 and back to one end of resistor P9. This is also part of the grid circuit of J2 back to condenser C9. Upon movement of resistor P9 there is a change of potential on C9 with a corresponding change on the grid of J2. Plate output from J2 will then vary as to the amount and direction of the movement of resistor P9, assuming an increase of light on photoelectric tube V2.

This will cause an increase in plate output of J1 with a corresponding unbalance in primary of T2 and an induction of potential in secondary of T2 which will cause thyratron G1 to fire. This in turn will run control motor and move resistor P9 in the proper direction to change the grid potential of J2 to increase its plate output until it equals the plate output of J1.

At this point they are in balance and there is no longer a secondary potential in T2 and G1 ceases to fire. However, through the above mentioned closed circuit, the change of potential on condenser C9 caused by the movement of resistor P9, will bleed off at a rate determined by the value of resistor P6. This in turn restores the grid potential on J2 to its original value and unless the light intensity on V2 has been

corrected there will again exist an unbalance in T2 which will again fire G1 and repeat the cycle.

This results in a stepping action with the length of time between steps variable over a wide range by adjusting the length of time required to bleed off the charge on condenser C9 through resistor P6. This provides a simple adjustable throttling range with complete reset to original balance point. Through an identical circuit we have resistor P8 moved by the fuel feed regulator to change the potential on condenser C8, and, thereby change the plate output of J1.

Since an increase in fuel will cause the combustion gases to darken, there will be less light received on V2 with a corresponding drop in the plate output of J1. To overcome the time delay between adding fuel and detecting the resultant darkening of the gases, the movement of the fuel regulator will move resistor P8 in the proper direction to cause an immediate drop in plate output of J1. This effect can be held for any time desired by setting rate of bleed of C8 through P5 and is normally set to bleed away or reset after sufficient time has elapsed for the gases to reach the photocell V2.

Photo-electric cell V1 is mounted adjacent to and in the same light beam as photo electric cell V2. Any changes in light intensity will register on both photo electric cells alike. Output of photo electric cell V1 is taken through one stage of amplification, tube A, whose plate output in turn is indicated through a dc milliammeter calibrated in terms of smoke density. Plate output of tube A is matched to the range of the meter by adjustments of resistor P11 as bias adjustment and resistor P10 as meter adjustment. This circuit is entirely independent of the electronic relay cirsuit and gives the operator a continuous visual indication of smoke density irrespective of the operation of the electronic relay.

A hand control switch gives the operator a choice of Automatic operation or manual Raise, Lower or Stop. The Automatic position connects the cathodes of thyratrons G1 and G2 to grounded side of line and completes the circuit for their operation. Either Raise or Lower position of the switch disconnects this cathode connection, making the electronic relay inoperative and giving direct electrical connection to run the motor in either direction.

Chicago Magnavox Office

A new Chicago office at 737 North Michigan Avenue has been opened by The Magnavox Co., Fort Wayne, Ind., to expedite its manufacturing, sales and service operations. Ray Olson has been named to supervise the new headquarters.

RADIO LINKS

(*Continued from page 94*)

amount before it is necessary to replace them.

"Ultra-Short-Wave Receiver for the Cape Charles-Norfolk Multiplex Radiotelephone Circuit," by D. M. Black, G. Rodwin and W. T. Wintringham, all of Bell Telephone Labs., Inc., New York, covered the development of a receiver to demonstrate practicability of radio equipment for use in unattended multiplex radiotelephone links in toll telephone systems. Receivers built in accordance with the principles outlined have been in continuous service in the 12-channel multiplex radiotelephone circuit between Cape Charles and Norfolk, Virginia, since October, 1941.

The receiver, which is of the triple detection type, is designed to receive double sideband transmission at a fixed frequency in the range of 150 to 160 megacycles. The heterodyning signals are obtained from a temperature controlled crystal oscillator which provides the high degree of frequency stability required. Specially designed band-pass filters, in conjunction with a feedback amplifier are used in the intermediate frequency section of the receiver to accommodate the wide-band signal and provide the high level of signal necessary to drive the final detector. It should be noted that in the present double sideband system, the use of multiplex imposes requirements on non-linear distortion many times more severe than is required for single channel systems. The subject was discussed at some length.

Automatic volume control provides essentially constant output from the receiver to the carrier telephone terminal. Alarm circuits indicate when the received signal is off frequency or entirely absent. A loop-test oscillator is provided to check the operation of the equipment at one end of the circuit in case of trouble. An arrangement is provided to check the condition of the tubes in the receiver to anticipate tube failure.

"Ultra-Short-Wave Transmitter for the Cape Charles-Norfolk Multiplex System," by R. J. Kircher, Bell Labs., New York, and R. W. Friis, Bell Labs., Deal, N. J., described in further detail certain physical and electrical phases of the transmitter equipments. "Radio-Relay Communications Systems in the United States Army," a paper by Lieutenant-Colonel William S. Marks, Jr., Captain O. D. Perkins, and W. R. Clark, all of Signal Corps Ground Agency, Asbury Park, N. J., described the use of frequency-modulated very high-frequency radio sets in place of wire lines in Army tactical com-

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Address E. H. Reinschmidt,
Superintendent of Design,
Collins Radio Company,
Cedar Rapids, Iowa.

munication circuits.

During the early phases of the war and pending development and production of equipment designed to meet requirements, standard police - type frequency - modulation sets were adapted for use. These were used with great success during the Tunisian, Sicilian and Italian campaigns. They principally provided simplex teletype circuits from higher headquarters to lower units. By the use of radio repeater or relay stations these circuits were extended several hundred miles.

A broad-band frequency-modulated very high-frequency set designated AN/TRC-1 was developed for use in conjunction with voice frequency-carrier equipment CF-1 and CF-2 to provide multichannel voice and teletype circuits over a single radio frequency. This has met with great success and was a most important communication factor in the Normandy invasion and Battle of France. It marks the first real marriage of wire and radio communications in the Army and provides an integrated communication system.

The advantages of a radio system over conventional wire lines under certain conditions were pointed out, such as a saving in men and materials, establishment and maintenance of communications in a fast-moving situation, use over water, enemy territory, etc.

RADAR PATENT POOL

(*Continued from page 94*)

ance of the patents.

Captain Dow's suggestion of a pool of radar patents to operate as a non-profit corporation was that the pool be initially financed by a government loan, and organized by the entire electronics industry. He realized the problem, presented to the industry, is not a simple one. The solution might lie in negotiated agreements. Then again, the problem might be solved by a single pool of the entire industry or by two pools, one for patents held by the larger holders and the other for patents held by the smaller holders.

2,000-3,000 patents

Captain Dow estimated that the corporation would have to concern itself with between 2,000 and 3,000 essential patents, about one-half of this number being considered in the distribution of royalty profits for any one accounting year—he suggested a uniform royalty of 6 per cent of the selling price of radar equipment be paid the corporation by licensees. To simplify the work and profit distribution of the corporation, he explained that RCA, A. T. & T., General Electric and Westinghouse probably control one-half or more of the essential patents. Thus after the determination of essentiality of their patents by the corporation these four companies could be paid 3 per cent of the division of royalties above costs of functioning, the remaining 3 per cent of the profits going to the other members on the basis of their participation in patents.

The proceeds from the operations of the corporation in licensing radar equipment manufacturers would be distributed to each pool member in proportion to the value of patent rights contributed, Captain Dow proposed. He felt that infringement suits between pool members and licensees should be non-existent after a satisfactory showing of the use of an invention and the establishment of the availability of the patent to the corporation and its licensees. Captain Dow felt that the proposed uniform royalty of 6 per cent would not be excessive from the licensees' viewpoint as they would be relieved from the need of paying pyramided royalties.

The corporate structure of an all-industry Radar Patent Pool could comprise a board of directors, a president selected by that board, and a patent department, legal department and accounting department, Captain Dow stated. The directors would be elected by the pool members, the votes being determined by the profit-sharing value of the patents contributed by each member. Membership would be limited to companies, agencies or individuals contribut-

ing essential patents, and would continue during the life of these patents.

Captain Dow contemplated that the corporation would obtain licenses under all essential radar patents and under all non-radar patents essential to the manufacture, sale and use of radar equipment, holding the right to grant sub-licenses under such patents in that field. "If the past policies of the government in patent matters are any criteria of the future," he added, "I feel that the government will license the pool upon a royalty-free basis under its considerable block of pending radar patents, but will wish to retain any voting rights given members."

The division of royalties among the participating patent holding companies and groups would be on the basis of the "use classification" of the invention. It was proposed that the patent pool corporation place patents in five classes with reference to extent of use: Class 5, which would have the highest weighted factor, would comprise the patents used in more than 75 per cent of the radar equipments sold by licensees in the preceding year; Class 4 would comprise the patents used in 50-75 per cent; Class 3, 25-50 per cent; Class 2, 10-25 percent; and Class 1, patents used in less than 10 per cent. A Patent Classification Board, with its members and staff cleared by the War and Navy Departments so as to permit studies of confidential military radar, would be established. The valuation weight factor for Class 5 patents would give that classification at least 15 to 20 times the profit-sharing value of a Class 1 patent.

Small companies

The successful establishment and operation of this proposed radar patent pool would require the full cooperation of all holders of major blocks of pertinent patents. This cooperation would have to be extended to make the plan attractive to the many holders of small blocks of patents adding that foreign holders of United States patents essential to radar—of which there may be a considerable number—should also be admitted.

Praising the accomplishments and the contributions to the war effort made by the radio-radar-sonar manufacturing industry and by the radio-electronic scientists and industrial laboratories, Captain Dow stated that during the calendar year of 1944 there was delivered to the Navy in excess of $1,300,000,000 worth of radio, radar and sonar equipment, exclusive of a very large amount of equipment purchased directly from the Army. The dollar value of the delivery of electronic equipment to the Navy has risen from approximately $4,000,000 a

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month in 1941 to $100,000,000 per month in 1944.

Captain Dow proposed that two major programs, achieved during the war through the cooperation of the Armed Services and the radio-electronic manufacturing industry, be continued after the peace: a $25,000,000 annual Navy expenditure for research and development in radio, radar and sonar; and the establishment of a postwar standardization association to which the Navy should and would contribute, if needed, $1,000,000 a year. The Armed Services hope, he stressed, that the component standardization benefits achieved during the war will not be shelved, but will be expanded and improved. Original lack of standardization, he said, probably cost the Navy $100,000,000 in this war.

RECORDING OSCILLOSCOPE

R. F. Wild and D. C. Culver,
Research Section, Brown Instrument Co.,
Philadelphia

This paper reported the details of a battery operated two-channel recording oscilloscope for use as a flight vibration recorder. It will record two input signals of any frequency between 5 and 300 cps and between 0.5 millivolts to 2 volts amplitude, derived from vibration pickup devices or strain gages, together with marking signals to establish a time base on the records. A 2 in. cathode ray tube operated

at about 540 volts is used, and an electronic switch operating at about 20 kc provides the simultaneous double-trace.

Records are made on 2¼ x 3¼ (12 exposure) film pack. An F2 lens is used in the camera. Signal traces on the screen of the cathode ray tube can be viewed directly. Recurrent and single sweep is provided at three different fixed speeds. The instrument, including batteries, weighs 27 lb. and measures 6 x 12½ x 16½ in. It is completely self-contained.

MINIATURE TUBES

R. L. Kelly and N. H. Green, RCA Victor Division, RCA, Harrison, N. J.

Recent investigations show that miniature tubes undoubtedly will fill an important need in future developments. The development of power amplifier and rectifier types of these tubes complete the series necessary for home receivers, other miniature types have already been developed. Typical savings of 20 to 40 per cent in equipment size were reported. Following are amplifier characteristics of modern rf types of miniature tubes:

Type	Transconductance (umhos) for 10 ma. cathode current	C in + C out (uuf)	Transconductance C in + C out
6AC7	7600	16.0	470
6AG5	5500	8.3	660
6J4	11000	5.9	1160
6J6	5500	2.6	2120

Bellows in Electronics

Bellows will play an ever-increasing part in the developing science of electronics, predicts Chicago Metal Hose Corp., manufacturer of stainless steel bellows. Bellows will be especially important, says this Maywood, Ill., concern, in connection with the operation of relays, which must introduce a certain amount of delay. That is, applications in which the relay does not operate until several seconds or minutes after the flow of current. This is sometimes done through the use of a "Dash-pot," which is actuated by a solenoid, operated in turn with current furnished by electronic devices. Other increased uses for bellows are in electronic turbo-regulators and to measure the intake-manifold pressure of aircraft engines—the bellows moving the arm of the potentiometer, and electronics doing the rest. Because a bellows can measure both temperature and pressure, they have many uses in the new designs of such electronic recording and control equipment.

FRENCH 1000-LINE

(*Continued from page* 124)

erable time abroad under assignment to OWI, has permitted to become public the report which he completed after seeing the French installation in operation. He says:

"At the invitation of Mr. Barthelmy, chief engineer of the Compagnie de Compteures at Montrouge, a suburb of Paris, Messieurs Paley, Taylor, Maj. Murphy, Della Cioppa, Fox, Major Sigmon and myself witnessed a demonstration of French television on October 25th. This company is the largest French manufacturer of metering equipment of all types and its subsidiary, the Compagnie Francaise de Television, is engaged in the research and manufacture of television equipment.

"The first demonstration, a 450-line picture onto a screen approximately 4 ft. x 6 ft., took place in a small theatre seating about seventy people. The program material was both live and film pickup. The quality of the projection was quite good when considering the quality of the same picture as viewed on a 12 in. tube. The projection tube is approximately 6 in. in diameter and operated with a current of one milliampere at 35,000 volts, the tube being air cooled. The 450-line picture as viewed on a 12 in. pickup tube appeared to be not as good as the 441-line picture I saw at RCA, Camden, two years ago.

"All cameras used Iconoscopes, operating at approximately 1500 volts, appeared to be well engineered both electrically and mechanically and seemed to be mounted in Pyrex glass with the end of the tube ground and polished. Because of the shortage of mica, the Compagnie de Compteures has developed a screen which is formed of an aluminum sheet which is oxidized and the mosaic then deposited on the oxide. One of the engineers stated that the aluminum oxide coat gives an insulation resistance of several hundred megohms and that the final silver coat is deposited on the mosaic, after the tube has been sealed off, by evaporation of silver from little 'keepers' contained within the tube.

"The film projector comprised a cine projector and a pickup which consisted of an Orthicon fitted with a photo-cell and followed by an electron multiplier amplifier built into the Orthicon. An interesting feature of this device was that two pictures were focused on the screen of the Orthicon and scanned separately. Electrostatic lenses were used.

"A demonstration was then held of the 1050-line system as viewed on a cathode ray tube of 15 in. diameter. The picture was extremely good, the definition and contrast

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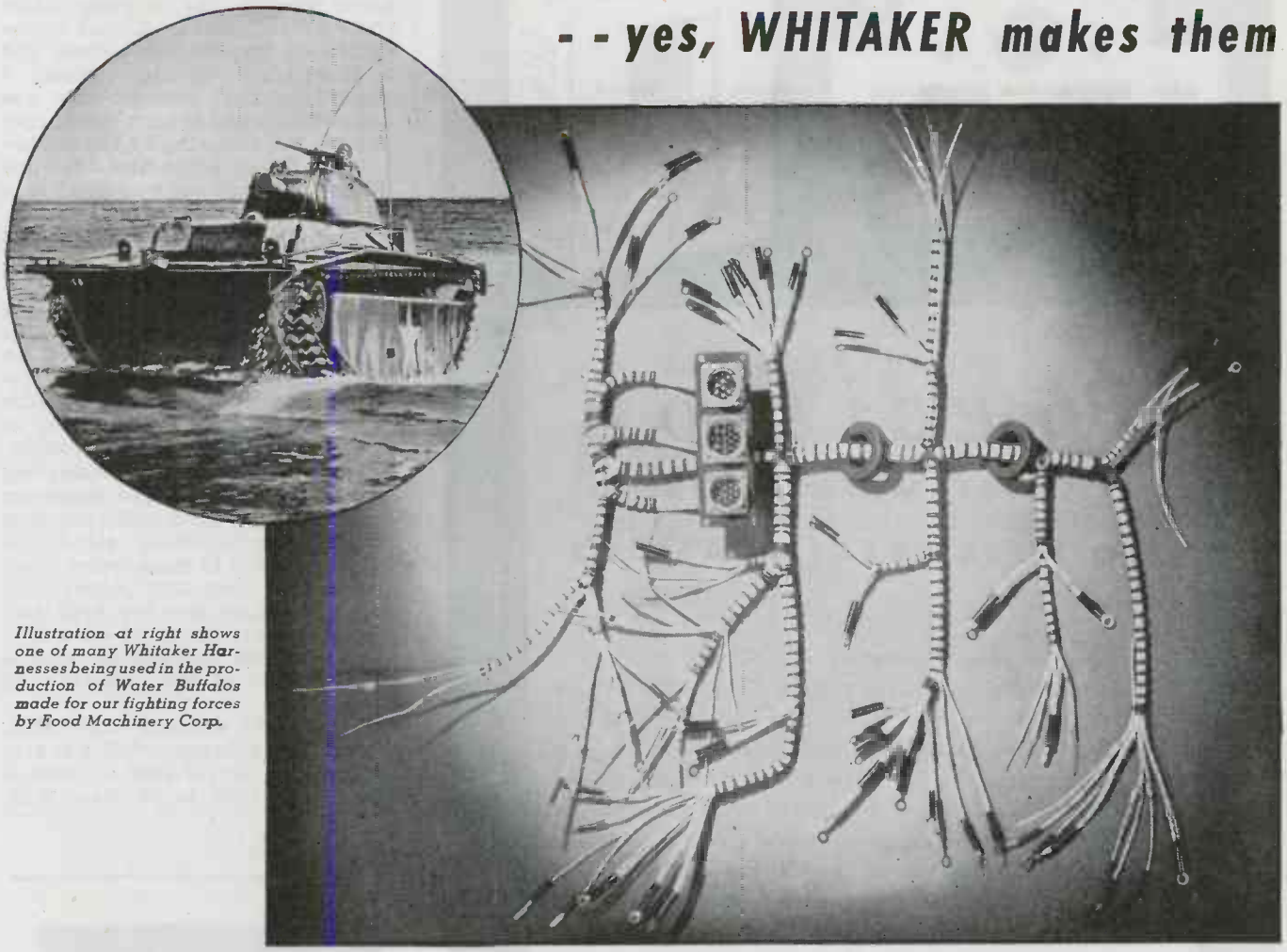

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being excellent. At a distance of six or seven feet from the cathode ray tube, the quality of the picture was quite comparable with that of home movies. The program material was a duplicate of that transmitted on the 450-line system and in comparing the two systems, I would say that the 450-line was somewhat better than a newspaper picture, but distorted by the stroboscopic effects, while the 1050-line picture was not quite as good as a fine-line magazine print.

