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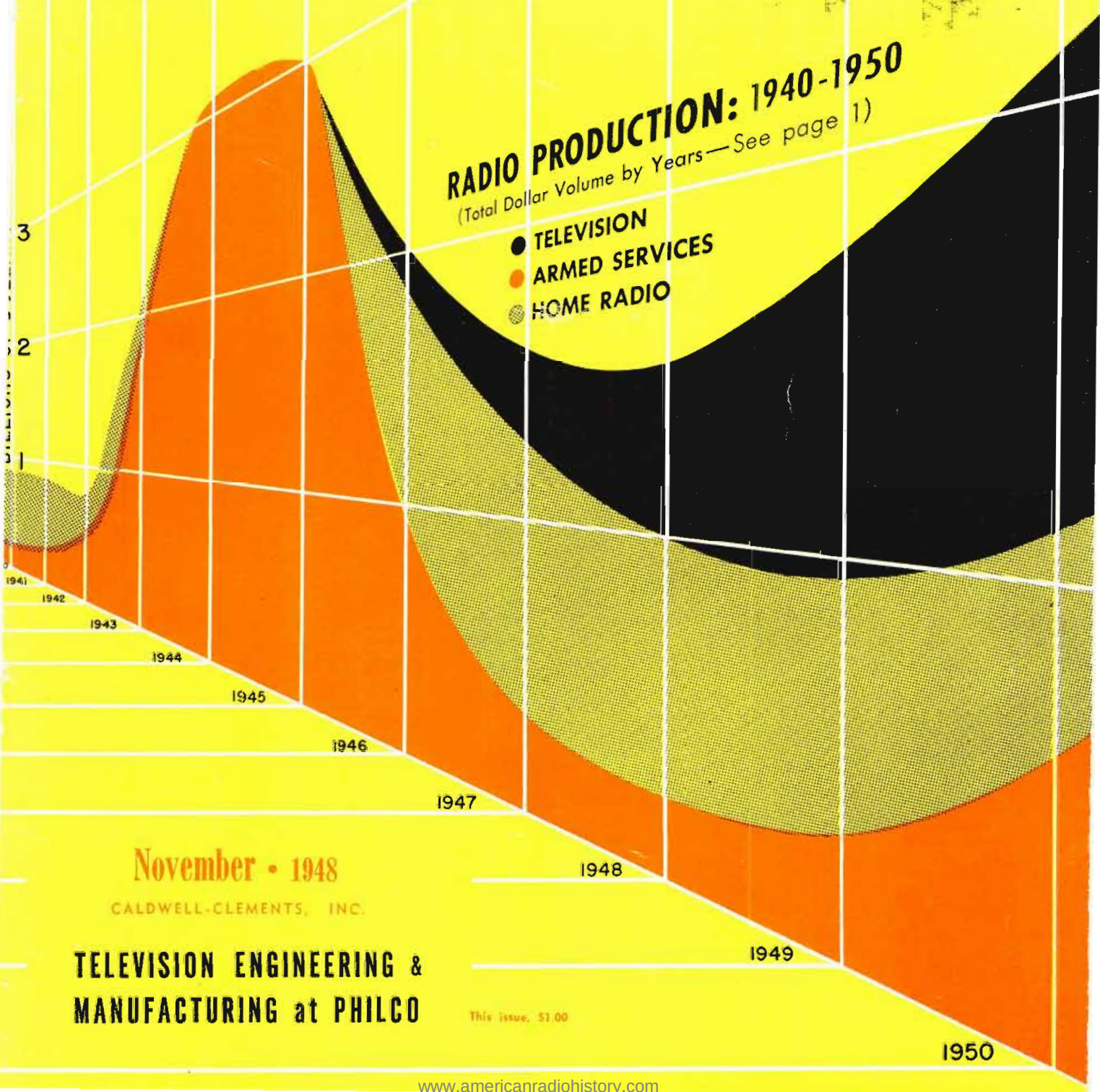

November • 1948

CALDWELL-CLEMENTS, INC.

TELEVISION ENGINEERING & MANUFACTURING at PHILCO

This issue, $1.00

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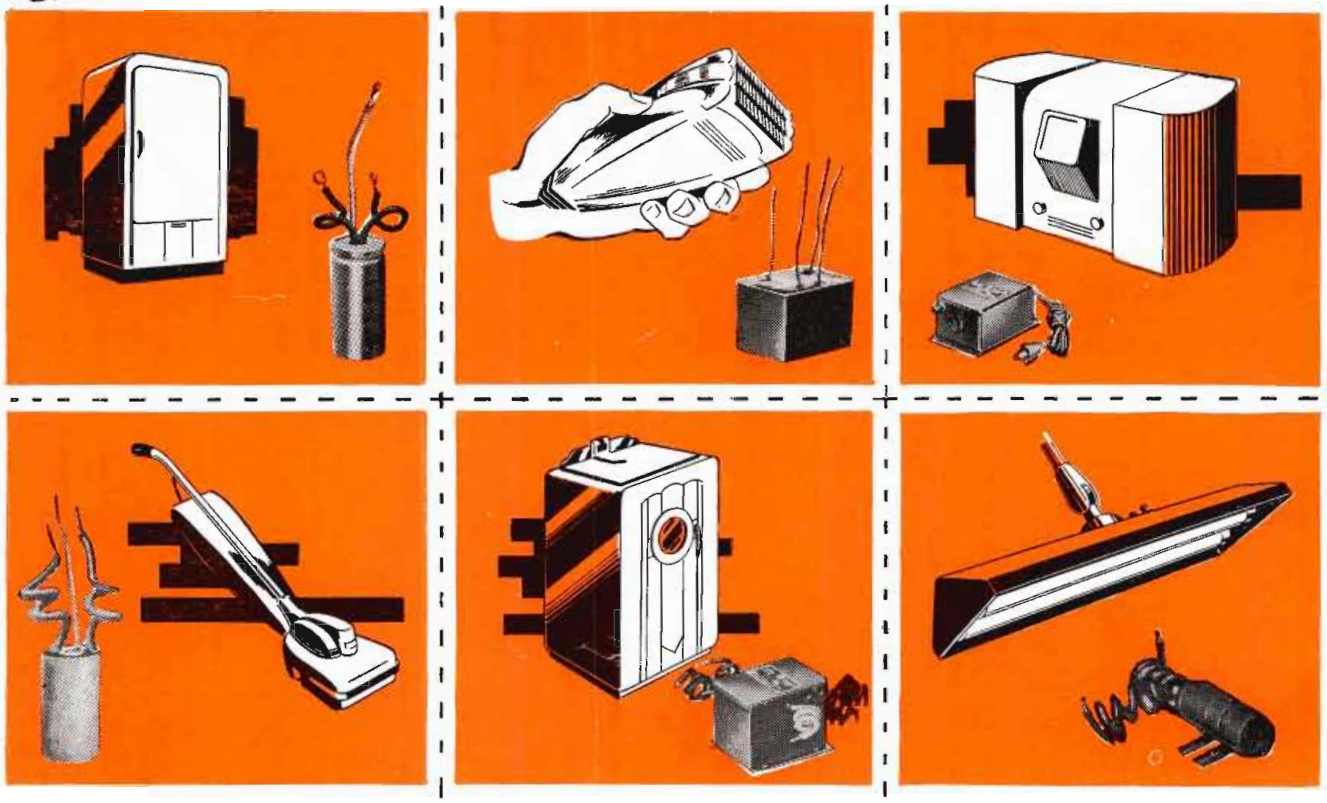

When we say Radio Noise-*Proofed*—we mean Radio Noise-*Proofed*. It's no trick at all to build a filter with high attenuation at 150 kc *or* 100 mc . . . but to build one which filters at 150 kc *and* 100 mc—*as well as all points in between*—is a horse of a different color. We know because we've done it. It is only one of hundreds of *available* types of C-D Quietones designed for all standard requirements.

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TELE-TECH

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NOVEMBER, 1948

COVER: RADIO PRODUCTION; 1940-1950—How Total Output for Decade Is Divided between Civilian Radio, Civilian TV, and Military Radio-Radar Equipment.

From left to right, this cover chart shows (1) the pre-war scale of home-radio production, (2) the tremendous rise of military radio production during the war years—with erasure of civilian radio, (3) the sudden cutback of military radio after V-J Day, with resumption of civilian radio, (4) the rising volume of television output, with eventual contraction of radio, and (5) the recent and future increases in military and defense radio-radar production. In this front-cover chart, civilian radio and TV are priced at retail levels. A corresponding graph on page 53 of this issue, shows the radio industry's output as divided between civilian radio, civilian TV, and military radio, but scaled at manufacturers' selling prices,—that is, direct gross income to manufacturers.

Editorial Contents

CALDWELL-CLEMENTS, INC., Publication Office, Orange, Conn., Editorial and Executive Offices 480 Lexington Avenue, New York 17, N. Y., Tel Plaza 3-1340

Publishers also of RADIO & TELEVISION RETAILING

The 1304 is *TOPS!*

TOPS in Reproduction quality—operating convenience

REPRODUCTION QUALITY? The Western Electric 1304 Set combines the 109 Type Reproducer Group with its extremely low intermodulation distortion and a unique new driving mechanism (shown in Fig. 1) that cuts flutter to a value lower than many standard recording equipments.

Even the small amount of flutter originating in the mechanism's simple gearing is damped in the novel filter of Fig. 2. Result: a flutter level, *including wow,* of less than 1/10 of 1% *at both 78 and 33-1/3 rpm.*

The platter has been isolated from the sources of rumble by means of the drive isolation coupling (Fig. 4), the fabric belt, and by mounting the entire drive mechanism on rubber vibration mounts (Fig. 3). The large drive pulleys, the use of large belt wrap around, and an adjustable spring loaded idler pulley prevent belt slippage problems.

OPERATING CONVENIENCE? Speed change-over at the throw of a switch. Acceleration to 33-1/3 rpm in *1/9 revolution*—to 78 rpm in *less than 1/2 revolution.* Rapid slowdown — no overdrive — convenient flange on platter for quick stopping.

And playing time variation is *less than ± 2 seconds in 15 minutes!*

Scientific placement of elements facilitates operation. An annular groove in the platter makes it easy to grasp edge of 10- or 12-inch records. 706A Guard provides automatic arm rest, keeps stylus from dropping on panel, catching in turntable felt, or striking edge of revolving platter.

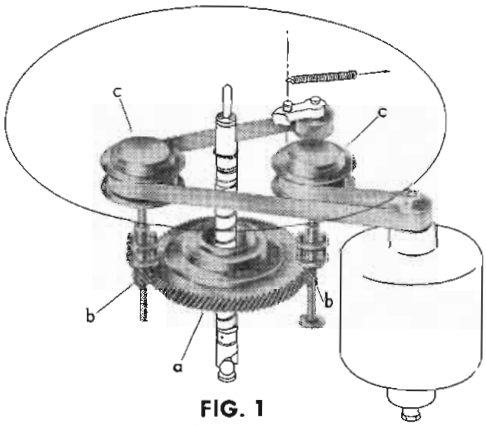

FIG. 1

A single helical ring gear (a), is permanently meshed with two pinion gears (b), each driven by an overriding clutch (c). Reversing direction of motor rotation disengages one overriding clutch, engages the other to change platter speed. Permanently meshed gears eliminate possibility of flutter caused by wear of engaging and disengaging.

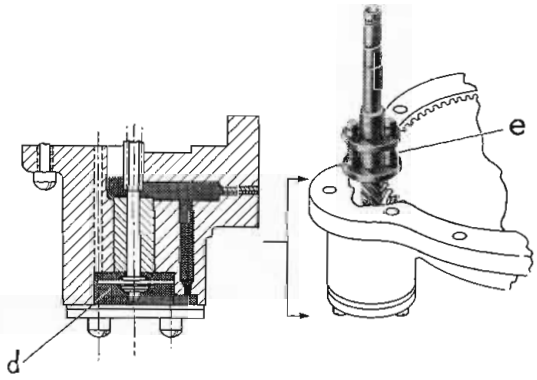

FIG. 2

As shown in cut-away view, a coupling (e) allows each pinion and associated shaft to move a short distance along its axis. The bottom of each pinion shaft projects into an oil-filled chamber (d) for damping axial motion. Because of the helical gearing and the high inertia of the turntable platter, irregularities in the drive tending to cause flutter are taken up and damped in axial motion of the driving pinion.

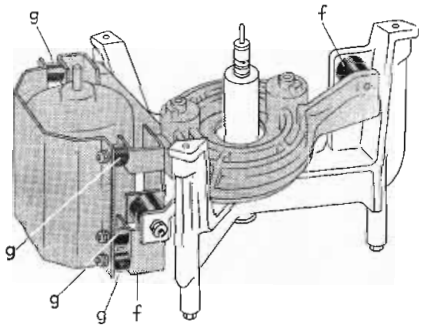

FIG. 3

The entire mechanism, including motor, floats separately from frame and platter shaft on three large rubber mountings (f). Motor, in turn, is isolated from the gear system by smaller rubber mountings (g) and the use of belt drive.

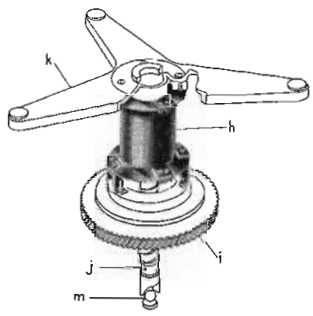

FIG. 4

Drive isolation coupling (h), provides the only connection between driving gear (i), platter shaft (j) and platter support (k), completing the separation of drive mechanism from platter. This coupling—very rigid in rotational plane, highly flexible in all others—transmits the driving motion, but isolates the rumble-causing motion. Platter and support ride on a hardened single ball thrust bearing (m).

TOPS in flexibility of installation

THE WESTERN ELECTRIC 1304 Type Reproducer Set is a single compact unit, readily adaptable to a wide range of installation requirements. It is available in a variety of cabinet arrangements to permit the greatest possible flexibility in installation.

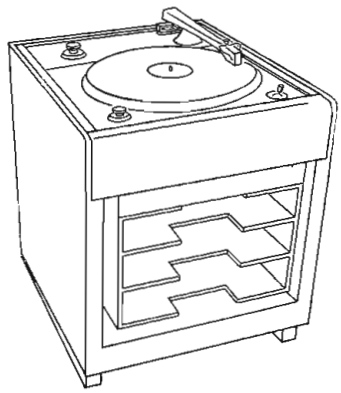

FIG. 5

The 1304 Reproducer Set includes a floor type cabinet with or without a removable door. The 701A Shelf is available which provides record storage space (Fig. 5), or the cabinet may be arranged for mounting standard amplifying equipment (Fig. 6). In either case, additional space for equipment is available at the rear of the cabinet.

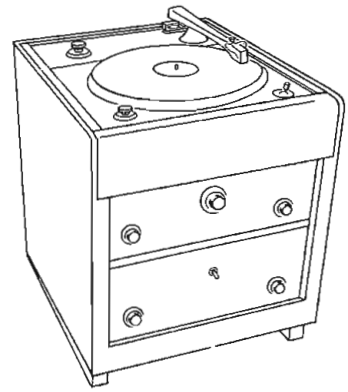

FIG. 6

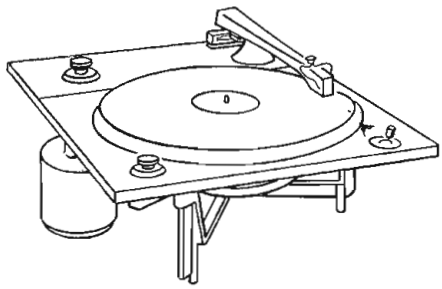

FIG. 7

If you want the superb reproduction and the operating convenience of the 1304—but prefer to use an existing table or a specially built cabinet—just specify the 304 Type Reproducer Panel. This is a complete panel unit, all ready to install, with exactly the same drive mechanism used in the 1304. The 109 Group with 706A Guard, on-off and speed-change switches and platter are all included.

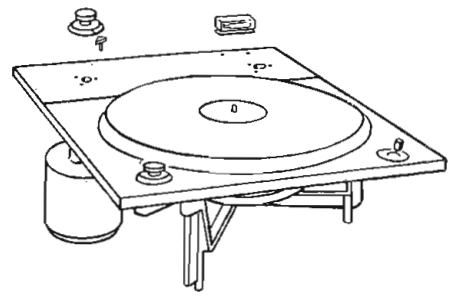

FIG. 8

You can also use the drive mechanism of the 1304 with your own reproducer group. The 305A Panel is drilled to take the 109 Type Group, and is furnished with 706A Guard, equalizer knob and the required hardware for mounting the 109 Type Group. The 305B Panel can be drilled in the field to mount reproducer groups other than the 109. (706A Guard and equalizer knob not included.)

For complete information on the 1304 Reproducer or Reproducer Group — or on the 304, 305A or 305B Panels — call your nearest Graybar Broadcast Representative. Or write Graybar Electric Company, 420 Lexington Avenue, New York 17, N. Y.

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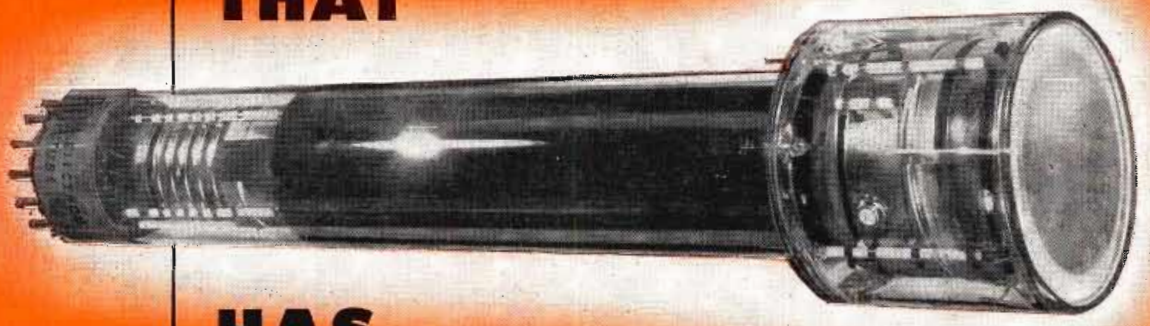
Tele-Tech®, November 1948, Vol. 7, No. 11. Regular price per copy 25 cents. Published Monthly by Caldwell-Clements, Inc., Publication Office Orange, Conn., Editorial, Advertising and Executive Offices 480 Lexington Ave., New York 17, N. Y. Direct all subscription inquiries to Orange, Conn., or to 480 Lexington Avenue, New York 17, N. Y. M. Clements, President; Orestes H. Caldwell, Treasurer. Subscription rates: United States and possessions, $3.00 for two years. Canada (Canadian Funds Accepted) $4.00 for two years. Pan American Countries $5.00 for two years. All other countries $7.50 for two years. Entered as second class matter June 9, 1947, at the Post Office at Orange, Conn., under the act of March 3, 1879.

Printed in U.S.A. *Reg. U.S. Pat. Off.

The 5655 has three sections: (1) Image, (2) Scanning, (3) Multiplier. The image section contains a semi-transparent photocathode on the inside of the face plate, and on this the scene televised is focused by an optical lens system. This causes the photocathode to emit a stream of electrons from each illuminated area (proportional to the light striking the area), and these are focused on one side of the "target" where they produce a charge pattern. The opposite side of the target is scanned by a low-velocity electron beam from an electron gun in the scanning section. Electrons from the gun are turned back at the target forming a return beam which has been amplitude modulated by deposition of the electrons at the target, in accord with the charge pattern whose more positive areas correspond to highlights of the televised scene. In the multiplier section, the return beam is directed to a 5-stage amplifier (using secondary emission to amplify electron beam signals), and here the modulated beam is amplified at least 300 times—to drive the first stage of the video amplifier.

THE TUBE THAT



HAS DONE MOST FOR TELEVISION HAS 95%

NICHROME* V

METAL PARTS

This is the RCA Image Orthicon 5655—super-sensitive eye of the television camera. Developed primarily for studio use and applications employing artificial illumination, it is several times more sensitive to light at low levels than the fastest motion picture film.

Only 15¼" long, it has over 150 precision-made parts, many assembled under microscopes.

These parts must remain unmagnetized by the strong magnetic fields of the focusing and deflection coils that surround the tube. Magnetized, they would produce fields of their own, and prevent proper operation.

When the parts are assembled, the glass housing of the tube is sealed. Temperature of the glass during sealing operations is raised to over 1600°F., temperature of the parts to as much as 900° F.

Under these conditions of manufacture, the alloy used must not only be entirely non-magnetic but possess high resistance to heat and oxidation. The only alloy that most satisfactorily meets these specifications is Nichrome V. *That is why 95% of the metal parts in the RCA Image Orthicon 5655 are made of Nichrome V.*

Driver-Harris manufactures over 85 alloys for the Electronic and Electrical fields. These are distinguished for giving exceptionally efficient, long and economical service—most particularly where requirements are unusually tough. So send us your specifications. As with the Image Orthicon, it is most probable a D-H alloy will best solve your manufacturing problems.

*Nichrome is manufactured only by

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HARRISON, NEW JERSEY

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Manufactured and sold in Canada by
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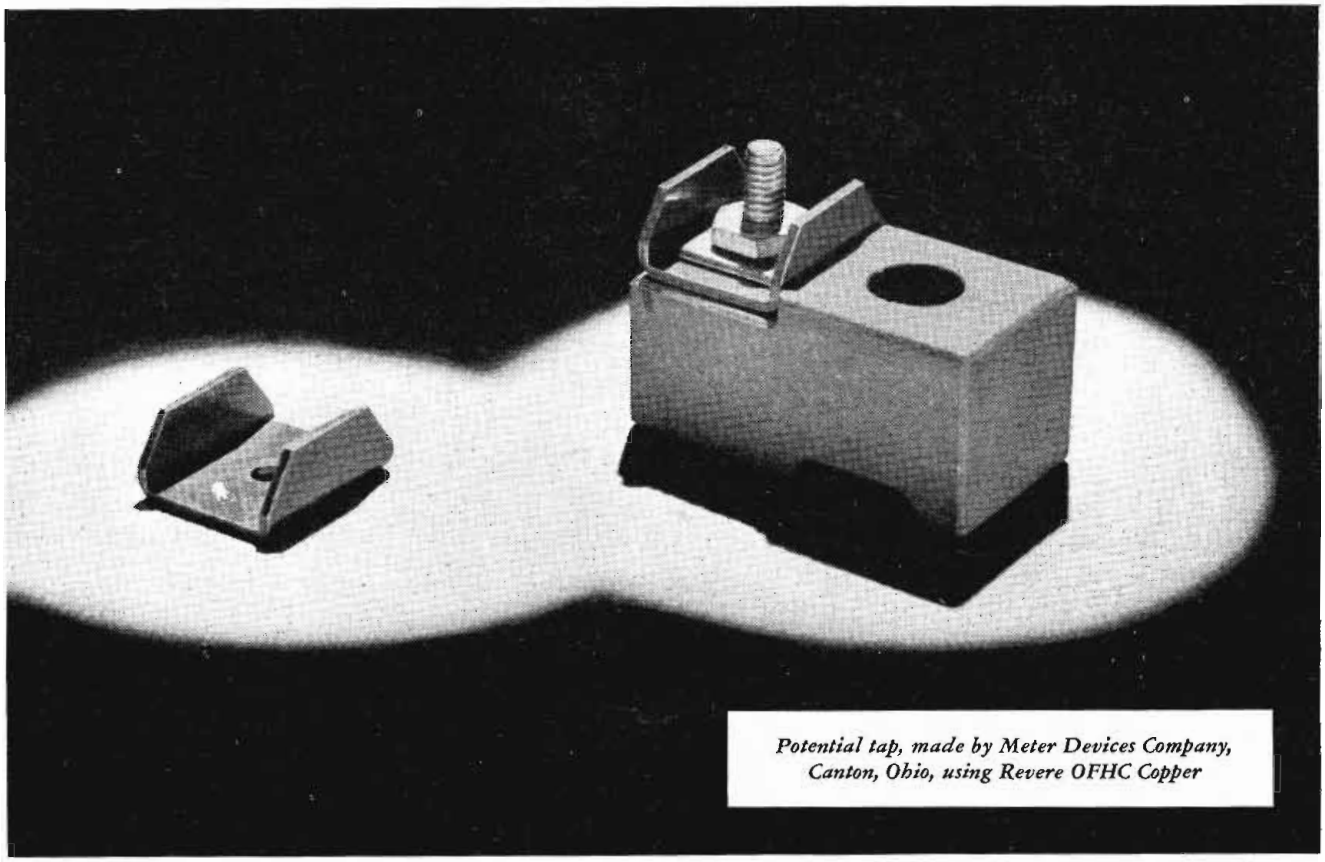
IT PAYS TO LOOK AT COST PER PART NOT PRICE PER POUND!



Potential tap, made by Meter Devices Company, Canton, Ohio, using Revere OFHC Copper

THERE'S certainly nothing complicated-looking about the small stamped channel section of .042" gauge copper shown in the accompanying illustration. And that's what makes this story all the more interesting.

It is told by Mr. T. J. Newman, Manager of the Meter Devices Company, Canton, Ohio.

"Even a relatively simple application can cause trouble," says Mr. Newman, "a lot of trouble—if you are not using exactly the right metal for the particular job.

"In our case the problem centered around this small stamped channel, originally made of electrolytic copper with a Rockwell B 35/45. The part is bolted to a porcelain base and mounted on the test panel in a standard electric meter box. Used on the service box for test purposes, it allows the connection of a small feed-in wire off the main lines to supply the potential coils in the meter.

"Sounds simple enough. Yet complicated trouble came quickly. It started with cracks in the bends. And that resulted in a high percentage of rejections, along with expensively close inspection.

"It was then that we called in the Revere Technical Advisory Service. Acting on their recommendation, we exactingly tested potential taps made of OFHC Copper with Rockwell B 49/50. Results were so satisfactory that we placed a considerable production order.

"In doing so we frankly paid a premium for OFHC. But that premium is much more than offset by our saving in scrap and the all-around reduction in costs. Our potential taps now have no more cracks in the bends—there are no rejections whatever—and expensive inspection has been eliminated."

Thus the Meter Devices Company has learned, by its own exacting tests, that the premium purchase of OFHC Copper is a real economy. Once again it is proved that the real guide to economy is the cost of the finished part, not the price per pound of the metal of which it is made.

This progressive company is only one of the many modern industrial organizations that have profited by calling in the Revere Technical Advisory Service. Perhaps you would profit too. We suggest that you ask the nearest Revere Sales Office for more information.

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TELE-TIPS

RAILROADS SQUAWK—From the railroads, in particular, which would lose 19 out of their present 60 frequencies and from the telephone companies which were squeezed into the same bands as limited common carriers, the Commission was on the receiving end of forceful "squawks" and opposition to its allocation blueprint during recent hearings. The taxicabs and motor buses and trucking industry were likewise dissatisfied with too little space. All in all, the FCC will have a most difficult task in trying to meet its "target date" of deciding the final allocations by the end of this year.

COLOR-TELEVISION equipment that cost several hundred thousand dollars, built for the ill-fated CBS color-wheel experiments, after lying useless for months, may soon find a humanitarian use in the hands of surgeons. For showing surgical operations to special student audiences, color TV has value far ahead of black-white, say wielders of the scalpel.

MECHANIZATION OF GLASS TV TUBES—Now that mechanized manufacturing processes are replacing the old time-consuming hand methods, it may not be long before the supply of 10 and 12-inch tubes will be abreast of the demand. Predictions advanced last Spring that television-set production would reach a million in 1949 are being revised upward and set production estimates for next year now range between 1,600,000 and 1,800,000. As result of break in the production bottleneck, the 16-inch tube may become as cheap as the 10 and 12-inch tubes are today and all-glass picture tubes may be priced lower than the metal tube.

RUSSIAN RADIO ENGINEERS at recent international conferences showed themselves to be pretty good fellows and worked hard on their technical assignments, but relied upon their political companions for many public statements. Russian radio delegates were chiefly drawn from ranks of college professors back home in Sovietland.

ALLOCATION KNOW-HOW seems furthest developed among U. S. international radio experts. Delegates from United Kingdom, India, USSR and Australia soon realized that while they were familiar with the theory that underlies international frequency allocation, the US group, with long practice in this science, were so far ahead that the best thing for the other nationals to do was to stop and learn American methods! The British seemed to learn quickest.

S. G.

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New, advanced

IRC EXCELS JAN-R-11

TYPE BT

BTR	unexcelled at ⅓ watt
BTS	unexcelled at ½ watt
BTA	unexcelled at 1 watt
BT-2	unexcelled at 2 watts

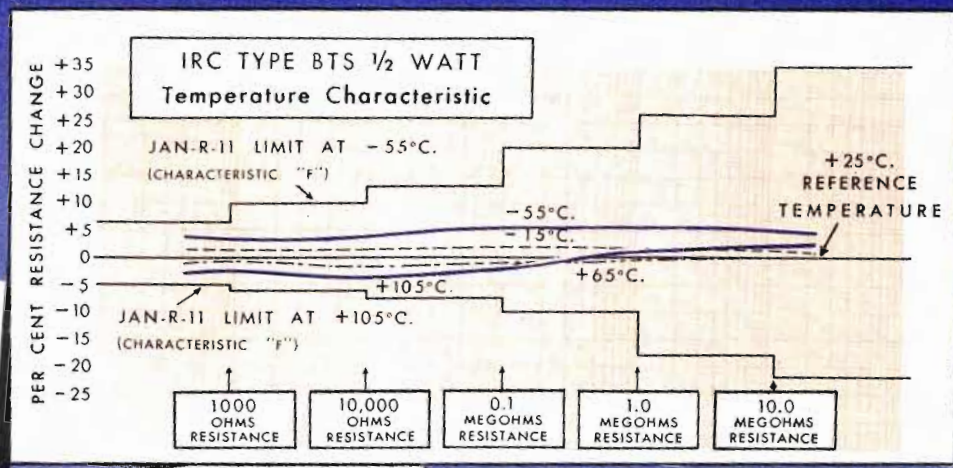
IRC's leadership proven by these Test Results for ½ watt Type BTS — equally outstanding performance of ⅓, 1 and 2 watt types is shown in Catalog Bulletin B-1.

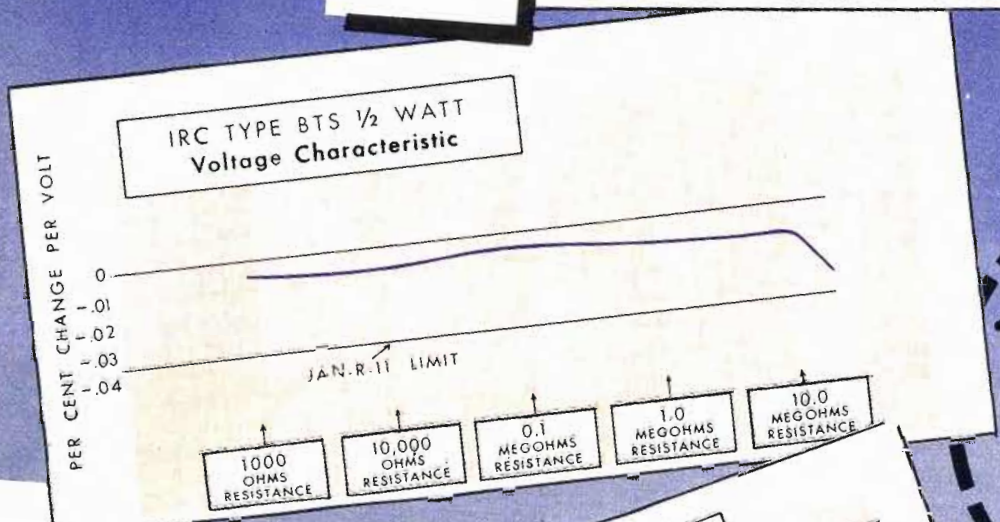
BT *means* **B***etter* **T***echnically*

compare this ADVANCED resistor to JAN-R-11 SPECS

IRC MEETS JAN-R-11

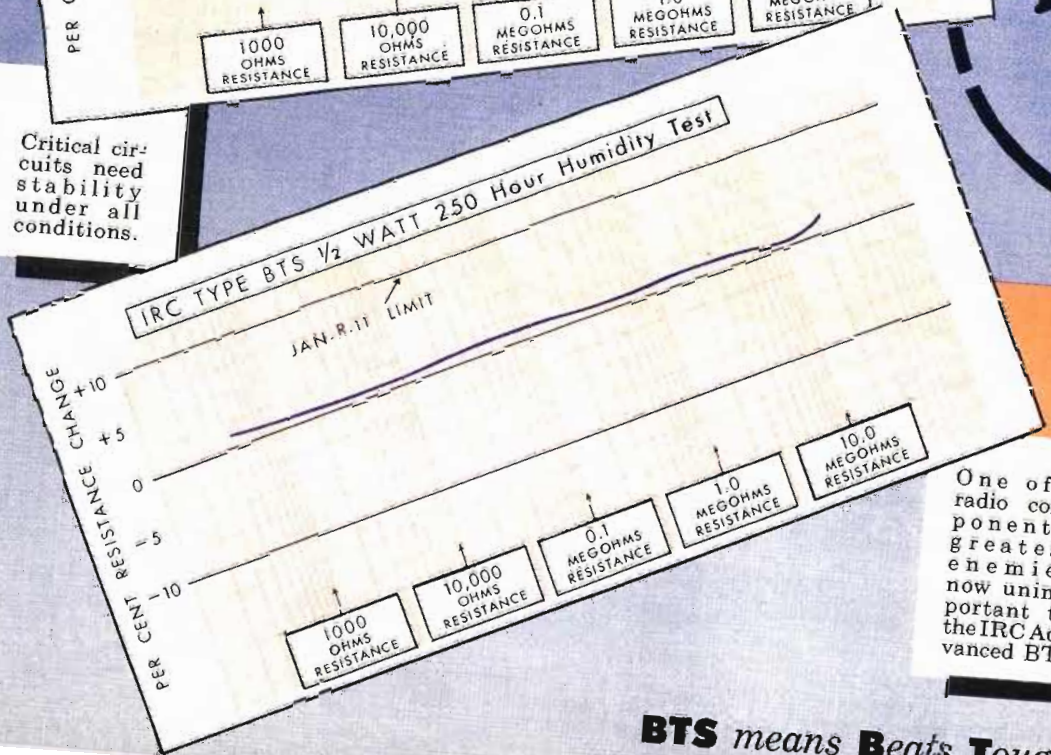
Temperature extremes used to play havoc—no longer true.





IRC BEATS JAN-R-11

Critical circuits need stability under all conditions.

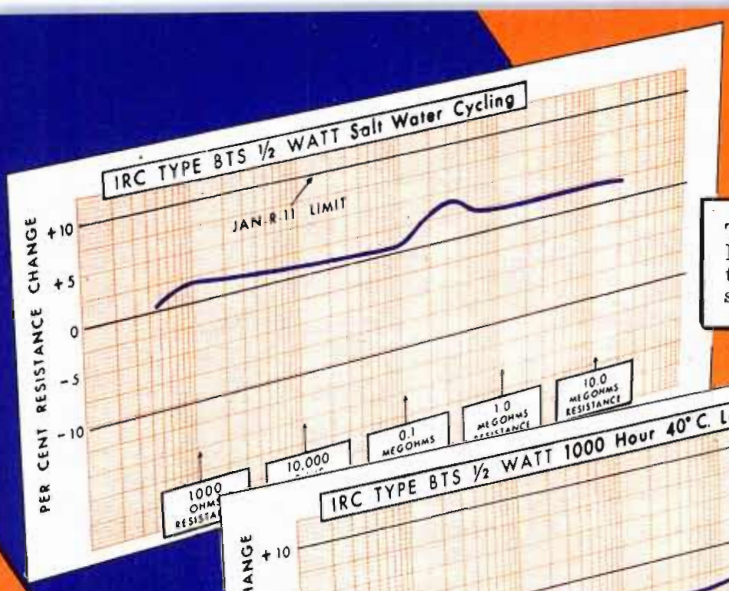


One of a radio component's greatest enemies now unimportant to the IRC Advanced BT.