"Both the 450- and the 1050-line systems were interlaced. The engineers stated that they had a system of interlacing by changing the phase of the synchronizing signals to avoid the necessity of using an odd number of lines, but no explanation was given. The synchronizing pulses on both systems were in the black at fifty frames per second.

"All transmissions as described above were by wire. The engineers stated that the band width required for the 'high definition' system was between 12 and 15 megacycles. Upon questioning, they also stated that they had transmitted the 'high definition' picture material on a frequency of 200 megacycles, with a power output of approximately 70 watts.

"The French delegate to the IRU, whose name I do not recall, was also present. He stated that a decision would soon have to be made with

respect to carrier frequency as the P.T.T. (Poste Telephone Telegraph) were engineering a coaxial cable system for France and that before planning could proceed intelligently the carrier frequency required for this television system should be known to them.

"The transmitter in the Eiffel Tower was used to provide a television service for German troop hospitals and operated until August 16, 1944. This transmitter was damaged by the Germans when they left, but it is now being repaired and R.D.F. expects to initiate a television service on December 15th, using the 450-line system as used by the Germans. Several R.D.F. people stated that they expected to switch to the 1050-line system, but they do not appear to be in agreement on the date of the switch—their estimates ranging from two to ten years.

Lighting system

"The studio building large theatre studio was fitted with the usual theatrical appurtenances and contained a unique floodlighting system consisting of about thirty 5 kw. floodlights, with a well-designed control console for remotely turning and focusing the floodlights. The control room was in the rear of the theatre where good visibility of the entire stage could be had. Facilities were available for mixing the outputs of six cameras, with talk-back circuits to each camera. Several large cathode ray tubes approximately 24 in. in diameter were available for viewing the outputs of the various cameras.

"Mr. McLean of the BBC stated that he felt that the BBC 405-line picture was superior to the French 450-line picture and, as I have stated above, I likewise felt that the television material which I viewed in the United States two years ago was superior to the French 450-line material. I would expect that the American and British 400-line systems are comparable in quality, but it must be remembered that British television activities ceased in September, 1939."

Welding Control Course

A new seven-part training course on electronic control for resistance welding to be taught by slide sound films, lesson books and instruction manuals has been prepared by the extension training department of the Westinghouse Electric & Mfg. Co., 30 Fourth Avenue, Pittsburgh. Produced originally for Westinghouse engineers, the course has been made available to engineering groups and individuals. Eight to ten hours usually is allowed for the full course which is covered in seven pocket-size manuals.

ELECTRONIC TACHOMETER

(*Continued from page* 81)

calibration accuracy depends entirely on the level of the constant current supplied to the switching tubes. Therefore, a calibration check can be made by a simple reading of this current value. The output indication meter, therefore, can be switched in whenever necessary and adjustments readily made so that the meter reads a prescribed value of current (noted by an equivalent frequency on the scale).

Frequency measurements

The Model 505-A may also be used as a frequency meter, for accurate measurement of frequencies of alternating voltages in the range from 10 cps to 50 kc. The frequency may be read off directly when the tachometer is supplied with a meter scale calibrated in rps; when the meter scale is calibrated in rpm, readings should be divided by 60 to obtain actual cps.

To measure an unknown frequency, the selector should be set to the USE position, and the range switch set to a range known to be higher than the frequency to be measured. (The signal voltage may then be applied to the input terminals, the lower terminal being the grounded connection.) The range switch should then be set to the range giving the most satisfactory reading.

The maximum possible meter overload is approximately four times the normal full scale current, and occurs at a frequency which is about 10 times the full scale frequency. Hence, reasonable care should be used to prevent continuous overload of the meter, although no damage can occur in the rest of the instrument when frequencies greater than full scale values are applied.

Glenn-Roberts Moves

Manufacturing activities of Glenn-Roberts Co., manufacturer of transformer-type arc welding equipment, are now being conducted in the firm's new factory at 3100 East 10th Street, Oakland 1, Cal. The new structure houses administrative offices, engineering department, a fully-equipped electrical research and testing laboratory, machine shop, stamping, coil winding, impregnating and baking departments, mechanized assembly line for welders, and complete production facilities for the company's electronic components manufacturing division. A modernization program for the company's Indianapolis plant is being planned, to be undertaken as soon as conditions permit.

OF VITAL CONNECTORS

It's human to take the "little things" for granted. Yet, a goodly percentage of the electrical troubles . . . in your plant, or in your products in your customer's plant . . . are due to nothing more than poor connections. *Check with your maintenance or service men on this point.* Then you will agree that more attention should be given to electrical connections.

Plant interruptions and electrical outages cost real money. And when competition again gangs up on you, your dealers and customers will expect the same high standards in connectors as in the other components you "build in."

Yes, electrical connectors *are* important . . . sufficiently so that you should insist that the connectors you use remain efficient, and trouble-free, in service. The kind that go on *quick*, and stay on fast; that withstand corrosion, temperatures, vibration, or shock. The kind that are available . . . in all sizes and for all purposes . . . here at Burndy. Let us send you our latest catalog. Burndy Engineering Co., 107 Bruckner Blvd., New York 54, N. Y.

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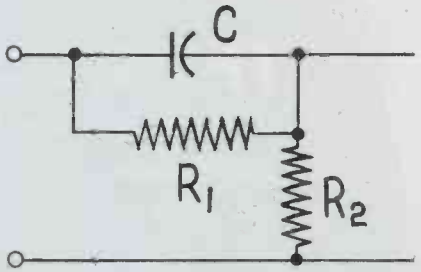
SERVO-MECHANISMS

(*Continued from page* 109)

the armature moves around until the electrical output of the rotor into the amplifier reaches a null.



It was shown that a compensating attenuator of the type shown could be added to the amplifier input, by which the damping and over-shoot can be controlled with a simple adjustment. When the time constant of the series circuit is correct the improvement in the system operation is roughly proportional to the attenuation. In other words, the time during which transients are effective, when a change in position is introduced, is reduced by a factor equal to the reciprocal of the attenuation provided by this network. However, the amplifier gain must be increased by a factor roughly equal to the square of the attenuation factor but this ordinarily need not give much concern to the designer.

ELECTRONIC HEAT

(*Continued from page* 111)

dollars per kwh, it will cost approximately $0.025 to $0.04 including direct operating cost, maintenance and amortization. It becomes economical, however, by virtue of one or more of these factors:

1. It produces a result not possible by other methods of heating.
2. It increases the speed of a process and saves labor and/or overall equipment cost.
3. It produces or confines the heating in the part or point where needed, thus reducing overall power consumption.
4. It is clean and compact.
5. It reduces rejects, or improves the production quality of a product.
6. It is flexible in its application.

Dielectric heating is applicable only to materials normally considered poor conductors of electricity or insulators. When the electrical resistivity of a material drops below 1000 ohm-cm, it is usually possible or necessary to use some technic other than dielectric heating.

In general, dielectric heating becomes attractive when the thickness of the material is sufficient to make it difficult to heat the material throughout by conventional means. In terms of inches, this will vary with the thermal conductivity of the material. Since the amount of energy introduced into the material is proportional to frequency the desire is to use as high a frequency as possible.

The length of the material may be such as to produce uneven heating due to standing wave effect. The higher the frequency used, the greater the probability of unequal voltage distribution over a given length or area. If the longest dimension of the electrodes is a small fraction of a wave length, or if the material is scanned, this effect is minimized. Ordinarily if the longest distance from the point of connection to the edge or corner of the high voltage electrode is less than 1/16 wavelength, very little trouble will be experienced. Heating will be sufficiently uniform to produce a variation of less than 20 per cent over the area involved.

The power input to the material is proportional to the voltage squared. Hence, if the voltage is increased sufficiently, considerable power can be supplied to the work at relatively low frequencies. The total voltage between electrodes should be kept under 15,000 volts. It is not impossible to use voltages above this value, but the additional precautions necessary to avoid corona and arc-overs are often more expensive than some other compromise.

NEW BULLETINS

"Quality Control"

"Quality Control" is the title of a new pocket size 140-page handbook on scientific inspection published by Continental Machines, Inc., 1301 Washington Avenue South, Minneapolis, manufacturers of precision measuring instruments. The use of over 200 photographs, diagrams, charts, and tables make the explanation of scientific inspection interesting and informative. Many conversion tables and measuring data give pertinent information for the precision measuring methods required in scientific inspection.

One section contains thirty-five subjects vital to quality control which are highlighted with examples showing how to use precision measuring instruments. Among such instruments and methods are new mobile inspection units, sine bars, vernier gages, optical flats, comparator gages, etc. Another section contains sixty-four key questions, along with their answers which serve both as a check and test of the knowledge gained by the reader in studying this handbook.

Measuring instruments are pictured, showing their use in everyday production, safeguarding that production from rejects by establishing uniform control throughout the whole production set-up. Gage blocks, a host of gage instruments, and accessories are described, including presentation of a new mobile inspection unit which brings the inspection department to the point of work. Supplementary information in the form of films, charts, etc., are included as further training aids on scientific inspection.

Silver-Impregnated Brushes

Engineering data on eight different grades of silver-impregnated graphite generator brushes are given in a folder published by Superior Carbon Products, Inc., 9115 George Ave., Cleveland. Silver impregnation reduces oxidation both at sea level and at high altitudes and is designed to give better commutation at high current densities now fairly common particularly in aircraft work.

Radio Components

Walter L. Schott Co., 9306 Santa Monica Blvd., Beverly Hills, Calif., has just issued a new 20-page catalog featuring and illustrating some 500 items. The first half is devoted to radio chemicals such as cements, lubricants, adhesives, varnishes, lacquers, polishes, refinishing kits, and many other chemicals for this type

ANNOUNCING AN ENTIRELY NEW CERAMIC CAPACITOR DIELECTRIC MYCALEX K

The MYCALEX CORPORATION OF AMERICA has developed and now has in production a new capacitor dielectric which embodies important new advancements in properties.

Designated MYCALEX "K," this new ceramic material is unique in that it offers a *selective* range of dielectric constants, from 8 to 15 at one megacycle.

Engineers whose requirements call for a material with a dielectric constant of 10, need only specify MYCALEX K-10. If a dielectric constant of 8 is indicated, MYCALEX K-8 will meet that exact requirement. Other applications might call for use of MYCALEX K-11 or K-12, etc.

MYCALEX K-10 already has been approved by the Army and Navy as Grade H1C5H4 Class H material (JAN-I-12). While other Class H materials are available, to the best of our knowledge these are all steatite or bonded titania or titanate types, obtainable only in relatively small dimensions and subject to wide variations in tolerances. MYCALEX K is available in sheets 14" x 18" in thicknesses of 1/8" to 1"; in thicknesses down to 1/32" in smaller sheets, and in rods 1/4" to 1" in diameter.

Of importance also is the fact that MYCALEX K series can be molded to specifications, with electrodes or metal inserts molded in. It can be fabricated to close tolerances.

So far as we are aware, the MYCALEX CORPORATION OF AMERICA is the exclusive developer and only supplier of this kind of capacitor dielectric.

Write today for further information to Department 11.

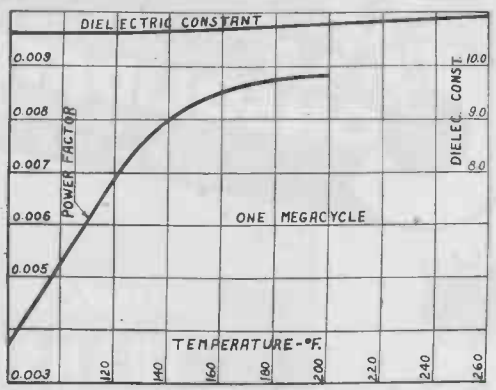
MYCALEX K-10

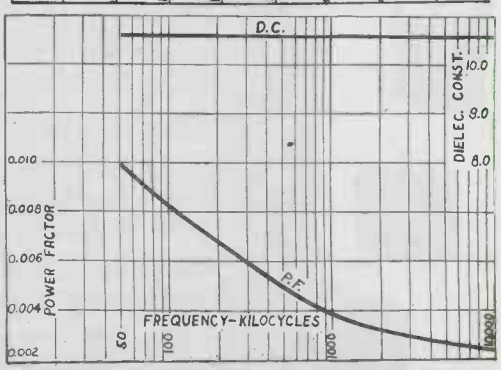
Grade H1C5H4, in accordance with JAN-I-12

Dielectric constant	10.6	1 megacycle
Q-Factor	310	
Loss Factor	0.034	
Volume resistivity	6.0 x 10^{12} ohms — cms.	
Dielectric strength	270 volts/mil (0.10" thickness)	
Modulus of rupture	9000 lbs. sq. in.	
Fractional decrease of capacitance with temperature change	0.0056	
Fractional increase of capacitance with temperature change	0.0076	
Porosity—no dye penetration after six hours at	10,000 lbs./sq. in.	

The above properties were measured in accordance with the procedures of JAN-I-12.

Density	0.116 lbs. per cu. in.
Specific gravity	3.22
Softening temperature	400° C.





OTHER PRODUCTS OF MYCALEX ARE:

MYCALEX 400—the most highly perfected form of MYCALEX insulation, approved by Army and Navy as Grade L-4 insulation. In sheets, rods and fabricated form.

MOLDED MYCALEX, available to specifications in regular shapes and into which metal inserts may be incorporated.

MYCALEX
THE INSULATOR
TRADE MARK REG. U. S. PAT. OFF.

MYCALEX CORPORATION OF AMERICA

"OWNERS OF 'MYCALEX' PATENTS"

Plant and General Offices
Clifton, N. J.

Executive Offices
30 Rockefeller Plaza
New York 20, N. Y.

of work. The second part covers radio and electronic hardware, including dial cables, trimounts, cable clamps, hexagon key wrenches, retaining rings, rubber grommets.

Capacitor Samples

To provide designers, experimental engineers, and production executives with a practical, working selection of ceramic capacitors, the Electrical Reactance Corp., Franklinville, N. Y., has prepared a handbook that contains 81 standard rating ceramic capacitor samples. In addition to actual working samples, this catalog includes plant illustrations which show the manufacturing processes and testing methods including the application of solid silver for condenser plates, which the manufacturer claims is non-aging, non-corrosive and maintains excellent conductivity. An A.S.A. Color Code is included.

Flexible Shaft Data

Flexible shafts have become a common source of transmitting movement for power, control and a host of other purposes probably unguessed at by the founder of the S. S. White Dental Mfg. Co., 10 East 40th St., New York, which this year is celebrating its 100th anniversary.

All of the older uses for which flexible shafts originally were designed, and thousands of new ones, are covered in the second edition of the "Flexible Shaft Handbook," a fabric bound book of some 256 pages that has just been issued. All necessary engineering data for flexible shaft applications are included in the book which is very well illustrated with photographs and diagrams showing a great number of industrial uses of the product. This second edition brings information and engineering data up to date, covering progress and the many developments that have been made since the first edition appeared in 1929.

Electronic Components

Cambridge Termionic Corp., Cambridge, Mass., which manufactures terminal lugs and lug attaching equipment as well as crystals and IF transformers, has issued a new catalog (No. 100) illustrating and describing these products. Included are turret terminal lugs, split and double end terminal lugs, hand swagers, UHF IF transformers, and x-ray oriented crystals.

Varnished Tubing

The proper selection of the type and grade of flexible varnished tubing and sleeving for various insulating requirements has been greatly facilitated by the comprehensive set of standards adopted by the Varnished Tubing Association, Inc. The new standards cover tubing and sleeving made from cotton, rayon, nylon and glass and include the physical and electrical characteristics of the different standard grades that are available, and the manner in which they should be designated when ordered. The new standards have been published in 8½ x 11 size for convenient use and filing by the Varnished Tubing Association, Inc., 420 Lexington Ave., New York.

X-Ray Diffraction

A new 12-page booklet that describes X-ray diffraction technics and applications has been published by North American Philips Co., Inc., 100 East 42nd St., New York. Diagrams, typical diffraction films, and several tabulations are given in order to show how Norelco X-ray diffraction equipment is used for identification, research and production. The booklet catalogues many specific problems that can be handled in the following fields: Alloys, asbestos, carbon, case hardening, cellulose, cement, cold-rolled steel, dry cells and batteries, electric silicon steel, steel forming, galvanic coatings, greases, ingot iron, patent leather, lime, linseed and china wood oils,

oleic acid, paper and parchment, plastic film, precious stones, rayon, resin, resistance alloys, rubber, textiles, tungsten, waxes and waxed papers, wood, cheese, dairy products and soil analysis.

Porcelain Enamel

A new 8-page folder giving engineering data for users of porcelain enamel, has been published by the Porcelain Enamel Institute, Washington, D. C. Contained in the booklet is a description of porcelain enamel, where it can be used, and why its use has proved successful. Its advantages are explained in detail. Representative applications for porcelain enamel are fully explained and illustrated. The book includes a discussion of the general considerations involved in engineering design of porcelain enamel products as well as material on fabricating. A page of diagrams is included illustrating correct design principles.

Portable Power

If you are interested in portable electric power plants using gasoline or Diesel engine driven generators, there is a wealth of information in a new folder being mailed by D. W. Onan & Sons, Minneapolis, Minn. The company makes some 65 basic models with power capacities ranging from 350 to 35,000 watts. Most produce standard 115 v 60 cycle current, but special windings for special purposes are available. The folder gives a lot of engineering data as well as specifications.

Electrical Specialties

New literature and prices have been issued by the Minerallac Electric Co., 25 No. Peoria St., Chicago, on steel hangers for cable, conduit and messenger uses, Jiffy steel clips (pipe-clamp), steel straps for messenger cable services on outlet boxes, porcelain insulating bushings and cable-pulling and insulating compounds. This company also manufactures the volt-telling Statiscope for warning workers by indicating potential in any electrical field. The literature shows dimension charts for ordering.

Electronic Processes

"Can Electronics Improve Your Product?", a new 32-page, illustrated booklet designed to help executives seeking sources for electronic features to be incorporated into mass-production products, has been published by Operadio Mfg. Co., St. Charles, Ill. This non-technical guide-book was prepared to provide practical information regarding the firm's facilities and

BH EXTRA FLEXIBLE FIBERGLAS SLEEVING

MAKE THIS

FLAME TEST

Hold a match under a piece of BH *Extra Flexible* Fiberglas Sleeving. The flame does not burn, char or otherwise affect it. And temperatures much higher than usually encountered electrically are just as readily resisted by the inorganic Fiberglas!

BH *EXTRA FLEXIBLE* FIBERGLAS SLEEVING

2 WAYS BETTER

NON-FRAYING • NON-STIFFENING

FEW electrical insulations can double in brass as heat insulations. Yet so effectively heat resistant is BH *Extra Flexible* Fiberglas Sleeving that actual service records show it refuses to burn even in direct contact with heat units. The reason—both yarns *and* impregnation are non-inflammable!

A special gum base and dye applied by an exclusive BH process is responsible for many more features. It permanently *prevents fraying, stiffening and abrasive wear.* The sleeving is unusually flexible and takes the roughest handling without fraying. It does not harden and crack with age—lasts indefinitely without deterioration. It is also non-crystallizing at low temperatures.

Fiberglas is non-absorbent and unaffected by moisture, oil or grease—qualities ideally suited to appliance manufacture for instance. And it has high dielectric and tensile strength.

"Punishment" tests prove that BH *Extra Flexible* Fiberglas Sleeving is the most logical insulation for a host of tough jobs. Why not see for yourself? It's available in all standard colors and all sizes from No. 20 to 5/8", inclusive. Write for samples today and compare!

BH SPECIAL TREATED FIBERGLAS SLEEVING UNAFFECTED BY HEAT UP TO 1200°F!

This is a high quality sleeving that will not fray when cut and withstands heat up to 1200°F. Yet no saturant is used in the exclusive BH process! Flexible as string, too. Made in natural color only—all standard sizes. Try it!

BH PRODUCTS

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

BENTLEY, HARRIS MANUFACTURING CO.

Dept. I, Conshohocken, Penna.

capacity for the production of electronic sub-assemblies and parts. Basic organization for electronics product development is fully illustrated and described, showing the business man how Operadio is equipped to augment existing engineering and production staffs in a variety of fields.

Rhombic Coupling

A new bulletin descriptive of rhombic antenna coupling devices and coaxial plugs and jacks has been issued by the Anrew Co., 363 East 75th Street, Chicago. Characteristics and engineering data are given for both products.

Scarce Parts

Hard-to-find parts and electronic components are listed in a new Special Supplement, No. 97, by Concord Radio Corp., 901 W. Jackson Blvd., Chicago. Meters, resistors, switches, speakers, relays, volume controls, test accessories, transformers, rheostats and other items are included.

Silver Soldering

A new 4-page bulletin issued by Superior Flux Co., 913 Public Square Bldg., Cleveland, O., describes Superior No. 6 flux for silver soldering and gives detailed instructions for its use. It is an alkaline, non-cor-

rosive, non-fuming flux, containing no free fluorides with an effective temperature range of 850 deg. to 1650 deg. Complete price information and laboratory and production test reports are included in the bulletin, as are data on twenty other welding and brazing fluxes.

Hermetic Terminals

A considerable variety of hermetically sealed terminals are illustrated and described in a catalog sheet issued by Electrical Industries, Inc., 42 Summer Avenue, Newark, N. J. Terminals are sealed in low expansion glass, annealed and bonded to Kovar metal, then tin plated ready for soldering.

Automatic Switches

Electrically operated switches with voltage ratings from 250 to 750 and current ratings of 30 to 1000 amperes are described in a 16-page booklet published by Automatic Switch Co., 41 East 11th St., New York; pictures of many applications are included, as are engineering data and circuit diagrams showing uses.

WIDE READING

Determining Young's Modulus

(*Continued from page* 114)

used for measuring sample elongation under various loads, using a fiducial mark on the sample.

Uniformity and reproducibility of the modulus measurements were found satisfactory; tests on one sample were established to be representative of the portion from which it was taken. On the average, the absolute results are good to about 3 per cent. Results of measurements on linen, ordinary viscose rayon textile yarns, cellulose acetate yarns, Nylons, and Cellophane under varying conditions are reported and discussed. The range of moduli found extended from 1×10^{10} to 50×10^{10} dynes per square centimeter; the half-wavelengths encountered in the tests ranged from 5 to 30 cm.

Electromagnetic Field of Symmetrical Antennas

C. W. Harrison, Jr. (Journal of Applied Physics, July, 1944)

Magnetic and electric vector components in the vicinity of an isolated, symmetrical, center-driven antenna of finite radius are computed. The derivation is based on the actual current distribution along the antenna and not on the conventional assumption of a sinusoidal antenna current.

Transit-Time Effects in Plane Diodes

Leon Brillouin (Electrical Communication, Vol. 22, No. 2, 1944)

Formulas are developed for the behaviour of electrons in a plane diode at the beginning, during, and

at the end of a discharge; at the beginning the space-charge moves towards the plate, at the end it recedes towards the cathode, in both instances the space-charge does not completely occupy the cathode-plate space.

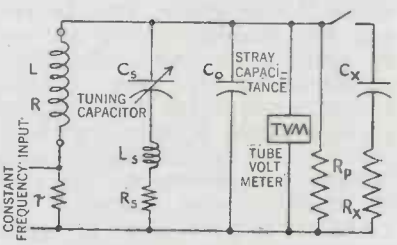
Transit time, field strength, voltage, electron velocity, electron position, electron current, displacement current, are computed for electron layers parallel to the cathode and the plate; current-voltage relations are derived. A phase delay between plate voltage and the electronic current of 0.38 times the transit time is established.

Most of the difficulties of measuring transit time are due to the fact that it is not constant, but differs materially for electrons leaving the cathode at different instants. This dispersion of transit times is investigated and found to be negligible over wide frequency intervals for tubes with small space charge effects. However, the efficiency of tubes with large space-charge effects is expected to decrease continuously with increasing frequency.

Measurements of the Residual Parameters of a Q-Meter

J. C. Simmonds and W. F. Lovering (Philosophical Magazine, London, December, 1943, and July, 1944)

For the determination of the series inductance L_s and the series resistance R_s of the capacitor C_s in the circuit below, C_s is tuned to resonance at the desired frequency.



The capacitance C_{s1} of the tuning capacitor at resonance is noted, as well as the Q-value, say Q_1, which is the ratio of the input voltage to the voltage across the capacitor, as indicated by the tube voltmeter. An unknown capacitor, C_x, having power factor p.f. due to its inherent resistance, R_x, is then connected across the circuit and resonance restored by reducing the tuning capacitor to C_{s2}. Let the new value of Q be Q_2. Then

$$C_x = C_{s2} - C_{s1} + \omega^2 L_s (C_{s1}^2 - C_{s2}^2), \quad (1)$$

C_{s1} and C_{s2} being given by the low frequency calibration of the tuning capacitor. C_x and ω are kept constant and L is varied, obtaining new values for C_{s1}, C_{s2}, Q_1 and Q_2 for various parts of the tuning capacitor (C_s) scale. $(C_{s1} - C_{s2})$ is plotted against $(C_{s1}^2 - C_{s2}^2)$; the

write for new bulletin 10CV-102

LABORATORY VOLTAGES accompany your equipment into the field with built-in CONSTANT VOLTAGE

On the drafting boards of hundreds of sales-minded design engineers, product insurance is being written into the specifications of new electronic and electrically operated equipment.

A critical analysis of sales department records of past performance usually discloses that the most frequent cause of equipment failure or sub-standard performance is the one most often overlooked — field voltages that do not correspond to the rated voltage at which the equipment is designed to operate.

Today sales-minded design engineers make certain that carefully controlled laboratory voltages, on which the operation of their equipment is predicated, go with it into the field, by writing "SOLA Constant Voltage Transformers" into their design specifications. In many cases the inclusion of the "CV" transformer is accomplished at an actual saving in cost over standard equipment design.

Thus rated voltage is available at all times because SOLA Constant Voltage Transformers instantly correct fluctuations as great as 30% to less than ±1% of rated requirements. These sturdy, automatic transformers require no pampering or supervision. They protect both themselves and the equipment against line surges and short circuits.

Standard units are available in capacities from 10VA to 15 KVA or special units can be built to your specifications.

Constant Voltage Transformers

SOLA

Don't forget to write for Sola's new Bulletin

Ask for Bulletin 10CV-102

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 14, Ill.**

resulting curve according to equation (1) should be a straight line, its slope is equal to $-\omega^2 L_s$, and its intercept on the "y" axis is C_x. Once the value of L_s has been established, C_x (or the value of any other unknown capacitor) can be computed according to the above equation from indicated values of C_{s1} and C_{s2}.

To evaluate the series resistance, R_s, the equation for the power factor is used:

$$\text{p.f.} = \omega R_x C_x = C_{s1}(Q_1 - Q_2)/C_x Q_1 Q_2 + \omega R_s (C_{s1} + C_{s2}). \quad (2)$$

$C_{s1}(Q_1 - Q_2)/C_x Q_1 Q_2$, for the above series of values of C_{s1} and C_{s2}, is plotted against $C_{s1} + C_{s2}$, giving a straight line. Its slope will be equal to ωR_s; R_x may be obtained from the intercept of the line with the "y" axis or from the equation. Since the series resistance R_s is a function of frequency, it should be determined for several frequencies within the range considered. Once R_s is known, the power factor of an unknown capacitor can be readily evaluated by means of the above formula if C_{s1}, C_{s2}, Q_1 and Q_2 are measured.

Similar methods are indicated to find the value C_o of stray capacities, such as that of the tube voltmeter, and the value R_p of any damping resistance in shunt with the circuit.

DIATHERMY PROBLEMS

(*Continued from page* 108)

vision experts they are likely to be discounted. The same cannot be said, however, for quenched gap outfits and to a lesser degree for self-rectified oscillator units.

It is to be noted that none of the 85,000 diathermy outfits and the (possibly) equally large numbers of industrial units are keyed or charged with the responsibility of signing call letters every 15 minutes! A 60 cycle diathermy blast sounds like (and on a television set —looks like) any other 60 cycle outfit whether on the same block or maybe miles away. It is clearly not feasible to have the FCC charged with responsibility for running down stations operating on other assignments; there just are not that many inspectors.

Doubts have been cast on the possibility of making the rules retroactive to catch existing sets, and unless the industries that find most use in such equipment are given practical and workable alternatives there would be no incentive for them to aid in bringing about any improvements. Shielding is not an answer. Read a list of all of the things that must be done in shielding to get even a 60 db improvement and figure whether a doctor would enter into a double shielded screen room, locking the entrances and observe at all times the other twenty-odd necessities. Neglect of any one item might obviate the whole shielding improvement, so that continuous checking with field test instruments would be needed. A room may look to be well shielded and still radiate the full amount.

Band width

If a person grants the premise that the advantages of medical diathermy to the public health is fundamental, it would seem that it would be necessary to provide a wide enough band at some point to permit satisfactory operating technic as recommended by Panel 12 of the RTPB after months of study. Just how wide this band would have to be, would necessitate a careful survey. A band width of ± 2 mc somewhere near 27 megacycles, would satisfy nearly every service having the aforementioned loading difficulties. Several other narrow band assignments would help those services where specific frequencies are needed. The exact location of any band would not be critical.

It may be said that recent research has shown that there are no "magic wavelengths" where miraculous cures are effected, at least down to those wavelengths in the neighborhood of one meter. Frequencies from 10 up to 200 megacycles are increasingly easier to

apply to therapy services, without encountering excessively high voltages, but up to now, the higher frequencies were more expensive to produce, so the tendency has been to stop at points between 20 and 60 megacycles.

Harmonic output is quite high in many designs, but here is a problem that could be solved quite easily. It may be mentioned that one of the advantages of tube oscillators for this service is that radiation can be detected only at the fundamental and its harmonics, whereas fairly complete "coverage" at all frequencies may be found with spark outfits. In this age there is little argument for the latter equipment from any standpoint, except cheapness.

Another possibility of great improvements in the interference situation is the more universal use of rectified power supplies in medical apparatus by doing away with the present "raw ac" units that give such obnoxious interference.

Preventing radiation

A great deal of value is found in the use of line filters that prevent radiation by rf getting back in the power lines. It is possible to accomplish much by the use of coaxial or parallel wire leads having low radiation properties up to a point where they must branch upon reaching the patient. (The usual output now in use has two pads each with its own separate lead and it is easy to separate these wires until a fairly efficient dipole inadvertently is provided!)

There are numerous other items that would form a useful "code of good engineering practice" set up in the industry itself. Its leaders have expressed willingness toward the formulation and use of such a code if they are not hamstrung by a lot of unworkable requirements.

In this era, the insurmountable problems of one day are made obsolete and forgotten about in a few years because of technical advances. Medical application of therapy is still in its infancy as there were few interested in deep fundamental research before the war. Who knows whether some particular wavelength will be found that will resonate with particular bacteria, etc., and which will permit selective heating of definite parts of the body by directed beams of high frequency energy, with the excess absorbed by "sinks" just beyond! For the present it is hoped that assignments can be arrived at that will prevent program disruption and at the same time can be readily applied. Rules that would regulate a good service substantially out of existence would solve nothing. R.R.B.

MALLORY POTENTIOMETERS

Provide Precision Control for the Electronic Pilot

CAPABLE of making more than 300 flight corrections per minute, the electronic automatic pilot made by Minneapolis-Honeywell Regulator Co. has helped thousands of four-engined bombers to hit targets accurately and then fly home safely. Dependable, precise performance of the autopilot has been possible because it is built with precision parts such as wire-wound Mallory Potentiometers.

In precision instruments, communication, test, laboratory, medical and industrial electronic and electrical equipment . . . potentiometers and volume controls, variable and fixed resistors made by Mallory are standard equipment. Engineers specify these Mallory precision parts because of their sturdy construction, efficient design and excellent electrical characteristics under all operating conditions.

Variable Wire-Wound Resistors — Available in three standard types, from 0.5 to 150,000 ohms, 2 to 9 watts. Single and multiple units, with or without AC switch.

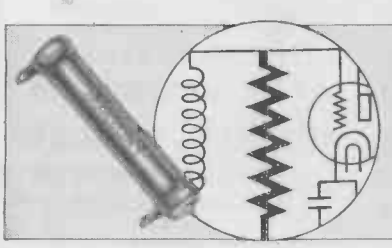
Variable Carbon Resistors—In standard and midget types from 5000 ohms to 9 megohms. Noiseless in operation. Rugged terminal construction and improved resistance to humidity.

Fixed and Adjustable Wire-Wound Resistors —Available from 1 to 100,000 ohms and 10 to 200 watts. Maximum wattage dissipation. Resistant to humidity.

Resistors, volume controls, capacitors, switches, jacks, plugs, vibrators, rectifiers, power supplies and other precision standard electronic parts are available from your nearest Mallory distributor. Ask him for your copy of the Mallory catalog, or write us today.

Make it a policy to consult Mallory for engineering assistance while your designs are still in the blue print stage.