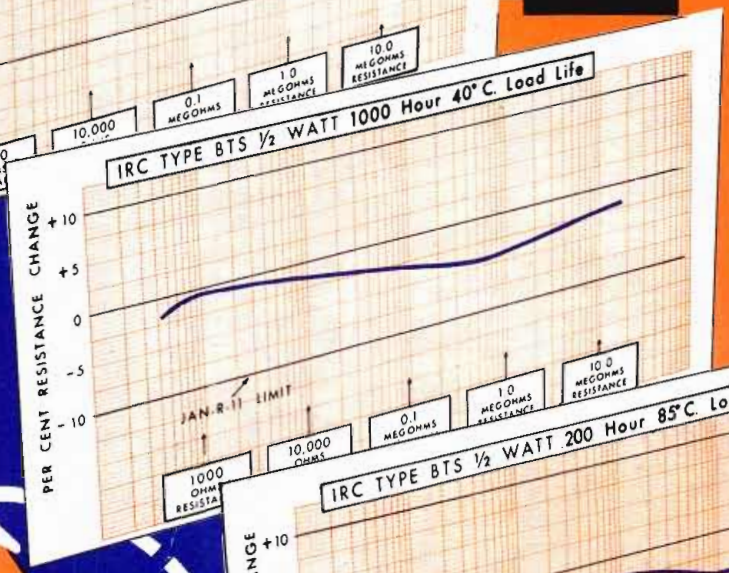
NEXT PAGE SHOWS EQUALLY AMAZING RESULTS IN OTHER CHARACTERISTICS

BTS *means* **B**eats **T**oughest **S**pecs

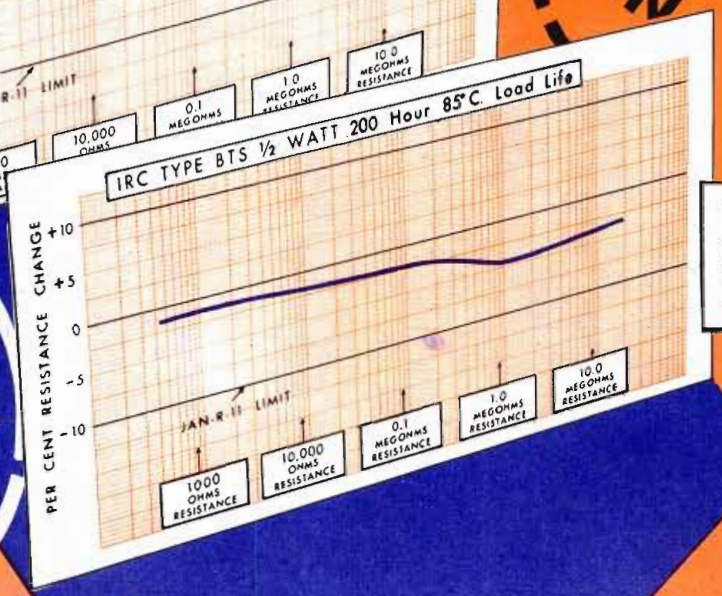
IRC'S ADVANCED BT AGAIN DEMONSTRATES SUPERIOR IRC ENGINEERING AND PRODUCTION TECHNIQUES



The Armed Forces need these results.



IRC EXCEEDS JAN-R-11



High ambients and dependability need these results.

IRC EXCELS JAN-R-11

BT *means* **B***etter* **T***elevision*

There is no blue sky surrounding this advanced resistor. Performance of this new Type BT has been proved by independent testing agencies. It is in production now . . . hundreds of thousands are coming off production lines daily. Its outstanding characteristics are particularly evident in high ambient temperatures, and it easily performs the rigorous requirements of television.

Standards for resistor performance set by this new IRC resistor are so advanced, you need complete information on its characteristics. Although Test Results shown here are only for ½ watt Type BTS, comparable data is available for BTR, BTA and BT-2 . . . Technical Data Bulletin B-1 gives you the full story. We shall be glad to rush it to your desk or drawing board . . . or to have our representative review your requirements in the light of this advanced resistor. Use the handy coupon below.

International Resistance Co.
401 N. Broad St., Phila. 8, Pa.

I want to know more about IRC's advanced BT Resistor:

- ☐ Send me Technical Data Bulletin B-1
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IRC

POWER RESISTORS • PRECISIONS • INSULATED COMPOSITION RESISTORS • LOW WATTAGE WIRE WOUNDS • RHEOSTATS • CONTROLS • VOLTMETER MULTIPLIERS • VOLTAGE DIVIDERS • HF AND HIGH VOLTAGE RESISTORS

INTERNATIONAL RESISTANCE CO., 401 N. Broad St., Philadelphia 8, Pa.
IN CANADA: International Resistance Company, Ltd., Toronto, Licensee

PREPARED BY

NOW Magnavox produces over 100 different speaker models exclusively for the manufacturing trade. From start to finish they are researched, designed and produced by engineers whose sole business is the making of better loud speakers . . . whose complete plant facilities are constructed specially for the quickest, most efficient manufacture of quality loud speakers!

The modern 2½-acre Magnavox Paducah factory is a model of engineering achievement. Everything from the building itself to the equipment and method of line assembly used is new and different. And the innovations measure up! World-famous Magnavox speakers now are coming off the line at a greatly accelerated pace.

All the skill and experience Magnavox has amassed in thirty-three years of service to the radio industry combine with a complete line of quality speakers to make this modern new plant loud speaker headquarters! Write for catalog today.

The Magnavox Company, Sales and Engineering Offices, Components Division, Ft. Wayne 4, Indiana.

Magnavox is the oldest and largest producer of quality loud speakers

Magnavox

has served the radio industry for over 33 years

SPEAKERS • CAPACITORS • SOLENOIDS • ELECTRONIC EQUIPMENT

FOR WHAT SERVICE DO YOU NEED TRANSFORMERS?

Check This List

Annunciators	Street Lighting Units
Signal Systems	
Controls and Relays	Mercury Lamps
Electronic Applications	Luminous Tube Lighting
Machine Tools	Fluorescent Lamps
Lower Voltages	Panel Boards
Scientific Equipment	Electric Fences
Oil Burners	Plant Power and Light Distribution Systems
Radio, Television Sets and Transmitters	Door Bell and Chimes

• Specialists in the design and quantity production of "Small" Transformers for over a quarter century—Jefferson Electric has to its credit a big share of the developments in this field. Leading manufacturers of products requiring such Transformers for years have regularly made them their first choice.

Practical helpful recommendations are yours for the asking. Your copy of Booklet 451 is ready for mailing. JEFFERSON ELECTRIC COMPANY, Bellwood (Chicago Suburb), Illinois. *In Canada:* Canadian Jefferson Electric Co., Ltd., 384 Pape Ave., Toronto, Ont.

Ballast for Fluorescent Lamps

JEFFERSON ELECTRIC

TRANSFORMERS

Mercury Lamp Transformer

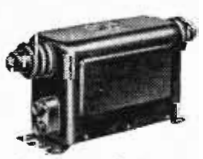
Power Circuit Transformer

Control Transformer

Radio Transformer

Oil Burner Ignition Transformer

Signal Transformer



Luminous Tube Transformer

Federal

SQUARE DEAL for Designers

Another FEDERAL achievement for better designed and better operating equipment.

More watts per cubic inch in your cabinet space . . . made possible by Federal's 26-volt RMS square and rectangular Selenium Rectifier plates. By materially reducing the number of plates required for a given output, this important advance in the art of Selenium Rectifier design and manufacture offers engineers and designers new opportunities for savings in space and weight. Now greater power—with the efficiency and dependability inherent in Federal Selenium Rectifiers—may be had without sacrificing compactness.

This is just one more example of Federal's leadership in Selenium Rectifier development. When you specify Federal Selenium Rectifier stacks, whether square, rectangular or round, you can be sure that Federal will help you see the job through. Our engineers are interested in every application, and are always ready to give you the benefit of more than a decade of Selenium Rectifier experience. For information, write to Department E266.

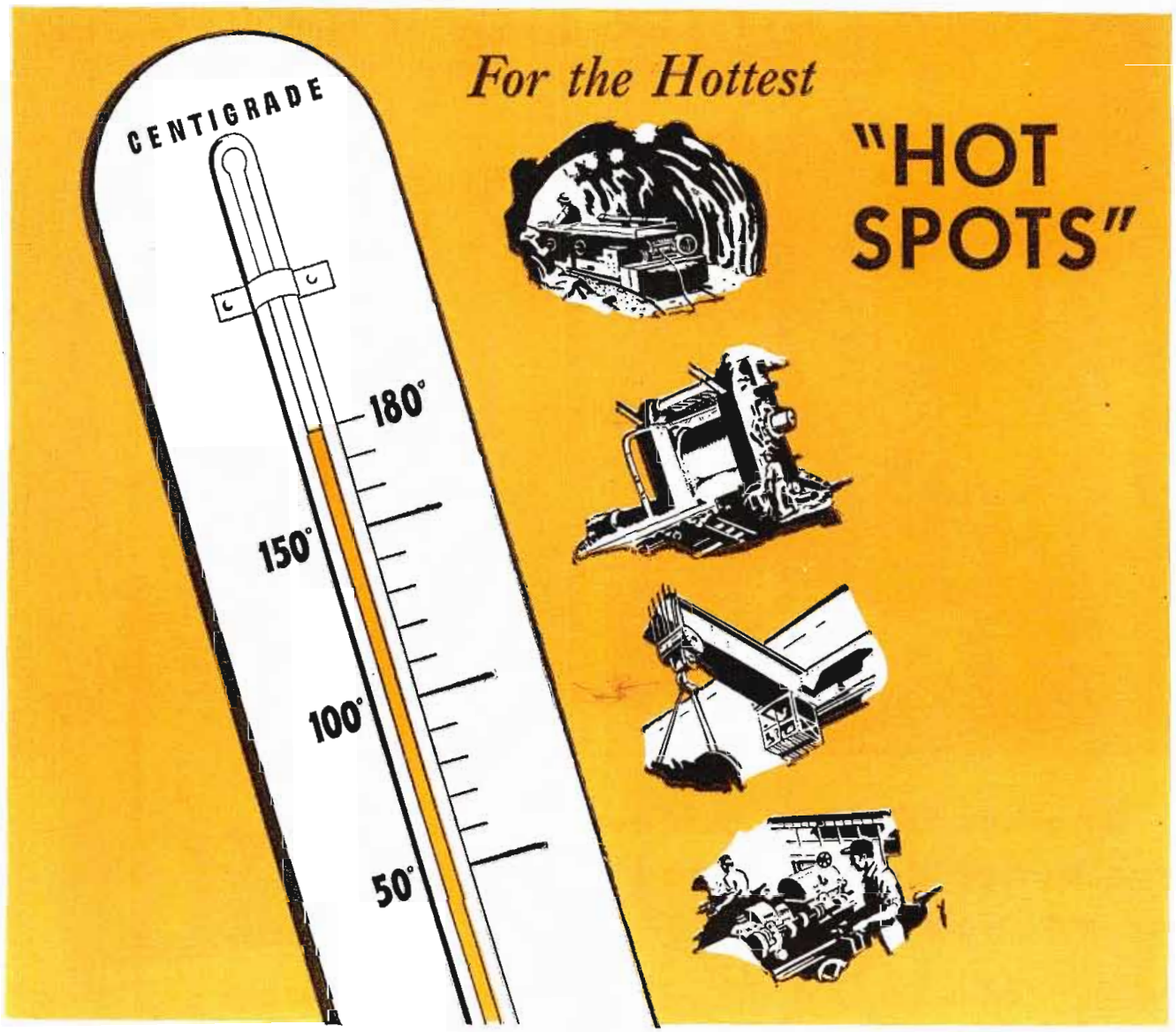
KEEPING FEDERAL YEARS AHEAD... is IT&T's world-wide research and engineering organization, of which the Federal Telecommunication Laboratories, Nutley, N. J., is a unit.

Federal Telephone and Radio Corporation

SELENIUM and INTELIN DIVISION, 900 Passaic Ave., East Newark, New Jersey

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp. 67 Broad St., N. Y.

A MAGNET WIRE



HOW CAN MAGNET WIRE, *even Silotex**, withstand continuous operation at extreme high temperatures?

The answer is in war-developed *silicones*, now brought to the magnet wire field by Anaconda in amazing glass insulated Silotex—bonded with *silicone varnish*. Such insulation qualifies for the new A.I.E.E. high-temperature rating of "Class H"...180°...a 140° rise in temperature over an ambient 40° C!

Even at operating temperatures around 180° C, here's what Silotex offers: Greater life expectancy, greater over-load protection, immunity to ambient temperature, greater moisture resistance, reduction in fire hazard. For complete information on the properties of Silotex, write to Anaconda Wire and Cable Company, 20 N. Wacker Drive, Chicago 6, Ill.

48444

ANACONDA

Anaconda

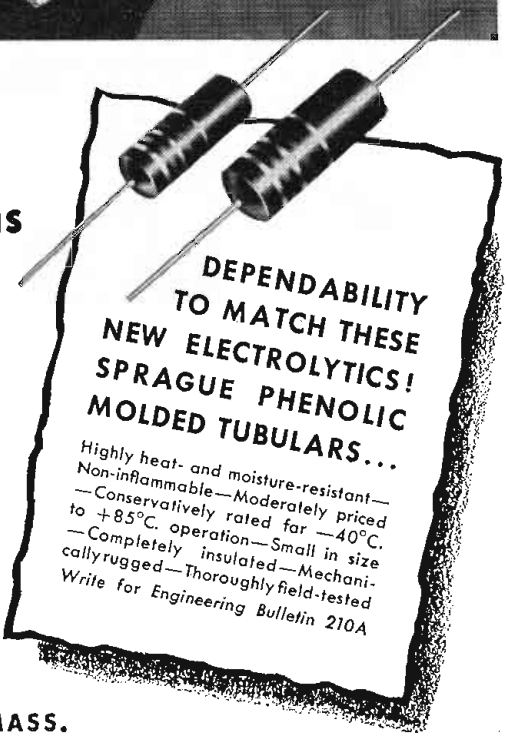
SILICONE BONDED SILOTEX* *Magnet Wire*

*Reg. U. S. Pat. Off.

for TELEVISION'S exacting applications

Designed for dependable operation up to 450 volts at 85°C. these new Sprague electrolytics are a good match for television's severest capacitor assignments. An extremely high stability characteristic is assured, even after extended shelf life, thanks to a special Sprague processing technique. Greatly increased manufacturing facilities are now available.

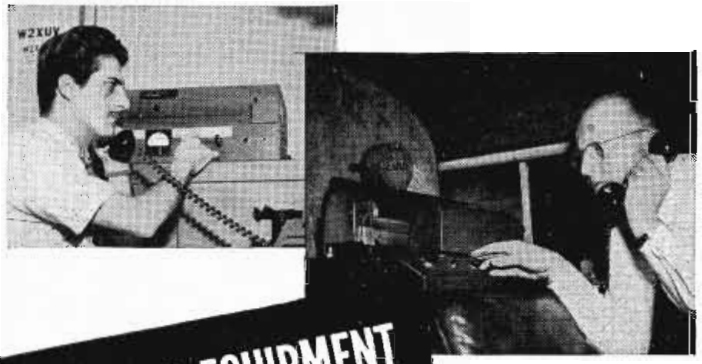
Your inquiries concerning these new units are invited.



SPRAGUE ELECTRIC COMPANY · NORTH ADAMS, MASS.

PIONEERS OF **SPRAGUE** Capacitors * Koolohm Resistors ELECTRIC AND ELECTRONIC PROGRESS

*T. M. Reg. U. S. Pat. Off.



Sitting before the sound-photo machine in the New York Daily Mirror radio car, John Reidy, the Mirror's chief photographer, advises the Mirror office (extreme left) that a photo is coming through.

The heart of the sound-photo receiving equipment at the office is Sylvania's Glow Modulator Tube, Type R1130B. A pin-point of light emitted by this tube is focused on a sheet of photographic paper attached to a revolving cylinder. As the cylinder revolves, the photograph is faithfully reproduced as it is being broadcast!

N.Y. DAILY MIRROR'S SOUND-PHOTO EQUIPMENT *with Sylvania tubes* HELPS SCOOP THE NEWSPAPER FIELD!

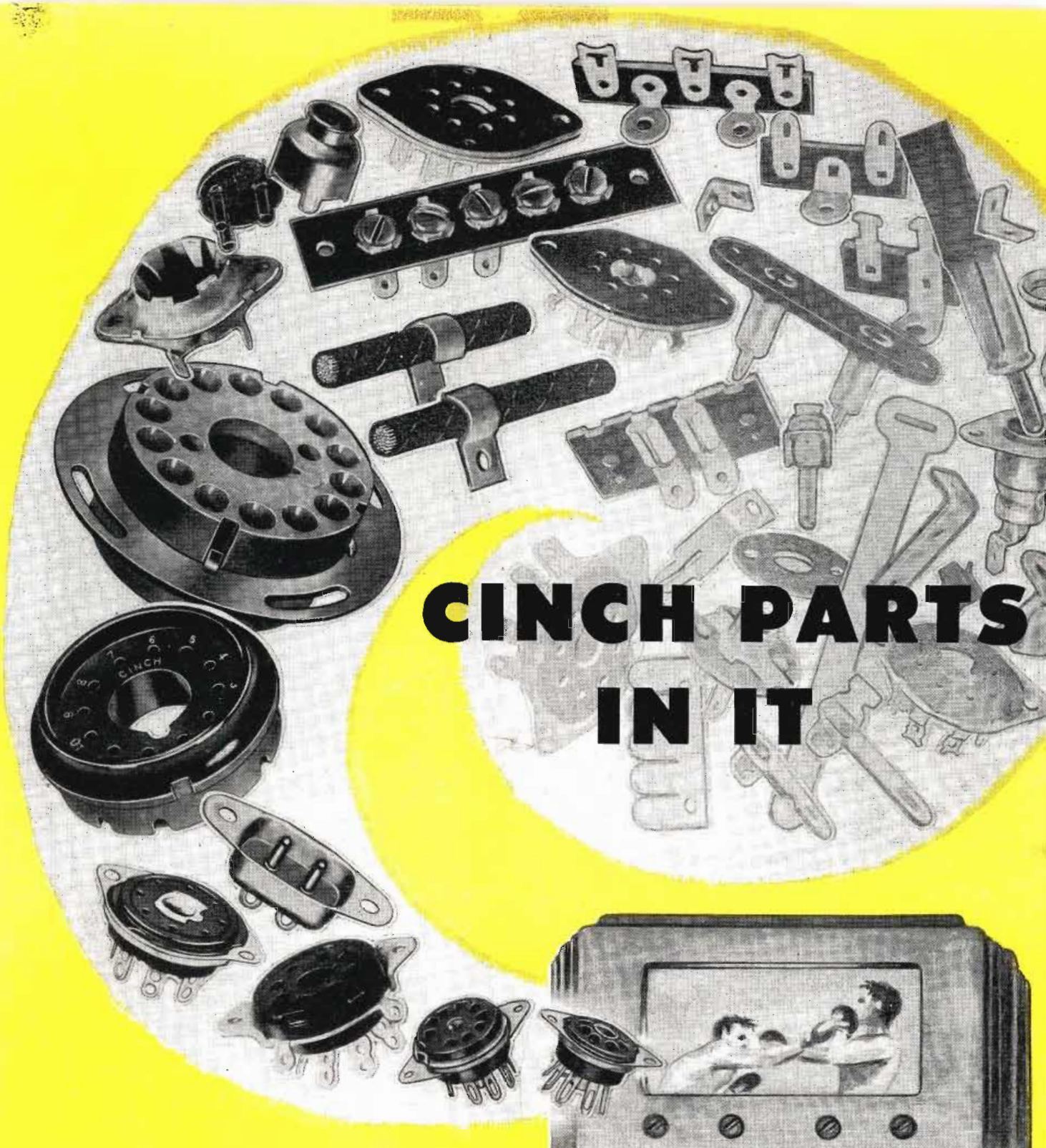
LINK FM SETS — SYLVANIA-tubed, too — transmit on-the-spot photos to paper's home office!

Pioneer in the radio car field, the New York Daily Mirror has made excellent use of its sound-photo apparatus. Equipped with Link Radio Communication units, the Mirror car has been in a position to scoop other newspapers by radioing pictures taken on the spot as soon as they are developed in the mobile photo-lab.

In these units, 36 highest quality Sylvania tubes, ranging from Lock-Ins to standard glass and GT tubes, help insure trouble-free operation of this ultra-modern method of photo-news reporting! For information on Sylvania tubes, see Sylvania Distributors, or write Radio Tube Division, Emporium, Pa.

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS



CINCH PARTS IN IT

Cinch Metal Plastic Engineering goes to the heart of the whole communications system with its dependable small assemblies . . . often anticipating the need, and always fully performing the service required. So that today . . . judged by service, by numbers in use . . . and of course by the testimony of its users . . . Cinch Parts are standard.

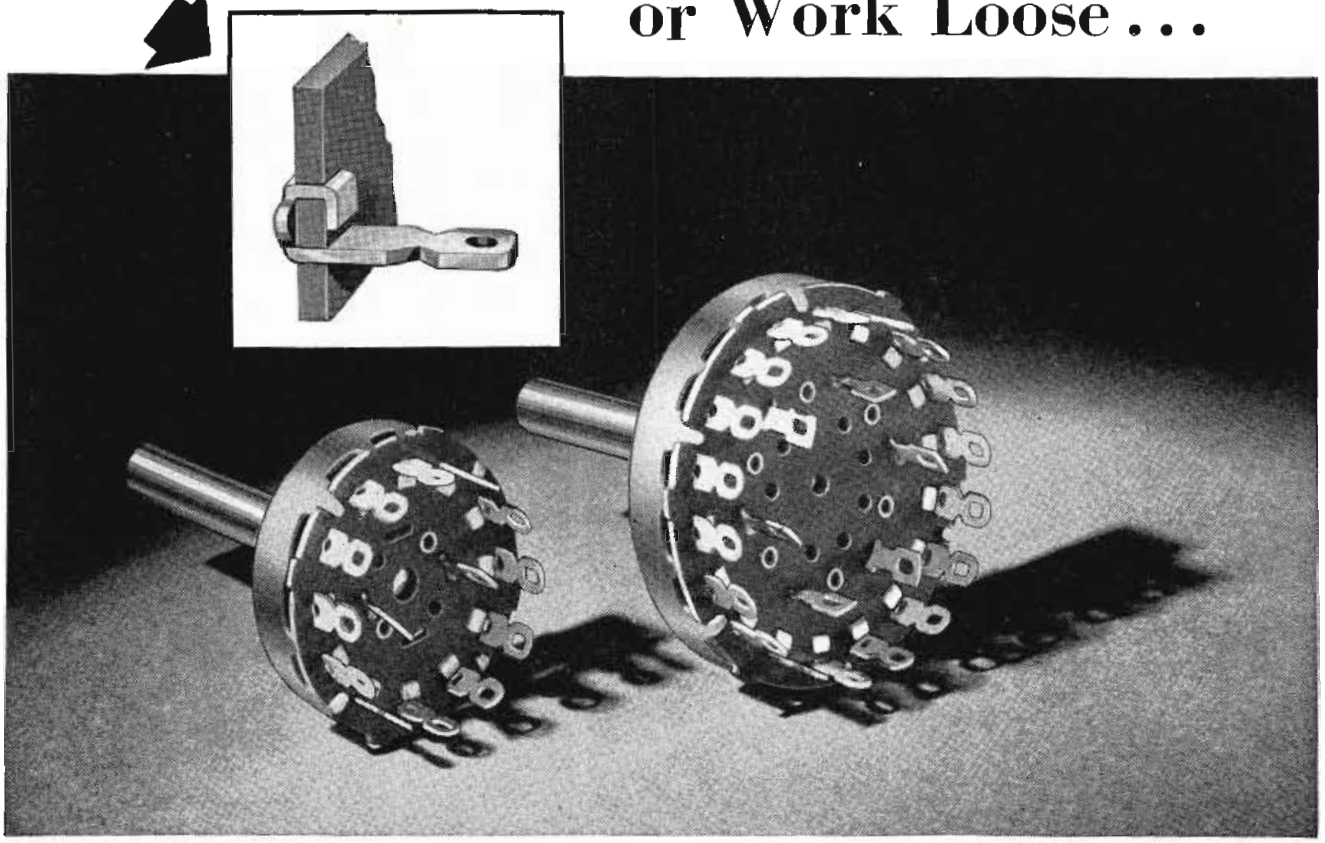
AVAILABLE AT LEADING ELECTRONIC JOBBERS . . . *everywhere*

CINCH MANUFACTURING CORPORATION

2335 WEST VAN BUREN STREET ☆ **CHICAGO 12, ILLINOIS**

Subsidiary of United-Carr Fastener Corporation - Cambridge 42, Massachusetts

This Terminal Won't Pull Off or Work Loose . . .



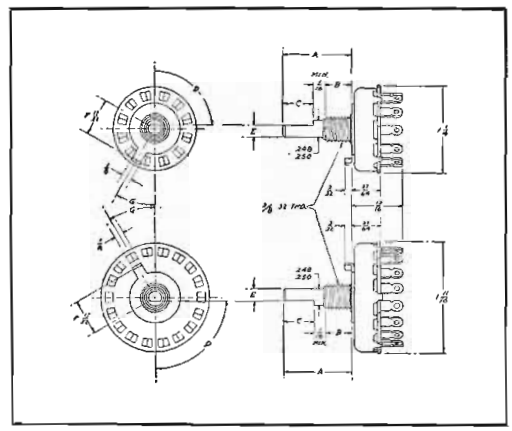
. . . IT'S ONLY ONE FEATURE OF THIS COMPACT LOW VOLTAGE MALLORY SWITCH

The inset at the top of this picture shows how the terminals of Mallory 3100 Switches are doubly fastened by a wrap-around method which holds them tight and secure against damage and at the same time provides them with a smoother contact surface.

What the picture cannot show is that the stator is made of low-loss XXX Phenolic especially selected for good insulation properties at high humidities . . . that a metal web spaced between the terminal contacts improves non-shorting construction . . . that terminals and stator together provide an excellent solder shield.

Small size, of course, is another distinguishing feature of these 3100 Switches, of which millions have been sold to manufacturers of radios, inter-communication systems and test equipment. The larger model, shown above, is 1 1/16" in diameter and has 18 position 20° indexing, embracing one to six circuits. The smaller model, with 12 position 30° indexing, embracing one to four circuits, is only 1¼" in diameter.

For more details, send for Mallory 3100 SWITCH Engineering Data Folder. A wide range of standard stock types is available through convenient Mallory Distributors.



ASK FOR

3100 SPECIFICATION SHEETS

Printed on tracing paper to permit blueprinting, these sectional drawings indicate standard and optional dimensions—make it easy for you to order production samples built to your exact requirements.

P. R. MALLORY & CO. Inc.

MALLORY SWITCHES

(ELECTRONIC, INDUSTRIAL and APPLIANCE)

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

OHMITE Resistors

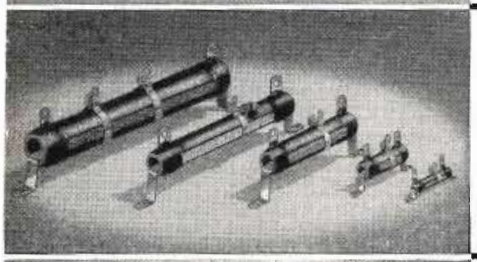
Sizes and Types for Every Service

LUG TYPE

Most popular type for general purpose applications. Connected by soldering or bolting to lugs. Protected by vitreous enamel coating.

FERRULE TYPE

Winding terminated on metal bands for mounting in standard fuse clips. Provides easy interchangeability without tools.

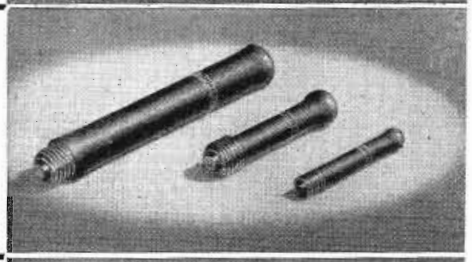


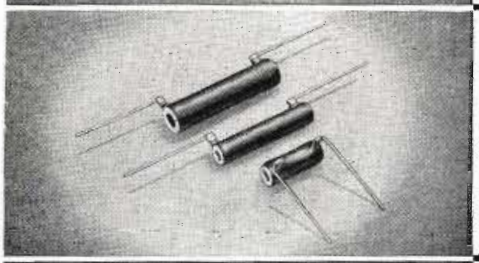
"DIVIDOHM" ADJUSTABLE TYPE

Provided with adjustable lugs for securing odd values of resistance quickly and easily.

EDISON BASE TYPE

Mounted in ordinary lamp type screw sockets for easy interchangeability without the use of tools.



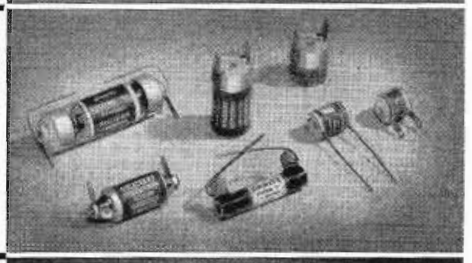


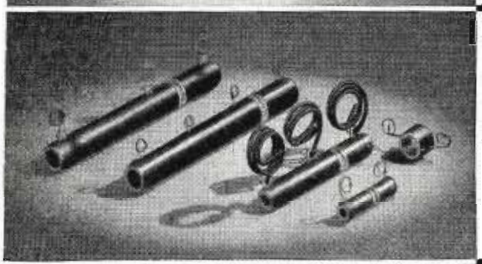
WIRE LEAD TYPE

Small vitreous enameled resistors which can be connected and supported by their own wire terminals. Maximum size approx. 20 watts.

PRECISION TYPE

Low wattage resistors of ± 1% or closer tolerance. Made in vacuum impregnated, glass sealed, or vitreous enameled type units.



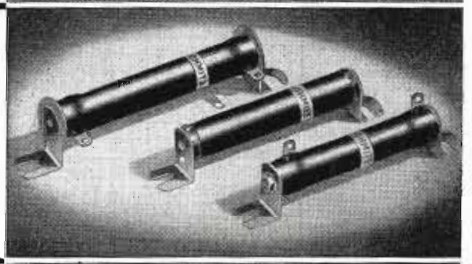


FLEXIBLE LEAD TYPE

Winding is connected to stranded bare or insulated leads. Used where it is desired to have connecting wires a part of the resistor.

BRACKET TYPE

Have metal end brackets. Live bracket type is connected by bolting brackets to panel terminals. Dead bracket type has separate lugs.



"CORRIB" TYPE

Has edge-wound, exposed corrugated ribbon winding. For low resistances where 100 watts or more must be dissipated in small space.

NONINDUCTIVE TYPE

For radio frequency circuits where constant resistance and impedance are required. Made in rugged, vitreous-enameled type construction.

In addition to the many types of resistors shown above, Ohmite offers resistors in more than sixty different core sizes, and a wide range of wattages and resistance values. Ohmite engineers will be pleased to help you in selecting the right resistors for your needs.

OHMITE MANUFACTURING CO.

4907 Flournoy Street Chicago 44, Illinois

Write on Company Letterhead for Catalog and Engineering Manual No. 40.

Contains 96 pages of useful data on the selection and application of rheostats, resistors, tap switches, and other equipment.

Be Right with...

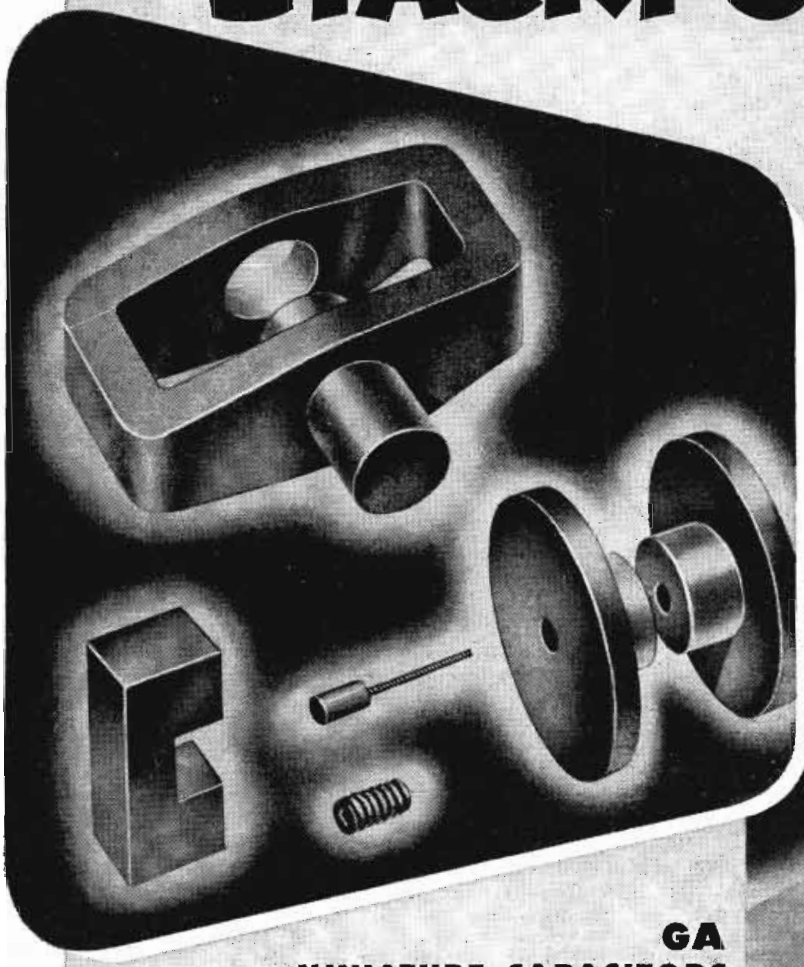
OHMITE

RHEOSTATS · RESISTORS

TAP SWITCHES

Industry's First Choice

STACKPOLE PROD



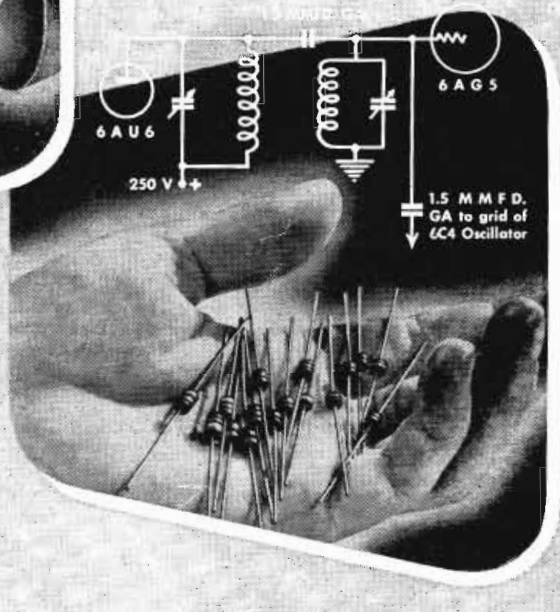
IRON CORES

From horizontal deflection and flyback transformer cores to i.f. and other types, Stackpole offers a complete line.

Type 10034—For use with tubes of any size in horizontal deflection circuits. Assures uniform results, saves materially on assembly costs.

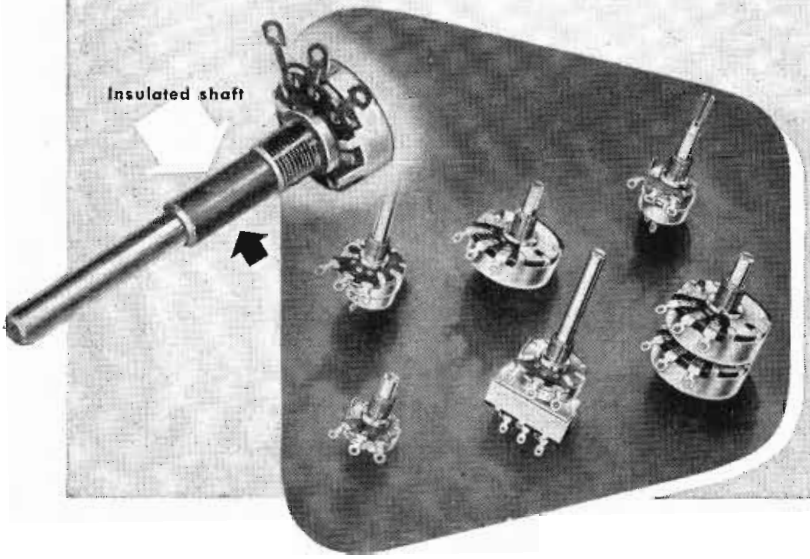
Type 10748—A smaller horizontal deflection or flyback transformer design for tubes up to 10" diameter.