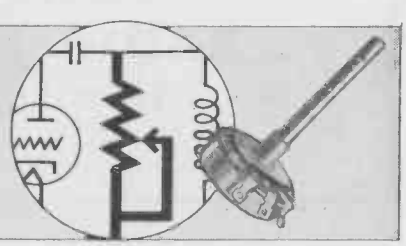
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA



P.R. MALLORY & CO. Inc

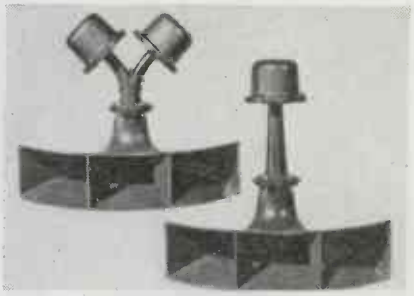
MALLORY

FIXED AND VARIABLE RESISTORS



WHAT'S NEW

(*Continued from page* 118)



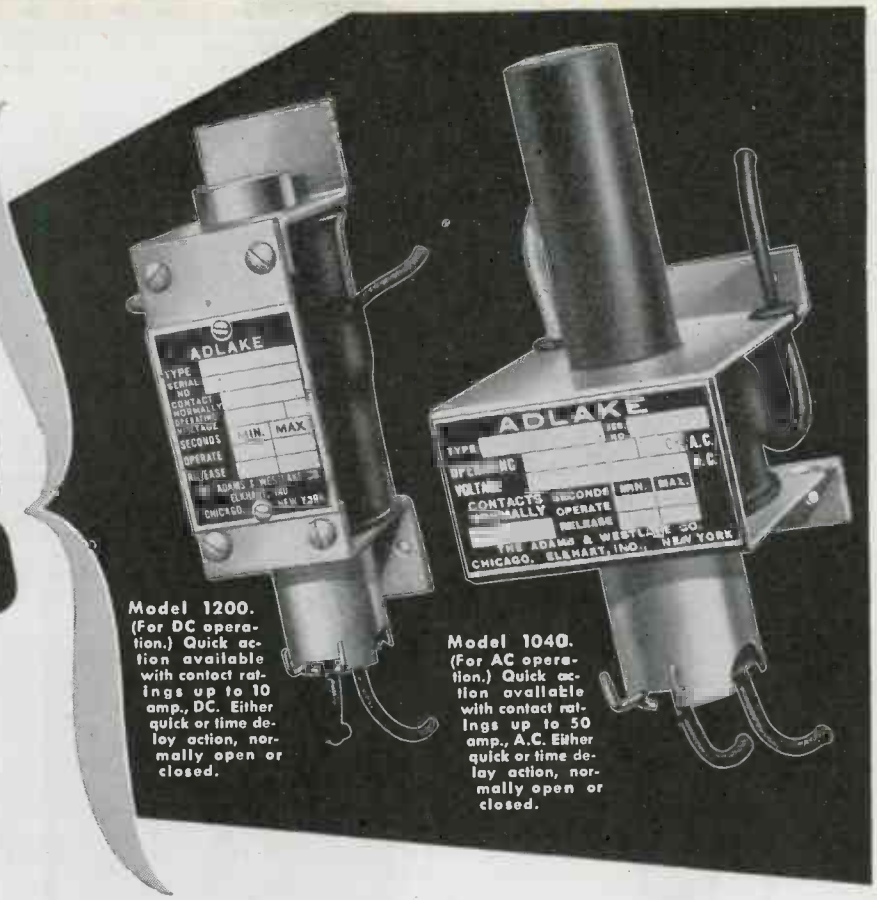
Loudspeaker Unit

A new loudspeaker, Type 26-B, designed to operate with maximum intelligibility through high noise levels and with uniform distribution over horizontal angles of 120 and vertical of 40, has been brought out by the Langevin Co., 37 W. 65th St., New York. The unit is cast aluminum, equipped with heavy universal mounting brackets, and is designed for economy of installation. It handles power input of 40 watts when equipped with 2 Jensen U-20 drive units.

Capacitors for Oscillators

A new line of high-frequency, parallel-plate capacitors, designed for use in the resonant circuit of high-frequency electronic oscillators such as those used in electronic-heater equipments, has been developed by General Electric Co., Schenectady. Connected in parallel with an inductance coil, this class HFP, water-cooled capacitor constitutes the resonant circuit which determines the frequency of the oscillator. These units are available in standard ratings ranging from 2,000 volts, 0.025 microfarad to 9,000 volts, 0.0056 microfarad. The new capaci-

RELAYS



Model 1200. (For DC operation.) Quick action available with contact ratings up to 10 amp., DC. Either quick or time delay action, normally open or closed.

Model 1040. (For AC operation.) Quick action available with contact ratings up to 50 amp., A.C. Either quick or time delay action, normally open or closed.

READY, PROMPT TO PERFORM

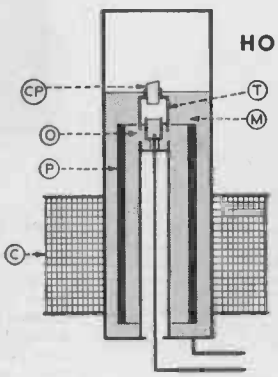
Under the most exacting conditions . . . heat or cold, dirt, dust or moisture . . . Adlake Plunger-type Relays are ready on the job. Their mechanism, encased in armored glass or metal cylinders and then hermetically sealed, is impervious to the elements and oxidation.

Adlakes are prompt to give instant contacts, clean break-offs, because they use fast-moving, liquid metal mercury . . . positive in operation; silent and chatterless; will not burn, pit or stick. Yes, Adlake Relays have snap action that stays snappy . . . absolutely no tendency toward lazy, snail-pace motion.

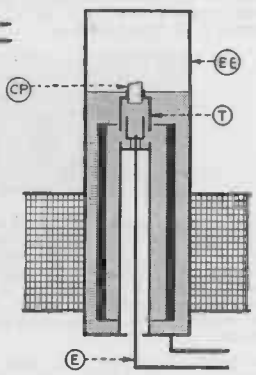
No other relays are as simple, rugged, dependable. For timing, load or control circuits, you can design them into every kind of equipment and be assured of continuous, trouble-free service.

There's an Adlake Relay for all needs. May we suggest the type best suited for yours? Write for free bulletin.

HOW THEY WORK



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



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

Adlake TRADE MARK

THE ADAMS & WESTLAKE COMPANY

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

MANUFACTURERS OF ADLAKE HERMETICALLY SEALED MERCURY RELAYS FOR TIMING, LOAD AND CONTROL CIRCUITS

tors employ a synthetic dielectric liquid which is particularly well adapted for high-frequency applications. It is chemically stable and is kept free from contamination in manufacture.

New Taylor Tubes

A license to manufacture grid-controlled rectifier tubes has been extended to Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago, by General Electric and two new types have been put in immediate production. They are TT-17 and 873. The former is comparable to the GE-FG17 and the latter is an 872A with an added grid control. Specifications of the TT-17 are: filament, 2.5 volts ac at 5 amps; inverse peak plate volts, 5,000 at 2 amps; average plate current, ½ amp; negative starting grid voltage; mercury-vapor type; size 6¼ x 2-5/16 with large plate connection at top, ceramic insulated; small 4-pin ceramic base with filament and grid connection to pins. The 873 specifications: filament, 5-volts at 6.75 amps; inverse peak plate volts, 7,500 at 5 amps; average plate current, 1.25 amps; size, 8¼ x 2-5/16 with large top plate connection ceramic insulated; negative starting grid voltage; jumbo 4-pin base ceramic insulated with metal shell; mercury-vapor type.

Kelvin Bridge

The use of new technics in modern electronic developments has brought about the need for new measuring methods, and the extension of the range of older ones. For example, a war-time need arises in connection with the use of thin metallic or otherwise conducting films for electrical purposes. For this application, the Kelvin type, double-arm bridge has been found well adapted for production measurements of the electrical resistance of specific regions of such films, where the contact resistance occurring at the point of contact of the measuring electrodes is variable and is often as large or larger than the film resistance being measured. The P.I.B. modified Kelvin bridge, manufactured by the Universal Electronic Labs., Inc., 461 Tenth Ave., New York (18), N. Y., provides a precision instrument, permitting measurement of resistances of from 1 to 10,000 ohms with an accuracy of ±.1 per cent or ±.1 ohm, whichever is the larger, for all practical values of contact resistance. The power level employed in the bridge is sufficiently low to permit the measurement of films of exceedingly low thermal mass without troublesome heating. The bridge consists of two sets of equal high resistance ratio arms, a standard arm consisting of a high quality, 5 decade (0.1 ohm to 10,000 ohms resistance) box with an accuracy better than .1 per cent. The circuit uses an electronic null detector, consisting of a high-gain amplifier terminated in a visual indicator tube. Bridge excitation is obtained at sixty cycles through an electrostatically shielded transformer fed from the 115 volt power line. In addition to its primary function as a double arm bridge, the device has the following several features which render it more

America's foremost Family of Alloys

AT YOUR SERVICE FOR 45 YEARS

Best proof of the superiority of D/H Alloys lies in the record. For 45 years, Driver-Harris has been the foremost producer of an internationally recognized group of alloys.

Best known member of this famous alloy family is NICHROME*—most widely used of all resistance alloys. No less renowned and equally preferred in their specialized fields are the more than 80 other D/H Alloys.

Underlying this preference is the quality plus factor in every D/H Alloy assured by the high degree of metallurgical control that enters into their manufacture from furnace to spool. Therefore, to insure longer life and improved performance in your product, send your metal specifications to us and depend on it . . . Driver-Harris will supply the alloy possessing the best electrical and physical properties for your requirements.

D/H
SPECIAL PURPOSE ALLOYS SINCE 1809

Driver-Harris COMPANY

HARRISON, N. J.

Branches: Chicago · Detroit · Cleveland
Los Angeles · San Francisco · Seattle

ARMY NAVY

FOR ELECTRICAL RESISTANCE

NICHROME*
NICHROME*V
ADVANCE*
HYTEMCO*
CHROMAX*
MAGNO*
MIDOHM*
COMET*
LUCERO*
MANGANIN
11 ALLOY
30 OHM ALLOY
LOHM*
90 OHM ALLOY

FOR HEAT OR CORROSION RESISTANCE

NICHROME*
NICHROME*V
NICKEL A†D†E†Z†
CIMET*
MONEL†
K-MONEL†
R-MONEL†
D/H STAINLESS STEELS
INCONEL†

FOR RADIO SETS AND TUBES

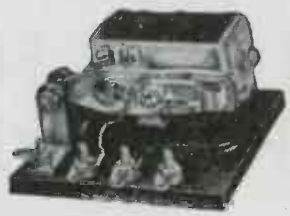
NICHROME*
NICHROME* V
NICHROME* 111
GRIDNIC A-B-C-D-E-F*
RADIOHM*
MANGANIN
ADVANCE*
52 ALLOY
FILAMENT ALLOYS
D/H STAINLESS STEELS
NICKEL A†D†E†
MONEL†
42 ALLOY
NILVAR*

FOR SPARK PLUG APPLICATION

MAGNO*
R-63 ALLOY
SPECIAL NICKEL ALLOYS

In addition to the above general classifications many other industries are served by Driver-Harris Alloys. Space does not permit listing them all.

useful and versatile as a laboratory or as a production instrument: (1) By shorting out the second set of ratio arms a conventional Wheatstone bridge is readily obtained, the accuracy of which is determined by that of the comparative decade standard mentioned above. (2) Convenient provisions are made to permit the insertion of any standard impedance (resistive or reactive) in place of the resistance box which may be used comparatively for general impedance measurement. (3) Panel accessibility of the detector permits its use as a high impedance, sensitive ac null indicator for general laboratory use. (4) Similar accessibility of the standard resistance arm permits its use as a general purpose decade resistance box. The instrument is contained in an oak carrying case, 14 x 15 x 8½ in., with removable lid. Operation is from the 115 v. 60 cycle line.



Snap-Action Relay

The Struthers-Dunn Type 79XAX relay has been redesigned. All parts are readily accessible and sensitivity adjustments may be made quickly. The armature of the 79XAX almost completes its travel in either direction before the contacts snap into the new position. This feature permits an unusually broad range of use including vacuum tube circuits, overcurrent protection, pulsing circuits, and applications where extremely close differential or extreme sensitivity of operation is required. The standard adjustment is 60 ampere turns in the coil at approximately .02 watt results in

WATCH FOR THE Sentinel POSTWAR PLAN

SORRY . . . no details, yet! These will be released when Victory is nailed down. However, we can tell you that Sentinel will be ready for production the moment war demands relax. Designers, engineers, production men and sales experts have put their heads together to shape Sentinel's plans for the future.

To build and establish new markets for its army of dealers, Sentinel continues to advertise nationally . . . Radio on nationwide programs creating ready consumer acceptance for Sentinel Radios. Backed by quick deliveries, you, as a Sentinel dealer, will be assured of a sound, constructive plan for sure profit.

LISTEN . . .
to Sentinel's Nation-Wide Radio Program

● JOHN W. VANDERCOOK analyses the news every Saturday afternoon, 5:30 to 5:45 E.W.T. over NBC's complete network. See local newspapers for time and station.

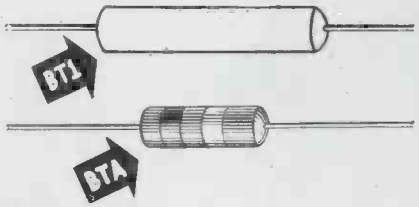
ARMY E NAVY

Sentinel RADIO

QUALITY RADIO SINCE 1920

SENTINEL RADIO CORPORATION, 2020 Ridge Ave., Evanston, Ill

contact pressures of 5 grams with contacts rated 5 amperes, 115 volts ac; or 0.5 amperes, 115 volts dc, noninductive. Contact ratings up to 10 amperes, 115 volts ac may be obtained with 100 or more ampere turns and a corresponding increase in power. A sensitivity of 0.005 watts with 30 ampere turns is obtainable with reduced contact pressures and ratings, and at an increased price. Maker is Struthers-Dunn, Inc., 1321 Arch St., Philadelphia.

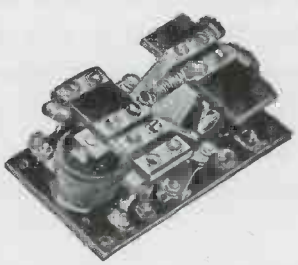


Insulated Resistor

Type BTA, insulated 1-watt resistor, made by International Resistor Co, 401 N. Broad St., Philadelphia, has characteristics similar to those of the widely used Type BT-1, although the new unit is only 60 per cent of its size. Tests indicate that the 56 deg. C. temperature rise of the BTA is lower than that of other 1-watt insulated composition resistors of comparable size. It is 0.718 in. in diameter, voltage rating 500-volts; covering a normal range of 330 ohms to 20 megohms.

Amplifier Cabinet

The Langevin Co., Inc., 37 West 65th Street, New York, has a Type 201-A wall mounting cabinet which permits universal installation of its 101 Series amplifiers to any flat surface. It is well ventilated and is designed for maximum accessibility for servicing and convenience of installation. Standard aluminum grey finish. Size: height 12 in., width 20 in., depth 12 in.



Interlock Relay Series

Series 50XBX 2-coil relays are an addition to the Struthers-Dunn types. A new style positive interlock between the two symmetrical operating elements requires no extraneous parts other than integral extensions of the coil armatures themselves. Application of power to one coil latches the contacts into one position. Power then applied to the other coil throws the contacts into a latched-in second position. A third unlatched position can be obtained by ener-

MYCALEX

SOLVES ANOTHER TOUGH INSULATION PROBLEM

Bushings for this G-E Temperature-Controlled Crystal Unit had to provide a high degree of electrical and thermal insulation. Yet they not only had to be small, but able to withstand great compressional stress.

Organic materials (phenolic, for example) could not be used for technical reasons. When ceramic and vitreous products were tried, the bushings broke under the strain.

Only G-E mycalex was found to be ideal on every count. In addition to showing small electrical loss and low thermal conductivity, it proved immune to fracture or crushing. In fact, when the bushings were tested for physical limits, G-E mycalex demonstrated no change whatever—even when screws broke off and compressing nuts were stripped of their threads!

G-E mycalex is the answer—often the *only* answer—to difficult electronic insulator requirements. These features explain a few of the reasons:

1. High mechanical and dielectric strength.
2. Low loss at high frequencies.
3. Arc resistance and heat resistance.
4. Easily subjected to drilling, filing, sawing, grinding, polishing.
5. Metal parts can be inserted or anchored during the process of molding.

Yes, General Electric specializes in producing fabricated parts as well as standard sheets, rods, and strips. For a free sample and detailed information about G-E mycalex mail the coupon at the right.

Hear the G-E radio programs: *"The World Today" news, Monday through Friday 6:45 p. m., EWT, CBS. "The G-E All-Girl Orchestra," Sunday 10 p. m., EWT, NBC. "The G-E House Party," Monday through Friday, 4 p. m., EWT, CBS.*

GENERAL ELECTRIC

177-M-C11—9918

Over 21 Years of Mycalex Experience —Your Assurance of Quality!

FREE—G-E MYCALEX BULLETIN

Electronics Department
GENERAL ELECTRIC CO.
Schenectady, N. Y.

Please send me a free sample and my copy of the booklet describing G-E Compression-Molded mycalex.

Name .....

Company .....

Address .....

.....

gizing both coils simultaneously. Produced in ratings from 6 to 200 amperes or more, and with practically any desired contact arrangements. Standard types provide for two auxiliary contacts, one in each coil circuit. Relays are small and compact, Type 50XBX103, having double-pole, double-throw main contacts, rated at 6 amperes at 24v dc is 3-7/16 in. long; 1⅞ in. high; and 1⅝ in. wide. Maker is Struthers-Dunn, Inc., 1321 Arch St., Philadelphia 7, Pa.

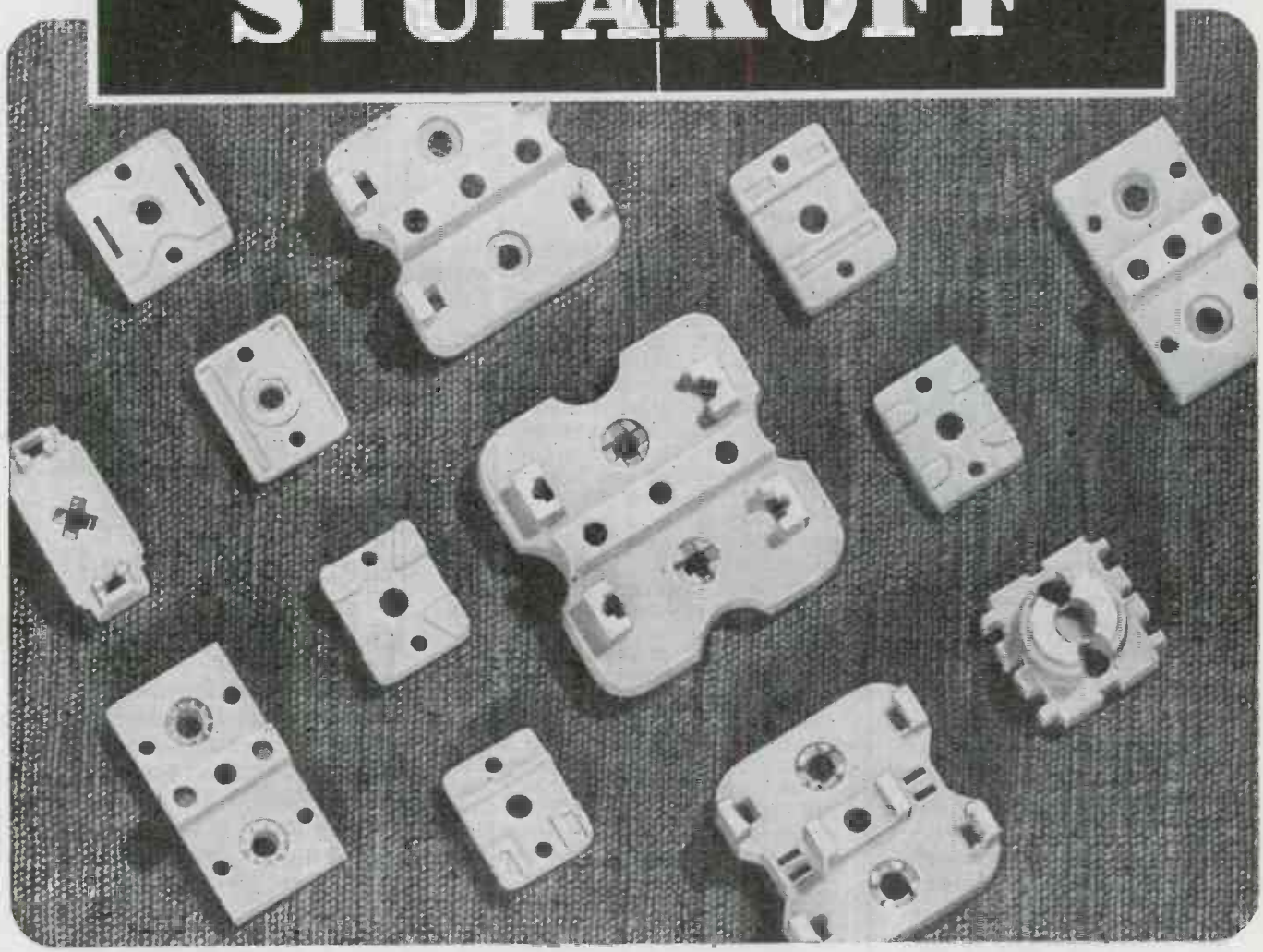
Bridging Amplifier

The Langevin Co., Inc., 37 West 65th St., New York, has developed a series of amplifiers (101 Type) designed for continuous service, to meet the need for medium gain, high power bridging amplifiers. Where increased power is desired any number may be bridged across busses from 1 to 1,000 ohms. All models in this 101 series will deliver 50 watts to a nominal load impedance with less than 3 per cent rms harmonic distortion at 400 cycles. The gain control provides continuous adjustment over a 40 db range and bridging connections. Chassis are 16 gage welded steel, zinc plated, and bonderized; finish light gray baked enamel; weight approximately 45 lbs.

Insulated Resistors

Integrally molded in one operation under laboratory controlled production standards, Stackpole Type CM insulated resistors have been designed to meet Army-Navy specifications. The new units are available in 1/3- (RC-10), ½- (RC-21), and 1-watt (RC-30) sizes in all required ranges. Their construction is such that they offer an exceptional degree of stability under load, the average change being less than 5 per cent after 1,000 hours under test at full load. They meet salt water immersion specifications. Maker is Stackpole Carbon Co., St. Marys, Pa.

Padder and Trimmer Bases by STUPAKOFF



- MECHANICALLY – ***STRONG***
- DIMENSIONALLY – ***ACCURATE***
- ELECTRICALLY – ***STABLE***

EXACTING characteristics are necessary for steatite bases used in the production of electronic equipment. The bases illustrated, produced by the Stupakoff method of precision manufacture, minimize production losses due to breakage and misfits in rapid assembly lines. Carefully selected, laboratory controlled materials reflect proper electrical characteristics into your completed assemblies. The highly vitreous state to which these bases are fired assures greater stability.

Stupakoff—manufacturers and developers of thousands of ceramic type insulators—offers specific solutions to *your* insulation problems. Modern production methods, trained personnel and competent engineering give assurance of sound ceramic service. Your inquiries will be given immediate consideration.

"FOR GREAT ACHIEVEMENT"

STUPAKOFF CERAMIC AND MANUFACTURING CO., LATROBE, PA.

Ceramics for the World of Electronics

Army-Navy "E" Awards

Burgess Battery Co., Freeport, Ill. (white star).

Erco Radio Laboratories, Inc., Hempstead, L. I., N. Y. (second star).

Radio Receptor Co., Inc., 251 W. 19th St., New York, N. Y. (second star).

Edwards & Co., Norwalk, Conn. (fourth "E").

Monitor Controller Co., Baltimore (Maritime "M" pennant).

Pacific Sound Equipment Co., Hollywood, Calif. ("E" award).

Formica Insulation Co., Cincinnati (second star).

Electric Coating of Fluorescents

Westinghouse has found another application for the electrostatic principle that has been used with great success in the Precipitron; instead of removing dust from where it is not wanted they are placing dust where it is wanted. The principle is being used to coat fluorescent lamps with phosphors.

The usual method of coating fluorescent tubes has been to suspend the phosphor dusts in a solvent which is allowed to flow through the tube after it has been carefully washed. When the tubes have been flush painted in this manner, they are allowed to dry and baked to remove solvent.

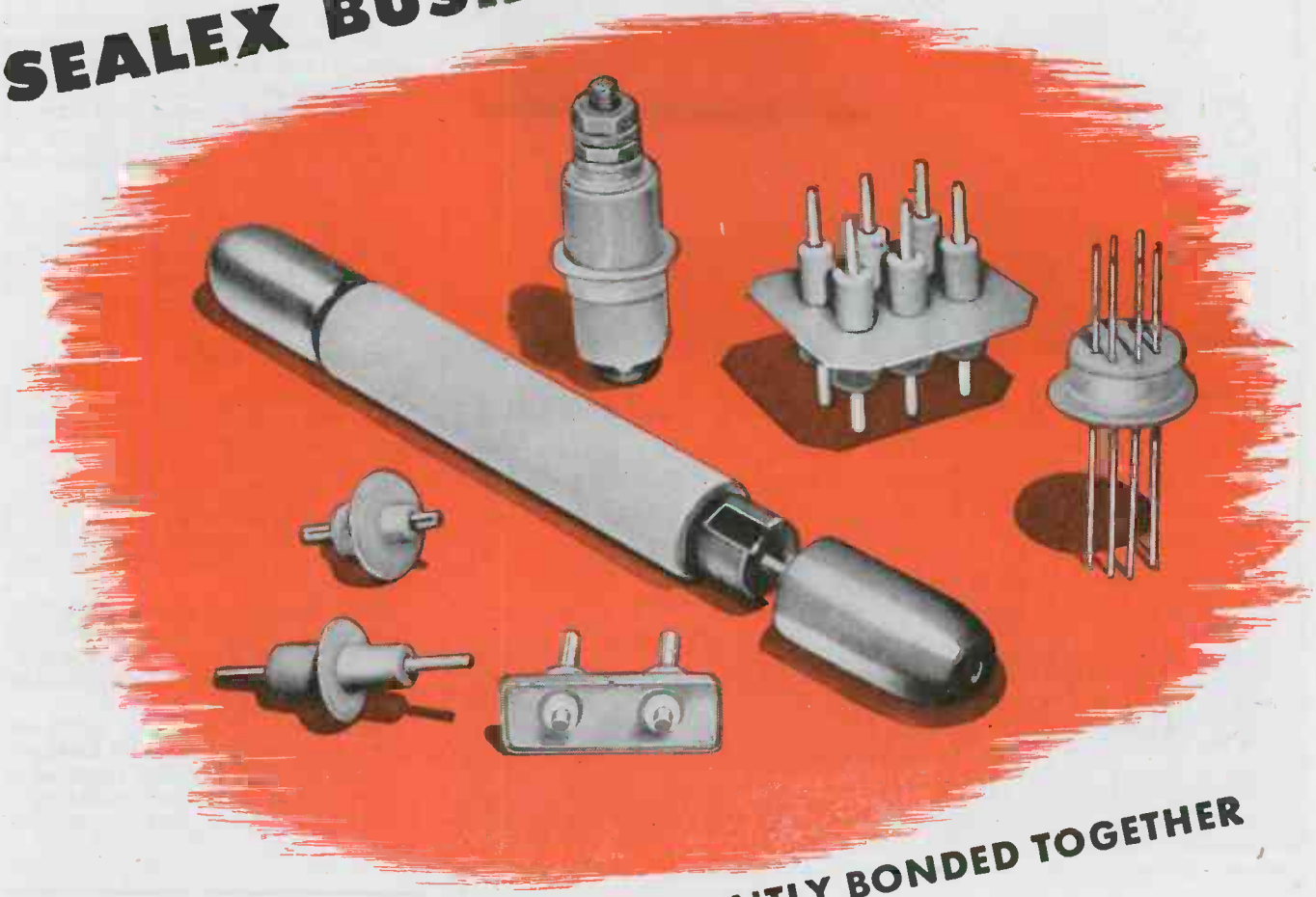
In the new method the tube is slipped over an ionizing wire and a high potential placed between wire and the tube. A smoke of the dry phosphor is made and blown through the tube. The phosphor particles are ionized positively and are driven by the strong electrostatic field to the glass walls where they give up their charge and adhere firmly and permanently to the glass. A subsequent treatment with a blast of moisture-saturated warm air smooths the inner surface.

The electrostatic method has several advantages, both to the user and to the producer of the lamp. A gain of 3 to 4 per cent in light efficiency is obtained. This results from the greater uniformity of phosphor distribution. By the new method phosphors are automatically laid on evenly. The ionized dust particles strike the glass, give up their charge, and immediately become insulating, leaving only uncovered areas to attract more dust. By the liquid-flow method, the draining end of the tube, of necessity, gets more phosphors than the upper end. The distribution of the phosphor, therefore, cannot be designed for maximum energy transformation.

Also, with the electrostatic method the tubes do not have to be treated at as high a temperature, which means less phosphor deterioration.

Tubes now do not have to be washed, as any clinging tiny dirt

SEALEX BUSHINGS



STEATITE AND STEEL PERMANENTLY BONDED TOGETHER

● SEALEX Bushings developed by General Ceramics and Steatite Corporation are the answer to the problem of hermetically sealing all types of communication equipment.

SEALEX Bushings will contain air at 50 pounds per square inch after a thermal change test of 25 cycles from −65°C to +125°C.

Available in single terminal and multiple terminal designs for high and low voltage requirements. Write for catalog.

Contact General Ceramics and Steatite Corporation for help in solving your hermetic sealing problems.

SALES REPRESENTATIVES

H. W. GEBHARD
737 No. Michigan Ave., Chicago, Illinois
J. J. PERLMUTH & ASSOCIATES
942 Maple Avenue, Los Angeles, Calif.
MICA COMPANY OF CANADA LTD.
P. O. Box 189, Hull, Quebec

ARMY E NAVY

General Ceramics AND STEATITE CORP.

GENERAL

KEASBEY NEW JERSEY

speck does not show. But with the flow method, a small spot of dirt becomes an island and the eddies of fluid around it leave their mark.

Using dry phosphors eliminates both the problem of handling liquids and the hazard attendant to volatile solvents.

This method can be used for any shape lamp. For curved lamps the phosphor dusts are preionized and blown into the empty tube.

Electrostatic precipitation of phosphor dusts marks another step on the road to superior illuminants and another triumph for a most useful engineering principle.

Calling All Cabs

The following news item, direct from the wires of Associated Press, may foreshadow the accepted modus operandi of the future:

"Cab No. 742 calling W8XAI. Contact Charity Hospital and have bed prepared for emergency maternity patient . . . Can you hear me, W8XAI?"

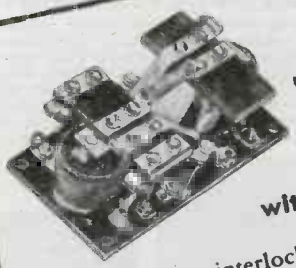
Paul Vergin, veteran Yellow Cab taxi driver, took a quick glance into the rear view mirror—yes, his passenger was a little nervous, but apparently all right.

He tuned his two-way radio set to transmitter W8XAI, and listened:

"Cab No. 742, Charity Hospital is standing by for your passenger."

Vergin sighed and mumbled:

FIVE OF THE 5,312 RELAY TYPES



A NEW "MEMORY" RELAY

with simplified interlock

A new style interlock represents latch-in relay construction in its simplest, most dependable form. Design of this Struthers-Dunn 50XBX series simplifies make-before-break, or break-before-make contact combinations. Contacts do not interrupt coil circuit until the "throw" is completed and they are latched in new position. Built to aviation specifications.

VACUUM SWITCH KEYING RELAY

The extreme reliability with which this Struthers-Dunn Type 78CCA100 Vacuum Tube Keying Relay holds its adjustments is the direct result of a rigid and simplified design utilizing an absolute minimum of parts. Exceptionally sturdy—designed for aircraft. All parts readily accessible.

7 poles including one D.T. pole handling high-voltage r-f currents by means of a vacuum switch. High-voltage parts rounded to reduce corona.

SENSITIVE SNAP-ACTION

in a new, simplified design

Applications for the Struthers-Dunn Type 79XAX Sensitive Snap-Action Relay range from vacuum tube circuits, to overcurrent protection, pulsing circuits, and jobs where extremely close differential or extreme sensitivity are required. Contacts remain in position *with full pressure* up to the instant of transfer. Write for Bulletin No. 251.

SHOCKPROOF to 90 G's

Here's a relay that won't operate unintentionally as a result of shock or vibration—the Struthers-Dunn Type 17AXX designed to meet exacting B2A specifications. Small in size, light in weight, it meets and exceeds all specifications for such services.

WRITE—*for your copy of the big Struthers-Dunn Relay Catalog and Data Book . . .*

EXTRA HEAVY-DUTY CONTACTS

Struthers-Dunn Nutcracker Type 61HXX100 meets the call for relays for extreme services, particularly where severe overloads may cause trouble on units having a less generous heavy-duty contact safety factor. Typical applications include those such as aircraft landing light controls, or controlling a number of solenoids simultaneously. Readily adaptable to different specifications.

STRUTHERS-DUNN, INC., 1321 ARCH ST., PHILA. 7, PA.

STRUTHERS-DUNN

5,312 RELAY TYPES

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND DALLAS • DENVER • DETROIT • HARTFORD • INDIANAPOLIS • LOS ANGELES • MINNEAPOLIS • MONTREAL NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

"Guess these new things are gonna be all right."

Jesse T. Smith, president of Yellow Cab Co., of Cleveland, Inc., gave this incident as "a good example of how we've used these two-way radio equipped cabs."

"Getting a doctor to his patient and calling hospitals to prepare for an emergency victim will be only a matter of contacting our transmitter under this setup," he said, adding:

"The 90-day experimental period granted by the Federal Communications Commission ended Dec. 26. It has been so successful we have applied for an extension and for eight or ten additional units."

The present experimental installation consists of a stationary transmitter located in an uptown building, station W8XAI. The two cabs furnished with sending and receiving equipment have call letter W8XAJ and W8XAK.

"From experiences recorded in this period, we think the radio sets will greatly benefit the cab business, the public, and the drivers, too. Service is stepped up and savings on tires, gasoline and equipment are tremendous.

"A fleet of radio-equipped automobiles could double or triple the present number of completed trips (3,000 daily) with a minimum waste of time and mileage." Initial cost for the equipment is $600 per unit, he said, but improved service would soon absorb this cost.

Bus-Truck Lines Seek Radio Frequencies

A number of applications for experimental radiotelephone systems for urban vehicular and bus and trucking communications are before the FCC, and Commission decision on these projects may not be handed down until the allocations plan has been determined. In addition, the FCC is expected to weigh a policy question of whether a single existing or new public service company should handle the urban and public highway mobile radiocommunications services.

It is speculated that, if a fusion of the highway and urban mobile services should be placed under a single public service communications company on the basis of a national or localized scale—either the telephone companies or a new agency—it might well serve the railroad terminals and yards as a means of conserving frequency space.

In the meantime, the Association of American Railroads is giving careful consideration to the proposal of the AAR Telegraph and Telephone Section for the establishment of a central radio-communications engineering committee

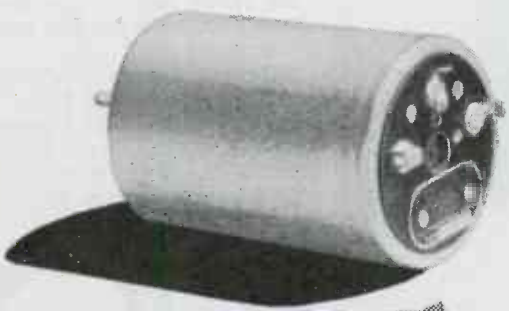
EAD

Now Available

CENTRIFUGAL BLOWER UNITS AND MOTORS

MODEL J50A BLOWER UNIT
60 CYCLES
115 VOLTS

Delivers 10 cu. ft. per minute of free air. Weight 2.15 oz. Overall diameter $3\frac{11}{16}$". Overall length $4\frac{1}{16}$".



POWERED BY MODEL J49C
60 CYCLES 115 VOLTS 1/300 H.P.

Weight 16 oz. Diameter $1\frac{3}{4}$". Length $2\frac{11}{16}$".

OTHER E. A. D. MOTORS

MODEL J31A—400 Cycles. 115 Volts. 1/100 H.P. Weight 15 oz. Diameter $1\frac{15}{16}$". Length $2\frac{29}{32}$".

MODEL J33D—400 Cycles. 115 Volts. 1/50 H.P. Reversible motor for intermittent duty or continuous fan duty.

MODEL J71 — 60 Cycles. 115 Volts. 1/50 H.P. Continuous duty. 3 lbs. diameter $3\frac{5}{16}$". Length $3\frac{1}{8}$".

MODEL J72 — 400 Cycles. 115 Volts. 1/15 H.P. Weight 3 lbs. Diameter $3\frac{5}{16}$". Length $3\frac{1}{8}$" for intermittent duty or for continuous fan duty.