O.T. Types . . . and dozens of standard and special types to match any circuit requirement.



GA MINIATURE CAPACITORS

These tiny units cost no more than homemade "gimmicks" yet offer outstanding advantages in terms of greater stability, higher Q, insulation resistance, breakdown voltage and non-inductiveness. Standard capacities include .5—.68—1.0—1.5—2.2—3.3 and 4.7 mmf.



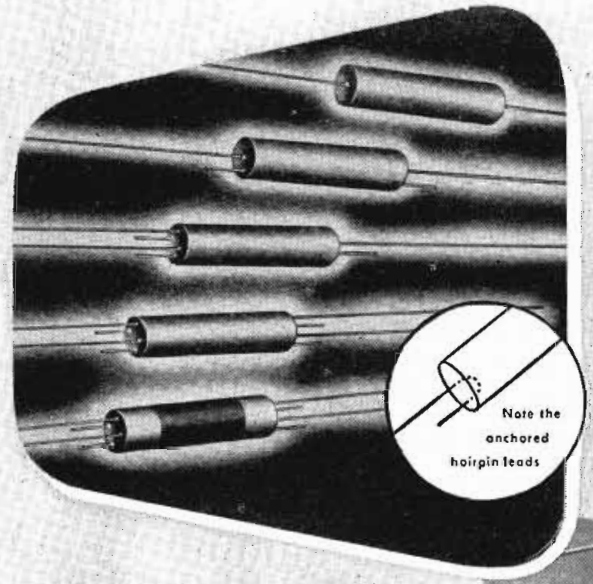
VARIABLE RESISTORS —CONTROLS

Insulated shafts as required

Stackpole controls, single or dual, are available in numerous types and with wattage ratings and other characteristics adequate for modern television applications. Samples on request to quantity users.

STACKPOLE

UCTS for TELEVISION



MOLDED COIL FORMS

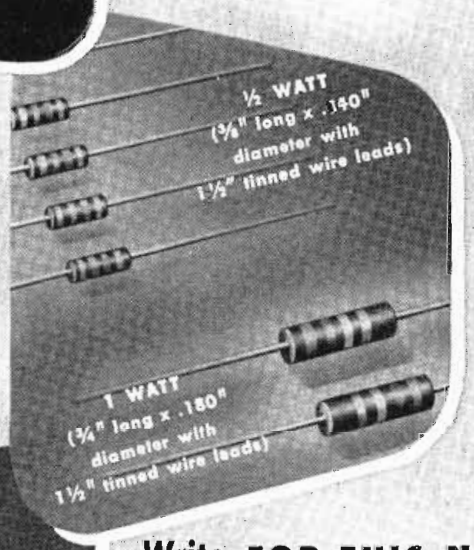
for choke and peaking coils

The advantages of Stackpole Molded Coil Forms as inexpensive mechanical supports for windings include: reduced space factor; easier assembly; point-to-point wiring with one-third fewer soldered connections; extreme flexibility of application *and absolute minimum cost.* Types include units with coaxial leads, single hairpin leads, single hairpin lead at one end with double hairpin lead at other end, and double hairpin leads at each end. Iron core sections can be incorporated in most types.

Note: These values apply to type DR coil forms only	Dielectric Constant	"Q"
600 Kilocycles	4.7	28
1000 Kilocycles	4.7	36
2.3 Megacycles	4.7	45
20 Megacycles	4.7	118
48 Megacycles	4.5	90

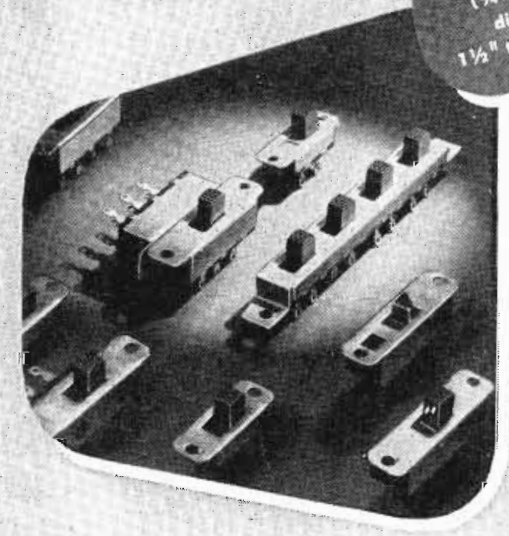
INEXPENSIVE SNAP SLIDE OR ROTARY ACTION SWITCHES

These popular Stackpole switches add greatly to the sales appeal and convenience of almost any electrical product. Standard, low cost types are available for practically any switching arrangement or type of operation.



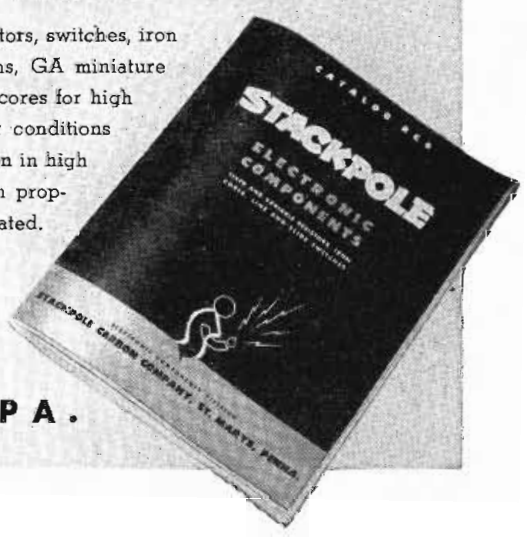
FIXED RESISTORS

The result of more than 15 years specialized manufacturing experience, Stackpole Resistors meet modern television specifications —whether from a moisture-protection, insulation or overload standpoint, or satisfactory high frequency characteristic. Standard ranges are from 10 ohms to 20 megohms in the customary ± tolerances of 5%, 10% or 20%.



Write FOR THIS NEW STACKPOLE ELECTRONIC COMPONENTS CATALOG

Fixed and variable resistors, switches, iron cores, molded coil forms, GA miniature capacitors and Polytite cores for high capacity stability under conditions of humidity and vibration in high frequency circuits when properly supported and insulated.



CARBON CO. • ST. MARYS, PA.

For top-flight quality *and* rock-bottom economy *in telecast programming . . .* DU MONT *Type 5130-B*

16mm SOUND *Telecasting Projector*

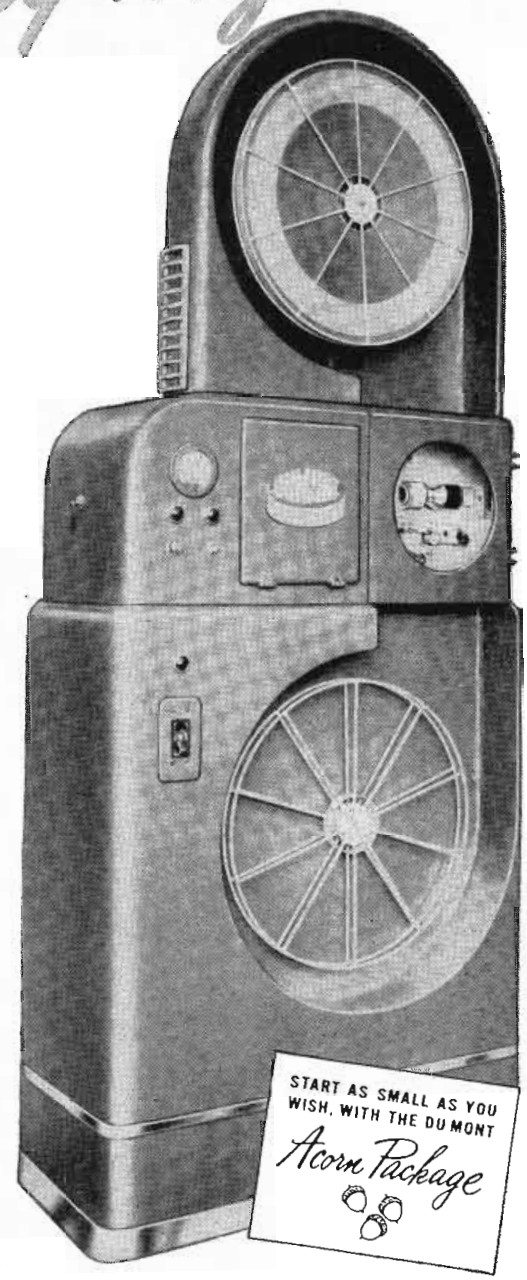
Superlative movie programming utilizing economical 16 mm sound films—that's the meaning of this latest Du Mont achievement.

Designed and built "from scratch" to meet the exacting needs of movie telecasting. Not to be confused with usual improvisations. Definitely, with this unique projector, movie telecasting comes of age.

Ready for the heavy-duty service normal to telecast operations. All parts readily inspected, checked, replaced, when needed. Self-contained. Fully enclosed. Streamlined. Smartly designed.

Better movie presentations over the air are bound to follow the installation of such equipment by telecasters seeking the largest audiences.

Details on request. Meanwhile, submit your telecasting problems and requirements.



START AS SMALL AS YOU WISH, WITH THE DU MONT *Acorn Package*

FEATURING . . .

Complete with sound preamplifier and necessary power supplies.

Sound system response of 50 to 5000 cycles—quality of reproduction limited solely by film sound track.

Ample reel reservoir capacity permitting use of 4000 ft. feature movies.

Synchronous locking type driving motor ensuring perfect tie-in with television sync generator.

Lamp assembly and pull-down mechanism available for instant replacement.

Adjustment for both positive and negative film.

Light output far exceeds previous equipment, permitting use of low sensitivity pickup tubes even with narrow vertical blanking interval.

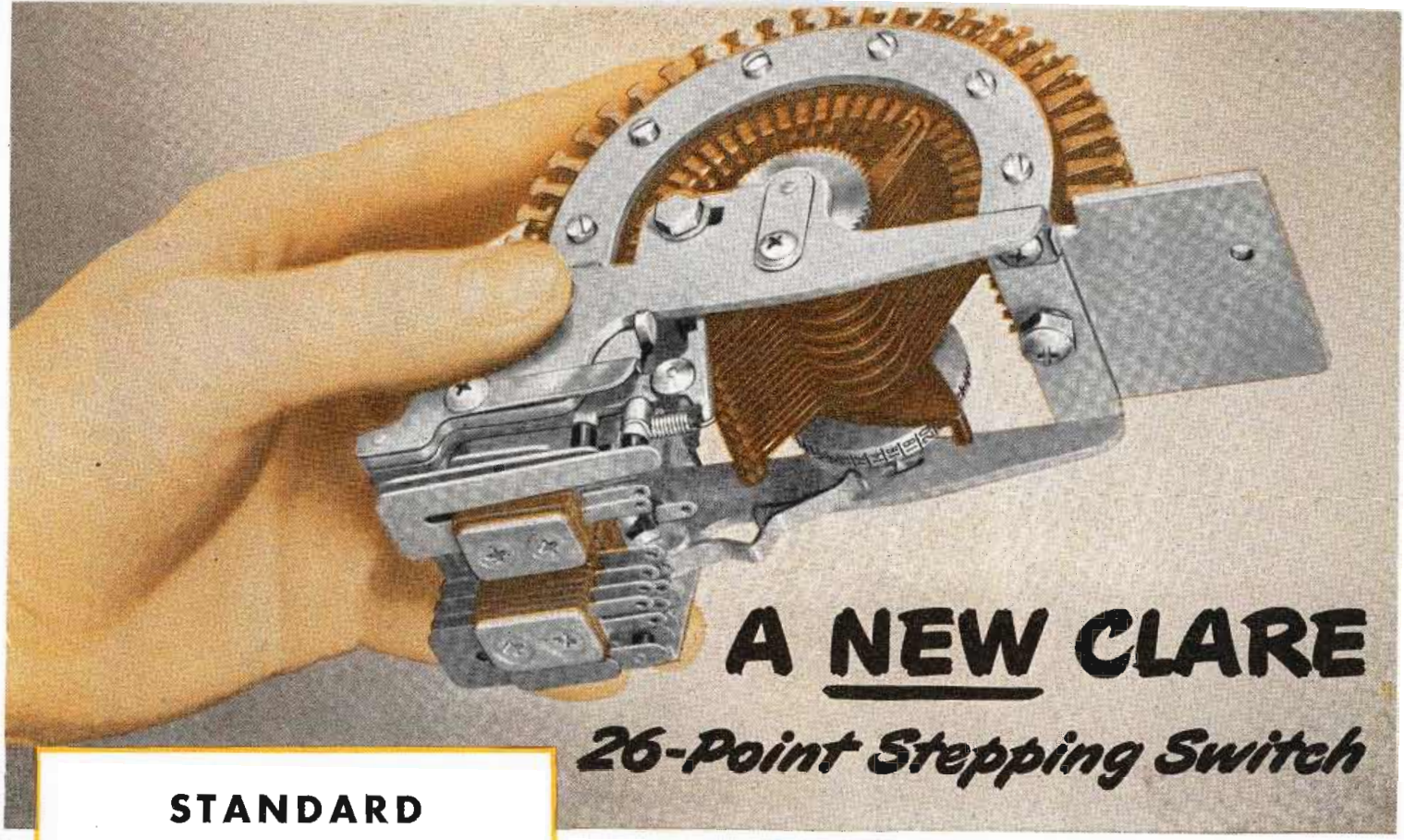
For direct throw on television mosaic or with intermediate translucent screen and prism for utilization of Image Orthicon Camera for film pickup.

Built for continuous use on an average of 20 hours weekly. At least 3000 hours' life expectancy for major components.

In sum, the stability and performance which television film pickup has needed for many years.

DUMONT *First with the Finest in Television*

ALLEN B. DU MONT LABORATORIES, INC. • TELEVISION EQUIPMENT DIVISION, 42 HARDING AVE., CLIFTON, N. J. • DU MONT NETWORK AND STATION WABD, 515 MADISON AVE., NEW YORK 22, N. Y. • DU MONT'S JOHN WANAMAKER TELEVISION STUDIOS, WANAMAKER PLACE, NEW YORK 3, N. Y. • STATION WTTG, WASHINGTON, D. C. • HOME OFFICES AND PLANTS, PASSAIC, N. J.



A NEW CLARE
26-Point Stepping Switch

STANDARD SPECIFICATIONS

OPERATION:
Automatic (self-interrupting) or remote controlled.

WIPERS:
One to ten, traversing individual contact levels.

INTERRUPTER SPRINGS:
Form 1B (to open the operating circuit at the end of each step). Contacts are single platinum-iridium.

OPERATE SPEED:
Remote controlled operation: maximum 30 steps per second. Self cycling operation: average 60 steps per second, with 48-volt power supply.

FINISH:
Framework ond armature: cadmium; Bank contacts and wipers: phosphor bronze.

MOUNTING:
Frame drilled ond tapped at each end to accomodate No. 8-32 mounting screw.

DIMENSIONS:
Overall lenght: 6-9/16 in.; width: 2-3/8 in.; height: 4-5/8 in.

NET WEIGHT:
27 oz., approximately.

SHIPPING WEIGHT:
4 lbs., approximately.

Write for Clare Bulletin 101 on complete details.

For Selection - Sequence Control - Counting - Totalizing

Selection of any channel or circuit path from a total of 26 or 52 circuits is provided by this new CLARE Stepping Switch.

This selection may be at the rate of 30 steps per second on remote control—up to 60 steps per second on self-cycling operations. Operating at these speeds, the switch gives a minimum life of 5 million half-revolutions or 130 million stepping operations.

Each of the ten levels possible for the Type 26 Switch, or the five levels of the Type 52 Switch, is unit-molded in Bakelite. Hand positioning of individual contacts is thus eliminated, and each bank level is easily replaced if a contact becomes damaged in service.

In operation, a pair of double-ended wiper springs is stepped over each bank level of 180 degrees. One end of the wipers is engaged with the bank contact at all times, one end is always free of the bank. The stepping magnet may be remotely controlled or wipers may be stepped automatically by interrupting the magnet circuit through a pair of interrupter springs. As many as eight auxiliary interrupter springs may be provided for other control or signal functions.

Like many other CLARE developments, this new stepping switch was designed to meet a specific requirement . . . has provided an answer to others. Whatever your relay problem, it will pay you to submit it to CLARE. Sales engineers are located in principal cities for your convenience. Look in your classified telephone directory . . . or write to C. P. Clare & Co., 4719 West Sunnyside Ave., Chicago 30, Illinois. In Canada: Canadian Line Materials Ltd., Toronto 13. Cable address: CLARELAY.

CLARE RELAYS

First in the Industrial Field

NEW!...the Roto Ranger

—automatically rotates one of 18 separate scales into position as you select the range.

SIMPSON MODEL 221 ROTO-RANGER
HIGH-SENSITIVITY A.C.-D.C. VOLT-OHM-MILLIAMMETER

Here is the only multiple scale test instrument of its kind in the world. It definitely reduces the possibility of errors by providing a single scale for each range of this finest of volt-ohm-milliammeters. As the selector switch is moved to the range desired, an ingenious gearing mechanism rotates a drum, bringing into place behind the meter window the proper scale for that range. Here is the equivalent of 25 separate instruments combined in one sturdy and compact unit. (18 scales; 7 additional direct reading ranges through use of high voltage and output jacks.) The patented Roto-Ranger principle eliminates the confusion of numerous readings on one scale, and the multiplying factors common to ordinary multi-range testers, by providing a separate scale for each range. There are no cramped calibrations in these full sized Roto-Ranger scales. Each is designed as it would be for a separate instrument.

Ranges

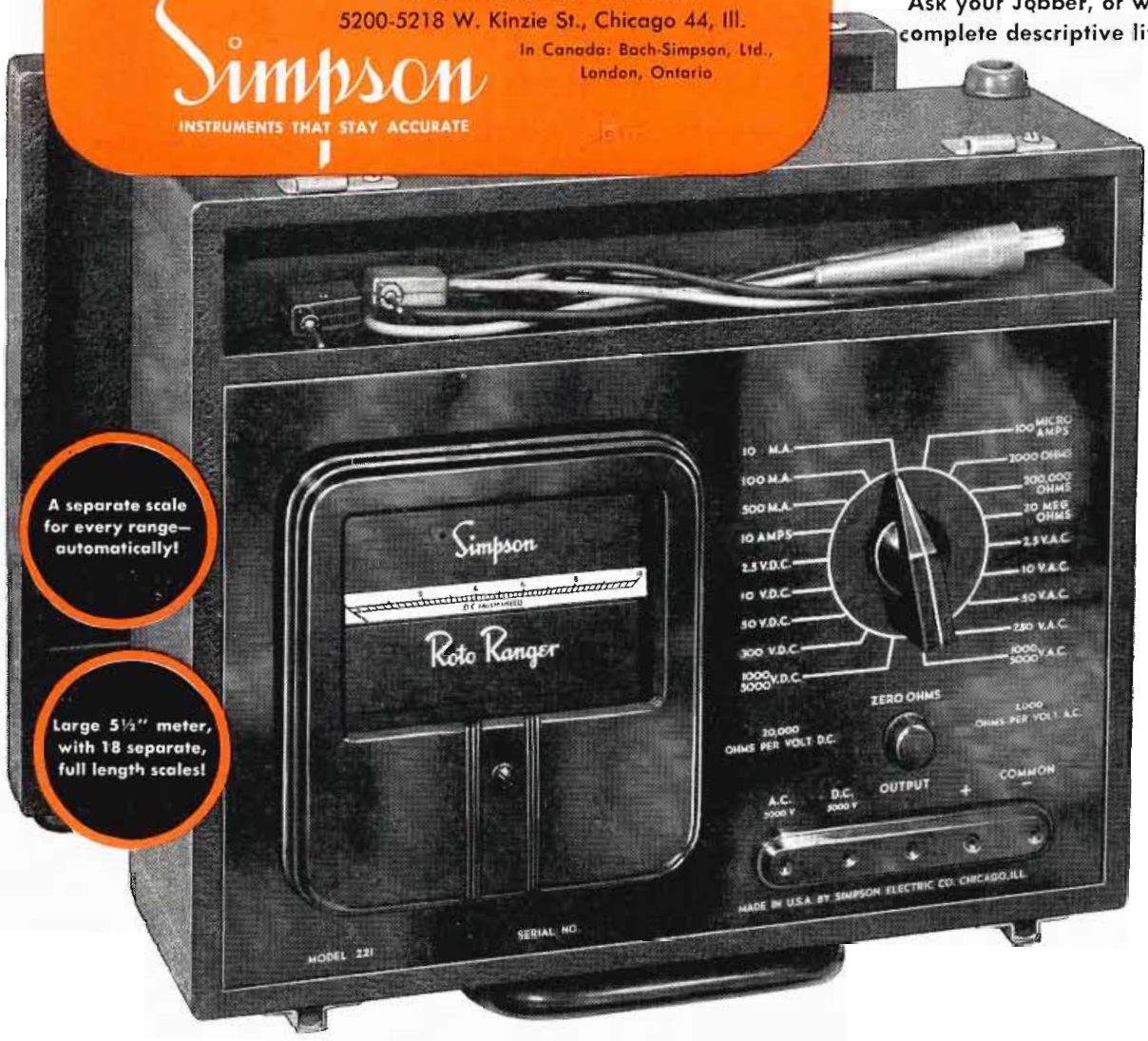
20,000 Ohms per Volt D.C., 1,000 Ohms per Volt A.C.
Volts, A.C.: 2.5, 10, 50, 250, 1000, 5000
Volts, D.C.: 2.5, 10, 50, 300, 1000, 5000
Milliamperes, D.C.: 10, 100, 500
Microamperes, D.C.: 100
Amperes, D.C.: 10
Output: 2.5, 10, 50, 250, 1000
Ohms: 0-2000 (12 ohms center), 0-200,000 (1200 ohms center), 0-20 megohms (120,000 ohms center).
Size: 12¾" x 10⅛" x 5⅜"
Weight: 8 lbs. 9 oz.
Price, complete with test leads and 28-Page Operator's Manual..... **$69.85**

High voltage probe (25,000 volts) for TV, radar, x-ray and other high voltage tests, also available.

Ask your Jobber, or write for complete descriptive literature

SIMPSON ELECTRIC COMPANY
5200-5218 W. Kinzie St., Chicago 44, Ill.
In Canada: Bach-Simpson, Ltd., London, Ontario

Simpson
INSTRUMENTS THAT STAY ACCURATE



PICTURE PROJECTION

Perfected by *Norelco*

The 2½" magnetic projection triode 3NP4 has a face as small as a compact and is only 10½" long.

HERE'S THE OPPORTUNITY THAT MANUFACTURERS OF TELEVISION RECEIVERS HAVE BEEN AWAITING!

. . . . . *10 SIGNIFICANT FEATURES* . . . . . .

1. Flat 16" x 12" non-reflecting picture provides fatigueless viewing from less than 5 feet and upward!
2. Wide-angle visibility – *square corners.*
3. True photographic black and white picture quality—no discoloration.
4. Compact unit—suitable for table model cabinets.
5. Long-life, low-cost picture tube.
6. Manufacturers can most economically extend their product range into projection television by adapting their 10" EM chassis for use with PROTELGRAM
7. Easy to service.
8. High contrast ratio and broad gray tone range.
9. Simple optical adjustment system.
10. *Quality built* after more than 10 years of development.

NORELCO PROTELGRAM consists of a projection tube, an optical box with focus and deflection coils, and a 25 kv regulated high-voltage supply unit, making possible large-size home projection. More than ten years of exhaustive research resulted in this ideal system for reproducing a projected picture. The optical components are designed to produce perfected projection for a 16" x 12" image, the optimum picture size for steady, distant observation and also for *proper viewing at less than 5 feet.*

Other NORELCO products include standard 10" direct-viewing tubes and special-purpose cathode-ray tubes for many applications.

NORTH AMERICAN PHILIPS COMPANY, INC. Norelco

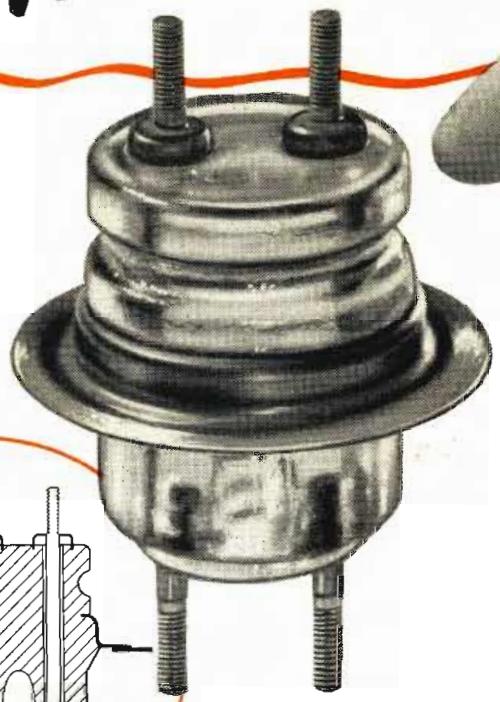
PROTELGRAM IS PICTURE PERFECTION IN PROJECTION

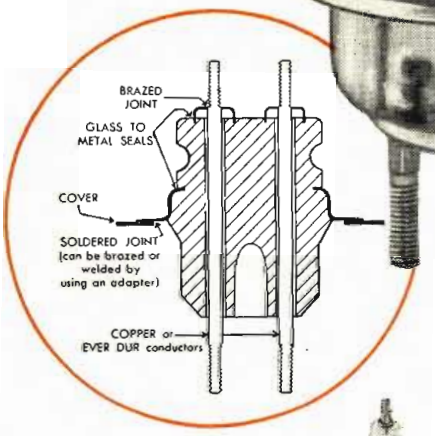
NORTH AMERICAN PHILIPS COMPANY, INC.

DEPT. T-11, 100 EAST 42nd STREET, NEW YORK 17, N. Y.

IN CANADA: PHILIPS INDUSTRIES LTD., 1203 PHILIPS SQUARE, MONTREAL ★ EXPORT REPRESENTATIVE: PHILIPS EXPORT CORPORATION, 100 EAST 42ND STREET, NEW YORK 17, N. Y.

Glass bushings Now Available



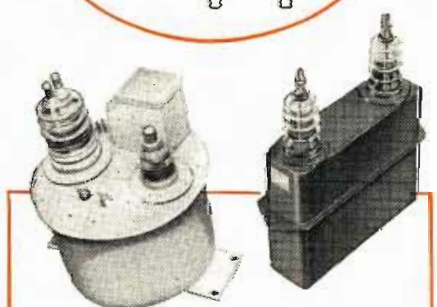


to manufacturers of electronic equipment

Can be welded, brazed, or soldered to case, forming a strong, permanent, hermetic seal that eliminates moisture problems and often permits more compact, light-weight design.

General Electric is now offering to other manufacturers the glass bushings that it has used so successfully on capacitors, rectifiers, modulator and instrument transformers, and other electrical equipment. These bushings are cast of an exceptionally stable, low-expansion glass. Metal hardware is a special nickel-alloy steel, fused to the glass in casting. Bushings are attached directly to the apparatus without gaskets—by soldering, welding or brazing the metal bushing flange to the metal case.

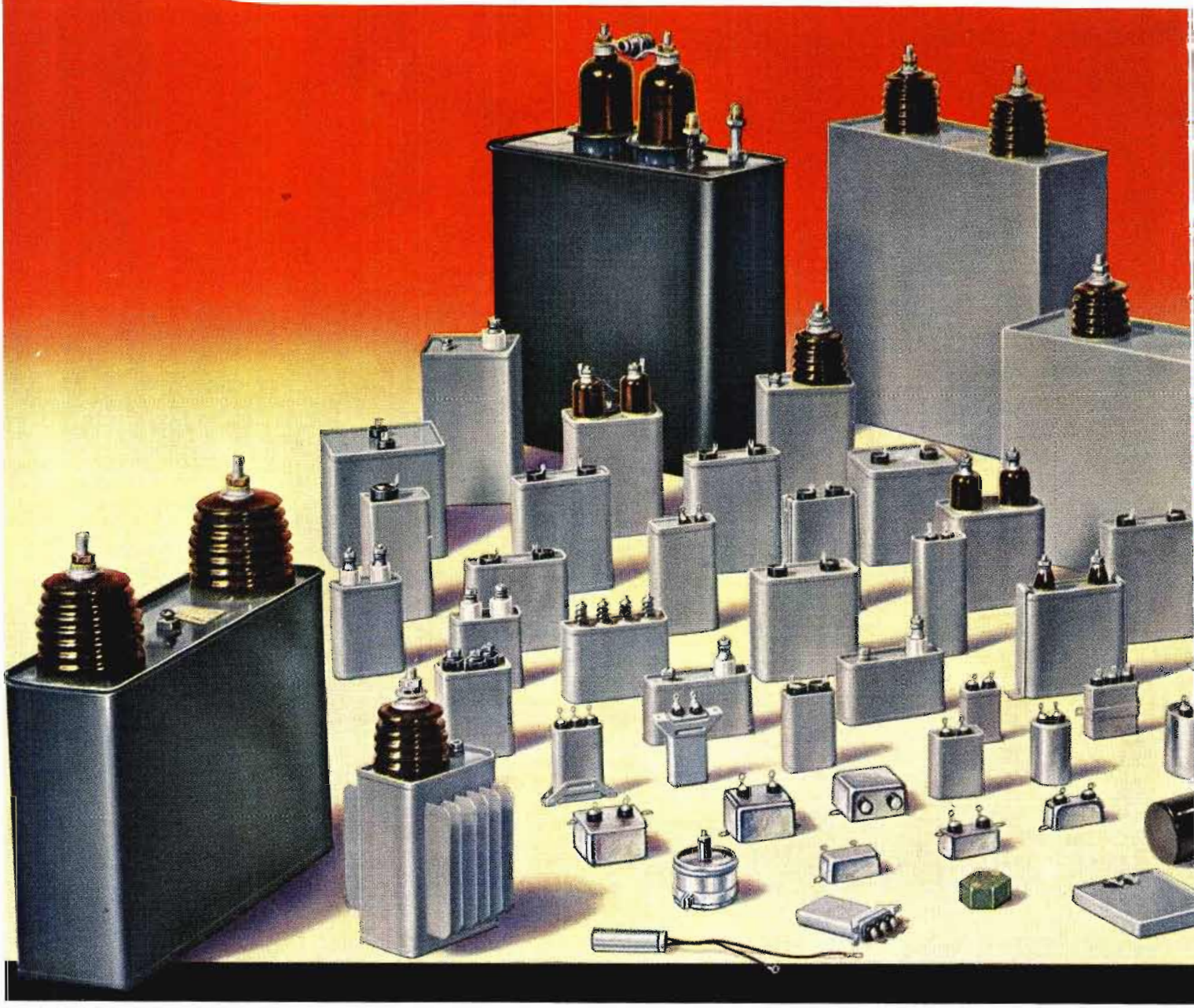
The resulting joint between bushing and equipment is permanent, vacuum-tight, and of high mechanical strength. It is especially desirable for equipment subject to vibration, shock, fungus growth or severe changes in temperature. These glass bushings are currently available to meet dry, 60-cycle, flashover values of from 10 to 50 kv, and in current ratings of 25 and 50 amperes (large sizes up to 800 amperes). They may be single or multi-conductor and can be provided with a top flange to permit mounting tube sockets directly on the bushings. Diameters range from 1⅝ to 3⅜ inches and weights from 2½ oz. to 4 lb.



The best way to evaluate these glass bushings for capacitors, modulator transformers, and other electronic equipment, is to see them. If you will send us a sketch and ratings of bushings you are now using, we will furnish you with samples of one or more of our standard glass bushings. Or write for Bulletin GEA-5093 which contains complete listings of our standard designs, allowing you to select the particular bushing you require. *Power Transformer Sales Division, General Electric Co., 16-215 Pittsfield, Mass.*

GENERAL ELECTRIC

SPECIALTY CAPACITORS

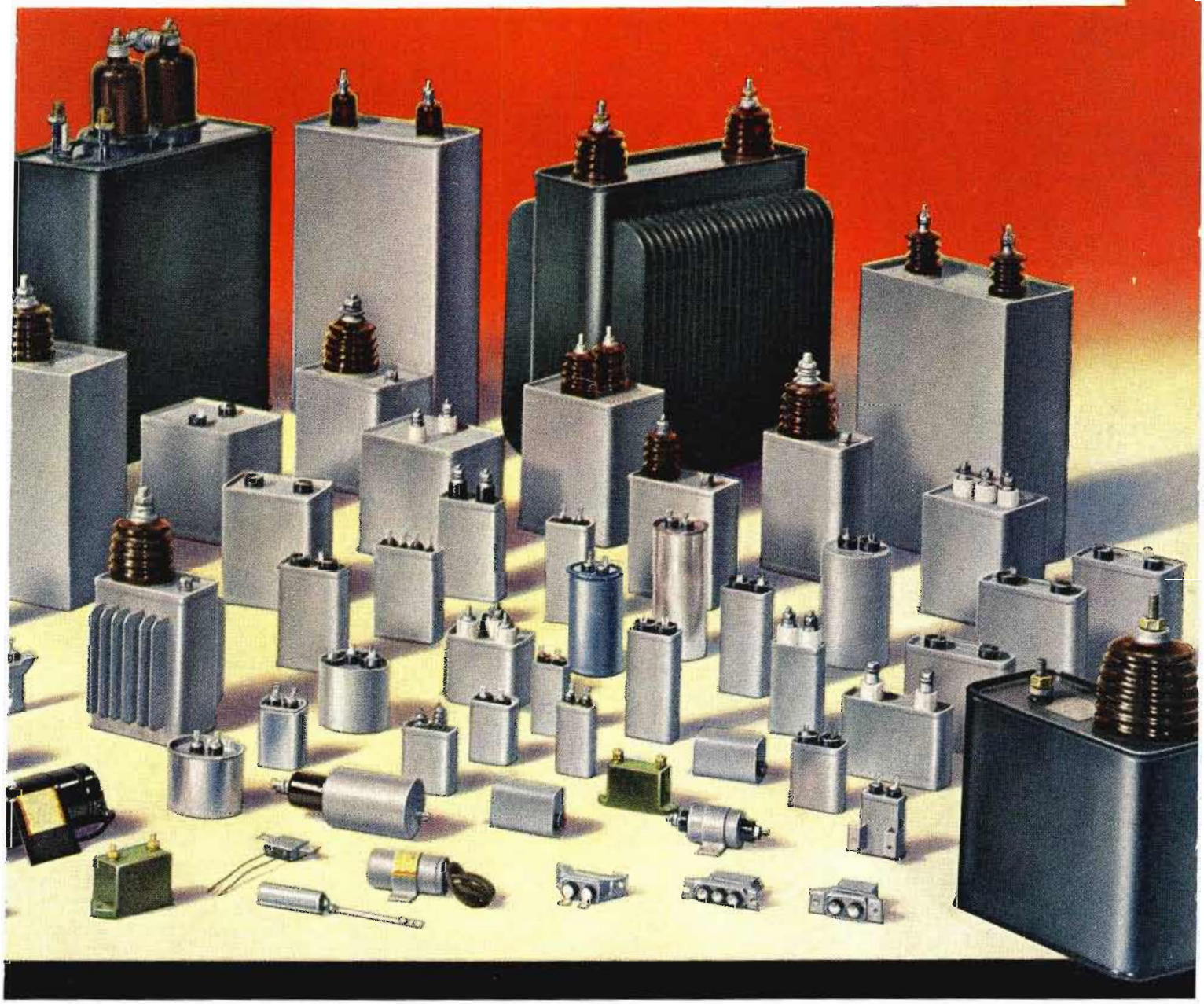


These publications will be of value to you. GEA-640B—an interesting picture story on capacitors. GEA-2621 and -4357 on d-c capacitors. GEA-2027 on general a-c capacitors. GEA-2526 and -4655 on ballast capacitors. Write Apparatus Department, General Electric Company, Schenectady 5, N. Y.

THESE are your capacitors. By and large, they are the result of challenges made on the drawing boards of your equipment design engineers—challenges that have led us to new concepts in capacitor development and design.

We have made contributions—the introduction of the liquid dielectrics Pyranol and Lectronol, the development of thin kraft paper and Lectrofilm, and the use of silicone rubber bushings and gaskets—all evidences of our efforts toward smaller size, lower weight, higher quality, and lower-cost capacitors.

But basically these capacitors have been built to meet your needs. We hope sincerely that you will call upon us whenever we can be of assistance.



GENERAL ELECTRIC

407-158

SERVICE-PROVED COMPONENTS

Available Over Wide Range of Ratings

The extensive experience gained by General Electric in design and manufacture of electronic components for the Armed Forces is available to builders of commercial electronic equipments. In many cases the range of available ratings is wider than ever before.

RESONANT REACTORS, OIL-FILLED, HERMETICALLY SEALED

Resonant-charging reactors, accurately designed and constructed for radar service. Usually required in ratings of 40 kv and below, 1 ampere and below and 300 henries and below. Higher ratings are being built, and can be considered. When required, small- and medium-size designs can be provided with 3 to 1 range of inductance adjustment.

PULSE TRANSFORMERS, OIL-FILLED, HERMETICALLY SEALED

Pulse transformers for use with either hard-tube or line-type modulators. Available in voltage ratings of 10 kv or above. These units are ideal for radar applications, stepping up or down, impedance matching, phase reversing and plate-current measurements. Also suitable for nuclear physics research work, television and numerous special applications in and out of the communications field.

FILAMENT TRANSFORMERS, OIL-FILLED, HERMETICALLY SEALED

Filament transformers available with or without tube socket mounted integral with the high-voltage terminal. Low capacitance. Ratings to match any tubes; insulated to practically any required level.

For price and delivery on the above components, write your nearest General Electric Apparatus Office or direct to General Electric Company, Power Transformer Sales Divisions, 16-215, Pittsfield, Mass.

GENERAL ELECTRIC

407-158A

Memo To TELEVISION MANUFACTURERS

INSUROK

is proving to be the RIGHT plastic material for a growing list of television manufacturers. Three grades of Laminated INSUROK you'll want to consider, for sheet stock or parts fabricated in our factory are

GRADES T-800 • T-640 • T-725

PROPERTIES OF T-800

Thickness	1/16"	1/8"	5/64"	5/64"
Volatile	0.30%	0.20%	0.31%	0.33%
Moisture Abs.	0.30%	0.18%	0.28%	0.28%
Expansion				
Center	.0001"	.0004"	.0001"	.0000"
Edge	.0000"	.0002"	.0001"	.0001"
Tests at Room Conditions				
Tensile				
Lengthwise		8,500		
Crosswise		7,300		
Modulus				
Lengthwise		1,195,000		
Crosswise		1,081,000		
Flexural				
Lengthwise		13,750		
Crosswise		12,300		
Compressive		35,000		
Specific Gravity	1.30	1.30		
Arc Test				
Maximum			26 sec.	22 sec.
Minimum			10 sec.	12 sec.
Dielectric Strength				
Short Time	658	540		
Step by Step	554	433		
Power Factor	.0197	.0199	.0206	.0190
Dielectric Constant	3.90	4.14	3.99	3.91
Loss Factor	.0767	.0823	.0821	.0742
Tests after 96 hrs. at 90% Relative Humidity 104° F.				
Power Factor	.0210	.0218	.0218	.0213
Dielectric Constant	3.99	4.31	4.11	3.98
Loss Factor	.0838	.0900	.0896	.0849
Insulation Resistance	167,000	166,000	225,000	330,000

COMPARISON OF INSUROK T-640 AND INSUROK T-725

Grade	T-640	T-640 Sanded	T-725	T-725 Sanded
Thickness	0.075"	0.078"	0.076"	0.077"
Volatile	0.45%	0.44%	0.31%	0.31%
Moisture Abs.	0.60%	0.67%	0.35%	0.40%
Expansion				
Center	0.0002"	0.0002"	0.0002"	0.0002"
Edge	0.0005"	0.0002"	0.0002"	0.0003"
Cold Flow				
122° F.	0.18%		0.21%	
212° F.	1.23%		2.25%	
Tests at Room Conditions				
Tensile				
Lengthwise	18,900	18,850	18,875	20,000
Crosswise	14,825	14,400	14,900	13,450
Modulus				
Lengthwise	1,385,000	1,340,000	1,395,000	1,550,000
Crosswise	1,125,000	1,250,000	1,265,000	1,145,000
Flexural				
Lengthwise	22,825	22,825	22,225	24,250
Crosswise	18,450	17,950	19,350	17,125
Dielectric Strength				
Short Time	680	664	715	692
Step by Step	604	598	653	641
Arc Test				
Maximum	78 sec.	138 sec.	86 sec.	135 sec.
Minimum	14 sec.	92 sec.	16 sec.	128 sec.
Power factor	0.0323	0.0307	0.0273	0.0278
Dielectric Constant	4.78	4.78	4.32	4.42
Loss Factor	0.154	0.147	0.118	0.123
Tests after 96 hrs. at 90% Relative Humidity 104° F.				
Power Factor	0.0394	0.0362	0.0301	0.0290
Dielectric Constant	5.08	4.88	4.49	4.66
Loss Factor	0.199	0.177	0.135	0.135
Insulation Resistance	17,500	25,500	117,800	95,400

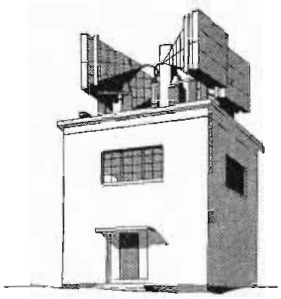
Insulation resistance tested according to A.S.T.M. method D 257-46 using tapered pins.

The RICHARDSON COMPANY

GENERAL OFFICES: LOCKLAND, OHIO FOUNDED IN 1858

Sales Headquarters: MELROSE PARK, ILLINOIS

CLEVELAND - DETROIT - INDIANAPOLIS - MILWAUKEE - NEW BRUNSWICK, (N. J.) - NEW YORK - PHILADELPHIA - ROCHESTER - ST. LOUIS



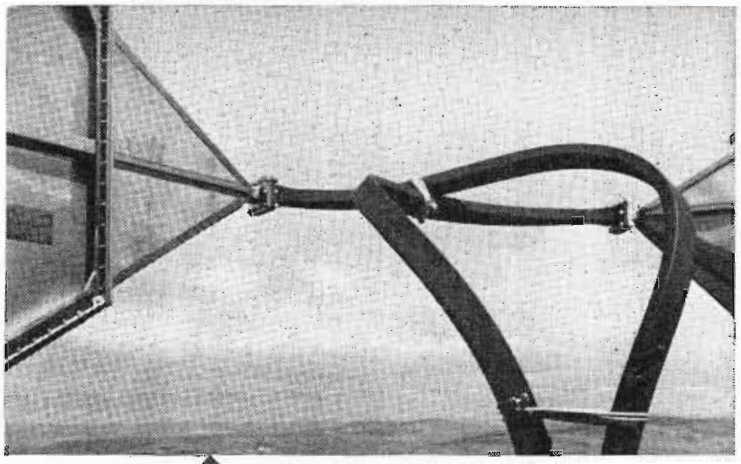
Pipe Circuits

UNLIKE radio broadcast waves, microwaves are too short to be handled effectively in wire circuits. So, for carrying microwaves to and from antennas, Bell Laboratories scientists have developed circuits in "pipes," or waveguides.

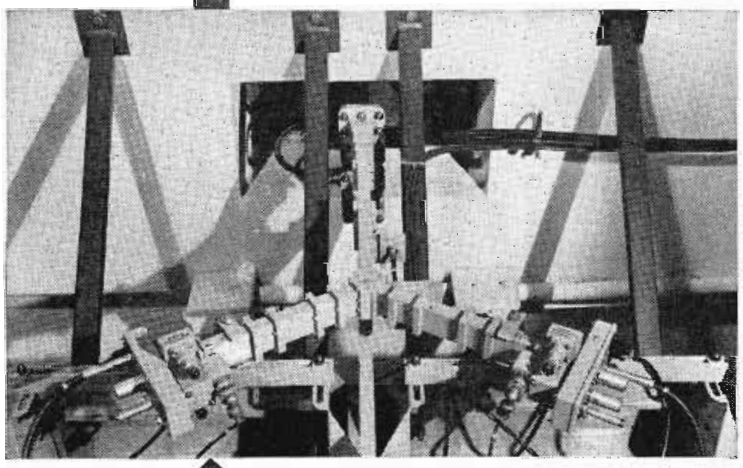
Although the waves travel in the space within the waveguide, still they are influenced by characteristics found also in wire circuits, such as capacitance and inductance. The screw or stud projecting inside the guide wall acts like a capacitor; a rod across the inside, like an inductance coil. Thus transformers, wave filters, resonant circuits – all have their counterpart in waveguide fittings. Such fittings, together with the connection sections of waveguide, constitute a waveguide circuit.

From Bell Laboratories research came the waveguide circuits which carry radio waves between apparatus and antennas of the New York-Boston radio relay system. The aim is to transmit wide frequency bands with high efficiency – band widths which some day can be expanded to carry thousands of telephone conversations and many television pictures.

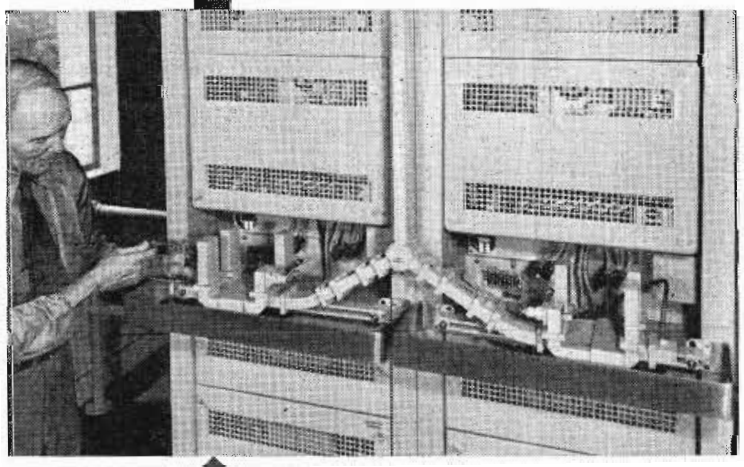
Practical aspects of waveguides were demonstrated by Bell Telephone Laboratories back in 1932. Steady exploration in new fields, years ahead of commercial use, continues to keep your telephone system the most advanced in the world.



3 The waveguide connects with horn antennas which are pointed toward similar antennas at the next stations miles away.



2 Looking upward, the waveguide continues through the roof of the station toward the antennas.



1 Base of a waveguide circuit in a repeater station of the New York-Boston radio relay system.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

NOW

A NEW FLUX FOR CORED SOLDER

"RESIN-FIVE"

"Resin-Five" Is More Active . . . More Efficient . . . More Stable . . . Than ANY Rosin Flux . . . And Yet

NON-CORROSIVE NON-CONDUCTIVE

ODORLESS!

. . . Yes—"RESIN-FIVE" is virtually without odor at relatively high tempero-. tures!

MOBILITY!

. . . "RESIN-FIVE" is so mobile it is *highly effective in sweating seams.* The activity and stability of "RESIN-FIVE" Flux make this an accomplished fact!

"Resin-Five is Available In 5 Core Sizes with Varying Percentages of Flux Content. Diameters ranging from .010" to .250"—All Practical Alloys!

ACTIVITY UNEQUALED!

. . . Just Think Of This—"RESIN-FIVE" will solder easily and readily such metals as Zinc, Brass, Nickel Silver, Nickel-Plate, Copper and Ferrous Alloys. REMEMBER "RESIN-FIVE" IS NOT CORROSIVE AND IS NOT CONDUCTIVE!

STABILITY!

. . . "RESIN-FIVE" is *STABLE* under the most extreme soldering temperatures and the Flux still does the jab!

Contact Kester's Technical Department and get the facts on this unusual product.

NON-CORROSIVE • NON-CONDUCTIVE

KESTER SOLDER

KESTER SOLDER COMPANY

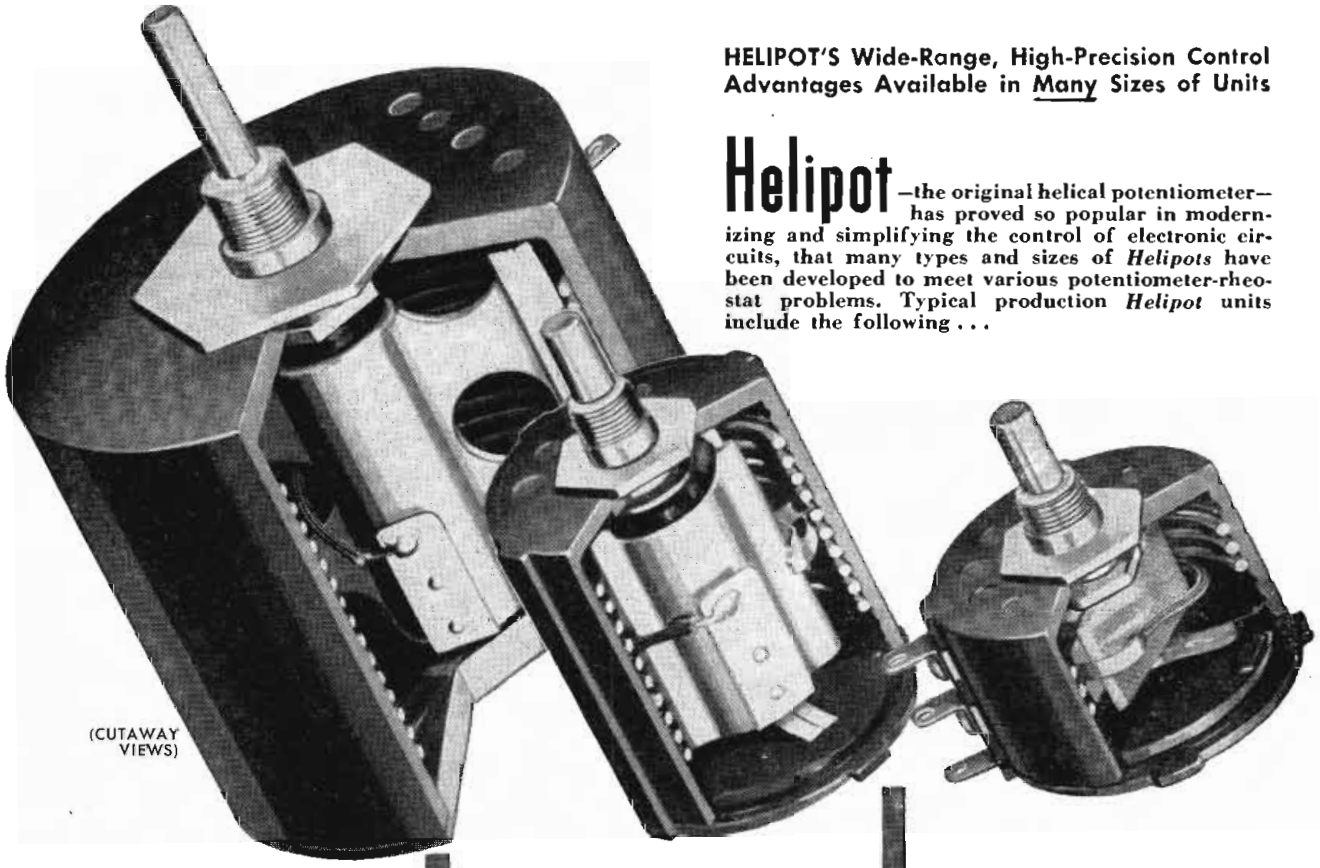
4201 W. Wrightwood Avenue, Chicago 39, Illinois

Factories also at Newark, N. J. • Brantford, Canada

There's a Beckman Helipot

(Trade Mark of the **HELI**cal **POT**entiometer)

to simplify YOUR Potentiometer—Rheostat Problems!



(CUTAWAY VIEWS)

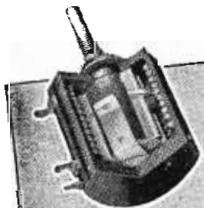
HELIPOT'S Wide-Range, High-Precision Control Advantages Available in Many Sizes of Units

Helipot—the original helical potentiometer—has proved so popular in modernizing and simplifying the control of electronic circuits, that many types and sizes of *Helipots* have been developed to meet various potentiometer-rheostat problems. Typical production *Helipot* units include the following . . .

MODEL B—Case diameter—3.3"; Number of turns—15; Slide wire length—140½"; Rotation—5400°; Power rating—10 watts; Resistance ratings—50 to 300,000 ohms.

MODEL A—Case diameter—1.8"; Number of turns—10; Slide wire length—46½"; Rotation—3600°; Power rating—5 watts; Resistance ratings—10 to 100,000 ohms.

MODEL C—Case diameter—1.8"; Number of turns—3; Slide wire length—13.5"; Rotation—1080°; Power rating—3 watts; Resistance ratings—5 to 30,000 ohms.



WIDE CHOICE OF DESIGN FEATURES

Not only are *Helipots* available in a wide range of sizes and ratings, but also can be supplied with various design features to meet individual requirements . . .

- Available with special length shafts, flatted shafts, screwdriver slots, etc.
- Can be supplied with shaft extensions at each end to permit coupling to indicating instruments or other devices.
- May be provided in ganged assemblies of two or three units, all operating from a common shaft.
- Available with linearity tolerances of 0.1%—and even less.
- Models A & B can be modified to include additional taps at virtually any point on windings.

. . . and many other special features.

Investigate the many important advantages to be gained by using the *Helipot* in your electronic control applications. Write outlining your problem!

Have you latest data on DUODIAL — the turns-indicating knob dial? If not, write!

SPECIAL MODELS

In addition to the above standard *Helipot* units, special models in production include . . .

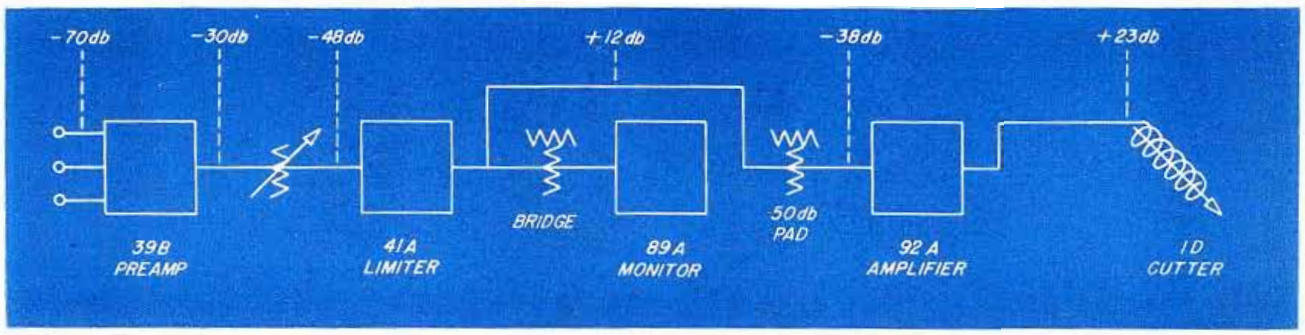
MODEL D—Similar to Model B, above, but longer and with greater length of slide wire. Case diameter—3.3"; Number of turns—25; Slide wire length—234"; Rotation—9000°; Power rating—15 watts; Resistanee ratings—100 to 500,000 ohms.

MODEL E—Similar to Model B, but longer and with greater length of slide wire than Model D. Case diameter—3.3"; Number of turns—40; Slide wire length—373"; Rotation—14,400°; Power rating—20 watts; Resistance ratings—150 to 800,000 ohms.

Send for HELIPOT Literature!

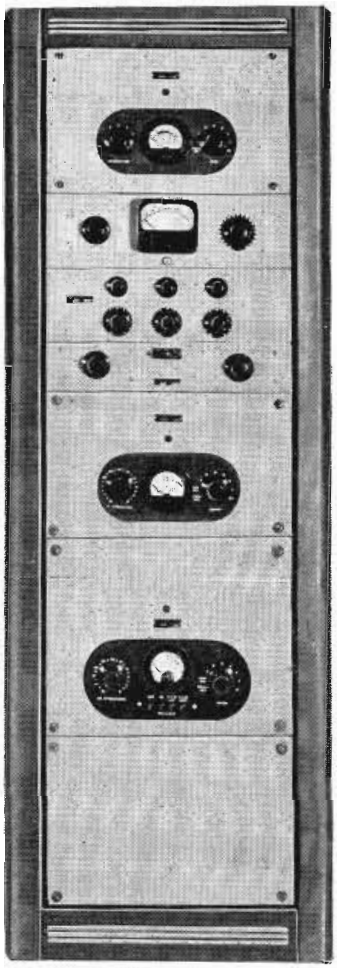
THE Helipot CORPORATION

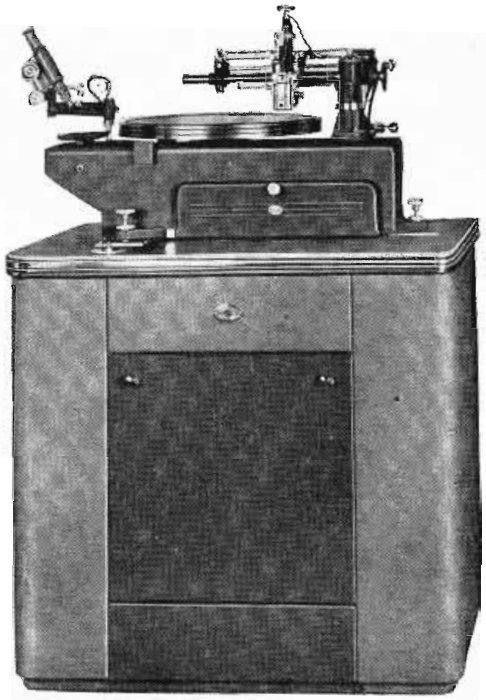
SOUTH PASADENA 3, CALIFORNIA



You're sure

WHEN IT'S 100% PRESTO





Pictured here is an all-Presto single channel recording system. Above is the block diagram, worked out for this equipment by Presto engineers.

WHEN YOU NEED recording or transcription equipment you can't go wrong if you make the complete system 100% Presto.

For Presto is the world's foremost manufacturer of recording and transcription equipment and discs. And Presto's experience with countless installations, including all the big ones, will aid you in achieving greater efficiency and trouble-free operation.

The recorder is the 8DG with direct gear drive. The amplifiers are the 39-B three channel preamp, the 41-A limiter, the 92-A 60 watt recording amplifier, and the 89-A monitor.

Multiple channel installations consist of as many duplications of the basic channel as are needed with the addition of switch or patching facilities. When you think of recording, think of PRESTO.

PRESTO

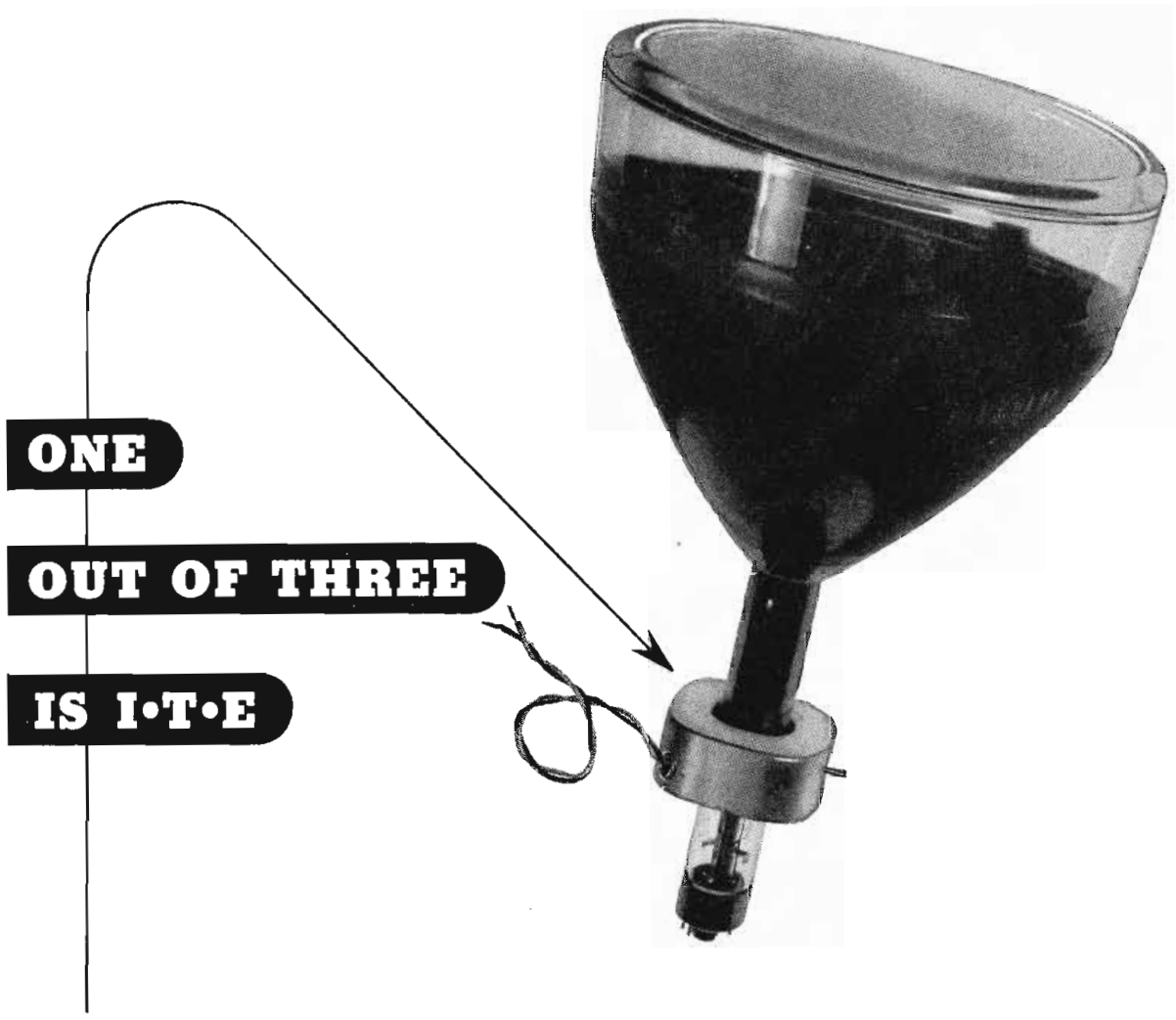
RECORDING CORPORATION

Paramus, New Jersey

Mailing Address: P.O. Box 500, Hackensack, N. J.

In Canada: WALTER P. DOWNS, Ltd., Dominion Sq. Bldg., Montreal

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



ONE OUT OF EVERY THREE television sets equipped with magnetic deflection means utilizes an I-T-E Focus Coil! — testimony enough to the dependability, effectiveness, and manufacturing economies to be obtained with these precision-built coils.

I-T-E Focus Coils are made for use with tubes 10″, 12″ and 16″ in size. They are completely *engineered* for quality throughout. Best uniform-cross-section enameled copper wire is wound on a core of acid-free, impregnated paper. Terminals are securely anchored — will actually withstand a 16-lb. pull on each lead. Entire wound assembly is completely enclosed in a pressed-steel case, which is zinc-plated to resist corrosion. The coil center-hole is sufficiently large to allow adjustment of raster on screen.

I-T-E Focus Coils are available in three standard mountings, and specified mountings can be supplied on request.

For complete technical information on I-T-E Focus Coils—or on other I-T-E precision-built wire-wound products — write, specifying your needs.

I-T-E

FOCUS COILS

The Leader In Technical Excellence

I-T-E CIRCUIT BREAKER CO., RESISTOR DIVISION

19TH & HAMILTON STREETS, PHILADELPHIA 30, PA.

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • AUTOMATIC RECLOSING CIRCUIT BREAKERS • RESISTORS • SPECIAL PRODUCTS

PHILCO

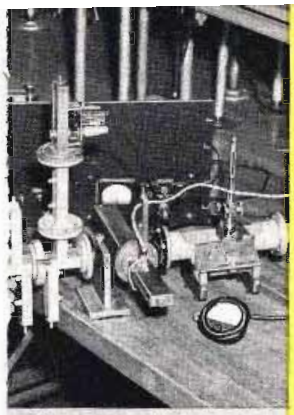
ONE OF THE WORLD'S FOREMOST ENGINEERING ORGANIZATIONS

With a research, engineering and field staff of more than 1000 technically trained individuals, Philco is today applying *more manpower to its farflung engineering activities* than to any other phase of the company's operations except the actual manufacture of its products.

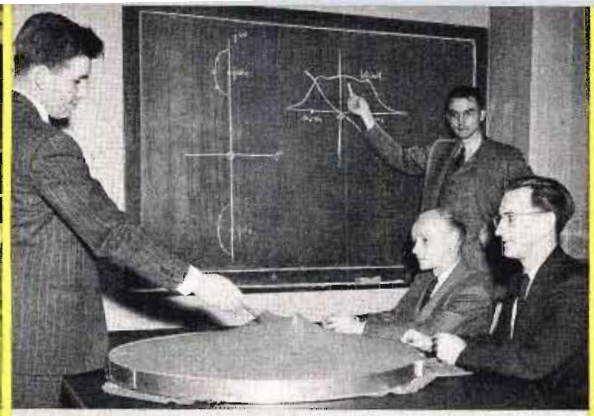
Philco scientists and engineers are engaged in a diversified program ranging from fundamental research in various fields of physics, chemistry, electronics and applied mathematics to design and development work on hundreds of materials, components and finished products. Manufacture of these products—home and auto radios, radio-phonographs, television receivers—refrigerators, freezers, air conditioners—mobile radio-telephone, microwave relays and communications equipment—radar, loran and military devices—calls for additional engineering talents applied to mass production. And still other engineers are making important contributions in such activities as Philco television station WPTZ and a worldwide organization of field service engineers.

Another important phase is the company's participation with leading technical institutions in joint undergraduate cooperative courses and in advanced graduate and postgraduate studies.

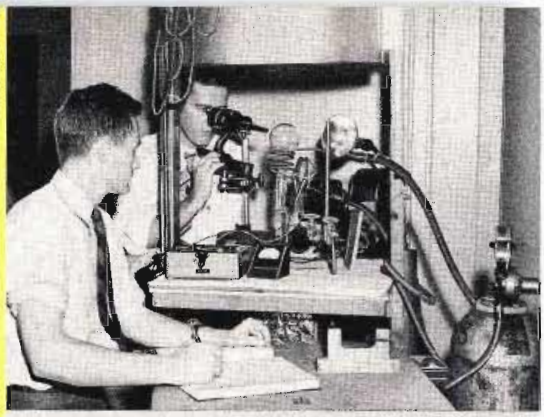
On the pages within are presented some illustrations of the scope and character of the work being done by Philco scientists and engineers to advance the frontiers of knowledge in electronics.



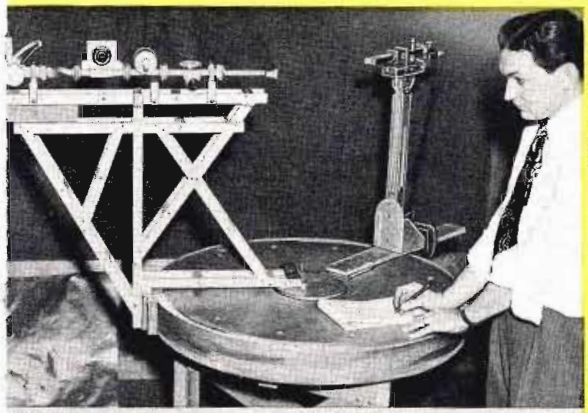
wave "plumbing" is being
tions for precise frequency
vision relays.



This model clarifies the mathematical problems of designing a complicated wideband amplifier. This technique has been of the greatest value in designing television receivers.



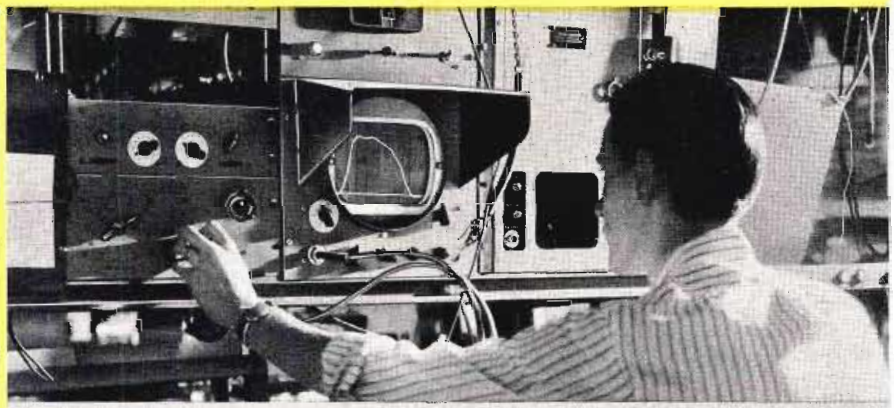
Optical properties of thin evaporated films are investigated in one of the Philco physics labaratories. Such films are important in television tube research.



of microwave radiation requires careful design of feed horns for
on of the reflecting antenna dish. Horn patterns are being mea-
ating table surrounded with a radiation-absarbing background.

The trend towards subminiaturized construction is being applied to many types of present-day equipment by Philco research and development engineers. This model of a plug-in unit provides a sweep generator circuit that is readily replaceable.

a cathode ray picture tube for a Philco television set are
neet engineering "specs". Many man-hours of engineer-
ich precision test equipment to simplify mass production.



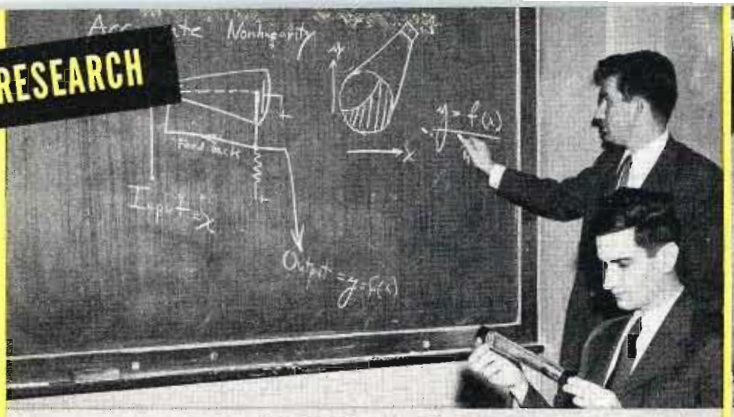
This equipment is used for padding IF amplifiers of television chassis as they move along a powered belt. Throughout the Philco plants is similar specialized test equipment, each element designed by engineers who are experts in mass production requirements.

r 500 Philco Technical Representatives serve with the Air Force, Army and
y as a world-wide organization of instructors and maintenance experts
king with radar, radio, communications and refrigeration equipment.

A key function of field service engineers is training distributor and dealer personnel to service such products as television sets. Philco has given full training to more TV servicemen than all other manufacturers combined.

PHILCO

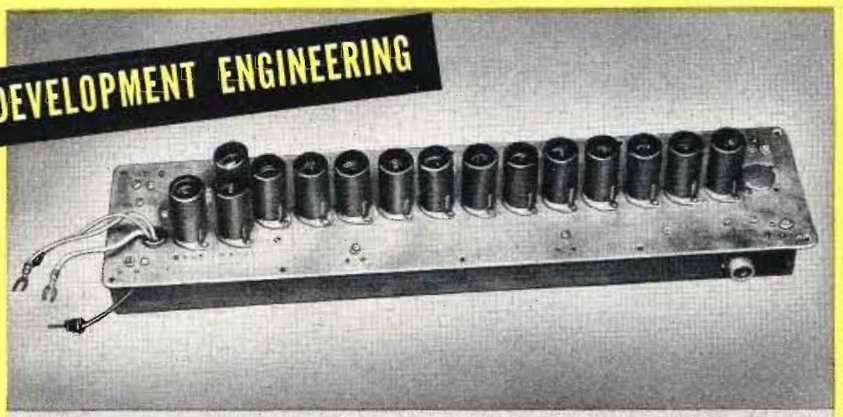
RESEARCH



The "Monoformer" is a form of cathode ray tube developed by Philco to yield a voltage related to ony fixed curve inscribed on the special screen of the tube. Important uses are forecast in computer circuits.