OTHER CENTRIFUGAL BLOWER UNITS

MODEL J53—28 Volts, D.C. — Delivers 22 C.F.M.

MODEL J57—60 Cycles. 115 Volts. Centrifugal Blower. Delivers 110 C.F.M.

MODEL J80A—60 Cycles. 115 Volts. Axial flow. Delivers 65 C.F.M.

MODEL J51 BLOWER UNIT

400 CYCLES, 115 VOLTS

Delivers 22 cu. ft. per min. of free air. Weight: 21.5 oz., Diameter $3\frac{11}{16}$", Length $4\frac{9}{32}$".

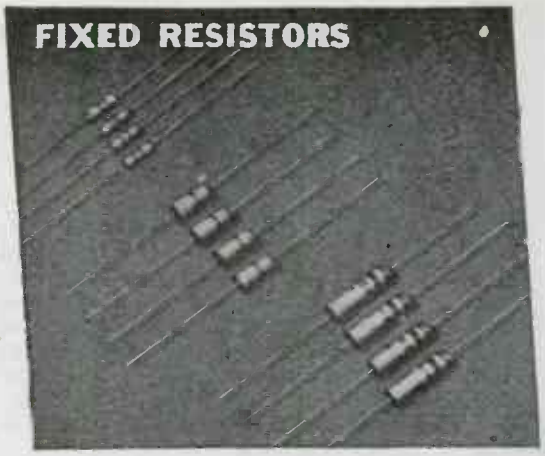
EASTERN AIR DEVICES, INC.
An Affiliate of the Fred Goat Co., Inc., Est. 1893
589 DEAN STREET, BROOKLYN 17, N. Y.

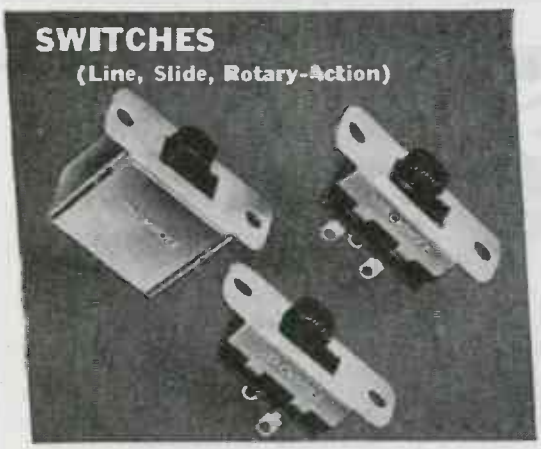
to coordinate the plans and expansion of railroads for use of radio and inductive train communications systems, but the Association has not yet reached a final decision.

Among the applications recently received by the FCC was an interesting experimental device of the Bendix Aviation Corp.'s Radio Division for the broadcasting of railroad crossing warnings to motor traffic. This plan would be similar to the warning system, it was indicated from FCC sources, in use at the Bear Mountain Bridge in New York. The Bendix device would be low powered with 2 watts and would be on frequencies between 35 and 45 mc and 60 and 75 mc.

The Southwestern Bell Telephone Company has filed applications for two experimental systems for urban mobile service at St. Louis and Houston, using 250 watt land stations with FM and 12 experimental portable mobile stations with 15 watt transmitters at St. Louis and six portable mobile FM stations at Houston. The frequencies sought are 116.35 mc for the land stations and 118.35 mc for the portable mobile stations.

Bendix Radio Division received approval from the FCC Dec. 19 for one portable Class 2 coastal harbor station on the Great Lakes and two portable mobile ship stations to be located on board the Pere Mar-





WRITE FOR YOUR COPY!

...for today's needs ...for post-war planning

USE this new 1944 Stackpole Electronic Components catalog as your guide to up-to-the-minute Fixed or Variable Resistors; Iron Cores; and inexpensive line, slide, or rotary-action Switches. In addition to *complete* information and dimension diagrams on the components, you'll find data pages and charts that will prove mighty handy in your daily work. Please ask for Catalog RC6.

STACKPOLE CARBON COMPANY, ST. MARYS, PA.

STACKPOLE

BRUSHES FOR ALL ELECTRICAL ROTATING EQUIPMENT • CONTACTS
WELDING RODS, ELECTRODES, AND PLATES • CARBON PIPE • BRAZING BLOCKS • RHEOSTAT PLATES & DISCS
CARBON REGULATOR DISCS • PACKING, PISTON, & SEAL RINGS • SINTERED IRON COMPONENTS, ETC.

quette railroad car ferries operating on frequencies 116,350, 118,350, 156,-525, 161,325 and 161,775 kc with 10 watts power, to experiment in the radiotelephone dispatching of car ferries and operation of trains in connection with the ferries.

An application has been filed by Bendix Radio for proposed experimental stations of the Greyhound bus lines in Southern California, comprising 12 land stations and four portable mobile stations, using A3 emission with 50 watts power for the fixed stations and 5 watts for the portable mobile and 5 experimental frequencies in the 150 megacycle band.

Air Associates Inc. has applied for an experimental system to handle communications of interstate trucks in Southern California hauling perishable goods, seeking one land station with 45 watts and two portable mobile with 10 watts and using A1, A2 and A3 emission with 16 different frequencies ranging from 116 to 162 mc.

The Turner Motor Delivery Ltd. of Los Angeles is seeking one land station and two portable mobiles using 118.25 and 156.525 mc. The Bowen Motor Coaches have filed for two land stations at Fort Worth and Houston and one portable mobile using 2,398 kc and 300 watts power for the land stations and 100 watts for the mobile station and A3 emission.

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with these versatile WESTON Test Instruments

The Multi-Purpose, Super-Sensitive Analyzer

(MODEL 772)

A compact and practical wide-purpose instrument with sensitivity of 20,000 ohms per volt, or 1000 ohms per volt, on dc ranges.

Ranges — all self-contained

Voltage, a-c and d-c — 0-1000/250/50/10/2.5.

Current, d-c — 0-10/1 amps. — 0-250/50/10/1 milliamps. and 100 microamps.

Ohms — Full Scale — 30/3 megohms — 30,000/3000 ohms. Center Scale — 250,000/25,000/250/25 ohms.

Decibels — −14 to +2, −2 to +14, +12 to +28, +26 to +42, +38 to +54.

(Voltages up to 5000 dc available through use of external WESTON Televerter, Model 766.)

The Direct-Reading, Self-Contained INSULATION TESTER

(MODEL 796)

This compact direct-reading resistance tester eliminates hand cranking and thus makes leakage testing a simple one-man job especially in unaccessable places. Tests up to 200 megohms at test potential of 350 to 500 volts d-c; although, the current at terminals is only a few microamperes. Operates from long life, light-weight batteries. There are no vibrators to replace. Ranges: 0-20-300 megohms full scale; 0-.5-5 megohms center scale. Size 8" x 9⅛" x 8".

The Industrial Circuit Tester

(MODEL 785)

Recognized as the most complete unit for routine maintenance tests, and for testing needs which require an ultra-sensitive instrument.

Ranges all self-contained

D-C VOLTAGE . . . Six Full Scale Ranges of: 1/10/50/200/500/1000 volts (20,000 Ohms per volt).

A-C VOLTAGE . . . Six Full Scale Ranges of: 5/15/30/150/300/750 (1,000 Ohms per volt).

D-C CURRENT . . . Six Full Scale Ranges of: 50 Microamps . . . 1/10/100 Milliamps. . . . 1/10 Amps. (Higher ranges, at half scale reading, with 100 mv. external shunts).

A-C CURRENT . . . Four Full Scale Ranges of: .5 1/5/10 Amperes. (Higher Ranges with external current Transformers.)

RESISTANCE . . . Five Full Scale Ranges of: 3,000/30,000/300,000 Ohms . . . 3/30 Megohms. Center Scale Values . . . 25/250/2,500/25,000/250,000 Ohms. (Self-Contained Batteries)

With production currently running slightly ahead of war requirements, a limited number of the popular WESTON test instruments shown herewith are available and are offered subject to prior sale. Orders can be placed direct, or with the WESTON representative in your vicinity. Literature available from...WESTON Electrical Instrument Corporation, 666 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON
INSTRUMENTS

ELECTRONIC USES OF SILICONE INSULATION

● Dow Corning silicones, a new class of semi-inorganic high polymers based upon silicon and oxygen instead of carbon, are bridging the gap between the completely organic products on the one hand and the completely inorganic materials on the other. These new organo-silicon oxide polymers[1] are now available in a variety of physical forms and were described in considerable detail by Shailer L. Bass, Director of Research, Dow Corning Corp., and T. A. Kanppi, Manager of Product Engineering of the same company, before the annual Rochester meeting in November.

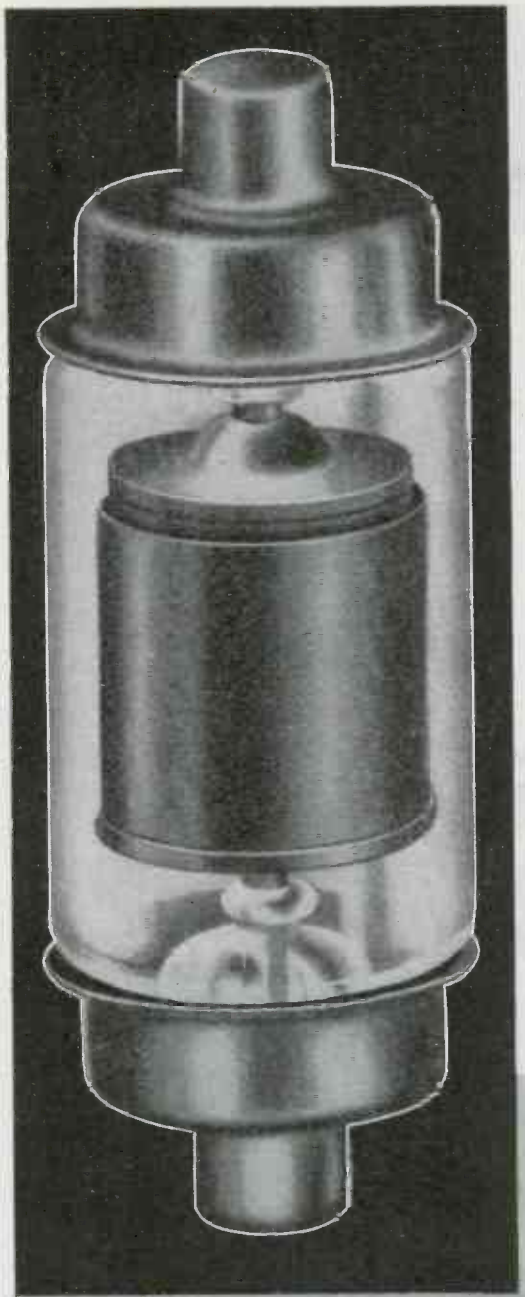
Sand provides a source of silicon which when heated with coke and chlorine forms silicon tetrachloride. One or more chlorine atoms in silicon tetrachloride are then replaced by hydrocarbon radical to produce a variety of organo-silicon chlorides. These are treated with water to remove all the chlorine and the by-product, magnesium chloride. The silanols so formed condense with each other to build up large molecules in a manner similar to the hardening of a silicic acid gel or the setting of a phenol-formaldehyde resin.

In general, silicones extend the range of service temperatures well beyond the limits of thermal stability of conventional organic materials in the same physical form. Their heat resistance, their general inertness, and their good dielectric properties are due in large part to the fact that they are built upon interlacing structures of silicon and

[1] Chem. & Eng. News, 22 1134 (1944); Chem. & Met. Eng. 51, 66, 138 (1944)

DIELECTRIC PROPERTIES OF TYPICAL DOW CORNING FLUIDS
(at 25 deg. C. and 50 per cent relative humidity)

	Type 500, viscosity = 3 centistokes		Type 200, viscosity = 350 centistokes	
Frequency Cycles	Dielectric Constant	Power Factor	Dielectric Constant	Power Factor
10^2	2.412	.0001	2.74	.0001
10^3	2.41	.0001	2.73	.0001
10^6	2.405	.0002	2.72	.0002
10^7	2.40	.0002	2.71	.0002
10^8	2.39	.0002	2.70	.0006



Jennings RADIO

NEW HIGH VACUUM

VC 50 TO 250 JENNINGS CAPACITORS

FOR FASTER, CLEANER AND MORE UNIFORM INDUCTION HEATING

Westinghouse

has incorporated the Jennings High Vacuum Capacitors in their standard radio frequency generating and control equipment, ranging in frequencies wide enough to meet all probable dielectric and induction heating needs.

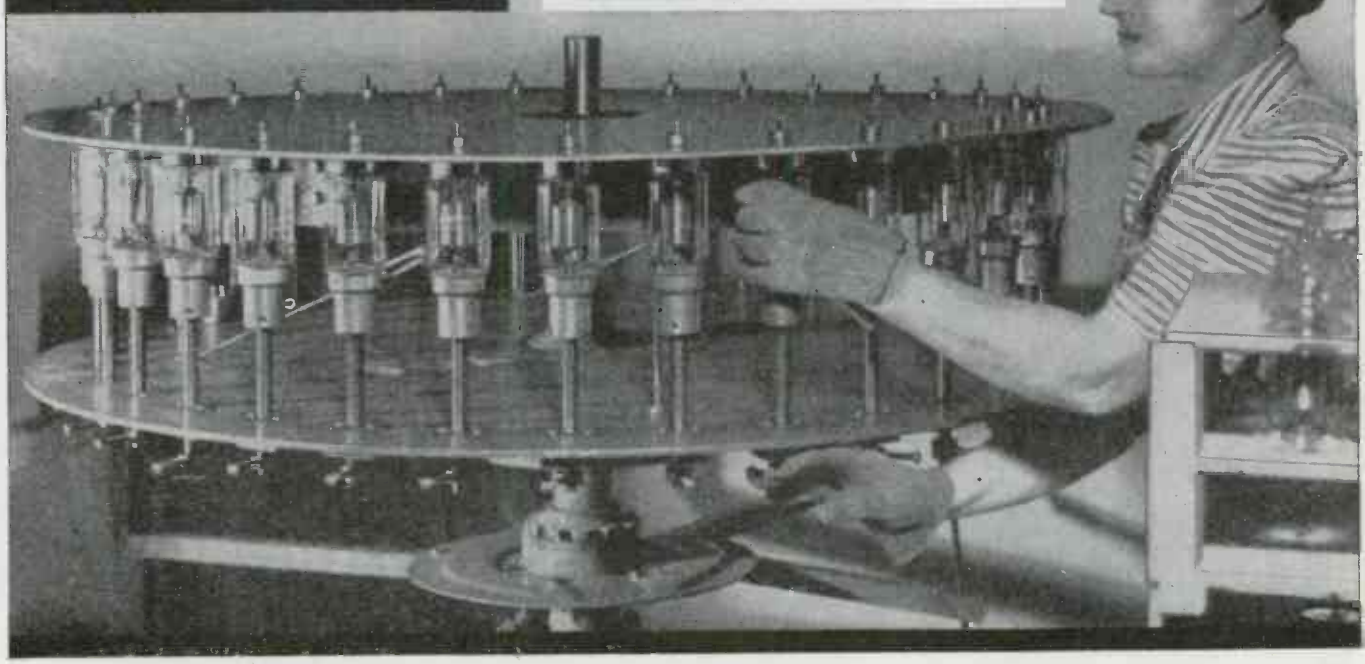
TROPICALIZE *your equipment with Jennings Capacitors*

Literature will be mailed on request

JENNINGS RADIO MANUFACTURING COMPANY
1098 EAST WILLIAM STREET
SAN JOSE 12 • CALIFORNIA

Transmitting Tubes and Vacuum Condensers

PHOTOGRAPH SHOWS OPERATION OF ROTARY BASING MACHINE FOR JENNINGS CAPACITORS



oxygen atoms similar to those existing in vitreous silica. Most of the structural types shown there can be duplicated in the silicones.

During the search for glass-like silicone polymers, a series of water white, odorless, inert liquid silicones was discovered and was one of the first families of silicone polymers to reach commercial production. Before the war, these new liquid silicones were laboratory curiosities chiefly interesting for their unusual combination of properties.

Dielectric strength

Their dielectric strength is 250-300 volts per mil at 100 mils. Their volume resistivity is in the order of 10^{14} and does not drop below 10^{12} at 200 deg. C. The low dissipation factors of these liquid silicones at elevated temperatures or at high frequencies and their inertness to moisture indicate them for use in liquid filled condensers.

All liquid silicones tend to wet and adhere preferentially to siliceous surfaces and the non-volatile higher viscosity types can be rather permanently absorbed. Use is being made of this property to produce water-repellent surfaces on glass and ceramic insulator forms. Articles so treated have a highly water repellent surface and when the insulator is exposed to high humidities under condensing conditions,

the silicone film prevents the moisture from forming a continuous liquid film over the surface.

A translucent silicone grease of vaseline-like consistency has been developed for use as a lubricant for ignition cables, to reduce corona cutting of the insulation and to permit easy wiring of ignition harnesses. It is stable to heat and retains its vaseline-like consistency from —40 deg. C. to 200 deg. C., and generally is inert and resistant to oxidation. Although it is a soft grease in appearance, it has the unusual property of not melting on exposure to heat. It has no solvent effect upon synthetic insulations or rubber, and tends to prevent the hardening of these materials when heated in contact with air. It also produces a water repellent surface on high tension cables and provides an effective seal against moisture when used to fill disconnectable junctions.

The replacement of cotton, paper and other organic spacing materials by Fiberglas, asbestos and mica, has resulted in a considerable increase in heat resistance of electrical machines. However, full advantage could not be taken of the heat resistant properties of these inorganic insulations because of the temperature limitations of organic varnishes and impregnants.