This imposing array of micro used to check design calcula selective filters used with tele

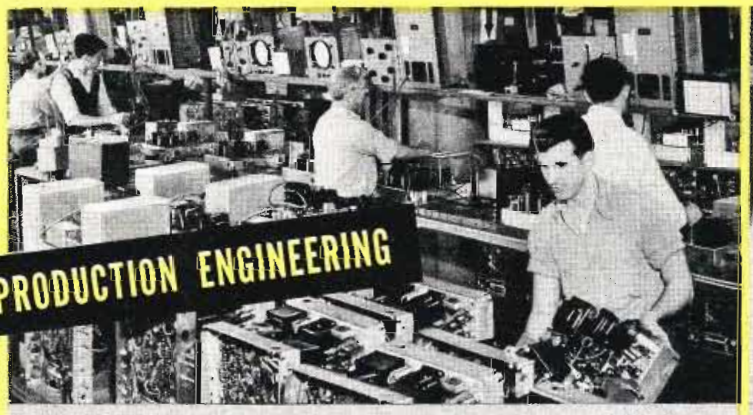
DEVELOPMENT ENGINEERING



Television relaying requires IF amplifiers such as the 75 mc strip shown here with bandwidths of over 20 mc. Philco has developed a design method that assures high quality of transmission over long distances through the use of such "transparent" circuitry for relaying.

The transmission proper illuminati sured on this rat

PRODUCTION ENGINEERING



Aligning and testing television sets on a moving conveyor are typical Philco advances in the art of electronic mass production. Skilled factory engineers design such vast operations with *engineered efficiency* in every detail.

Electrical characteristics of checked to make sure they ing skill go into designing s

This WPTZ transmitter, designed and built by Philco engineers, provided more hours of television broadcasts than any other television transmitter in the world during the nine-year span from 1939 until 1948.

SERVI

Ove Nav wor

MICROWAVE RELAYS FOR TELEVISION AND COMMUNICATIONS

PRODUCTS OF PHILCO ENGINEERING

GOOD PRODUCTS stem from good engineering. Philco products have established a world-wide reputation for quality during the 56 years of the company's history, and that reputation has been solidly founded on engineering achievement.

Now, as Philco extends its research and engineering scope far beyond the horizons of a few years ago, the men and women of its vast laboratories are engaged in a diversified program of pioneering the new and even better products of tomorrow. Today new opportunities for engineers and research scientists are opening up in Philco's expanding activities in radio, television, refrigeration and industrial electronics.

AIRBORNE RADAR

AUTOMOBILE RADIO RECEIVERS AND AM AND FM COMMUNICATIONS EQUIPMENT

LORAN FOR MARINE AND AIRCRAFT NAVIGATION

RECORD PLAYER FOR MICROGROOVE LONG PLAYING RECORDS

TELEVISION, AM, FM, RADIO-PHONOGRAPH COMBINATION

AS NEW AS THE FUTURE!

. . . the only transformer line of its kind

Advanced, practical engineering gives you

THESE OUTSTANDING FEATURES

1 SEALED IN STEEL CONSTRUCTION

Chicago Transformer's drawn steel cases provide convenient, compact mountings; seamless steel-wall protection against atmospheric moisture and corrosion; unsurpassed strength and rigidity to withstand shock and vibration; clean, streamlined appearance that adds eye-appeal to any equipment.

2 CHOICE OF CONNECTORS

Solder lugs or wire leads. Most units are available with identical ratings in two base styles to fit your price and/or wiring preference.

3 CHARACTERISTICS KEYED TO MODERN TUBES

Voltage, current, and output ratings have been designed for one purpose only—to fill the requirements of the receiving, transmitting, and industrial electronic tubes currently most in demand. No listings wasted on obsolete circuit needs. Result—a condensed, yet comprehensive, line that's right in step with today's new circuit designs.

4 EXACT MATCHING OF REACTORS

with power transformers. Current ratings of plate and filament supply transformers and of the high voltage plate transformers are matched by choke capacities specially designed for the purpose. Mountings match, as well, for uniform, "tailored" good looks.

5 TRUE HIGH FIDELITY THROUGHOUT 3 RANGES

Frequency response within ±½ db; distortion exceedingly low, even at low frequencies. These are the characteristics of the input and output transformers. Driver and modulation transformers provide response within ±1 db. All audio units are designed for frequency ranges that fit three classes of up-to-date audio application. Full Frequency Range: 30-15,000 cycles (good up to 20,000 cycles, where required). Public Address Range: 50-10,000 cycles. Communications Range (voice): 200-3,500 cycles.

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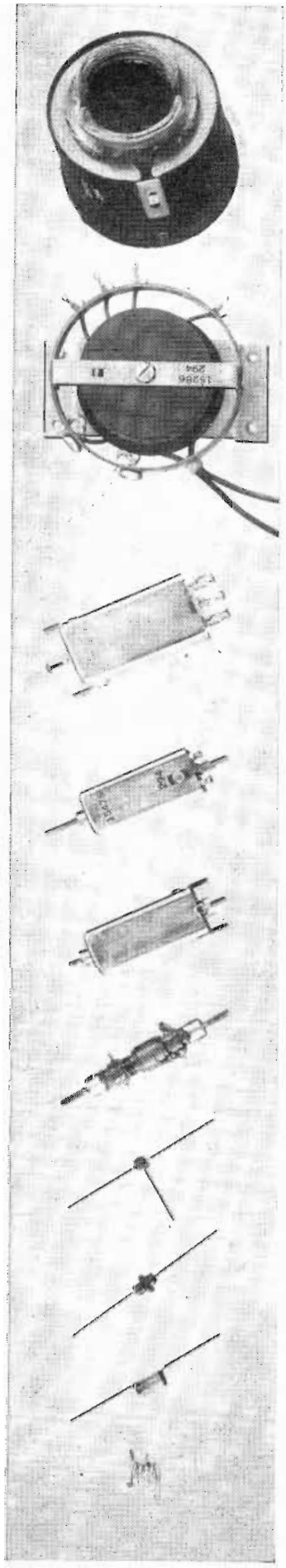

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Foremost Name

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THREE DECADES

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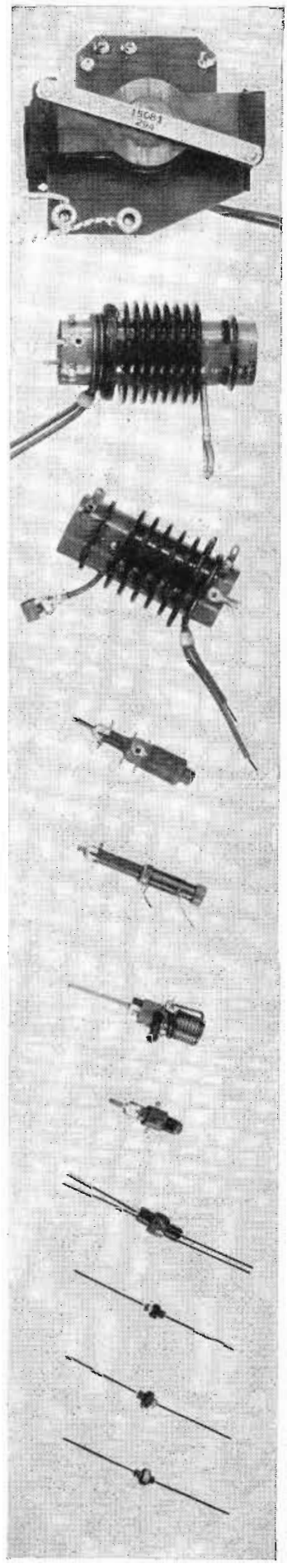


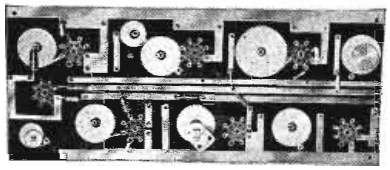
Die-Stamped Circuits for Radio and Television

The Franklin System provides mass production with greater uniformity, lower cost and less weight.

New stamping method produces inductances, tuner circuits, stamped wiring, ground connections, etc., all in ONE operation.

Franklin's die-stamped circuits for television, radio, broadcast and industrial electronic equipment are the industry's first major advance in high-speed economical manufacturing. What mass production methods accomplished in the automotive field is known to all. The one-piece body, for example, revolutionized automobile production. And, significantly enough, the process was one of stamping.

For 25 years, radio's production lines have been enslaved and slowed up by the limitations of hand-assembly, hand-wiring, hand-soldering and hand-testing.

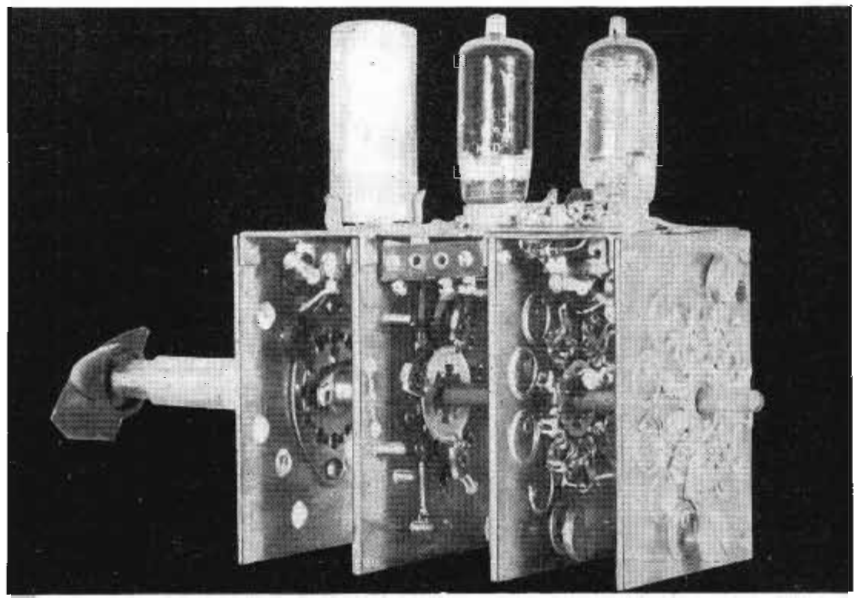


Sound Video Panel embodies the stamping method used to produce stamped circuits, inductances, high frequency coils, tuned circuits, ground connections, tube sockets and connections for components.

Never has the industry experienced the benefits of fast, low-cost production and its numerous by-products such as uniformity in quality and performance and reduction of human error.

Now, however, the industry enters a new era with great new possibilities of stepping up its output and lowering its costs. In one operation, at one stroke of a machine the complete wiring and inductance coils can be stamped. The same panel includes the sockets and pin connectors, permitting a single dip-soldering operation.

Typical of these operations are the Rotary Station Selector and the Sound and Video panel, illustrated on this page. These are among the more recent examples of the Franklin stamped wiring technique. The Sound and Video panel shows at a glance how a complicated and critical group of components is produced by, or embodied in, the stamping process.



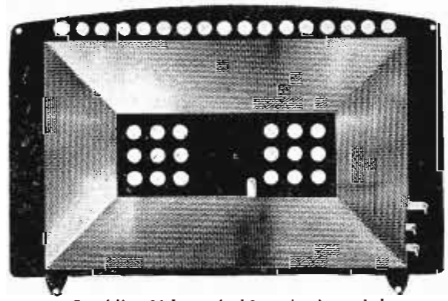
Typical 12 channel television selector switch without steel housing. All inductors are die-stamped by the Franklin stamping method.

This feature has long been known by radio manufacturers using Franklin Stamped Airloops; their accuracy and uniformity permits radio receivers to be produced and tested with a dummy antenna system. The Airloop, being a combination loop and cabinet back, can then be installed in the last operation.

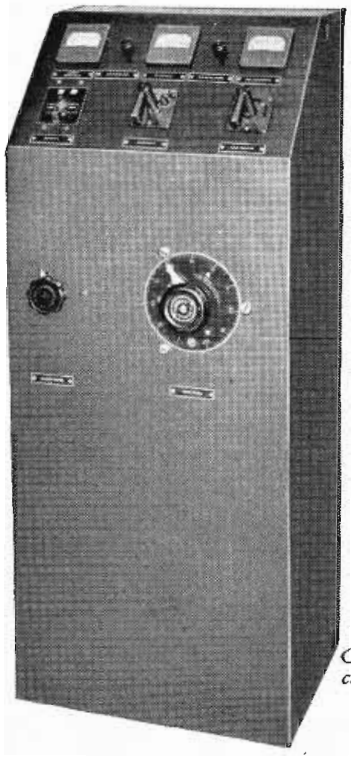
Our patented processes have insured precise duplication of these critical items as to electrical characteristics. The extent to which this feature of introducing exact and interchangeable units can facilitate the production of complicated circuit assemblies, may not be fully realized by some designers; for example, the RF or the IF assembly in the television receiver where the combined effect of circuit variables in each of several stages makes adjustment and alignment so complicated it must be done by technical experts.

In the Franklin system where the coils and wiring can be made identical in each assembly, many of the alignment operations are eliminated.

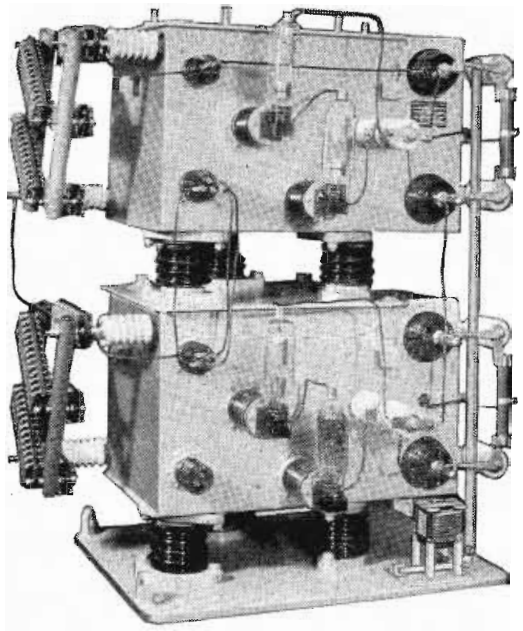
Development work on the Franklin Stamped Wiring technique has been stepped up and through the cooperation of the engineering departments of several of the larger television companies, rapid progress is being made. Those engineers who have had an opportunity to study our methods at first hand are convinced that this is the one known method of reducing television receiver costs. Franklin Airloop Corp., 4320 34th Street, Long Island City, New York. Adv.



Franklin Airloop (cabinet back and loop antenna) standard equipment with leading radio receiver manufacturers.



Control panel for use with cascade rectifiers.



This cascade rectifier, 42 inches high, delivers 70 kv, 15 ma d-c. Consists of two basic Kenotron-tube rectifier units.

Now SMALL RECTIFIERS FOR DC VOLTAGES up to 135 KV

New, within the last year, is this small cascade-type rectifier for generating smooth high d-c voltages. Suitable for laboratory and factory for testing and as power supply. Features: versatility, reliability, reasonable price and long tube life with much lower cost of replacement tubes. The rectifiers can be furnished for single-phase operation from 115- or 230-volt, 50- or 60-cycle power supply.

Basic unit is a 35 kv, 32 ma (continuous) rectifier, with necessary transformers mounted in an oil-filled steel tank. Each unit is 34″ wide, 25″ deep and 21″ high. Up to four units can be stacked, giving d-c voltages up to 135 kv. Output voltage ripple, peak to peak, will not exceed 0.1% per milliampere.

A CONTROL PANEL can be supplied which will provide smooth output voltage control over the complete range from zero to maximum. Accuracy of output voltage, with this panel, is ±5 per cent of full scale; accuracy of current indication, ±2 per cent. Overcurrent protection is included.

SUITABLE FOR INTEGRAL MOUNTING. Because of its small size, this rectifier can often be mounted within the enclosure housing your own product. Such integral mounting is usually preferable from all standpoints—lowers cost, saves space, and improves appearance of the entire assembly.

STANDARD UNITS, IN REGULAR PRODUCTION. These cascade rectifiers are built up of standard units that are in regular production. They can be shipped on shorter schedules than are normal for this general class of equipment.

For prices and specific information, address inquiries to our nearest office, or to General Electric Company, Transformer Sales Division, 16-215, Pittsfield, Mass.

GENERAL ELECTRIC

401-55

This NEW DuMont Type 248-A

does the work of 2 oscillographs

1 WITH THE TYPE 5RP-A CATHODE-RAY TUBE AT 4000 VOLTS ACCELERATING POTENTIAL

The new Du Mont Type 248-A, which replaces the former Type 248 in the medium-voltage field, now employs the Type 5RP-A Cathode-ray Tube at an accelerating potential of 4000 volts. As a wide-band oscillograph (5mc) for studies of pulses and other signals containing high-frequency components, the Type 248-A still provides all the desirable features of the discontinued Type 248. In addition, it may be used immediately as a high-voltage oscillograph simply by plugging in a suitable power supply. No modification is necessary.

Thus the new Type 248-A can take the place of two instruments—a medium-voltage and a high-voltage cathode-ray oscillograph. And, best of all, production economies allow the new Type 248-A to be sold at the same low price of the former Type 248.

Now, more than ever, the Type 248-A excels any instrument in its class!

Du Mont Type 248-A
Cat. No. 1244-E, with 5RP2-A
$1870.00

2 AND FOR OPERATION AT 14,000 VOLTS ACCELERATING POTENTIAL, JUST PLUG IN THE TYPE 263-B HIGH-VOLTAGE POWER SUPPLY

The requirements of modern oscillography frequently demand relatively high accelerating potentials for the investigation and photo-recording of high-speed transients and pulses of extremely low repetition-rates. 14,000 volts accelerating potential is immediately available for these studies, with the Type 248-A, by simply plugging in a power supply such as the new Du Mont Type 263-B. No modification is necessary.

With the power supply and the Type 2088 Projection Lens, the Type 248-A becomes also a projection oscillograph.

The facility with which the range and versatility of the Type 248-A are thus increased, together with the availability of such Du Mont accessories as projection lenses, power supplies and oscillograph record cameras, is further evidence that in oscillography, Du Mont is *always* your best buy.

Technical details on request

Du Mont Type 263-B
High-Voltage Power Supply
Cat. No. 1208-E $142.50

DUMONT *for Oscillography*

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TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

TO MOBILIZE ALL RADIO FACTORIES—Too much military radio production is now being demanded of the "big" manufacturers, while hundreds of smaller plants get no part in defense output. The RMA industry mobilization proposal outlined on following pages would break up this concentration of Government orders, so that many manufacturers now turning out only civilian products would right away, get at least small defense orders. By working on these they would acquire the know-how of making Government equipment, which differs greatly from civilian goods in standards and technique. From this initial nucleus, the smaller factories could expand rapidly when called on for heavier defense production —or in case of war.

TV PROGRAM IDENTIFICATION—Television-camera designers may soon be asked to devise means of showing station call-letters and sponsors' names throughout all programs. Idea would be to have the unobtrusive station-identification appear in the lower left-hand corner of TV screen all the time the station is on the air. Above call-letters could be inserted single word designating the sponsor of program being viewed. Proposal stems back to the old-time Biograph movie days when each film had identifying name or trade-mark in all scenes. As suggested for TV, plan would answer repeated inquiries from video audience, "What station is this?" and "Who is the sponsor?"

TV identification idea has been discussed with several station execs and sponsors who seem enthusiastic about the benefits. We think the TV audience, too, will be glad to have such continuous identification.

GETTING DOWN TO BED ROCK—The communication industry is blessed with engineers who have not been too lazy to work out accurate theories or to solve the mathematical problems that have arisen. There was a time when electronic tube operation itself was explained by mechanical analogies, with marbles, shot, etc., simulating the electrons. While oftimes ingenious, these systems rarely explained things accurately enough to be of any value. Now, however, the electronic art has progressed so fast and so far, and the basic characteristics of circuit networks are so well known, that today many of the old problems in mechanics, physics, chemistry and other basic fields are quickly and accurately solved by electronic analog systems. When some such problem comes up, engineers are apt to search around for an electronic problem whose solution involves the same sort of mathematical relations, and then set up an analog that will give the answers.

YOUNG ENGINEERS VS. JOBS—Nearly 90% of the students now enrolled in electrical-engineering courses are taking studies which lead to degrees in communications or radio-electronic applications! This in spite of the fact that hundreds of heavy-current electrical engineering jobs are going begging, while radio jobs may soon be far behind the supply of men.

At present 35,000 seniors are enrolled in all the engineering courses in the nation, yet the prospect for engineering jobs to be available next June runs only about 29,000. Trouble and disappointment is evidently ahead for Graduation Day, 1949. And this will be even more acute on later anniversaries, when diplomas eventually are handed out to the present 50,000 engineering juniors, 73,000 sophomores, and 57,000 freshmen—with only about 26,000 jobs in sight!

RADIO ABSORPTION BY HUMID AIR—Dr. Van Vleck of Harvard first predicted, theoretically, that at certain wavelengths, microwaves would be absorbed by water vapor. When the U. S. Armed Forces encountered difficulty with K-band radar on humid days near the end of the war, Columbia University undertook a special study of the trouble.

During these researches, predictions of radio absorption were not only validated but extended. Water vapor was found to be strongly resonant with waves of about 1.33 centimeters. When humidity approaches that of a muggy tropical day, 94% of the energy is lost by waves beamed at targets only three miles away.

Other gases were also found to exhibit similar absorption characteristics, each resonant at a different frequency, as reported in the C. H. Townes' paper on microwaves before the Philadelphia Instrumentation Conference on a following page.

HOW "VIDEO" WAS BORN—It was way back in 1932 at an RMA sub-committee meeting in New York when the committee members, appointed for the purpose of proposing standards for TV, were asked to find a name for the frequencies that produce pictures, comparable with terms such as "audio". The committee consisted of Dr. A. N. Goldsmith, J. V. L. Hogan and Dr. A. F. Murray. Aften an hour spent on the problem, the three master-minds came up with three good names, one of them "video." Soon, however, all agreed that "video" best filled the bill. The word is believed to have come from the list furnished by John Hogan. Even then, the committeemen were not sure "video" would really catch on, until, months later, they saw it copied by the formal British wireless magazines, always slow to adapt Yankee technical terms.

To Put US Radio Factories on

An outline of the RMA plan for industry-wide prime contractors and sub-contractors. Aims to enlist all manufacturers of radio devices and parts

THE question of industrial mobilization can be made very simple by recognition of a few fundamental facts:

1. Industrial mobilization means all-out effort.
2. So that later all-out industrial mobilization can be accomplished in minimum time, we need NOW the intelligent utilization of all existing industrial facilities. This means:
   (a) Industry as a whole must participate.
   (b) Ultimate mobilization plans must be coordinated with *current procurement* as an essential preliminary to placing the industry in readiness for any all-out effort.
   (c) Individual elements of the industry must participate in the ratio of their ability to contribute.
   (d) Procurement must be channeled to individual elements of the industry to provide a sufficiently uniform flow of work to justify the establishment of departments suitably staffed and equipped to handle intelligently the work loads placed upon them.

While directed specifically to radio, this Plan may be readily applied to other industries.

The radio - electronic industry comprises a total of some 200 manufacturer-assemblers and some 150 parts suppliers.* The volume of completed radio apparatus produced in 1947 approached one billion dollars, which from current indications may shortly be the volume of military business alone. Of the 200 manufacturer-assemblers, approximately 50 companies had annual billings of five million dollars and upwards. Of this group of 50 companies, 40 had annual billings of 10 million dollars and upwards. The group of 40 companies just referred to may be divided conveniently into two portions.

First: A group of some 10 companies heavily engaged in the design, development and manufacture of military radio and electronic equipment but which, together, produce about 25% of the home radio equipment.

Second: A group comprising some 30 companies which devote their principal attention to the design, development and manufacture of home radio equipment and produce about 60% of the industry's volume, but are now doing little or no Government work.

Third: The remaining group of companies comprising some 160, produce about 15% of the home radio equipment. Although there may be some companies in this group which are doing a substantial amount of Government work in comparison to their size, in the aggregate the contribution of this group to the current preparedness program is not large.

The significant point in the preceding figures is the fact that the backbone of the radio industry is not now participating in the design, development and manufacture of military radio apparatus. It is fundamental that this great segment of the industry must participate if rapid all-out mobilization is ever to be accomplished with success, and this participation must be along the lines of good business procedure.

Assume that the backbone companies of the industry could be induced to undertake military work to a minimum of 25 percent of current billings and be assured of a reasonable profit. With this assurance and continuing production for the Government, an adequate military department could be supported. Such a military department would be headed and staffed by the type and character of people required for the particular operation. Such people are specialists and without the support of Government business, there is little incentive for many manufacturers to carry such people on the payroll. To implement this assumption, selected contracts, work

*In the business-office files of Tele-Tech and Caldwell-Clements, Inc., however, there are the names and addresses of some 1100 manufacturers of radio equipment and components.

Industry Mobilization Committee of the RMA

PRESENT plans for industrial mobilization of radio production are largely built around the original proposals of William A. MacDonald, president of Hazeltine Electronics Corporation. Supplementing these outlines, the RMA Industry Mobilization Policy Committee has considered other reports and material emanating from Washington.
The RMA Industry Mobilization Committee comprises:

Chairman, Fred R. Lack, vice-president Western Electric Co., New York
Vice-Chairman, Paul V. Galvin, president Motorola, Inc., Chicago

Harry A. Ehle, vice president
International Resistance Corp., Phila., Pa.

H. L. Hoffman, president
Hoffman Radio Corp., Los Angeles

Frank M. Folsom, vice president
Radio Corp. of America, Camden, N. J.

W. A. MacDonald, president
Hazeltine Electronics Corp., N. Y., N. Y.

George R. Haase, vice president
Operadio Mfg. Co., St. Charles, Ill.

R. C. Sprague, president
Sprague Electric Co., N. Adams, Mass.

25% Military Production Basis

and tasks should be let on a negotiated or other satisfactory basis to these qualified companies.

Other companies where a minimum of 25 percent of the total volume of business would not justify establishment of a special military department, could be assigned to specific companies as subcontractors, and encouragement offered to both the prime contractors and subcontractors to develop friendly working relationships.

With the elements and tools specified in the preceding paragraphs, it is expected that the following results could be accomplished:

a—Organization of a majority of the radio-electronic industry into a well-defined, coordinated activity.

b—Each prime contractor would have a well-staffed, well-organized department with a well-qualified head. This department would be susceptible to rapid expansion at short notice.

c—Each prime contractor would become experienced in design, development and manufacture of military equipment and in proportion to its ability to contribute.

d—Each prime contractor would be responsible for specified other companies to be used as subcontractors, thus placing responsibility for education of these other companies in the most experienced hands.

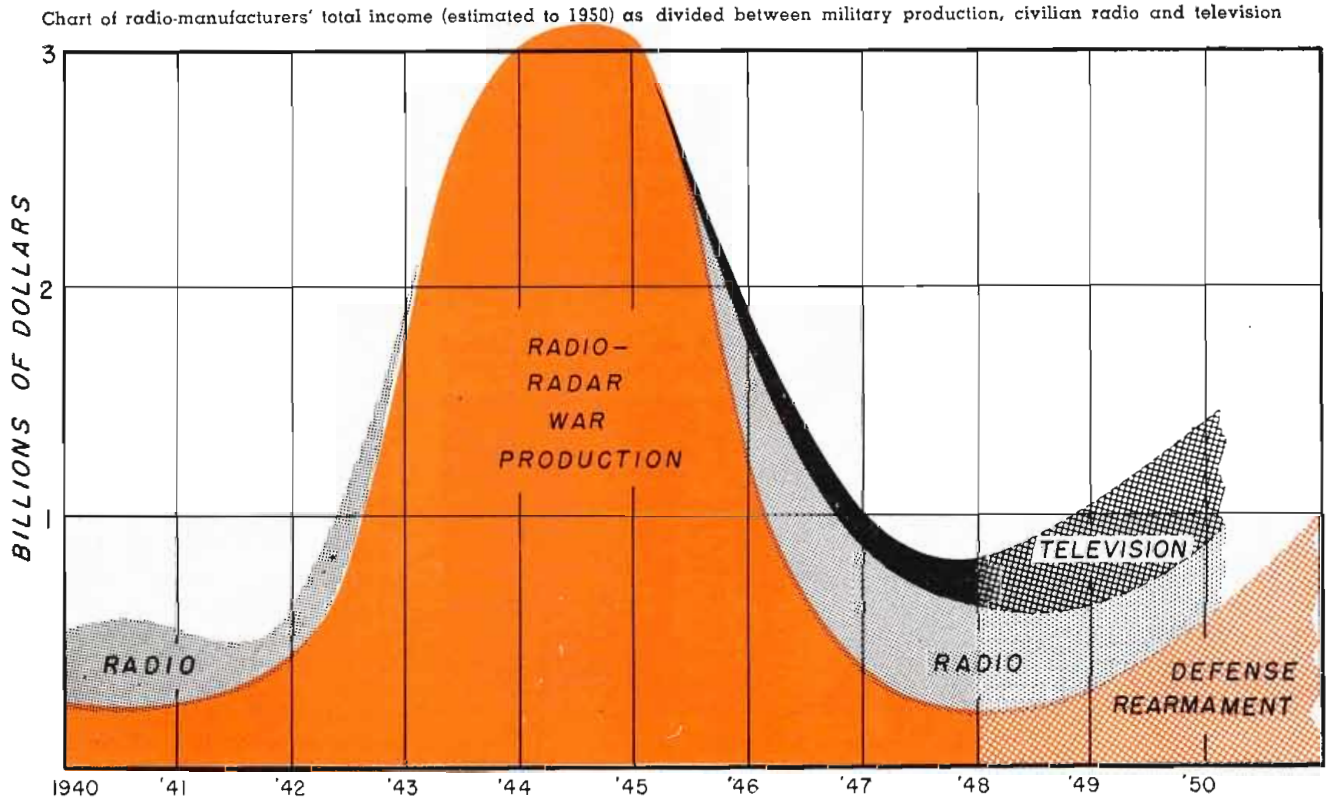
"Leader" Operation Proposed

To accomplish the preceding objectives RMA proposes that the "leader" type of operation, which was so successful in the shipbuilding industry and in certain phases of our radio-electronic industry during World War II, should again be put into effect. Details of the RMA Plan for accomplishing the above are very simple and should include the following:

1. Active support by the Secretaries of Defense, War, Navy and Air.
2. Appointment by the Government of a four-man committee including ranking and qualified officers representing the three Services and one civilian, chosen by the three Service Secretaries and recognized by his position in industry as being qualified, to properly coordinate and channel current procurement to leader companies.
3. Appointment by the Government of a strong industry advisory committee chosen primarily but not exclusively from a panel to be submitted by the RMA, to act as consultants and technical advisors to the Government committee referred to above.
4. With the advice of the industry committee, leader companies would be designated to assume the responsibility of educating and bringing along the large number of other companies in industry, through the medium of subcontracts in proportion to the ability of such companies to contribute.

(*Continued on page* 114)

Chart of radio-manufacturers' total income (estimated to 1950) as divided between military production, civilian radio and television



TV in UHF (475-890 mc)

Nineteen additional black-white six-mc channels proposed; upper 300 mc reserved for color, due in a few years — Higher tube powers seen

By ALBERT FRANCIS

THE GOLD-RUSH of '49 may be duplicated in the television field, this time in *Nineteen* Forty-Nine by the movement started at the Sept. 20 FCC hearing on opening the UHF (475-890 mc) band to commercial TV. And the "freeze" of current TV applications may well accelerate this event.

The purpose of the 4-day hearing was to discuss and place before the Federal Communications Commission the opinions of the TV industry on interference now experienced in television reception, propagation, utilization and equipment availability in this new band.

TV Interference, Present and Projected. Testimony indicated that interference is not bad now, except in a few locations such as Trenton, N. J., with only 35 stations now operating. Construction permits have been issued to 89 others, and of the would-be gold-rush TV broadcasters, 301 have filed applications. The latter have been "frozen" for about nine months until the FCC can review engineering rules and standards. More data on the effects of the troposphere are needed. Stations on the same channel should be spaced at least 150 miles (Norton says 280 miles), and this means fewer stations can be fitted into a national allocation plan. The 12 channels we now have are not adequate for the holders of CPs; therefore how can the 301 applicants be taken care of when the "freeze" ends? Only by opening up new and virgin territory (and that means the 475-890 mc band) can the situation be alleviated.

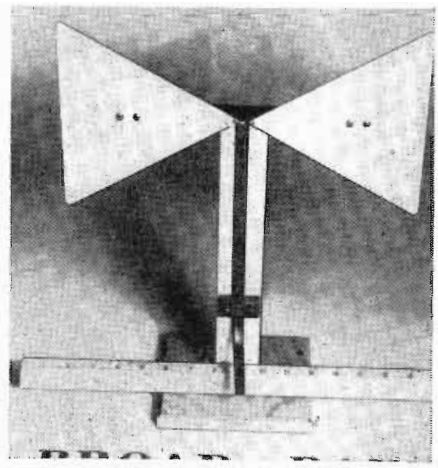


Fig. 3: Total width of this UHF television receiving antenna is 13½ in. This model will match a 300-ohm balanced transmission line

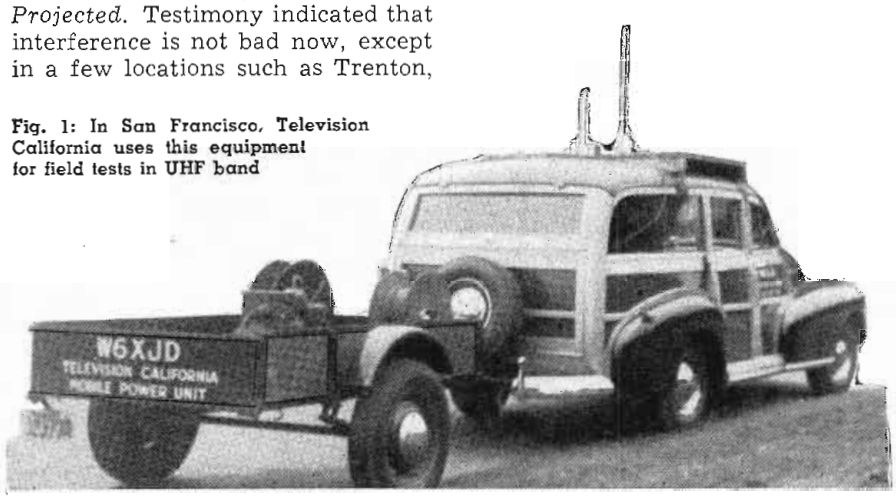
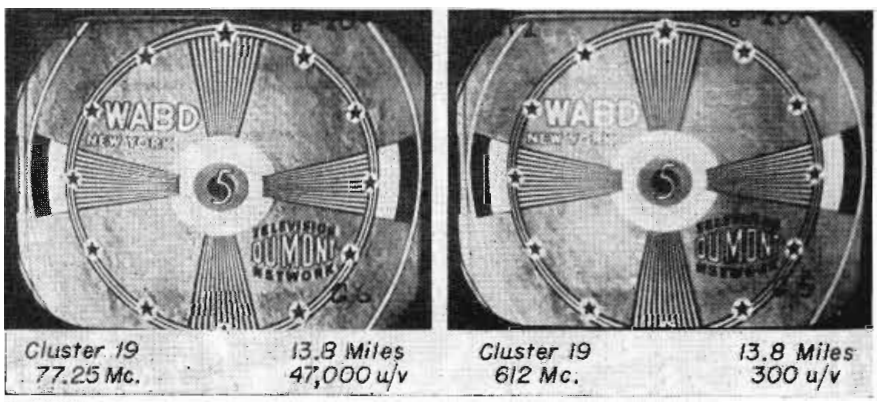


Fig. 1: In San Francisco, Television California uses this equipment for field tests in UHF band

Fig. 2: Compare the VHF picture received on 77.25 mc (left) with the one transmitted on 612 mc (right). Both transmissions are from same antenna site, 13.8 miles away



Should our present VHF television broadcasting be continued without change? The answer is "Yes," as given in a summary of the hearing by FCC Chairman Wayne Coy.

Among those offering testimony were: Joint Tech. Advisory Committee; TV California Television Broadcast Association; Bureau of Standards; DuMont Labs.; Cowles Broadcasting; Eitel - McCoullough; RCA-NBC; Westinghouse; Zenith; Paramount. Four witnesses urged the FCC to examine the spectrum between 300 mc and Channel 2, to try to find additional space for TV. Unused Government assignments, under IRAC, are in this region.