Silicone varnishes

The introduction of silicone varnishes with their greater thermal stability is making possible a new class of electrical insulation—insulation in a class by itself not only for heat resistance but also for moisture proofness and for its ability to withstand tough service conditions. For example, a silicone varnish has been developed especially for high temperature insulation impregnation, type #993. It is used to bond Fiberglas or asbestos-served magnet wire, to varnish Fiberglas or asbestos tapes, cloths and sleeving, and as an adhesive for bonding mica sheets to silicone varnished Fiberglas cloth in the production of a flexible insulation.

This insulating varnish is applied and handled in a manner exactly similar to conventional organic varnishes except that higher baking temperatures are required. After drying off the solvent, the equipment is usually given an intermediate bake for 2 to 4 hours at 150 deg. C. after which it is cured for 1 to 3 hours at 250 deg. C. until the varnish becomes tack-free. This baking converts the silicone to a hard but flexible resin which effectively seals the equipment against moisture.

This silicone resin is not deteriorated by oil and is unusually re-

sistant to chemicals. The silicone aging curve is over 100 deg. C. higher than the organic varnish. Projected down to normal operating temperatures of the organic resin, this means much longer life for the silicone insulation, or a higher permissible operating temperature for the silicone at the same life expected of the organic varnish at a lower operating temperature.

The greater thermal resistance of high temperature insulation may be used to advantage in the following ways:

Thermal resistance

1. To prolong life of electrical equipment greatly in locations which are hot, wet or subject to severe corrosive conditions.
2. To give greater freedom from overload failures.
3. To permit increased horsepower output for a given size.

The higher operating temperatures made possible by high temperature silicone insulation also make possible higher output by simply adding more load on an existing design. Many types of electrical machines are larger and heavier than they would necessarily be if high temperature silicone insulation were used.

Sporadic E?

The Associated Press reports from Buffalo: Desk Lt. August Brose nearly jumped out of his chair at suburban Amherst police headquarters last night when a voice over his radio announced a grass fire.

"What is this anyway?" exclaimed the lieutenant, thinking of the 3 ft. blanket of snow that keeps Amherst's grass fireproof. Then he relaxed. "Miami," added the voice.

Amherst's new radio operates on the same wave length as the Miami police radio.

Airplane Cabin Temperature Control

A completely automatic system for temperature control of military and postwar civilian aircraft cabins has been developed by the Minneapolis Honeywell Regulator Co.

Regulating cabin temperatures has been a problem because in normal service an aircraft may move from one temperature condition into another perhaps 50-deg. different in a matter of seconds. Accurate anticipating means must be provided to compensate for such rapid changes. The new system utilizes electronic amplification of temperature signals, obtained from coils of resistance wire, and motor control to position mixing dampers

in the ducts leading to the plane's gasoline-burning air heaters.

The setup includes an "outside air compensator" or two small coils of wire in the ducts bringing outside air into the plane's heaters and to the cabin. Resistance vs. temperature changes in the wire are amplified for operation of the motor which positions the mixing damper for the correct proportioning of outside air to the heated air from the burners. The "cabinstat" is another coil, mounted in the passenger compartment. Its varying resistance "signal" is combined with that of the outside air compensators, so that the actual operation of the mixing dampers is the resultant of the several signals.

If the plane takes off while ground temperatures are 70-deg., no cabin heat is required. As the plane climbs, outside temperature drops rapidly. The outside compensator takes note of the fact at once and begins delivery of heat to the cabin, long before the cabin thermostat would have begun to operate. In traveling quickly from a cold to a warm area, as in descent, the cabin thermostat might be calling for heat, but the outside sensing element "knows" that less heat will be required and less heat is delivered.

Television Nomographs

Nomograph charts never before available, providing radio engineers with an invaluable tool in the design of equipment for the UHF and television ranges, have been issued by the Federal Telephone and Radio Corp., Newark, N. J., associate of the International Telephone and Telegraph Corp. The set now being offered, twenty-five in number, represents the beginning of a projected series of more than one hundred graphic aids to the designer of radio, UHF and television equipment. Six of the charts are for use in the design of double and triple tuned band-pass circuits in the UHF and television ranges, and provide a quick and easy means of answering the questions which arise in the design of such circuits. Two cover series and shunt-peaking methods of range extension in wide-band amplifiers; other charts relate to impedance characteristics in various types of transmission lines, including single wires in troughs and in square outer conductors; balanced two-wire and concentric lines, air-spaced, and with solid dielectric; quarter wave matching sections, and sending-end impedance in uniform lines.

Silver Soldering Contacts

Gibson Electric, 8362 Frankstown Ave, Pittsburgh 21, Pa., has published a new folder covering silver-solder-backed contacts in Gibsiloy and silver for brazing. The construction and advantages of solder

backed contacts and various methods of brazing are described. Listings and illustrations of standard forms and sizes in which solder backed contacts can be furnished are shown. Also illustrated are typical assemblies of solder backed contacts with various types of contact supports commonly used in electrical control apparatus. A table lists the characteristics of various Gibsiloy powder metal contact materials.

Mica Insulation

The Mica Insulator Co., 200 Varick street, New York, has published an 86-page illustrated manual on electrical insulating materials. The manual includes data, tables and values on sheet mica, built-up mica, laminated plastics, varnished cloth and tapes as well as miscellaneous insulating materials such as varnishes, twines and fiberglas.

RG Cables

A new Section "D" for the Amphenol complete catalog describing 26 different types of RG cables and also many companion high frequency connectors for UHF and electronic applications, has been issued by American Phenolic Corp., 1830 South 54th Avenue, Chicago. This catalog section brings up to date complete details and specifications governing the production of RG type cables as approved by the Army-Navy RF cable committee.

Electron Tubes

A wealth of engineering data on electron tubes of various sorts is included in a new file-bound catalog issued by General Electronics, Inc., 1819 Broadway, New York (factory at Paterson, N. J.) The book contains data and character-

PACIFIC HERO

Speeding radar production, Commander C. M. Wassel, addressed employes of the Lewyt Corp., Brooklyn, N. Y. President Alex M. Lewyt at left

istics on eight transmitting triodes, five mercury vapor rectifiers, five high vacuum rectifiers, two grid control mercury vapor rectifiers, four power amplifiers and two voltage regulators.

CBS Television Course

A special 60-week, three-part course in the operation of television studio and transmitter equipment, open to technical employees of the Columbia Broadcasting System was started Feb. 12, and is being given by the Division of General Education and College of Engineering of New York University, under direction of Dr. Peter Goldmark, CBS director of engineering research and development department, and Robert Serrell, member of CBS television engineering operations, assisted by Mason Escher, technical staffer representing the International Brotherhood of Electrical Workers.

The 25th-floor penthouse atop the CBS building at 485 Madison Ave., New York City, has been converted into a schoolroom for the 175 registrants, who have a choice of four sessions to attend—Mondays, Tuesdays and Wednesdays from 7:00 to 9:00 PM, EWT, and Thursdays from 1:00 to 3:00 PM, EWT.

Replies of the registrants to a questionnaire for curricular suggestions are reflected in the format of the new course, which was developed jointly by representatives of New York University, the Columbia network, and the International Brotherhood of Electrical Workers. An outline of the three parts of the course follows:

PART I—Review of mathematics and basic electrical theory titled "Electrical Circuit Theory for Television." Scheduled from the opening session, February 12, through June, 1945, and will be presided over by Dr. Irving F. Ritter, Professor of Mathematics at the College of Engineering. Professor Mario C. Giannini, Director of War Training at the College of Engineering, will address the opening session.

PART II—"Vacuum Tube and Communications Network Theory." Scheduled from September, 1945, to January, 1946.

PART III—"Television Theory and Practice." From February, 1946, to June, 1946.

Synthetic Wax

Acrawax C, which is a high melting point synthetic wax, has many uses in industry, quite a number of them being described in a 16-page booklet published by Glyco Products Co., 26 Court Street, Brooklyn, N. Y. The product is available in block form, in granule form and as a powder. Characteristics of the wax are included in the booklet.

Study Electronic Train Control

Experiments by the Rock Island Railroad in uses of radio communication for expediting freight traffic and for safety measures have proved their value, E. A. Dahl, electronic engineer in charge of the tests, said at the February meeting of the Collins Radio Technical Association at Cedar Rapids, Iowa. At the invitation of the CRTA members of the Iowa section of the AIEE were guests of the Collins company during a tour of the plant and at the dinner meeting.

Preceding the report by Mr. Dahl, a history of train control systems was presented by A. E. Ganzert, electrical engineer for the Rock Island lines. Beginning with the first system which utilized mechanical methods of tripping the air brakes on a train, Ganzert briefly described developments in automatic signals and controls. Early systems incorporated electromagnetic relays to operate signals in the engine cab. The rails formed part of the electrical system. These systems used a closed circuit; therefore were restricted by broken rails, broken wire, failure of power, or failure of any part of the system.

Signals were originated by wayside arrangements and were from a stationary point to a moving train. Polarized relays together with an "energy or no-energy" arrangement allowed a limited number of signals and signal lights to be used. Speed governors were used in conjunction with the electromagnetic signal system to indicate when the train was going too fast.

Coded current

In the latter part of 1943, centralized traffic control was installed on the Rock Island line between Blue Island and Rock Island, Illinois. This provides for signalling and reverse movements on main line tracks running in both directions.

A coded current system was developed by the Union Switch & Signal Co. In order to stay clear of 60 cycle fields present in some manufacturing districts, installations were made using 100 cycle and 140 cycle equipment. Various types of governors driven from the locomotive axle have been used to provide speed control through pneumatic equipment which became part of the air brake system.

More modern equipment is now available and is being used extensively, such as the coded current cab signal system now in use on the Rock Island railroad between Blue Island and Rock Island, Illinois. In this system 60 or 100 cycle current is applied to the rails, but interrupted 180, 120, or 75 times per minute through a code

transmitter at the wayside station to provide for the various cab signals. Locomotive equipment for such a system consists of a receiver at the front end of the locomotive, an amplifier, decoding relays, resonant units, acknowledging relay and switch, cab signal indicators, and a whistle.

In January, 1944, there were approximately 10,200 locomotives in the United States equipped for cab signals or train control.

In his description of his equipments, Dahl recounted the time saving of radio in railroading and predicted that radio will supplement the telephone, telegraph, and teletype communications in the highly developed technique of train operations; but said that those familiar with railroad problems "at the present time see no probability of radio superseding" these techniques.

On the basis of his work, Dahl said that the Rock Island is contemplating radio service in the fields of end-to-end train communication, yard service, communication between trains en route, on work equipment during emergencies, and stop-gap when wire lines are disrupted.

Radio contacts

Innumerable instances in which radio contact between engineer and conductor will save time were cited by Dahl, who made tests from a special railroad car along the Rock Island lines as he and his staff developed equipment and techniques in the past year. The greatest value will be found, he said, in speeding word on long trains or in poor visibility conditions when ordinary sight signals can not be used.

Communication with trains en route, from a fixed point, such as a tower or a station, is an entirely new service, providing supplemental service to written train orders and for relay from train to local station in case of breakdown or derailments. Dahl's developments also enable work crews on derricks, snow plows, or fire fighting equipment to make a radio link to the nearest wayside station, where wire lines complete the communication circuit. Units can also bridge gaps up to 15 miles in the wire lines, which may be disrupted by storms.

Dahl's experiments included carrier current on 175 kc, and radio on frequencies ranging from 40 mc to 2,700 mc. Extremely high frequencies are especially convenient for direct communications, since antenna lengths vary inversely as the frequency. Therefore, physical space necessary for antennas at high frequencies is small and the ultimate in antenna design may be used.

Not Much Short Wave Listening

Less than one of every twenty U. S. radio-listener families—or less than 2 per cent of the American public can be reached regularly by axis propaganda, even if all short-wave receivers were capable of receiving enemy programs. This fact was learned from a recent survey of radio listeners conducted by Sylvania Electric Products, Inc. Radio set owners in different parts of the United States and in different income groups were interviewed so that radio-listening habits could be determined as a guide to what the public will want most in the postwar.

The survey revealed that about 52 of every 100 sets now in use may be tuned to short-waves, although 37 per cent of them are never used for short-wave reception. Even among the short-wave listeners more than half said they listen rarely or occasionally and only ten per cent said they listened frequently. Evidently Americans have little or no interest in what the axis broadcasters have to say and so much if not all of the enemy radio propaganda falls on deaf ears.

During the last war there were no voice broadcasts but a powerful enemy station dot-dashed propaganda constantly. Civilian radio receivers were outlawed for the duration, while today many Americans can listen to the enemy if they want to but apparently most of them do not.

Radio's Greats

Great men are known in many cases quite as much for their idyosyncrasies and peculiarities as they are for the accomplishments. Discussing such things in "Radio's 100 Men of Science," author Orrin Dunlap, Jr., aptly describes several characters whose names are written large in radio history. Of them he says:

"Marconi — reserved, modest, punctual and neat; always the diplomat, moving within a small circle of his own choice, keeping his thoughts and observations much to himself, wondering when he might find a few leisure hours.

"De Forest—restless, enthusiastic; in his shirt sleeves testing some new idea in a maze of wires, oblivious to those waiting for him at the doorway; a good letter writer—a man who enjoyed the strife of life.

"Zworykin—quiet, daring, an outstanding scientist in electronics, telling of new wonders in television and no more excited about it than when relating his experience of being lost in the fog, skimming New York Harbor while flying his own plane; a genius with a good sense of humor. Ask him if he ever dreamed about electons and he

would answer, 'I sleep soundly!'

"Tesla — tall, mysterious octogenarian, seemingly disappointed with much of the past, looking with a cynical eye on the future, in his frock coat delivering a sermon-like talk on the ether, on light, on transmission of power by wireless, and on immortality.

Edison's eccentricities

"Edison—tireless, endowed with fine simplicities, broadcasting in an improvised glass studio in Madison Square Garden, throwing up his hands over his head as if surrendering to the mystery of it all, then smiling bashfully like a boy caught talking to himself as he hurries away from the microphone to sit alongside Mrs. Edison and his cronies, Henry Ford and Harvey Firestone.

"Sir Robert Watson-Watt—England's radar expert, visiting Radio City as the head of a distinguished British Scientific Commission; extremely friendly, radiating a quick sense of humor, most gracious in manner, the short, spectacled Sir Robert appearing more as the typical professor than a warrior of science who had done so much to save Britain from being blitzed to defeat."

Swedish Gold Medal to Dr. Alexanderson

Dr. E. F. W. Alexanderson, General Electric consulting engineer, was awarded the Cedergren gold medal on Feb. 9 by the Royal Technical Institute of Sweden. The award was formally bestowed upon the Schenectady scientist by Martin Kastengren, Swedish Consul General.

"It was around 1904 that Reginald Fessenden requested General Electric to build an alternator for a frequency — not of 60 cycles per second, nor of a few hundred cycles per second—but 100,000 cycles per second," Mr. Stockman said. "Everyone knew that such an alternator could not be designed, but Dr. Alexanderson seemed unaware of the fact, so he just went ahead and designed it. His alternator was tested in 1906 at Brant Rock in Massachusetts and became a great success. On Christmas eve of 1906 the Alexanderson alternator went on the air with voice transmission, and to those operators on ship and shore who happened to get this transmission in their earphones, it meant the advent of broadcasting. This story of the alternator reveals one of the outstanding characteristics of Dr. Alexanderson, the fact he is unafraid of difficulties and frequently does the seemingly impossible.

"About 1915 many alternators had been built and installed, and one 50-kilowatt Alexanderson alternator was installed in the Trans-

Atlantic Marconi company station at New Brunswick, New Jersey. Later a 200-kilowatt alternator was installed, making New Brunswick the most powerful station in the world.

"Ten years later, or about 1925, there were radio transmitters with Alexanderson alternators all over the world—in Dr. Alexanderson's native country Sweden, in Poland, England, Hawaii, and on both the east and west coast of this country.

25 years service

"It is quite interesting to note that the Alexanderson alternators at Rocky Point, that have faithfully served humanity for a quarter of a century, still are in practical use in competition with modern short-wave transmitters and cables, namely, when short-wave and cable communication break down during magnetic storms," according to Mr. Stockman.

"The alternator is not the only invention credited to the genius of Dr. Alexanderson, for there are 300 General Electric patents taken out in his name, covering a vast field of electrical engineering applications. Roughly speaking Dr. Alexanderson has taken out a new patent every seventh week over a period of 40 years."

Early television

Although most famous for his contributions to radio and electronics, Dr. Alexanderson has contributed many inventions to the field of power engineering. He and his laboratory associates have designed railway motors, converters, rectifiers, and electrical control equipment, including the amplidyne. He has contributed to facsimile and television. In 1928 he demonstrated home-television in Schenectady and in 1930 theatre television. This latter demonstration was at Proctor's theatre, where the orchestra was led by an image of a conductor projected from the research laboratory on a seven-foot screen.

Dr. Alexanderson has received many honors for his contributions. He received the Order of the North Star, from the hands of King Gustav V, the John Ericsson Medal, and recently the Edison Medal, highest award of the American Institute of Electrical Engineers. In 1934 he was elected to the Royal Academy of Science in Sweden.

"This Cedergren Medal is not only a tribute to Dr. Alexanderson as a scientist, but as well a recognition of him as a creator of good will and closer contact between two great democratic nations," Mr. Stockman said in concluding his remarks.

IRE-Building Fund Gifts Committee

In the campaign to secure donations of half a million dollars for a new building for the Institute of Radio Engineers in New York, Dr. W. R. G. Baker, vice-president of the General Electric Co., Bridgeport, Conn., heads the Initial Gifts Committee, other members of which are:

Brown, J. E., Zenith Corp., 6001 Dickens Ave., Chicago, Ill.

Buttner, H. H., International Tel. and Eel. Co., 67 Broad St., New York.

Beakes, W. E., Tropical Radio & Tel. Co., 1 Federal St., Boston.

Cummings, B. R., Farnsworth Telev. and Radio Corp., Fort Wayne, Ind.

Clement, Lewis M., Crosley Corp., Cincinnati.

Caldwell, Dr. O. H., Electronic Industries, 480 Lexington Ave., New York.