Utilization of the UH Band. The majority testifying agreed that the FCC Rules and Standards for this band should be the same as for the present VHF band, and that the same channel width of 6 mc be used. To the question of whether or not

color TV as well as black and white pictures should be broadcast in this new band, three said "Yes" (RCA, Zenith, TV California); those saying "No" were JTAC, DuMont, Paramount, Cowles. Norton thinks the entire UHF band should be reserved for color only. Those who said "No" made the following suggestions for accommodating color; Use microwaves; workout a reallocation plan later when color is ready; use CBS color now designed to work in a 6 mc. channel.

Color. Representatives of Color Television, Inc., described their color system. This utilizes the usual black-white system to transmit three images which appaer simultaneously, side-by-side on the picture tube. These, after projection through red, green and blue filters respectively, are superimposed to form color picture. They were able to demonstrate pictures over a wire circuit employing a 12.5 mc. channel width.

RCA reported progress in its laboratory on color TV. Certain improvements have been achieved as for instance, less noise in the signal from the flying-spot slide scanner due to the spot illumination possessing more red energy; development of cameras with 3 image orthicons; a new camera using a single camera tube is being developed. Receiver research includes a projection model using a miniature picture tube, another type employing reflective projection and a direct-view set using a special tube for color. Higher power transmitters are being completed for use in New York City for color broadcasting tests. Earlier plans for channel width reduction made possible by dropping the high frequencies in the red and blue channels have been checked and proven practical.

With substantial progress in apparatus design, there remains the continued investigation of propagation before the performance of a color television service can be evaluated. What everyone, including the FCC, wants to know is *"When* will this system be ready for public use?" As a guess, it appears at least two years will elapse. Naturally, the imminence of color will have considerable effect upon FCC allocations in the UHF band.

Propagation in the UHF Band. Compared with VHF television, it will be more difficult (from 1 to 12 times as difficult) to insure satisfactory pictures over the same area because of terrain factors and high attenuation of objects near the receiving antenna. More data is urgently needed on all phases of propagation in this new band.

Four independent field tests have been made and reported to the Commission in detail. Westinghouse submitted data covering Stratovision tests on 514 mc. DuMont in New York City transmitted on 612 mc, ERP 80 watts, antenna height 600 ft., and compared reception with that from WABD on 77.25 mc. Result was that UHF was found feasible for TV broadcasting.

Television California experimented in San Francisco with trans-

(*Continued on page* 118)

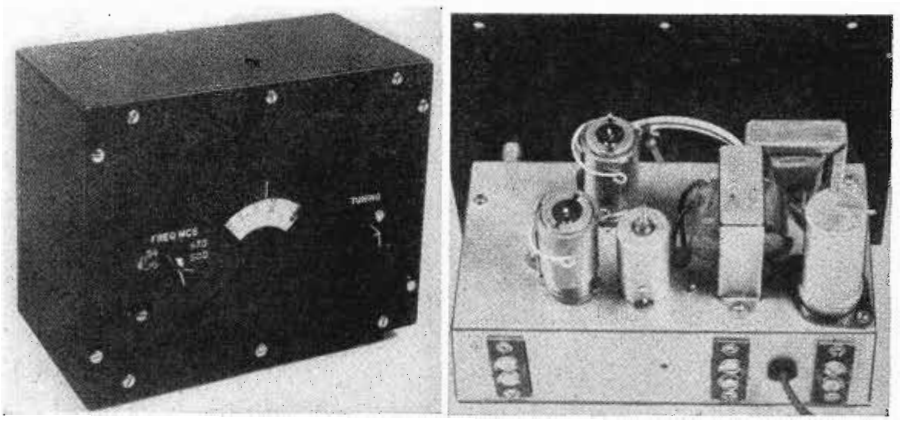


Fig. 4: Front view of RCA model B converter (left) and chassis without cabinet (right)

Fig. 5: Diagram of RCA's Model B Converter. Noise factor at 500 mc is 22 db above normal. Oscillator radiation at 450 mc is 9,000 microvolts at the input terminals of a receiver 100 ft. away, under normal conditions

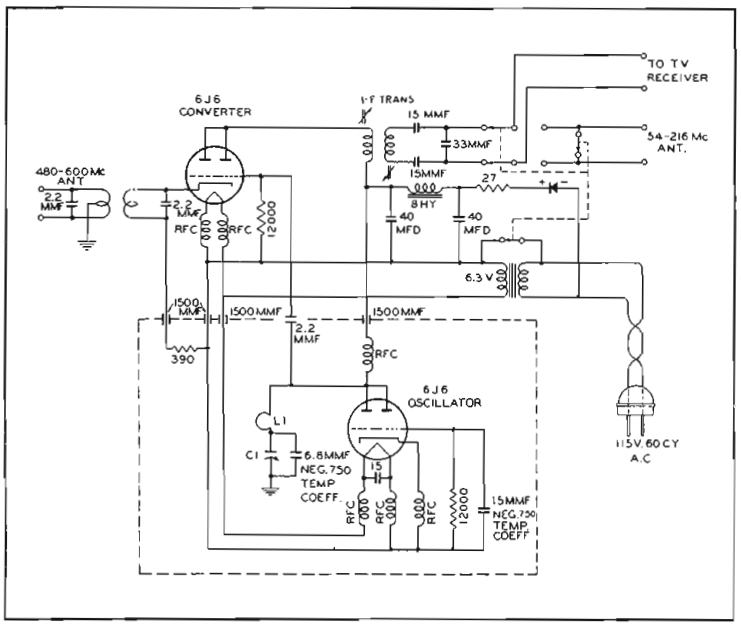
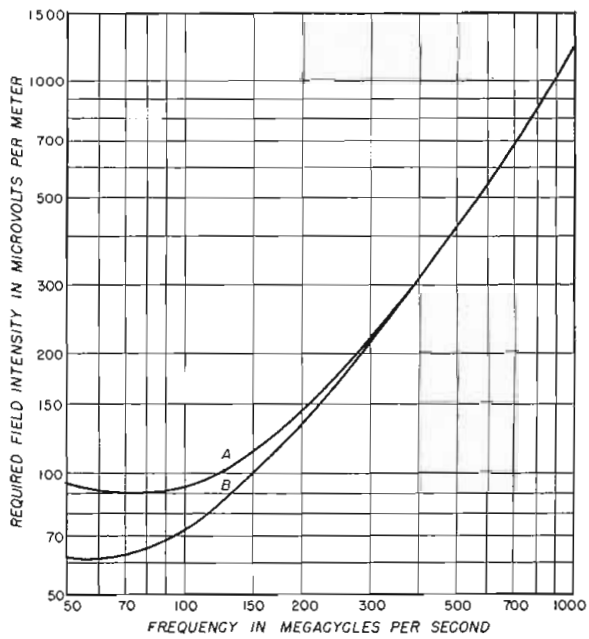
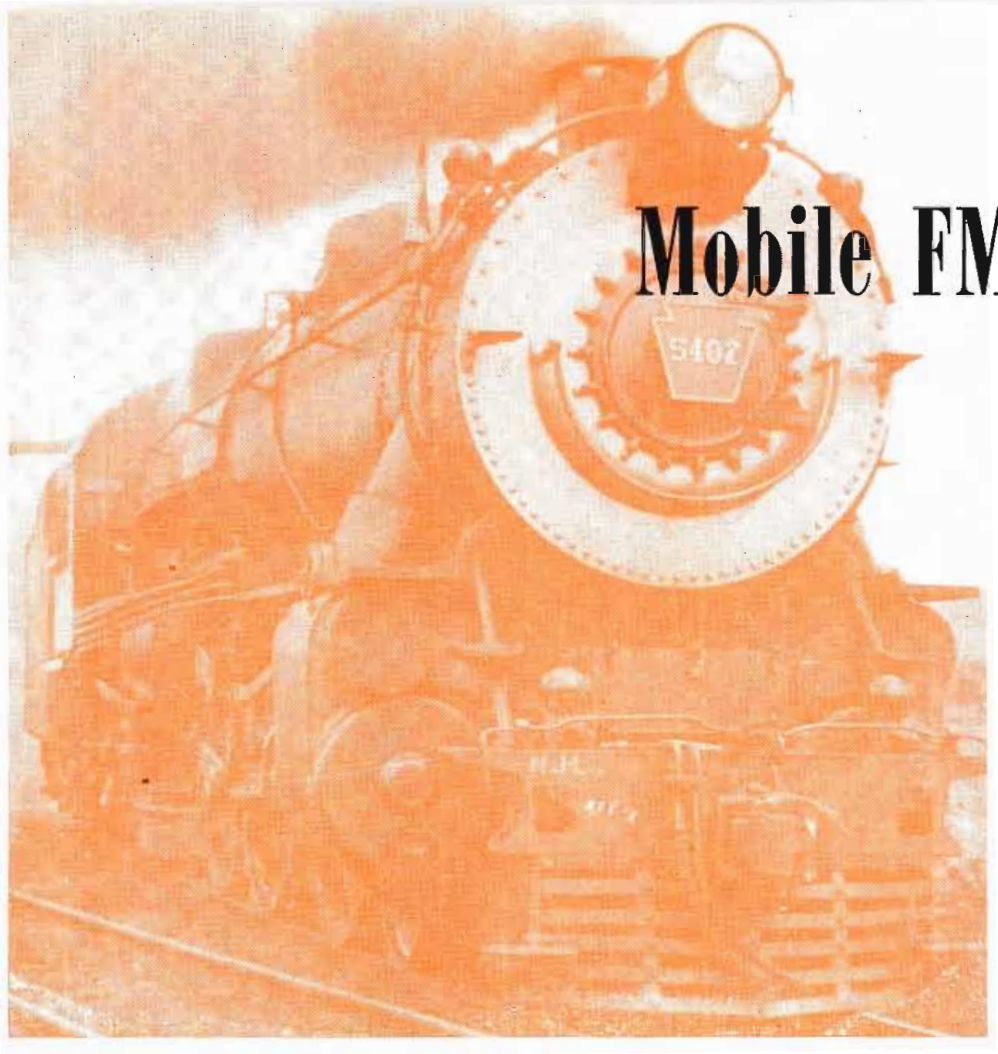


Fig. 6: Curves for comparison of required field intensity for satisfactory TV reception on UHF with VHF. The required field varies between the limits shown by A and B diurnally





Mobile FM Equipment

By A. A. CURRY,
Product Engineer,
Farnsworth Television & Radio Corp.

TWO-WAY radio communication, used during the war in ordnance plants employing modified 30-40 mc FM police-type equipment, pointed the way towards successful application of mobile radio in largescale railway operations. To implement railroad radio communications, the Association of American Railroads (Communications Section) worked out a frequency assignment providing six frequencies for the different railroad systems in the country, on the basis of FCC's allocation of 60 channels in the 152-162 mc band. The present plan provides for the separation in any one area of at least 120 kc between different railroad radio systems.

The AAR recommended detailed equipment specifications covering the major units of equipment. Farnsworth engineers supplemented these specifications with an extensive program of field tests under actual operating conditions before going into production upon a final line of equipment. Fifty complete sets of preproduction equipment were constructed for tests on various railroads over a period of two years. These tests resulted in much valuable information which was applied in the final design of mobile radio equipment.

A typical test made on the Detroit, Toledo and Ironton Railroad Co., with the Ford Motor Co. cooperating, investigated the effects of simultaneous operation and control of a satellite station and a main station operating on the same carrier frequency. Two fixed stations were involved in the test, one being located at the Flat Rock Yards and the other, the satellite station, being located at the Fordson Yard, approximately 14 miles apart. The mobile unit, when operated between these two stations, was unable to detect when it went out of range of one station and into the range of the other station, giving information for planning of mainline radio systems extending over considerable distances.

The field tests proved that the mechanical problems encountered in railroad service were of paramount importance. The equipment had to withstand continuous vibration, severe shock conditions at the instance of starting, the corrosive effects of coal smoke fumes, and the heat problem where a train may go from a desert condition where the ambient temperature is well over 100° and within a few hours be in a mountain region where the temperature may drop to below freezing. The equipment must also be protected against all types of mechanical damage. When units are mounted

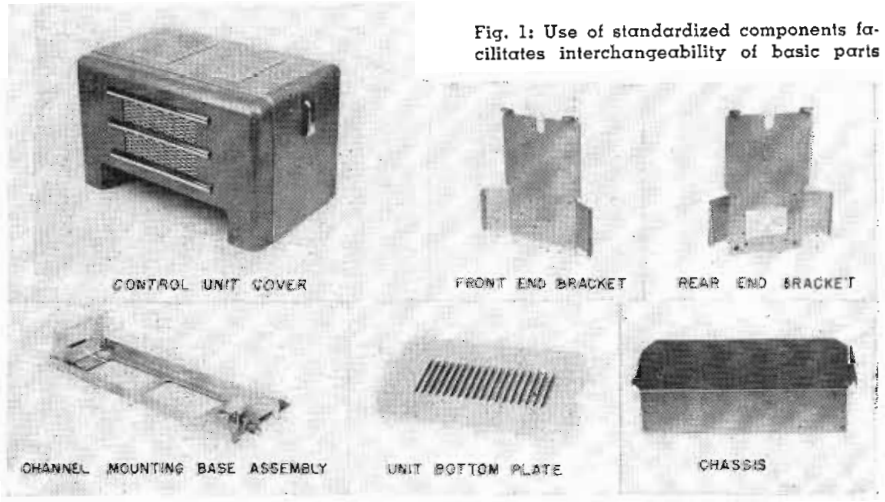


Fig. 1: Use of standardized components facilitates interchangeability of basic parts

Design for Railroads

First of Two Parts

Efficient two-way engineering requires long maintenance, interchangeable parts and flexibility in any fixed or mobile combination of equipment

on the tender of a locomotive there is always the danger of their being accidentally covered with coal or water. The clearance problems on most railroads are such that antenna design must be given careful consideration so as to avoid mechanical damage.

Maintenance responsibility is divided between two different groups. Established union set up for electrical maintenance on rolling stock is under the jurisdiction of the Electrical Maintainers Union. Any service by trained radio technicians will therefore have to be set up as a separate group and the maintenance of equipment must be done in a radio service shop rather than on the rolling stock. Individual equipment units must be easily handled and carried considerable distances in order to meet the maintenance problems involved.

The electrical problems involved in the design of the equipment are rather severe. The primary power available for operation of the radio equipment may be any of a number of different voltages which are in common use, namely 32, 64, and 110 volt dc, as well as 117 volt ac. None of these voltages are held to within very close limits of regulation, variations being found as great as 20% from normal.

To meet these problems, it was decided to use basic units which combine to make a system (Fig. 1). Five units were selected as follows: receiver, transmitter, power supply, control and accessory units. Space requirements of the larger units of equipment (receiver, transmitter, fixed station control unit and ac power supply) showed them to be approximately the same. It was therefore possible, through careful design, to keep all of these units to one standard shape and size, thus making it possible to design mechanical parts for the various units identical to be interchangeable. This interchangeability not only allows for manufacturing economy, but makes practical the use of tools and methods which could not have been justified if each individual unit required a separate size and shape chassis and cover. It also makes it possible to incorporate maximum flexibility in mounting the equipment into standard as well as special mountings. A typical arrangement is shown in Fig. 2.

The following equipment requirements have to be met:

1. Defective units must be capable of quick replacement. The operation of replacement must be made as foolproof as possible since non-technical personnel may be employed in this operation.

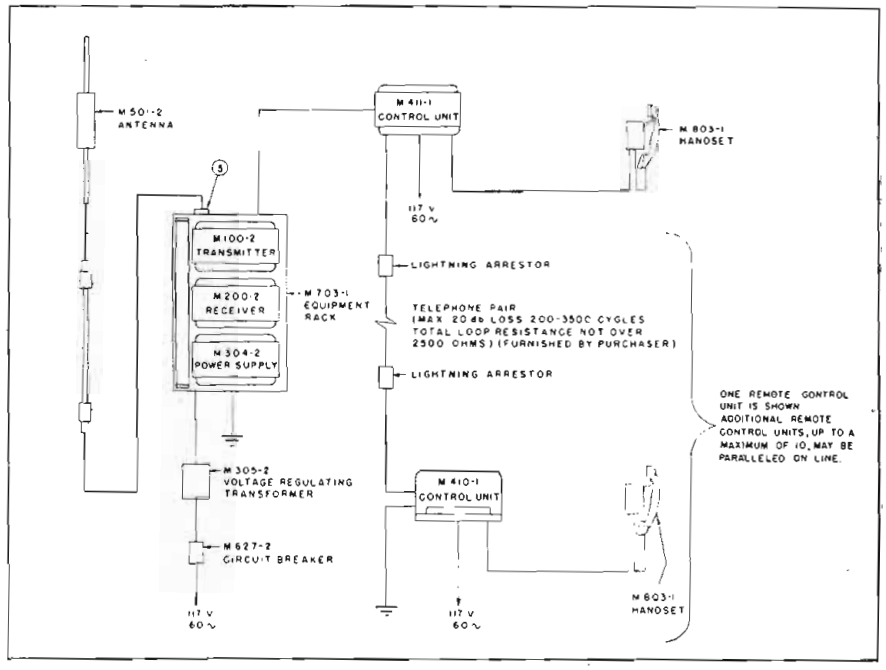
2. Exact mechanical and electrical interchangeability of all like units must be maintained.

3. No additional tuning adjustment should be needed or required at the time of installation.

4. Transmitter units must be capable of being sealed so that personnel unlicensed by the FCC can remove defective transmitters as well as all other units in the field.

For units to be quickly replaceable by non-technical personnel, a very ingenious mechanism was therefore developed for plug-in purposes. This mechanism performs the three distinct functions of holding the front of the unit so that it cannot "jack knife," it facilitates plug-in and out (even though plugs are used with heavy contact pressure), and it locks the unit into operating position against all shocks and jars. The mechanism which performs these three functions is simple and inexpensive to manufacture.

Fig. 2: Diagram showing arrangement of a typical Farnsworth remotely controlled fixed station installation with an operating position provided at the transmitter location



500 Watt TV Transmitter

Engineering design for residential areas where low-power provides needed coverage . . . May be installed "off limits" with 12X directional antenna

By M. L. GASKILL,
Engineering Products Dept., RCA Victor Div., Camden, N. J.

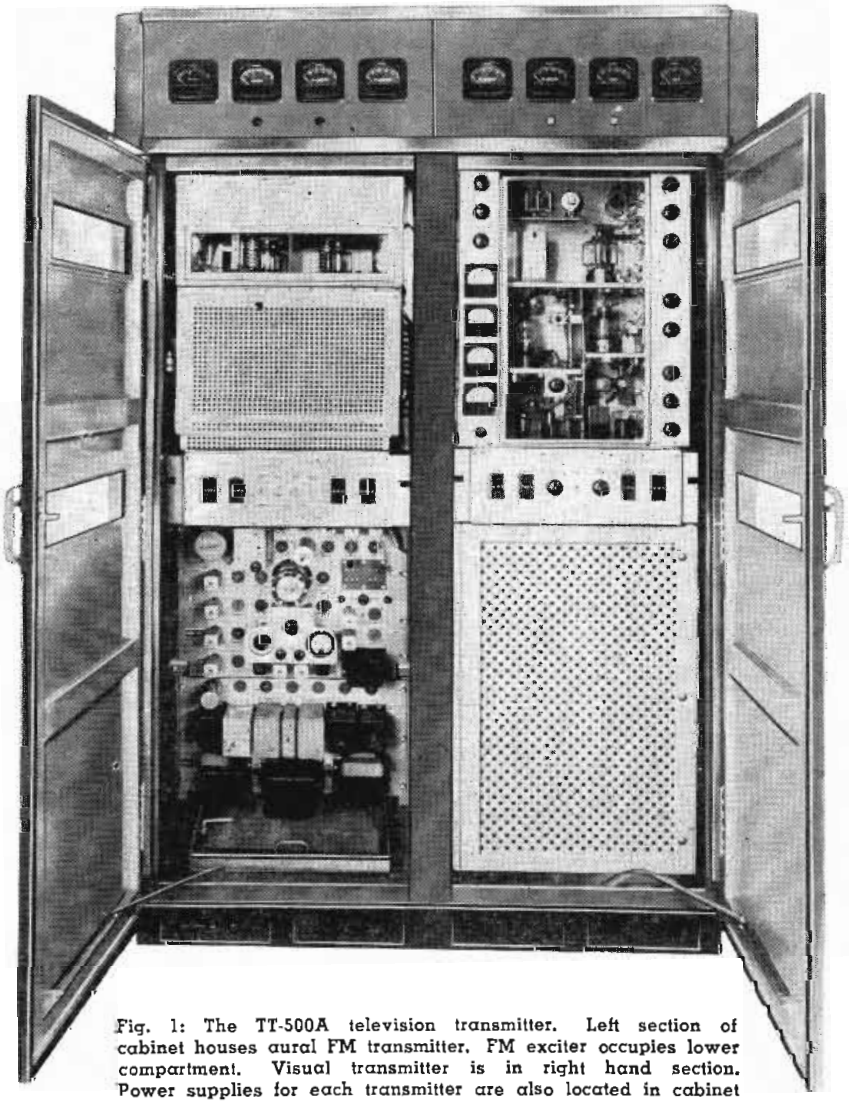


Fig. 1: The TT-500A television transmitter. Left section of cabinet houses aural FM transmitter. FM exciter occupies lower compartment. Visual transmitter is in right hand section. Power supplies for each transmitter are also located in cabinet

THE RCA TT-500 is a television transmitter capable of providing a peak power output of 500 watts. It is designed for use in areas (preferably residential) where a low-power transmitter will provide adequate signal strength and the desired coverage. In communities where building regulations preclude erection of a transmitter site, good service might be provided from a point outside the community limits. Directional antennas can be furnished which will provide gains as high as 12, resulting in a radiated power up to six kw, from the 500-watt transmitter. Such a system should provide a very strong signal in its most favorable direction.

The TT-500 television transmitter is furnished in two models: type TT-500A, which will operate in any one of the low-frequency channels 2-6 (54 mc - 88 mc); and type TT-500B for any one of channels 7-13 (174 mc - 216 mc). The two transmitters, which employ air-cooled tubes throughout, are nearly identical as far as outward appearance is concerned. Their performance specifications, which meet all of FCC standards, are identical. As might be expected because of the wide separation between the highest operating frequency and the lowest, however, the electrical design of the two transmitters necessarily differs.

Physically, each transmitter is housed in two identical cabinets, which can be installed bolted together as one unit 56 in. wide, or arranged on individual cabinets each 31 in. wide. One of these cabinets contains all the components of the visual transmitter, and the other cabinet contains those of the aural transmitter. Controls for both aural and visual sections of the transmitter are accessible through openings in the door of each cabinet.

Low-Band Transmitter

The visual section of the TT-500A low-band transmitter is shown in block diagram form. The complete transmitter consists of the carrier generating circuits, video amplifiers, modulator, power supplies, and the necessary control circuits.

The video amplifiers, modulator and rf circuits occupy the upper half of the cabinet (see Fig. 6). For the rf channel, an RCA 6V6 crystal oscillator drives a 6V6 doubler. This

is followed by an RCA 807 tripler, an RCA 4-125/4D21 doubler and two type 4-250A/5D22's in parallel as the final amplifier. Conventional condenser-tuned tank circuits are employed in the plate circuits of all these stages except the power amplifier, which is tuned by varying the tank inductance. This is accomplished by changing the relative proximity of two oppositely-wound coils.

High-level modulation is applied to the grids of the two 4-250A/5D22 tubes in the power amplifier. Therefore all rf stages can be simply meter tuned as straight-forward class C amplifiers. None of these stages except the power amplifier require neutralization.

The video system is a three-stage amplifier with excellent frequency and phase response. Video signals at RMA standard levels are fed into an RCA 6AG7 first video amplifier which is followed by another RCA 6AG7 video amplifier which drives three RCA 807's in parallel as the modulator. A clamp-circuit type of dc insertion is used in the grid circuit of the modulators. This circuit automatically maintains the proper black level.

The aural section of the transmitter is frequency modulated, of course, and has a power output of 250 watts in accordance with FCC requirements for television transmitters of this power. It consists of a "direct-FM" exciter followed by a single 4-125A/4D21 doubler, which in turn drives a pair of 4-125/4D21's in parallel as the power amplifier. Gold-plated variable inductances utilizing sliding contactors are used in conjunction with three element π networks (which incorporate the tube plate and grid capacitance) to tune the doubler and power amplifier. This circuit arrangement presents a high LC ratio, provides maximum band-pass and reduces distortion and losses to a minimum. Adjustments of the variable inductors are made directly from the front control panel.

Fig. 2: Transmitter control console. The left section contains a picture monitor and waveform oscilloscope; audio and video gain controls are on right

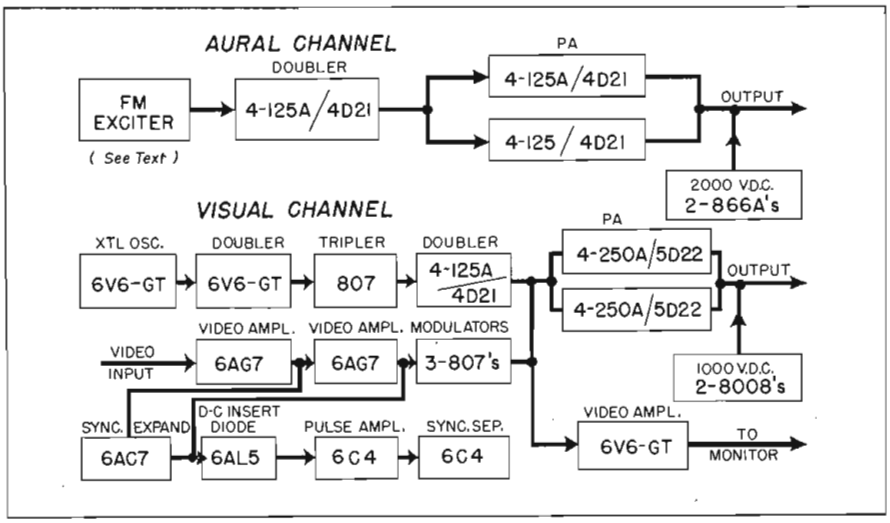


Fig. 3: Block diagram of visual and aural sections of the low band TT-500A transmitter

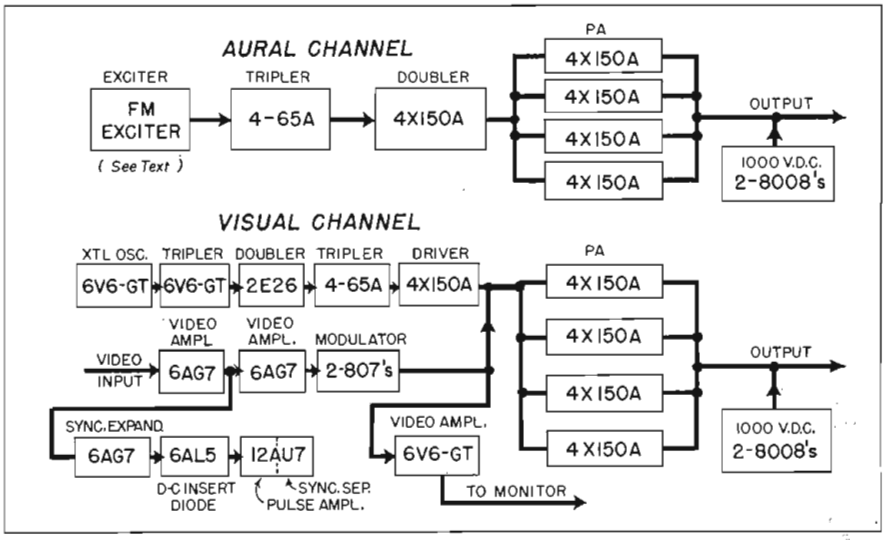


Fig. 4: Block diagram of visual and aural sections of the high-band TT-500B transmitter

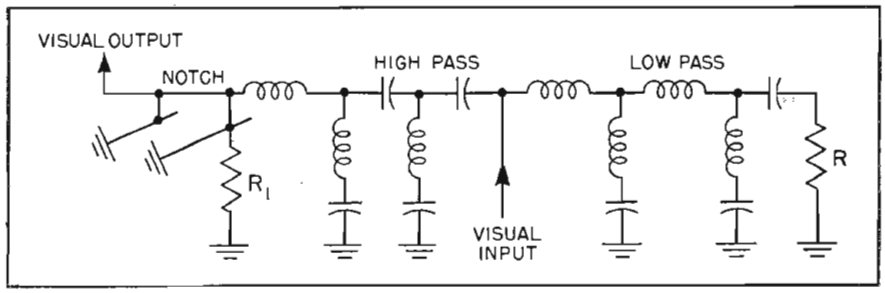


Fig. 5: Schematic interpretation of the vestigial sideband filter. Coaxial elements in the "loss-pass" filter provide cascaded resonant circuits which dissipate a part of lower sideband energy in the load resistor R. Those of notch filter are tuned so that load resistor R_1 dissipates energy at a frequency ¼ mc below the lower limit of the channel

The operating principles of the RCA direct-FM exciter are fairly well known, since this exciter has been used extensively in FM broadcast stations for several years.

The "mean" or carrier frequency is produced by a master oscillator which is followed by a small number of multiplier stages. Frequency modulation of the master oscillator is obtained directly by means of reactance tube modulators. When an

(*Please turn to next page*)

audio signal is fed to the reactance tube grids, oscillator frequency changes in exact accordance with the modulating voltage. The exciter operates between the limits of 27 and 44 mc. With a multiplication of two, a frequency range of 54 to 88 mc is obtained. Under modulation, the carrier frequency deviation is ±40 kc.

Center frequency stability is automatically maintained by a control circuit which operates by comparing a sub-harmonic of the modulated signal with that of a temperature controlled crystal oscillator. Frequency dividers reduce both signals to a common frequency in the range of 18.75 to 25 kc and a 90° phase angle between the signals applied to the balanced modulators, operates a two phase motor which has a compensating capacitor mounted on its shaft. This capacitor is connected directly across the tuned circuit of the modulator oscillator and automatically connects any frequency shift.

This system is a simple, direct method of producing high-fidelity frequency modulation and stable center-frequency operation. It provides a carrier frequency stability of ±.002%.

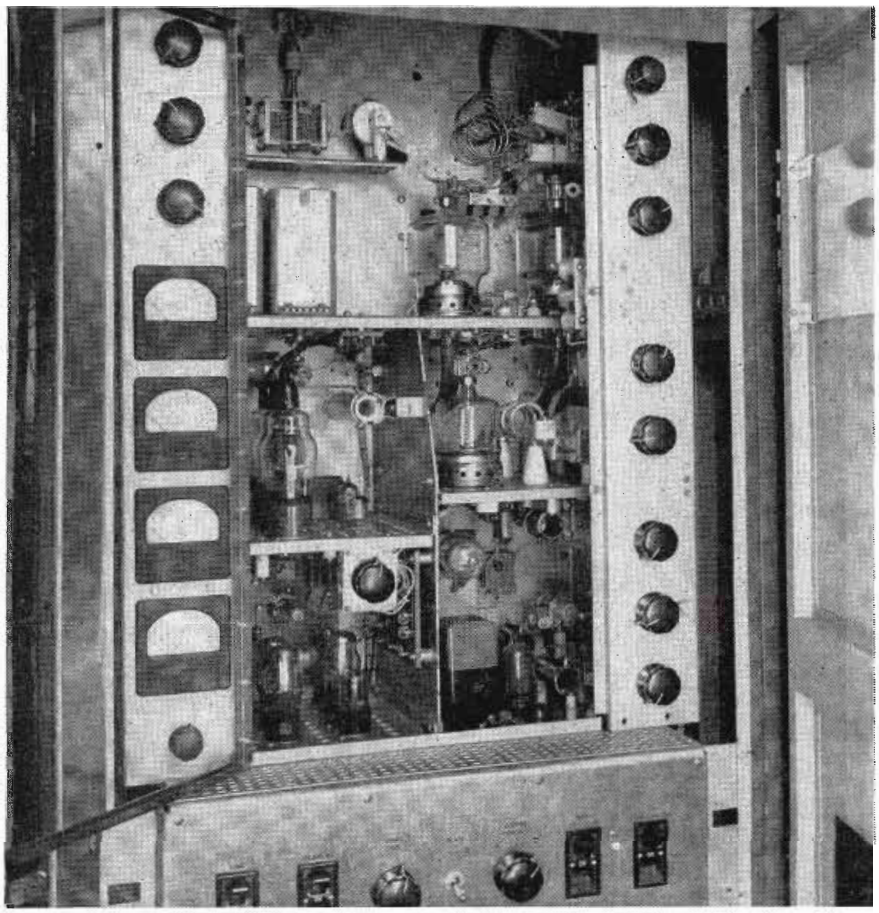
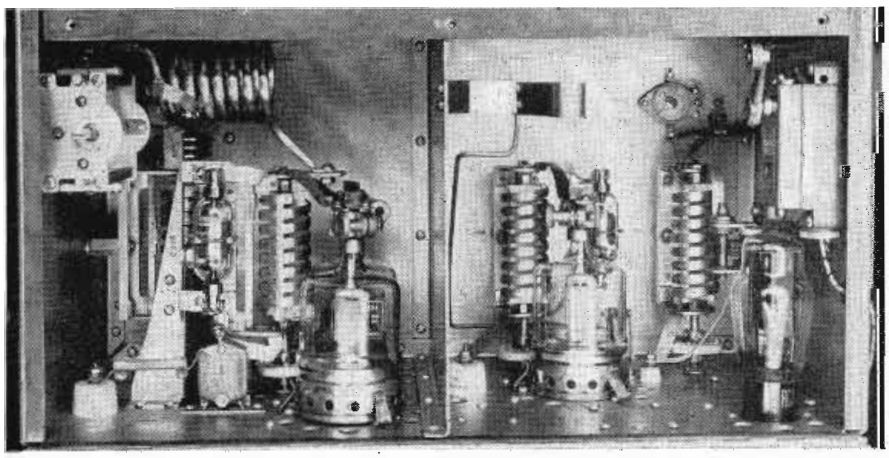


Fig. 6: Upper compartment of the visual section of 500 watt transmitter contains carrier generating circuits, video amplifier and modulator. A pair of 4-250A/5D22 tubes in parallel as final amplifier (top shelf) are grid modulated by 3-807's (left center)

Fig. 7: FM power amplifier (left) and double-driver stages (right) of aural section. Fixed capacitors are connected across tank coils. Tank tuning is by sliding contacts



High-Band Transmitter

Both the aural and visual sections of the high band type TT-500B employ four 4X150A tubes in parallel in the final stage. In the case of the visual section, these four tubes are grid-modulated by a pair of 807's. Relatively little power is required for complete modulation of these tubes. The transmitter provides a visual peak power of 500 watts.

The high band tube lineup is shown in the block diagram. A 6V6 crystal oscillator establishes the correct submultiple of the carrier frequency. This oscillator feeds a 6V6 tripler. The frequency is then doubled in the next stage which utilizes a type 2E26, and tripled again by a 4-65A in the following stage. The 4-65A in turn feeds a 4X150A doubler which drives the four 4X150A's in parallel.

Conventional capacitive and low-impedance link interstage coupling methods are used. Modulation takes place in the final stage, and so all the preceding stages can be narrow-band types providing optimum power amplification and ease of tuning. The frequency multiplying and driver stages are simply meter-tuned as straight class C amplifiers. Tuning of the final amplifier of both these transmitters is described in detail later. Of course, both transmitters employ a sideband filter which suppresses the undesired sideband. This greatly simplifies the tuning of the transmitter, as compared to transmitter employing low-level modulation and internal sideband cutting. This is easily recognized, because in the latter type, each low level modulated stage operates as a class B amplifier, and each stage must be adjusted for proper bandwidth to do its particular part of the sideband cutting.