Diehl, W. F., Airplane and Marine Insts., Inc., Clearfield, Penna.

Eastham, Melville, General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

Forbes, H. C., Colonial Radio Corp., 254 Rano St., Buffalo.

Goldsmith, Dr. A. N., Consulting Engineer, 597 Fifth Ave., New York.

Henney, Keith, McGraw-Hill Pub. Co., 330 W. 42nd St., New York.

Hogan, J. V. L., Faximile, Inc., 730 Fifth Ave., New York.

Israel, D. D., Emerson Radio and Phono. Co., 111—8th Ave., New York.

Jolliffe, Dr. C. B., RCA-Victor Div., Camden, N. J.

Kahn, David, Brunswick Co., 244 Madison Ave., New York.

Kenney, M. W., Seeburg, J. P., Corp., 1500-1524 Dayton St., Chicago.

Luboke, H. R., Don Lee Broadcasting Corp., 3800 Mount Lee Drive, Hollywood.

Larsen, P. J., Society of Motion Picture Engrs., 1401 Sheridan St., Washington.

Lack, Fred R., Western Electric Co., 120 Broadway, New York.

Manson, R. H., Stromberg Carlson Co., Rochester.

Miles, Dr. L. F., Maxon, Inc., 570 Lexington Ave., New York.

Noble, Dr. D. E., Galvin Mfg. Co., 4545 Augusta Blvd., Chicago.

O'Reilly, Gordon, Aeronautical Radio, Inc., National Press Bldg., Washington.

Phelps, Don, General Instruments, Inc., 829 Newark Ave., Elizabeth 3, N. J.

Pratt, Haraden, Mackay Radio and Telegraph Co., 67 Broad St., New York.

Poorman, Earle, General Electric Co., 570 Lexington Ave., New York.

Poppele, Jack, Station WOR, 1440 Broadway, New York.

Pacent, L. G., Pacent Engineering Corp., 79 Madison Ave., New York.

Senauke, Dr. Alexander, Amperex Electronics Corp., 79 Washington St., Brooklyn, N. Y.

Warner, K. B., American Radio Relay League, 38 La Salle Road, Hartford, Conn.

Wise, Roger, Sylvania Electric Products, Inc., 500 Fifth Ave., New York.

Lewis, George, Federal Telephone & Radio, 591 Broad St., Newark.

Sparrow, Ray, P. R. Mallory Co., 3029 E. Washington St., Indianapolis.

Listener Checker

Two radio developments—one of which will be a device for registering radio listening habits and is a decided improvement over the recorder registered several years ago —were included in last week's U. S. Patent Office Gazette and both patents have been assigned to the Radio Corporation of America. The other invention would permit the automatic selection of a type of program and could be adapted to virtually every type of home receiver, but because it would necessitate the use of a subaudible frequency for distinguishing the types of programs a number of radio station directors were dubious about the widespread utilization of the invention. The radio listener recording device was described as relatively inexpensive to manufacture, install and to read.

New Quick-set Dial Drill Sharpener Eliminates Guesswork...Keeps 'em Drilling Faster—Longer

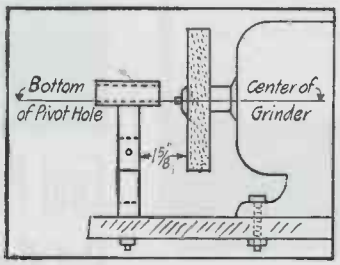
Attached to the Drill Sharpener, it adjusts drill edges to the proper angle for precision grinding, putting drill sharpening on a quick, efficient basis.

QUICK-SET DIAL easily and accurately adjusts Sharpener for sharpening drill from 5/32" to 1" sizes. Dial insures accuracy in measuring angles and clearances on twist drills, preventing trouble and making drills last longer. Dial-Set sharpened drills cut faster and more accurately, as the edges are alike and uniformly sharpened.

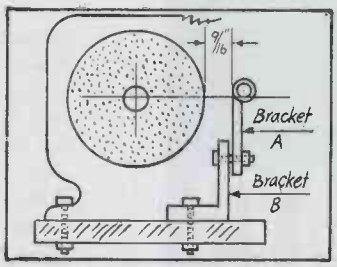
Precision built, calibrated and tested, unit is easy to set up and operate. Saves wear and tear on drill presses—prolongs drill life—cuts costs—improves quality—speeds output.

Another thing worth remembering is Wrigley's Spearmint Gum. That familiar red, white and green package which always meant "a help on your job." No more of this famous brand and flavor is being made for anyone now—even for the Armed Forces overseas—as Wrigley's stockpile of finest quality raw materials is all used up. But—remember Wrigley's Spearmint—The Flavor Lasts.

You can get complete information from Ameraco Industrial Specialties, 122 S. Michigan Ave., Chicago 3, Ill.



Front view of grinder



Side view of grinder

Z-59

Move Radar Division

The WPB Radio and Radar Division was moved middle of February from the Social Security building to the fourth and fifth floors of the Railroad Retirement building directly in the rear of the former structure. Director L. J. Chatten's office is Number 4006 in the Railroad Retirement building.

Edison Anniversary

Honoring the memory of Thomas Alva Edison by observing his 98th birthday anniversary, the Edison Pioneers paid tribute to the great inventor at a luncheon Saturday, February 11, at Hotel Astor, with Samuel B. Williams, editor of The Electrical World, as the principal speaker. Edison was born February 11, 1847, at Milan, O., and died October 18, 1931, at West Orange, N. J.

Aircraft Relays

Hart Mfg. Co., Hartford, Conn., which produces "Diamond H" aircraft relays and electrical control devices, has issued a new bulletin (30-D) covering its extensive line of relays. A quick reference index should be of valuable assistance in helping to locate units which will meet particular specifications. Dimensional drawings and engineering information on all types are included.

The House of KELLY

YOUR FOREIGN AND DOMESTIC DISTRIBUTION...

DISTRIBUTION of your products necessitates a consideration of foreign markets on the same plane as domestic. Now is the opportune time to become affiliated with an organization capable of handling the distribution of your line in markets all over the world.

Our organization, whose background covers seventy years of worldwide commerce, is interested in securing the export representation of manufacturers of quality products in the electrical and electronic fields.

Besides our facilities for export merchandising, our domestic sales network is available for securing immediate sales and distribution throughout the Metropolitan New York area, as well as all present export markets.

We would welcome an opportunity to analyze your distribution problems.

HENRY KELLY TRADING COMPANY, INC.

Distributors of Electronic and Electrical parts and equipment

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NON-CORROSIVE

Screw Machine Parts

MADE TO CLOSE TOLERANCES

DO your assemblies call for non-corrosive fastening devices or screw machine parts made to close tolerances? Allmetal has the "know how" and facilities to make such items accurately and economically, and to deliver them promptly. We have equipment for tapping, slotting, reaming, turning, stamping, broaching, drilling, threading and centerless grinding . . . and we work not only with stainless steel, but with monel, everdur, duralumin, brass, or other non-corrosive alloys. Write, wire or 'phone for our quotation.

Allmetal Screw Products Co.

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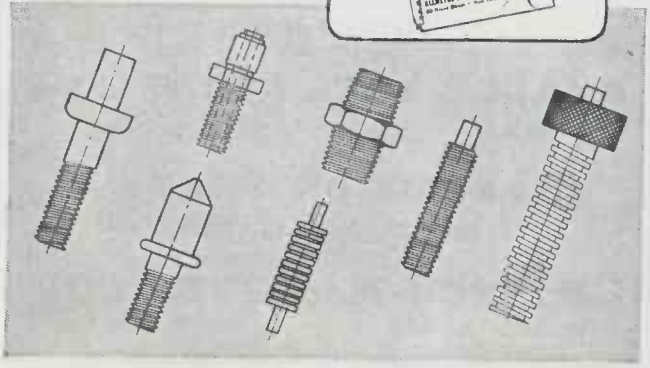
Send for FREE CATALOG

This new, 83-page catalog helps you select the correct size and type of non-corrosive fastening device for any particular job. Includes stock sizes, typical specials, engineering data, etc. Make request on company letterhead, please. Write to Dept. D



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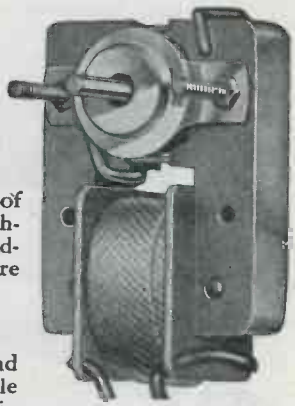
Condensed Power for Years of Service

VERSATILITY and dependability were paramount when *Alliance* designed these efficient motors—*Multum in Parvo!* . . . They are ideal for operating fans, movie projectors, light home appliances, toys, switches, motion displays, control systems and many other applications . . . providing economical condensed power for years of service.

Alliance Precision

Our long established standards of precision manufacturing from highest grade materials are strictly adhered to in these models to insure long life without breakdowns.



Model "MS"—Full Size Motor Measures 1¾" x 2 x 3⅛"

EFFICIENT

Both the new Model "K" Motor and the Model "MS" are the shaded pole induction type—the last word in efficient small motor design. They can be produced in all standard voltages and frequencies with actual measured power outputs ranging upwards to 1/100 H. P. . . . Alliance motors also can be furnished, in quantity, with variations to adapt them to specific applications.

New Model "K"—Full Size Motor Measures 2⅛" x 2⅜" x 3 3/16"

DEPENDABLE

Both these models uphold the *Alliance* reputation for all 'round dependability. In the busy post-war period, there will be many "spots" where these Miniature Power Plants will fit requirements . . . Write now for further information.

Remember Alliance!

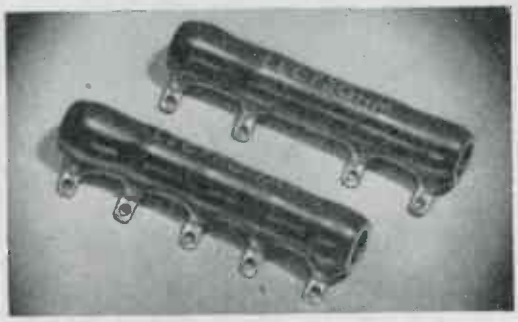
—YOUR ALLY IN WAR AS IN PEACE

ALLIANCE MANUFACTURING CO.

ALLIANCE . OHIO

SPECIAL RESISTORS

by Lectrohm



Developing new and special resistors to exacting specifications and for unusual applications is a full time specialty of Lectrohm engineers These units have the same quality silver soldered connections, by Lectrohm's own method, as the broadline of standard Lectrohm resistors, which includes fixed types, adjustable, ferrule terminal and "Rib-on-edge" Resistors, and Power Line and R.F. Plate Chokes. Standard tolerances of resistance are held to ±10%. Durable vitreous enamel coating embeds accurately spaced windings, connections and core making an integral unit capable of maximum performance. Send your specifications for recommendations and prices.

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ELECTRONICS

A complete line of a.c., d.c., and Universal motors; d.c. and all Freq. a.c. generators; motor-generators; converters; dynamotors; gas & Diesel Elec. plants; explosion proof units; Machines designed for every purpose.

COMPLETE ENGINEERING SERVICE

Our engineers will be pleased to discuss your problems and aid in the design of machines to meet your requirements.

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MORE RF KILOWATT HOURS PER DOLLAR WITH

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ELECTRONIC INDUSTRIES

Advertisers—March, 1945

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M-47

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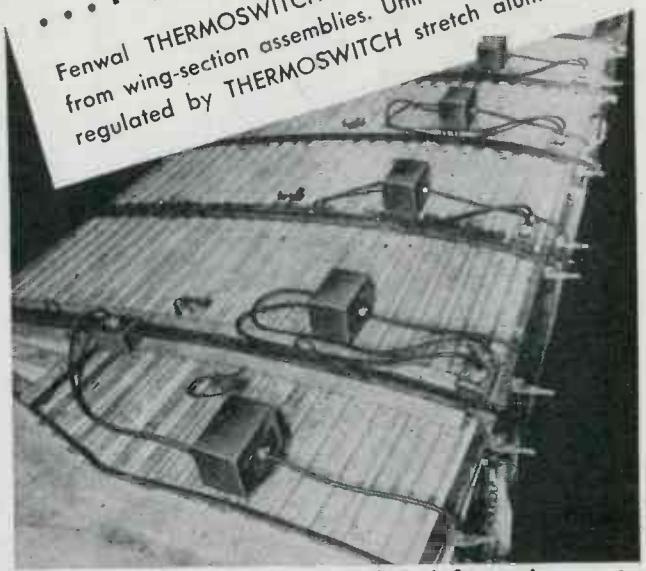
. . . requires temperature control

Fenwal THERMOSWITCH helps remove wrinkles from wing-section assemblies. Unit control heaters regulated by THERMOSWITCH stretch aluminum.



Write for catalogue and complete information . . . to

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EISLER EQUIPMENT
. . . the plus factor in tube manufacture

CHAS. EISLER specialized facilities are supplying high-efficiency manual, automatic and semi-automatic machinery for vacuum tube and electronic component production. Hundreds of devices are included — glass tube slicers, stem and sealing machines, flaring units, laboratory apparatus, etc.

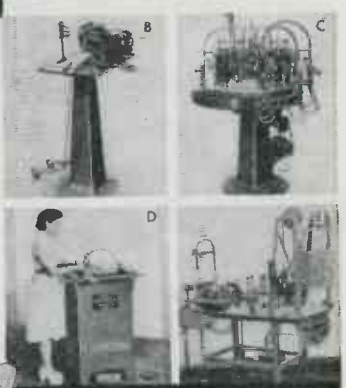
(A) No. 161-WH Glass Tube Constriction Forming Machine draws, rapidly, automatically.

(B) No. 16 - 2S Two - Head Bench Type Flare Machine. Capable of rapid, efficient production. Simple operation.

(C) No. 23-12LD, new type 12 head giant Tipless Stem Machine.

(D) No. 11-TU Glass Tube Slicer, makes clean, sharp cuts—does not require skill.

(E) No. 57-X Laboratory Unit for glass cutting, flaring, stem making, sealing-in, exhausting, basing.



Chas. Eisler

Eisler ENGINEERING COMPANY

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30 to 60 DAY DELIVERY
ON ATTENUATORS

We've progressed a long way from those early war days when, regrettably, deliveries were too often a hope and a promise. While we're not yet back to the luxury of filling many orders from the shelf, present production schedules assure prompt Daven Attenuator delivaries. Some standard models are available in small quantities for almost immediate shipment. 30 to 60 day delivery may be had on average quantities of most standard type Attenuators and many special types not requiring new engineering. Write for details on your specific requirements.

THE DAVEN COMPANY
191 CENTRAL AVENUE
NEWARK 4, NEW JERSEY

NEW FEATURES OF DAVEN ATTENUATORS

NEW DETENT GEAR: Large gear and roller mounted in recessed front end of cover, separate from resistive network, gives accurate indexing.

CERTAIN STOP: Extrusions of detent gear and steel attenuator cover form sturdy stop to rotation eliminating rotor-hub strain of previous method.

IMPROVED SHIELDING: Sturdy, snug-fitting steel cover affords superb electrical and dust shielding and greater all-around ruggedness.

CAPTIVE TERMINAL BOARD: Bakelite board held securely in position, readily released; new, heavy duty solder lugs.

ANTI-FUNGUS TREATED: On request.

SILVER ALLOY CONTACTS: Switch arm contacts and returns made of tarnish-resisting silver alloy lowers internal resistance. Other metals optional.

SEPARABLE COUPLINGS: (Feature of dual and multiple unit models) units easily separated for quick access to switch assemblies; simple, durable, foolproof.

SUPPORT THE RED CROSS ROLL CALL IN MARCH

NEW Xenon-Filled Thyratron

RCA 3D22

Moderately priced; rugged, single-ended construction; operates in any position; designed for relay and grid-controlled-rectifier applications, particularly those involving electronic speed-control of small D-C motors

¾-Ampere Average Continuous Current. The 3D22 is a sensitive, four-electrode thyratron conservatively rated to handle an average output of 0.75 ampere in continuous operation and a peak current of 6 amperes.

Single-ended, Sturdy, Compact Construction. Sturdily and compactly constructed for industrial service, the 3D22 is single-ended and requires no flexible leads for connections.

Control-Characteristic Stable Over Wide Temperature Range. Because Xenon gas is used, the control-characteristic is essentially independent of ambient temperature.

Low Preconduction Current and Low Control-grid Current. The low preconduction current and the low control-grid current permit the use of a high-value grid resistor to give increased sensitivity with a high-impedance circuit.

LIST PRICE **$10.75**

TECHNICAL DATA

ELECTRICAL

Heater for Unipotential Cathode:	
Voltage (A.C. or D.C.)*	6.3 ± 10% Volts
Current	2.6 Amperes
Tube Voltage Drop (Approx.)	10 Volts
Grid. No. 1 Control Ratio (Approx.)†	150

PHYSICAL

Mounting Position	Any
Maximum Overall Length	4⅞"
Maximum Diameter	2⅜"
Base	Medium Metal Shell Giant 7-pin, Bayonet

**Heater voltage must be applied at least 30 seconds before start of tube conduction.*
†For conditions with 0.1-megohm grid resistor and grid No. 2 volts = 0.
‡Averaged over any 30-second interval.

RELAY AND GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, Absolute Values

Peak Forward Anode Voltage	650 *max.*	Volts
Peak Inverse Anode Voltage	1300 *max.*	Volts
Peak Cathode Current	6 *max.*	Amperes
Average Cathode Current‡	0.75 *max.*	Ampere
Ambient Temperature Range	−75 to +90	°C

WRITE FOR ADDITIONAL DATA

MAIL TODAY!

RCA, Commercial Engineering Section
Department 62-29J, Harrison, N. J.
Please send bulletin on RCA-3D22 Thyratron, giving additional information for equipment-design purposes.

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RCA VICTOR DIVISION · CAMDEN, N. J.

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