In the FM aural channel of the TT-500B, the carrier center frequency is provided by the direct FM

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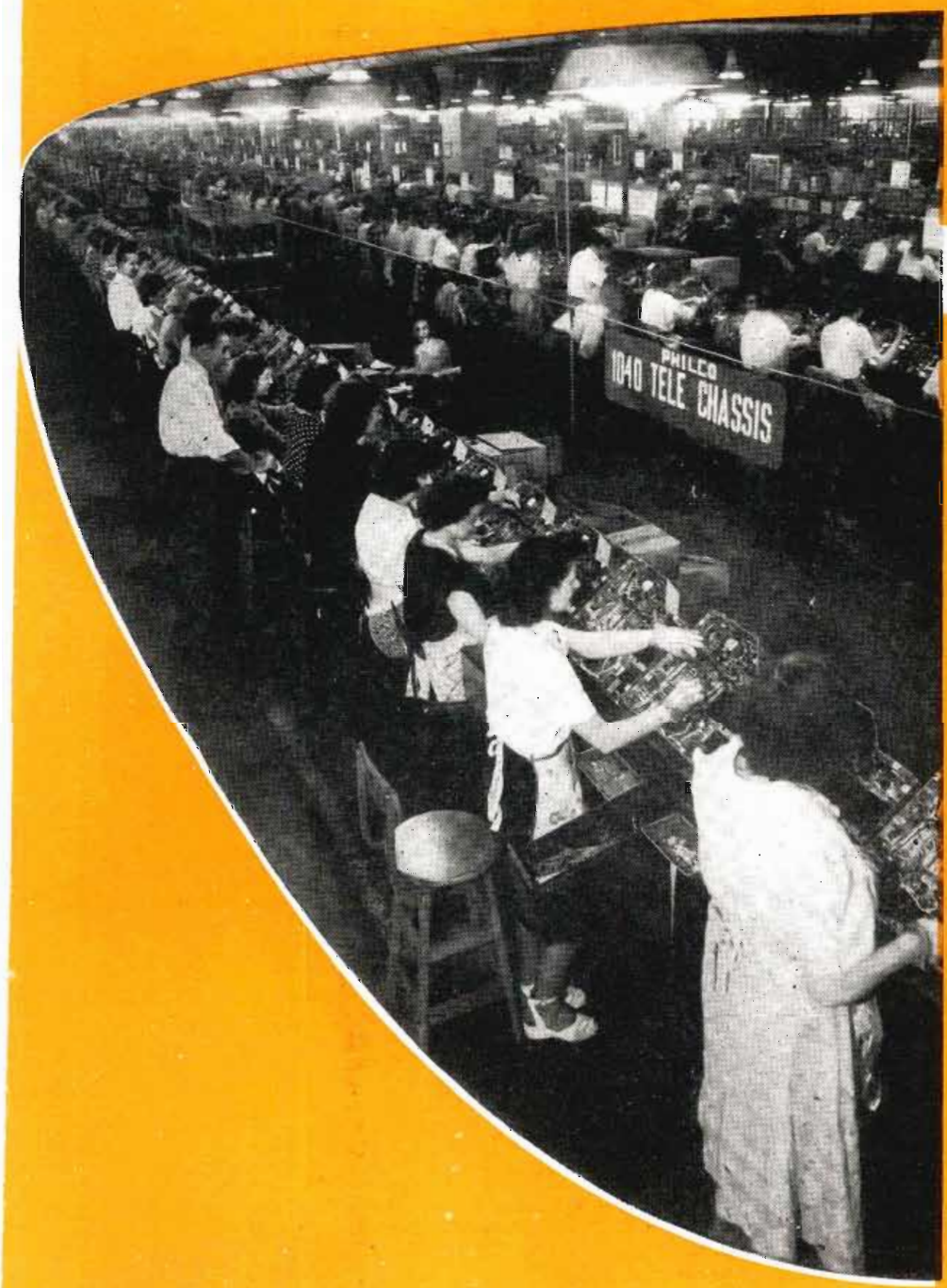
Television Receiver

DESIGN • ENGINEERING • MANUFACTURE



PHILCO Methods Analyzed

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- TV Chassis Engineering
- Research
- Chassis Fabrication
- Coil Manufacture
- Test Equipment
- Cabinet Design
- Cabinet Manufacture
- Tube Production
- Quality Control
- TV-Set Production
- Management
- Purchasing
- Special Services
- Cost Estimating

TELE-TECH · November, 1948
CALDWELL-CLEMENTS, INC.
480 Lexington Ave., New York 17, N. Y.

Designing & Engineering

SOME PHILCO PRODUCTION STATISTICS

An idea of the size and scope of Philco Corporation is gained from the fact that the Company has produced nearly 23,000,000 radios and radio-phonographs during the 20 years since it entered the industry in 1928. Throughout the past 18 years, Philco has led the industry in radio production, and in 1947 manufactured over 2,700,000 sets. Entering the refrigeration industry in 1938, Philco in only six years of production has also achieved a leading position in this field.

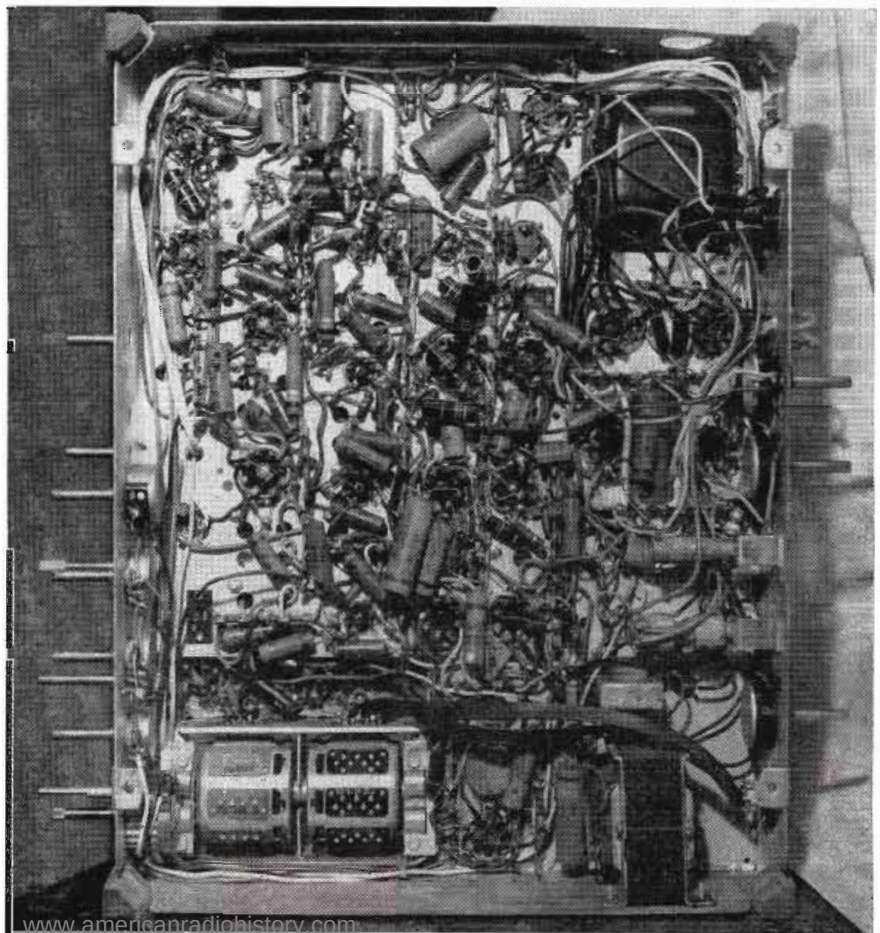
Wide engineering interest has been aroused by the application of this unique manufacturing experience to the mass production of television receivers.

With its conveyorized television operations expanding rapidly, Philco expects to reach a production rate of 10,000 TV sets a week in the first quarter of 1949.

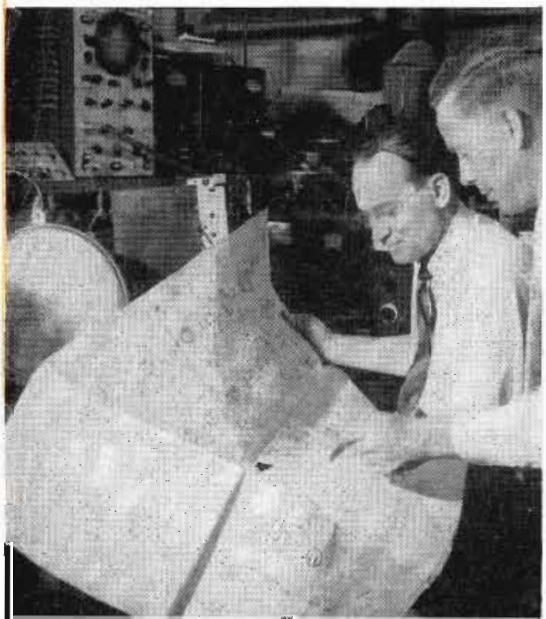
To realize this production level, the Company has invested more than $15,000,000 in television research and engineering and in production facilities. Its contributions to the fundamental advances making possible modern television have been outstanding, and today hundreds of members of its research and engineering organizations are working on the design, development and mass production of television receivers. Over 5,000 employees (of the 20,000 men and women employed by Philco) are engaged in the diversified television production activities outlined on following pages.

During 1949, the pace of Philco television manufacturing will be still further accelerated, and the Company's 1949 production schedule calls for an output of about 600,000 receivers, three times the production of the entire industry in 1947.

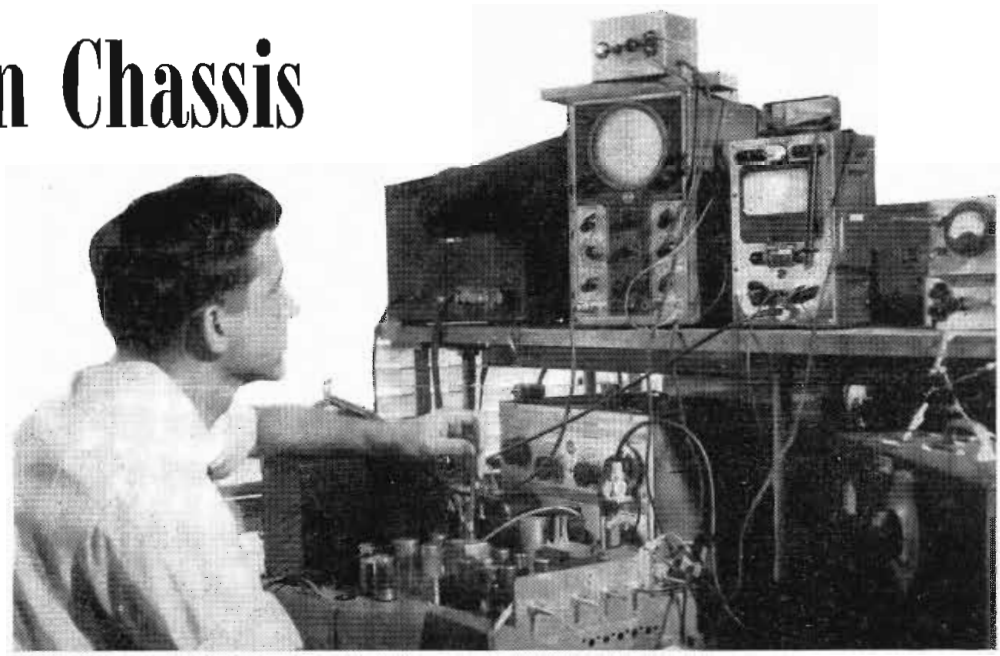
Left: Engineering design sample meeting the required performance characteristics as forwarded to Factory Engineering. Right: Modifications in wiring and component layout are apparent in sample which has been suitably adapted for technics used in mass-production



Engineers discussing circuitry of new TV receiver. Development of IF system having correct gain characteristics and frequency response is a major phase of design.



the Television Chassis

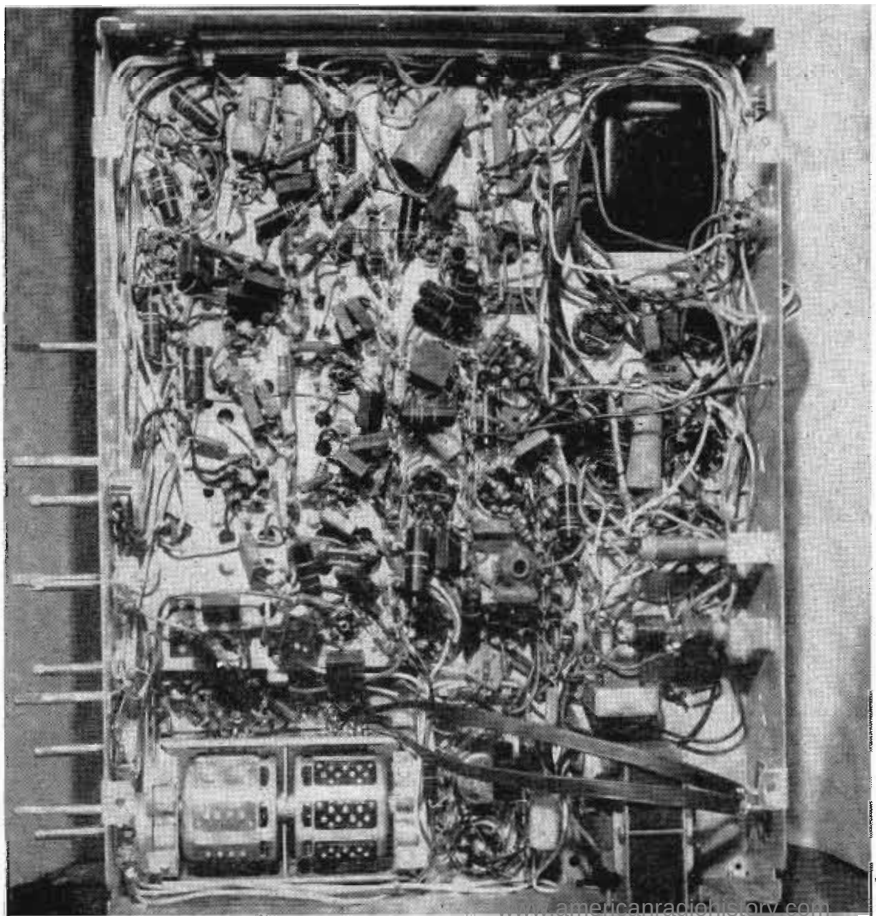


Circuit measurements with precision test equipment assure correct design specifications

THE development of the design of a Philco television-receiver chassis is an evolution that involves the teamwork of a considerable number of groups of research scientists and engineers, each with a different approach to the basic problem of creating a new and even better television set.

Fundamentally, the Design Engineering Department is faced with two problems. One is the need to develop new ideas for new television features, or even completely new receivers, which will have wide popular appeal. The second requirement is to incorporate these new ideas in functionally sound form so that the completed product will deliver satisfactory performance.

The start of the process of developing a new television receiver comes in a series of informal conferences among the wide variety of research scientists and engineers attacking the problem. Ideas are collected from groups in the Philco Research Division, for instance, on cathode-ray picture tubes and associated deflection and focusing circuits; on wideband amplifiers; on RF sections and tuners; on optics, if the model is a projection receiver. Some of these ideas may lead to improvements in existing models; others may contain so much basically new thinking that an entirely new type of television set evolves.



Other ideas come from several groups within the Engineering Department. The group working on Advanced Studies, for example, may contribute entirely new circuitry for an IF amplifier and perhaps suggest some new tubes and associated circuits for other sections of the receiver. Similarly, the components group frequently suggests modifications and improvements in both the designs and application of the hundreds of parts used in designing a complete television chassis. Engineering specialists in tooling and fabrication add their suggestions as to the mechanical layout and the incorporation of new features in an efficient way. Field engineers working with the field representatives of the Philco Service organization and with the company's distributors often suggest ideas based on experience with all sorts of operating conditions.

From all these sources and many others comes a wealth of ideas applicable to the design of a new television receiver. The Television Design Engineering group acts as the clearinghouse and coordination point where all these diversified concepts are considered, discussed, tested, and combined into a complete television system for a new model. As a result, this design engineering group of necessity includes a considerable number of specialists in various phases of television video and audio circuitry and components, as well as other engineers with experience in overall systems design.

When the ideas assembled by

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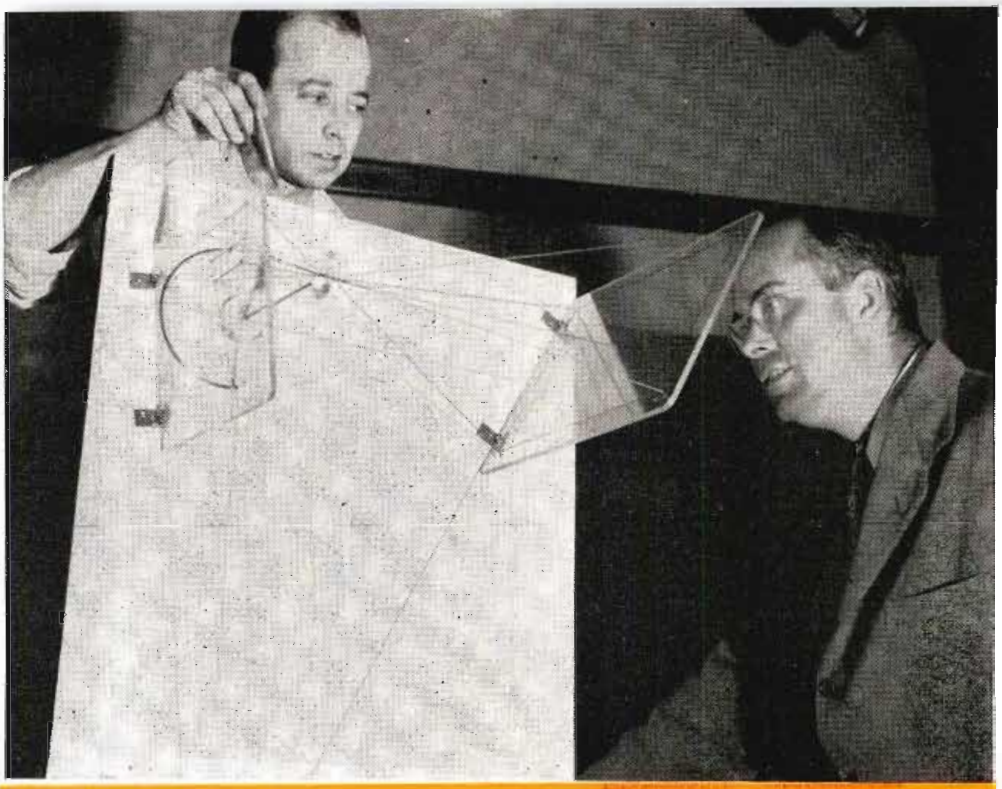
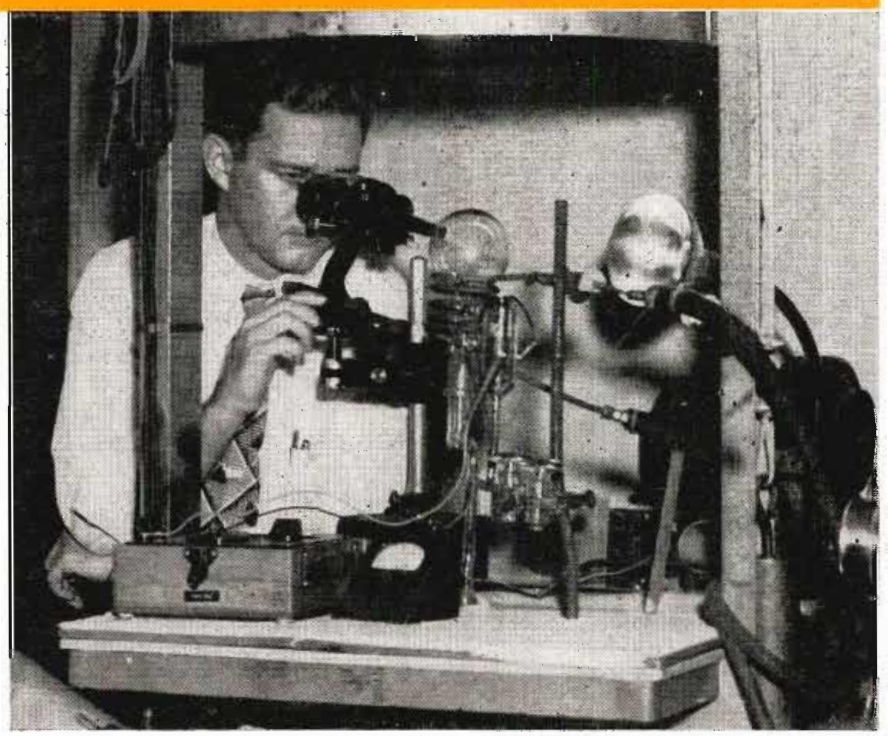


Ernest Traub, optical project engineer, and William E. Bradley, director of research, discuss projection-TV system. Wires delineate rays from keystone image to form rectangular picture

TV Research

A valuable and complete equipment of laboratory apparatus in the fields of optics, electronics, chemistry, and general physics, facilitates quantitative checking of results



Underlying present Philco receiver designs are broad scientific studies which go back 20 years in all of the branches of physics, electronics, chemistry, mechanics

MUCH of the basic technical work required for developing the variety of television receivers produced by Philco is the outgrowth of carefully planned research by groups of scientists and engineers. This work, during the past 20 years, has covered every field of physics, chemistry, electronics, electrical and mechanical engineering applicable to the fundamental problems of television transmission and relaying, as well as reception.

The breadth of this continuing research is emphasized because it illustrates the philosophy underlying the Philco Research Division. Scientists and engineers working there are encouraged to compare notes and find out what other groups are doing. There is a premium on teamwork.

To implement this philosophy, the Research Division holds frequent progress meetings to discuss each of the many projects under way in the laboratories. These meetings have two principal functions. One is to examine the progress of the scientific project and analyze the information being obtained by the research. The other purpose of these meetings is to eliminate any technical bottlenecks encountered in the work. This is accomplished by getting the advice of the director of research, and perhaps the assistant director and other senior members of the Division, who have a broad grasp of the principles to be applied in seeking a solution to the problem, as well as specialists in applied mathematics, circuitry, tubes or any other applicable subject.

The present Philco Research Division was formed in 1941 by gathering into one organization all the groups engaged in research in special subjects, among them the television, radio and phonograph fields. Prewar television research was concerned with developing and building complete electronic television systems, including transmitting and relaying equipment as well as receivers and antennas. Much of this work was pioneering and proved of

great benefit in developing industry standards for television. For instance, Philco was the first to transmit and receive 525-line pictures and pioneered in developing the use of FM sound for television.

During the war years, the Research Division did basic work in the development of circuitry, components and systems of many types of airborne radar equipments and VT fuzes, as well as some military applications of television. With the end of the war, extensive research was resumed in the fields of commercial radio, phonographs, television, communications, industrial electronics and allied subjects.

At present, the work of the Philco Research Division in television is of two general types. The first is the continuous fundamental exploration of new knowledge with some present or future bearing on television receivers. One of the groups concerned with this activity concentrates on developing new circuitry and associated components, especially in connection with RF, IF, video amplifier and sweep circuits for television receivers. A second group does basic tube development with emphasis on both projection and direct-view cathode ray picture tubes while another group of research scientists specializes on the problems of television optics. Television microwave relay development work by a fourth group has yielded some concepts and approaches, including subminiaturization of certain receiver sections, which may be of value in future television receiver design problems. Still another section, concentrating on test equipment, has developed such useful instruments as a flying spot scanner to provide pictures with varying amounts of contrast, an RF generator for signals on various channels and a monoscope generator for testing video response. This group also conducts propagation studies in various present and proposed frequency bands to determine propagation characteristics and study receiver and antenna response with a variety of designs.

Another general classification of the work done by the Research Division on television covers problems which demand an immediate solution rather than the long-range programs outlined above. Most of these problems involve aid to Design Engineering on some special feature of television receiver design on which trained research thinking is needed to provide clues toward a practical answer. For instance, new deflection and focusing circuits may be desired for a proposed new picture tube and chassis. Because of the tentative production schedule established, this becomes a "task force" project which receives top priority, with experts assigned to it who may, in turn, call on other groups in Research and Engineering for assistance. Special projects of this type also receive regular attention at progress meetings, as previously described, so that the thinking of Research Division leaders can be focused on the most difficult technical problems.

With projects consisting of long-range and immediate research studies, the output of the Division similarly divides itself into direct answers to assigned problems and basic reports which may cover a considerable section of a certain field and include answers to numerous questions or challenge further inquiry. In physical form, the Research Division builds experimental models of new circuits, components or systems to demonstrate the new principles which have been developed. These models often form the basis for parts of the future production designs evolved by Design Engineering.

Another tangible form of Research output consists of technical reports in which are contained full descriptions of the methods of analysis, technics and results obtained by each investigation. These reports

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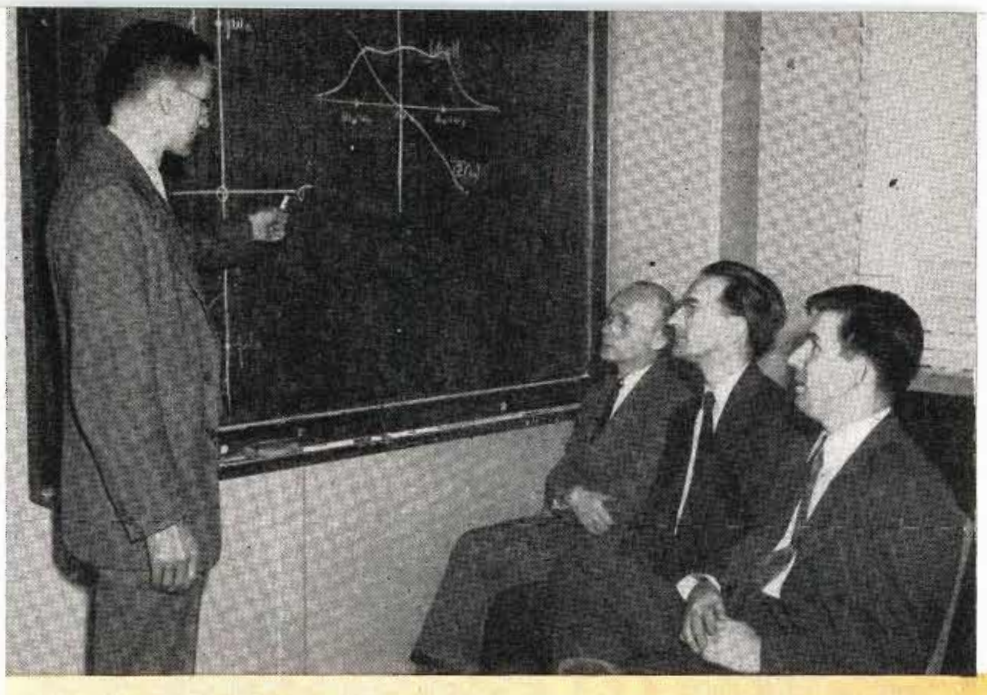
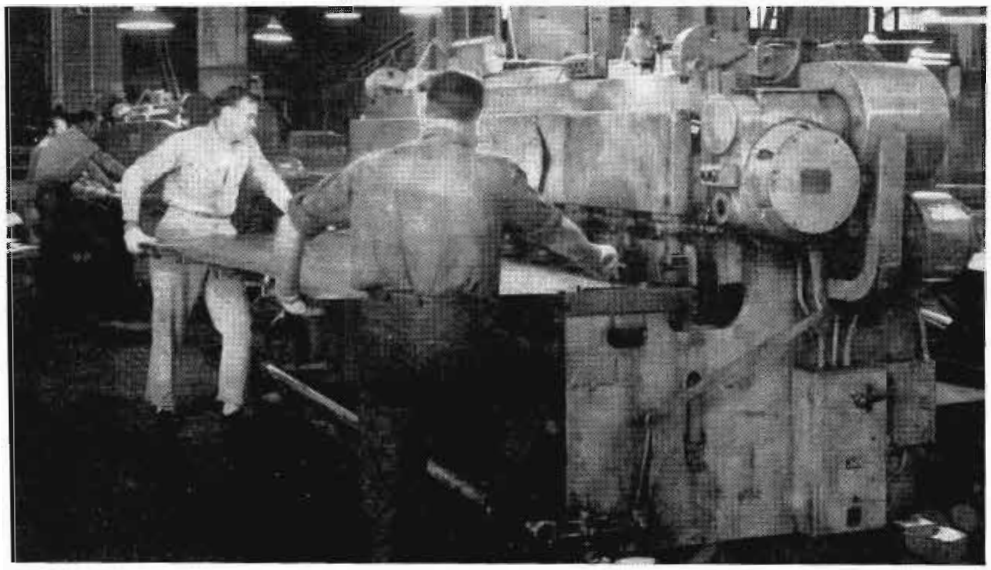


A group of research specialists discuss the "poles and zero" method of predicting TV IF amplification response, which can thus be determined without building an actual chassis

This flying-spot scanner, used to provide TV pictures of varying contrast range, is typical of aids to video development designed by the test-equipment section of the Research Division

Sub-Base Manufacturing

Modern machinery and mechanization in Philco's metal plant permits efficient cutting, stamping, shaping, welding and plating of all the metal chasses required in radio and in television production

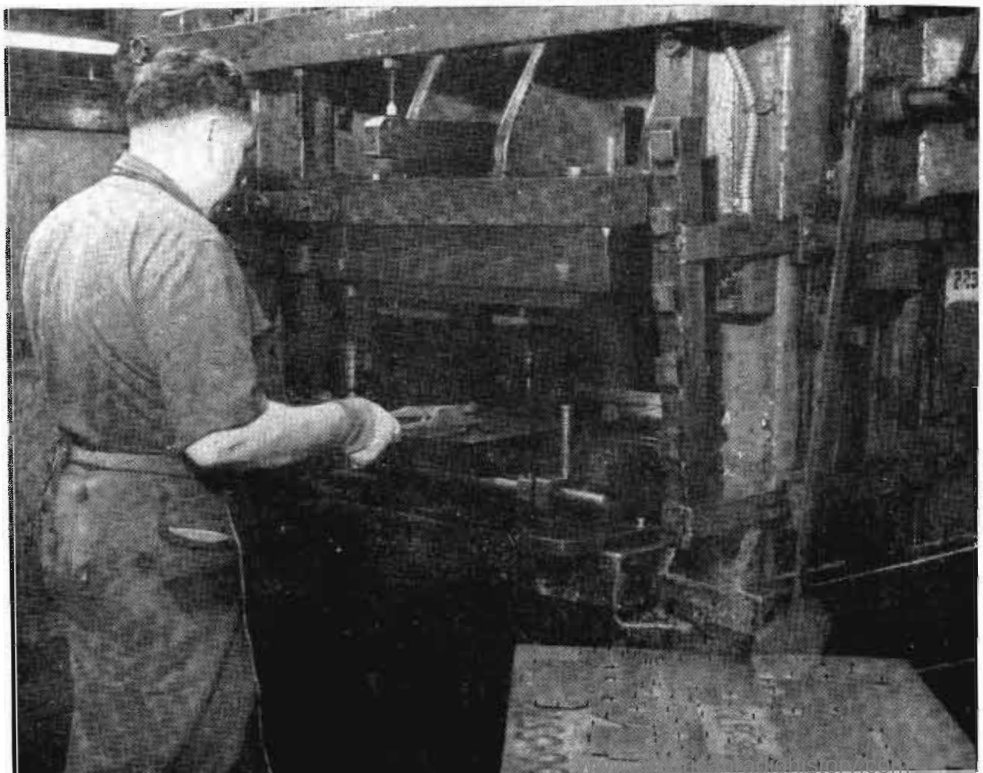


Incoming #16-gauge steel sheet metal being cut into blanks of the correct size for a television sub-base on a metal squaring shear. Foot-bar controls the machine's operation

PROBABLY the most outstanding individual component of a finished television receiver chassis is the metal sub-base, which in outward appearance is simply a piece of shaped and punched metal. Functionally, it has the all-important job of holding the assembled components rigidly in place. Sub-bases are a specialty at Philco, and the facilities provided at the Philadelphia plant allow for quantity production of almost any conceivable type of metal chassis. In the case of current television production, thousands of odd shaped sub-bases each having over 200 holes and cut-outs are made available to the main assembly line each week.

Sub-bases for television sets are ordinarily formed out of #16 gauge steel which is received at the plant in sheet form. Each steel sheet measures 48 x 120-in. An overhead crane delivers the incoming raw material directly to a bank of pow-

Press punching the larger holes and cut-outs. Operator's wooden handled suction cup facilitates handling of blanks while nailboard identifies any punch breaking during operation



Bending sides, inserting reinforcing indents, makes punched blank semi-rigid structure

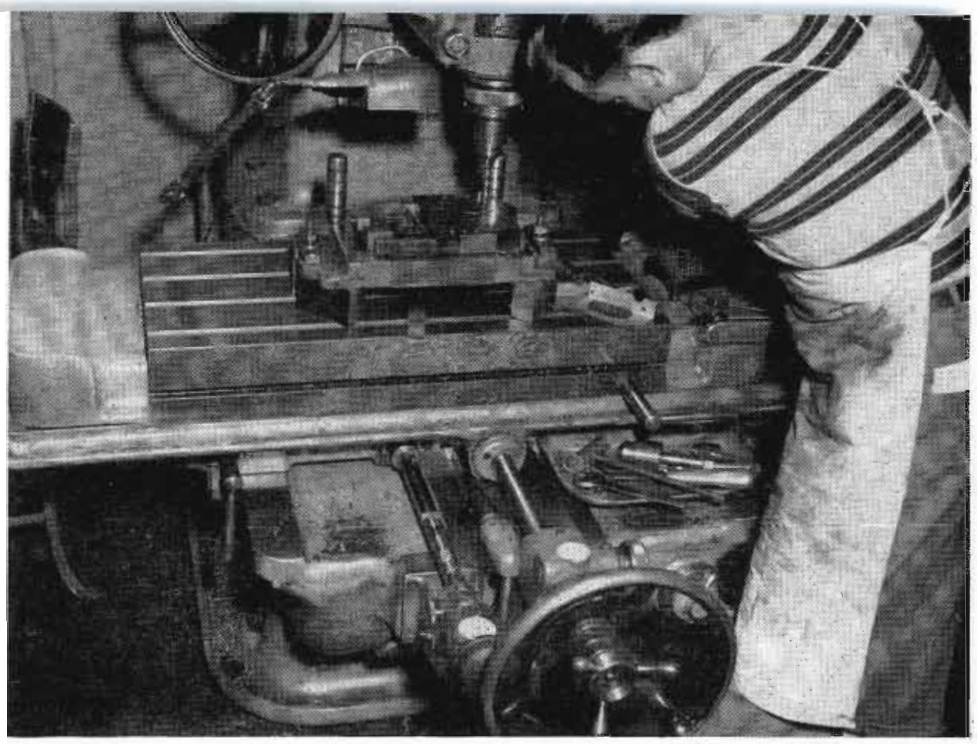
Operations

er squaring shears, from railroad freight cars. These shears cut each of the large sheets into 22 x 24-in. blanks, the size required for a television sub-base, and these in turn are fed into the punching and forming presses.

The plant is equipped with 85 different presses that range in capacity from 10 to 500 tons. In passing through the plant, the television sub-base blank is first subjected to three piercing operations where different sized holes and cut-outs are punched. The larger holes are punched first while smaller and odd shaped holes are added in subsequent steps. Each punching operation has been carefully engineered to avoid any stretching or tearing of the metal between the adjacent holes. A spot check is made periodically by the operators of each of the presses to be sure that none of the punches in the machine have been broken. For this purpose nail-boards are used, and these consist of a board larger than the sub-base in which brads or nails have been driven to outline each of the holes in their correct location as formed either by previous or current punching operations. If a punch has been broken, the sub-base will not fit over the nails and onto the board below, whereas if the press is operating normally a snug fit at all points is achieved. When a punch is broken, the press must be stopped until the die can be removed and the punch replaced. Philco, in maintaining its own tool and die shop, minimizes stoppages of this nature.

The tool and die shop employs 54 machinists and tool and die-makers. Their jobs, aside from repairing broken dies, include changing dies to conform with the latest engineering specifications and building new dies for each press operation when required. The construction of a new die or a new series of dies is both time-consuming and painstaking work, and accounts for a large percentage of the eight to ten weeks preparation time required before the plant can be geared to production.

At Philco, measurements for all dies are made by using the upper left hand corner of the die plate as a reference point. The die plates are drilled on a jig borer that has an accuracy of 0.0001-in. and is directly readable on an indicating gauge. The holes are drilled so that the punches will fit snugly and are countersunk to allow them to be flush with the back of the die plate. The die plates (upper and lower) are then mounted on die-sets which in turn are bolted into the presses. Tool and die-making requires considerable attendant machining equipment and consequently a variety of lathes, milling machines, shapers, and grinders are on hand.

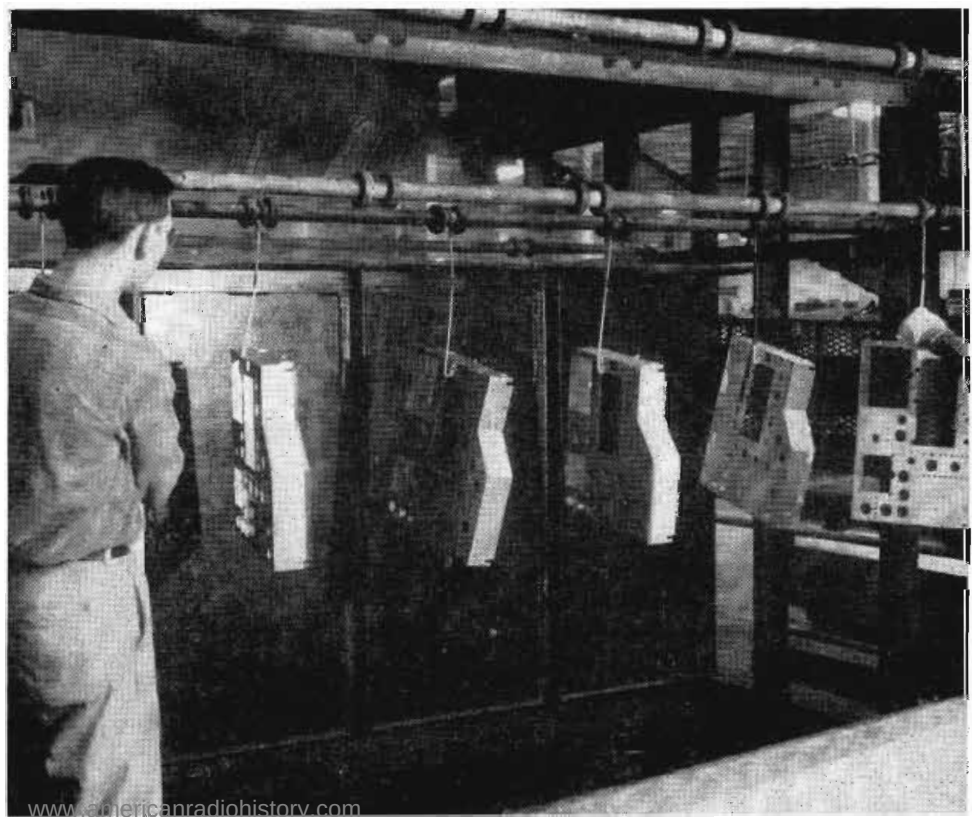


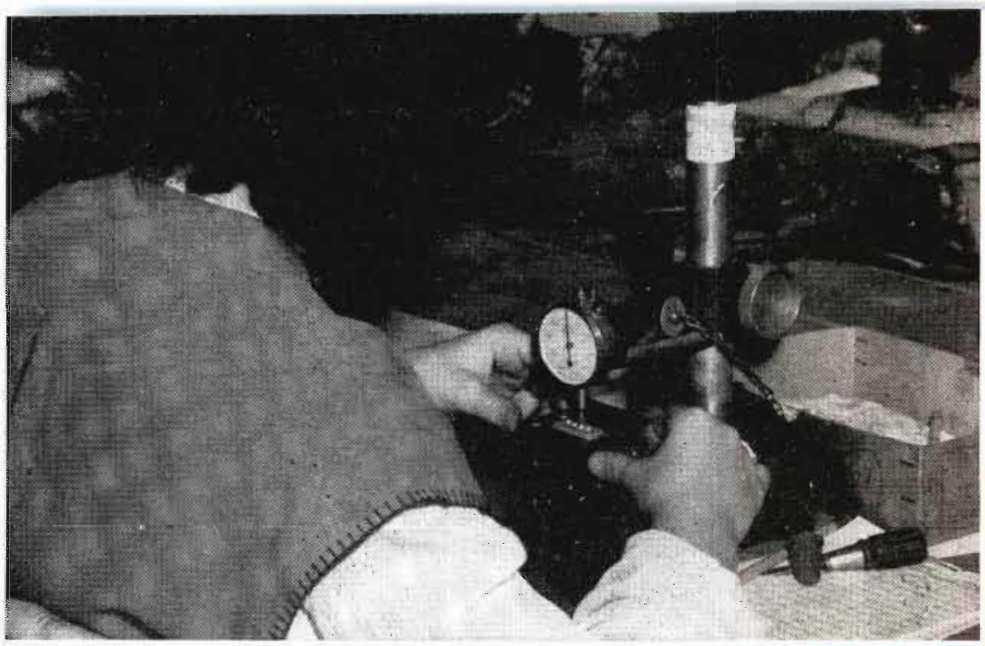
Drilling a die plate in a jig-borer. All die measurements are made from the upper left corner of the plate. Gauge in center foreground reads directly in 0.0001-in. graduations

Returning now to the television sub-base, after the piercing operations have been completed, the blank is fed into another press in which a forming die has been installed. It is at this point that the blank begins to take on the appearance of the component observed when looking at the finished television chassis. As the die descends into the center of the blank, all of the sides are

(*Continued on page* 90)

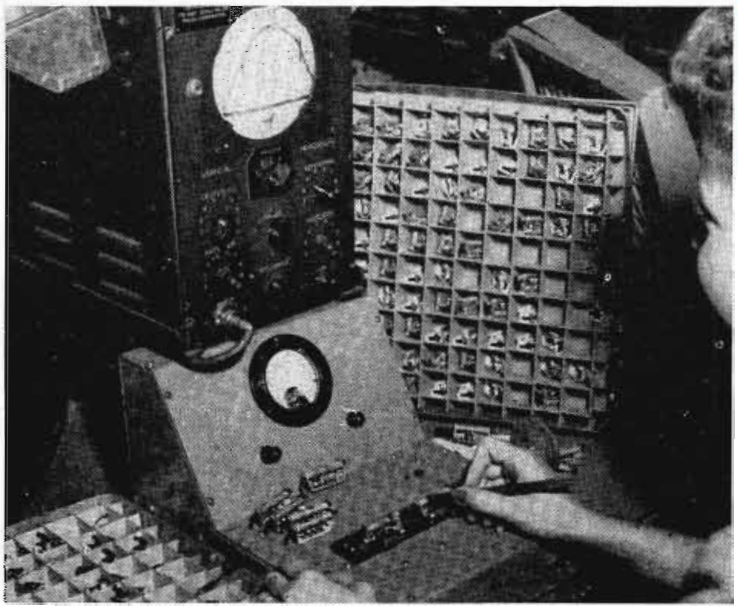
Finished television sub-bases emerging from one of the two automatic electroplating machines in Philco's plant 6. Standardized zinc plating prevents subsequent rusting of metal





Coil & Transformer Manufacture

Nearly 50% of total RF, IF and special coil assemblies required for radio and television sets are produced at Plant 20



↑ Direct reading mechanical gauge measures height of contacts in turret switch wafer

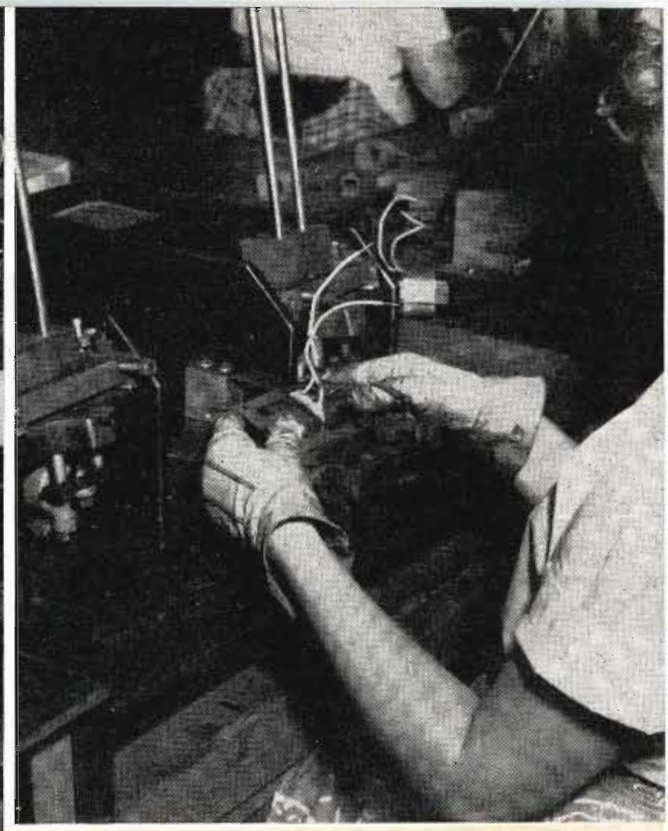
← Crayoned pattern on oscilloscope screen indicates response limits for correct location of the coils on the form

NEARLY 50% of Philco's total coil requirements come from its subsidiary plant No. 20 located between Trenton and Philadelphia, at Croydon, Pennsylvania. The two-story plant provides approximately 70,000 square feet of floor area and some 85% of its 1200 employees are actually engaged in producing various types of power transformers and rf and IF coil windings.

Each week Croydon ships production quantities on some 200 different coil components. New orders take about five weeks for deliveries.

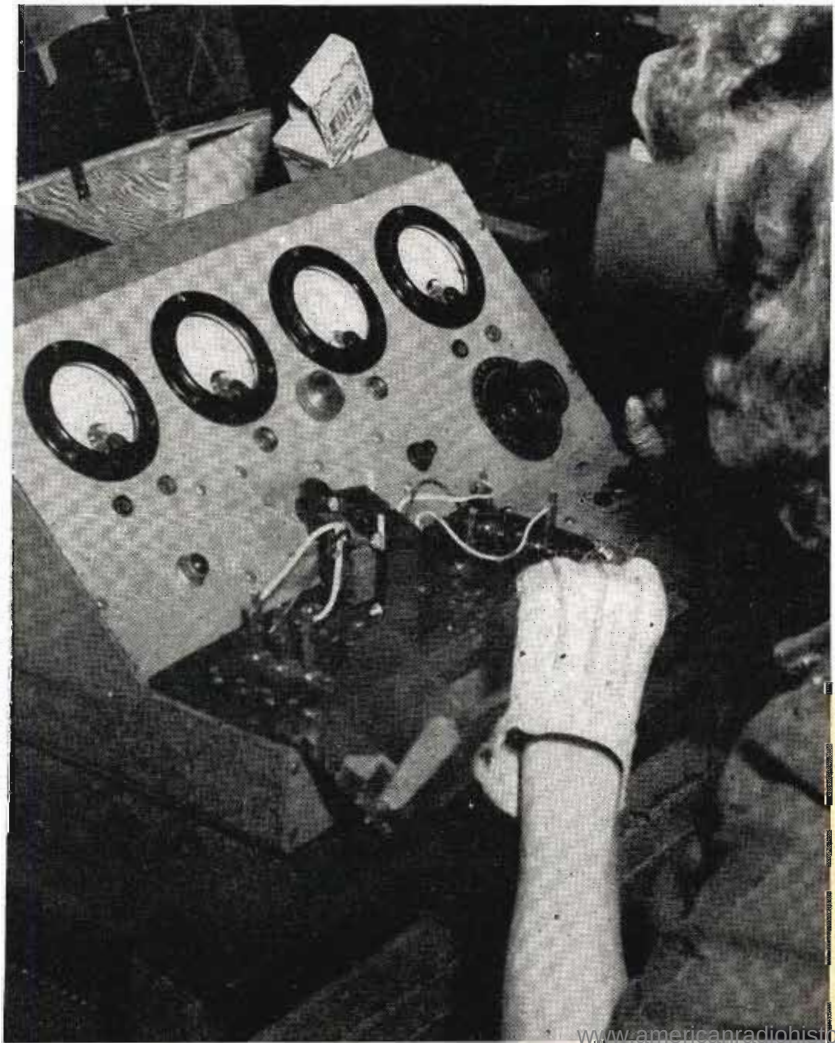
Three cathode ray tube focusing coils being wound simultaneously. Machine stops automatically when required turns are wound

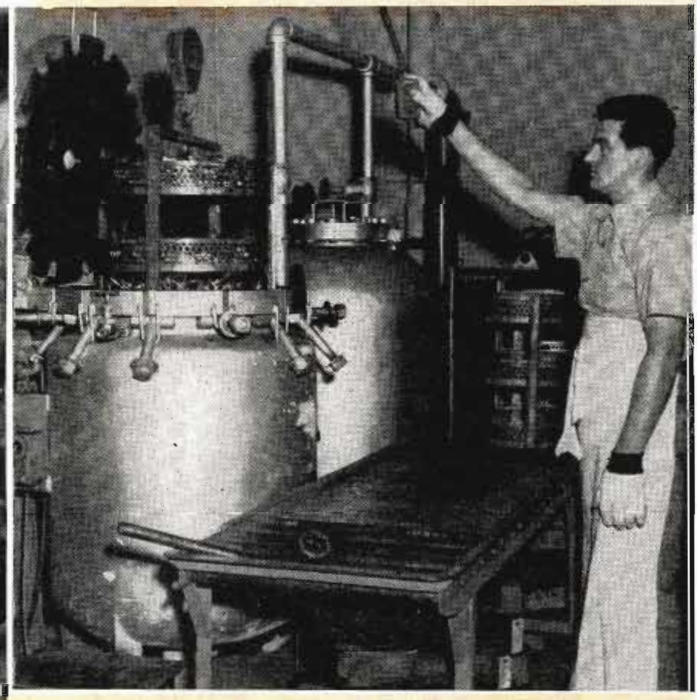
After connecting leads have been soldered to the start and finish of focus coil windings, unit is assembled into metal housing as shown



Above: "E" laminations are inserted through the superimposed primary and secondary windings alternately, as shown, and form the magnetic core of the transformer

Left: 19 secondary coils for small power transformers being wound on single form. In subsequent operation a band saw is used to separate each of the windings





Above: In order to seal transformer windings against moisture, units are impregnated with hot wax in evacuated vats

Left: Completed transformer being tested for power output. Connection clips are dead until operator closes the cover

Cabinet Design &

Heads of cabinet design section employ rough sketches as visual aids in determining which solution best meets desired specifications in new cabinet design

"Mock-ups" of new TV cabinets illustrate all design features and aid in establishing production methods

THE television receiver, in addition to being a device for receiving pictures and sound through the air, must also function as an article of furniture in the consumer's home. Furniture styles and trends change from year to year, and so it becomes the function of the cabinet design department to develop new cabinets that will be in line with current style trends.

The design of a new cabinet begins when, after a meeting with top management, the general performance and appearance characteristics of the new model have been determined. A product assignment sheet is then issued which directs the development of a new cabinet for a chassis that will be under simultaneous development in the television receiver design section.

The product assignment sheet will indicate the tentative price and the tentative production date of the new model. These two factors establish important boundaries for those responsible for cabinet design. The tentative price sets an approximate cost limitation, while the tentative production date defines when the new cabinet design must appear in quantity production.

Upon receipt of a production assignment sheet, a meeting is held between the chief technical director and styling director of the cabinet design section, and the desired features, characteristics, and materials of the new design are discussed. When the details have been organized they are turned over to an individual designer, or a selected combination of designers for development.

The number of industrial designers employed on any specific assignment is not fixed but will vary in accordance with the tentative production date. If this date is scheduled sufficiently in advance, the assignment may be given to only one designer, whereas if the production date is in the immediate future, as many as three or five designers may get the same problem at the same time.

The designers involved on the project prepare a series of rough sketches showing a number of possible solutions to the problem. These sketches are then screened by the chief designer and the better ones are selected for further development. Sometimes when a cabinet design involves unusual shapes that are difficult to illustrate in sketch form, modeling clay is used to work out an illustrative example.

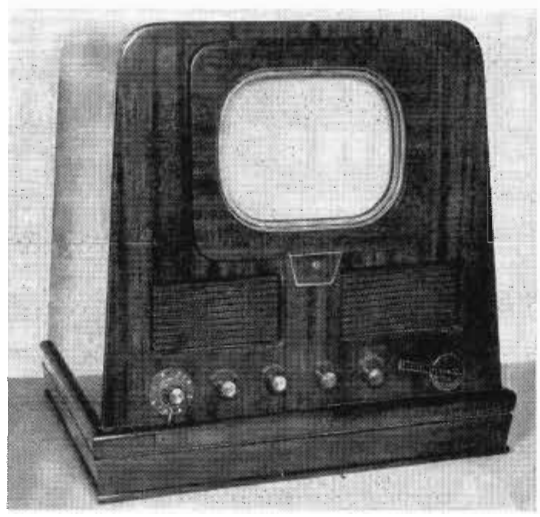
The rough designs selected are then worked out into full-size, accurate, detailed drawings from which a full-size model, or "mock-up", is made. The model shop available to the design group employs production type woodworking machinery. This minimizes production difficulties that might be encountered in translating a hand-built cabinet into a production model.

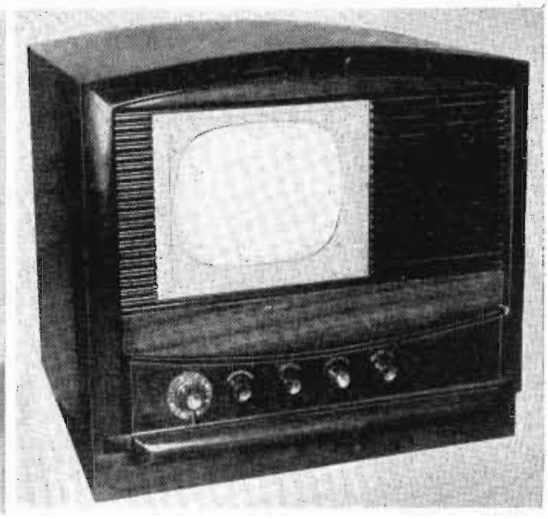
During the time that a new cabinet design progresses to the detailed drawing stage and to the model stage, close liaison between the chassis design group and the cabinet section is necessary to assure that the cabinet model will be of the correct size and shape for mounting the chassis assemblies.

Cabinet finishing is a major consideration in developing a design model and in fact a design's fate is often determined by the selection and execution of the finish. The cabinet design section at Philco has access to a complete finishing laboratory where nearly every type of production finish is stocked, and facilities for mixing any desired finish are available. Wood cabinet finishes usually consist of the toner stain for overall color, filler to close up the

Designers have quick reference to the latest cabinet hardware mounted on display boards

Product Development





At left is the original model of a 1001 cabinet which never reached production. The design was abandoned in favor of the cabinet style shown at right

pores of the wood, sealer to seal the wood against moisture, and several coats of clear lacquer to present a tough surface treatment. Plastic mock-ups are usually made from wood and finished to simulate the desired plastic.

A satisfactory appearance having been attained in the finishing process, the model is taken to the "fit-up" room. At this point the designer must see to it that every desired detail has been incorporated and must be satisfied that the model looks exactly like an operating model, even though it is only a mock-up. All knobs, dials, dial pointers, grille and grille cloth, must be absolutely perfect in appearance so that the model will be ready to be shown.

New models are shown to a group of sales executives at a special meeting where all factors such as saleability, cost, and tie-in with other current models are considered. If the model is not approved, modifications are studied that might make it acceptable when presented at a later showing, or the model is abandoned altogether and a fresh approach to the design is started.

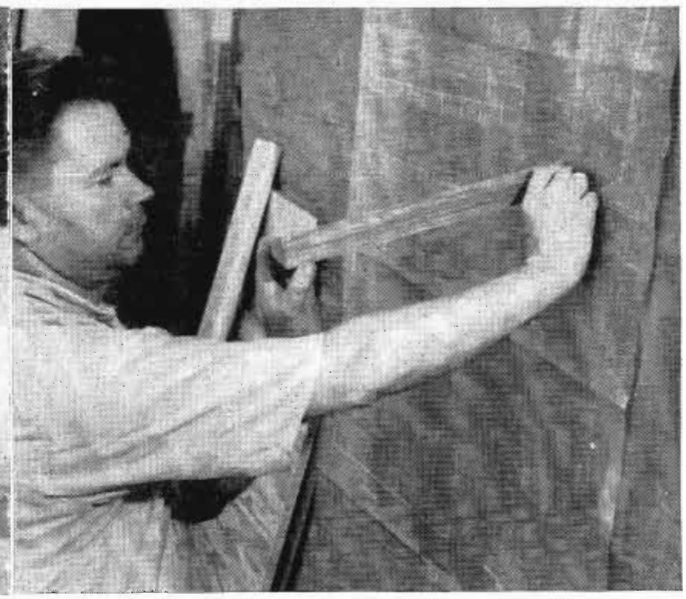
After the sample cabinet model has been approved, it is turned over to the furniture engineering section where production drawings are prepared and production samples are developed based on the newly designed model.

The cabinet sample forwarded to furniture engineering is closely studied for production methods which, incidentally, may vary from manufacturer to manufacturer. For example: some manufacturers may prefer to make the base of the cabinet out of one piece of material,

(*Continued on page* 87)

After a design has been approved, full-scale detailed drawings are prepared for use by model shop in constructing design sample

Cabinet-makers check the size of each component part against full-scale drawing and use production types of woodworking machinery



TV Cabinet Manufacturing Methods

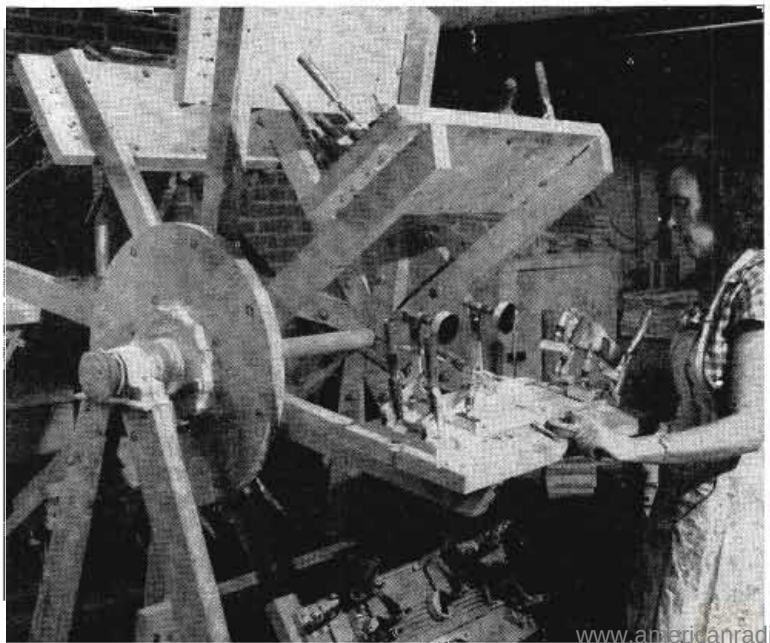
525 different construction operations required for consolette type cabinets

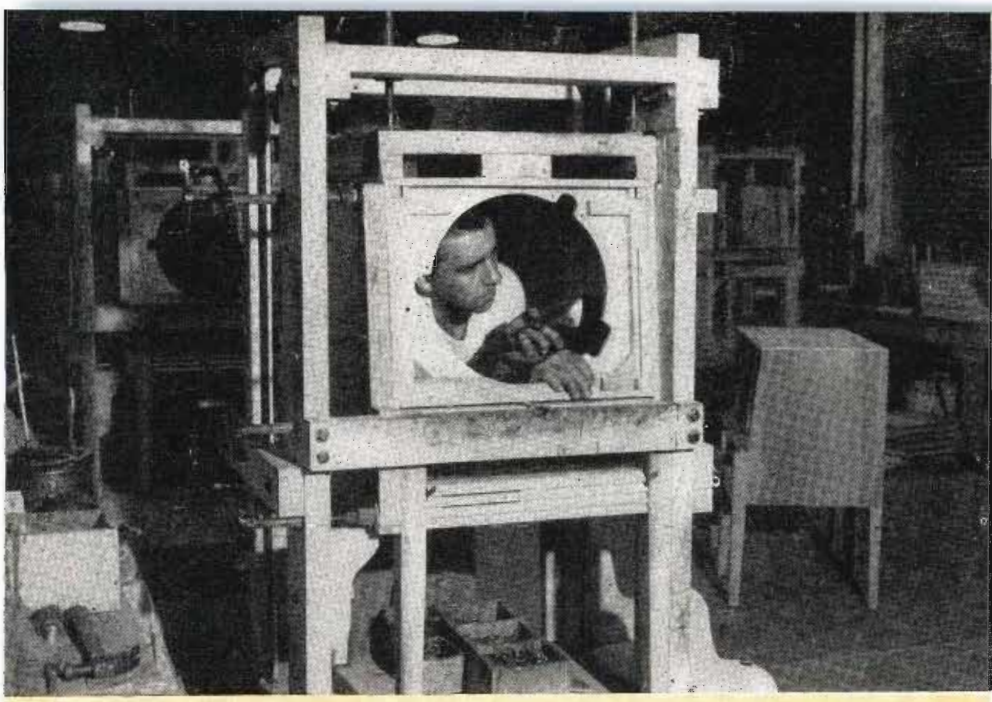
Machining instrument rail panels for a Philco television consolette is efficiently done in this automatic moulder at Watsontown. Note workman at right checking typical panel dimensions

Back posts for the consolette cabinets are glued, clamped together, and then placed in position on this sub-assembly damp carrier which rotates slowly. The glued posts dry in one 30-minute revolution

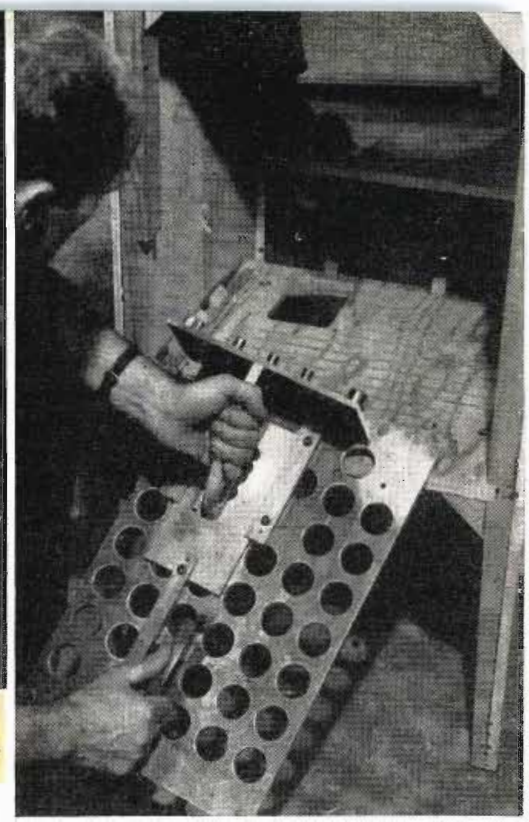
Grille overlays and top cleats are glued and then clamped together on this "merry-go-round." As the device revolves, the sub-assemblies dry

Dial inserts are glued into the instrument rail panel and this sub-assembly is clamped on a "ferris-wheel" for drying as wheel revolves





A specially built press holds the parts of a Philco model 1240 during major assembly operations This special jig checks cabinet size and panel hole locations to assure a precise chassis fit →



WATSONTOWN Cabinet Division of Philco Corporation produces a large number of the cabinets for Philco television receivers, utilizing 365,000 sq. ft. of working space in several modern plant buildings located on a 13-acre site in Watsontown, a small town in north-central Pennsylvania.

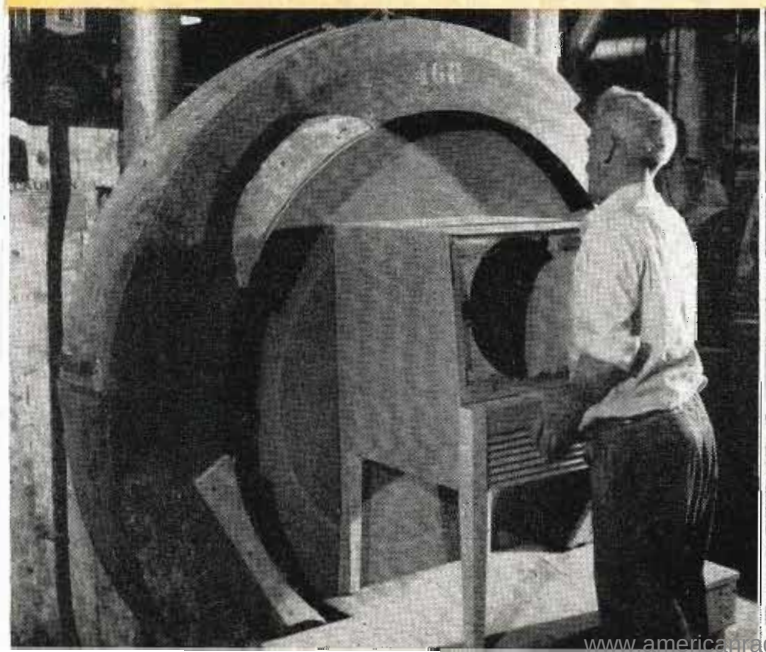
The entire process of making television cabinets is well integrated so that the 525 different operations required to produce a typical consolette flow smoothly, from the basic raw material—lumber in a huge seasoning shed — to packing the gleaming hand-rubbed finished cabinet in its carton.

At Watsontown, over 1,500,000 board-feet of gumwoods, walnut and mahogany are air-drying at any given time, or more than three months' supply at the average consumption rate of 100,000 bd. ft. each week. This lumber is all first air dried, then kiln-dried, and tempered for several weeks before cutting, so that the wood will not change dimensions when the completed cabinet is in the customer's home. Incidentally, it takes about 9 board feet of lumber to produce a typical Philco television receiver consolette.

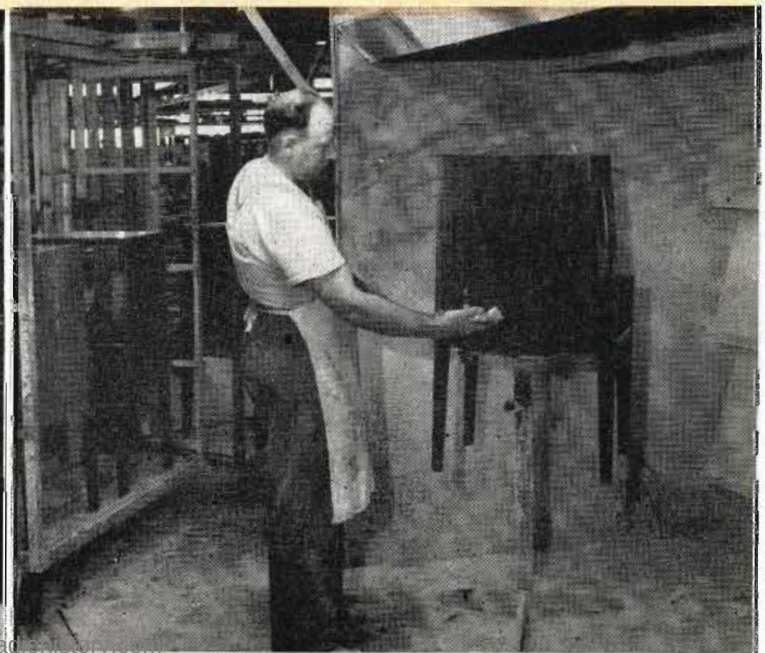
Seasoned lumber, its moisture content carefully checked, is cut and ripped in the "dimension plant" where any defects are removed and the wood is faced to level it, then put through moulders to give it the desired profile. Next step is the wood mill or "machining plant" where the final machining operations take place and some sub-assemblies are glued together. Careful planning to determine which parts can best be made by cutting and which should be glued, results in the most effi-

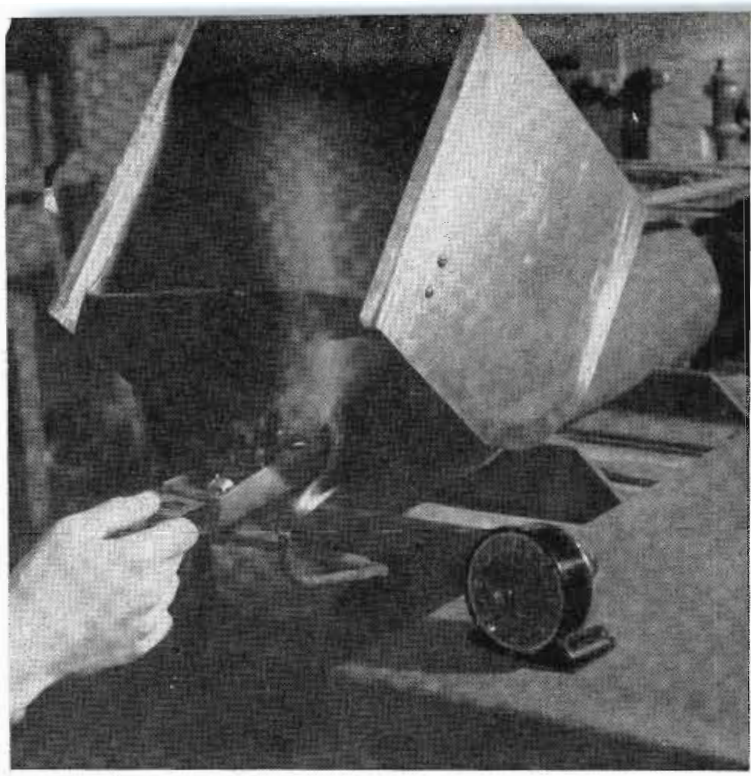
(*Continued on page* 87)

One of the large sanding machines used to quickly remove rough spots and do the final trimming on backs of television consolette cabinets



Consolette cabinets are carried by monorail conveyor to a specially designed spray booth where a final lacquering operation is performed





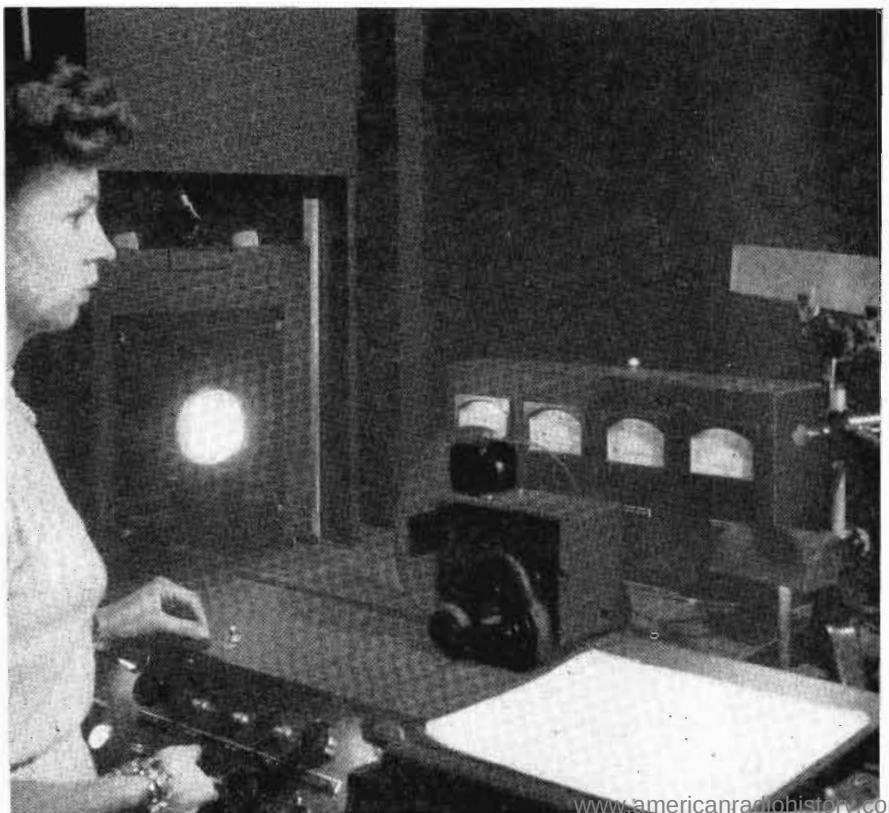
Clean, oxide-free parts are produced in hydrogen fired ovens at Lansdale. If oil, lint, oxides or finger smudges are not removed arcing, stray emission or leakage might occur in finished tubes

Cleaned, metallic parts, welded together, and mounted to a glass stem from the electron gun. Due to high voltages, careful 100% inspection is performed to assure freedom from quasi-short circuits

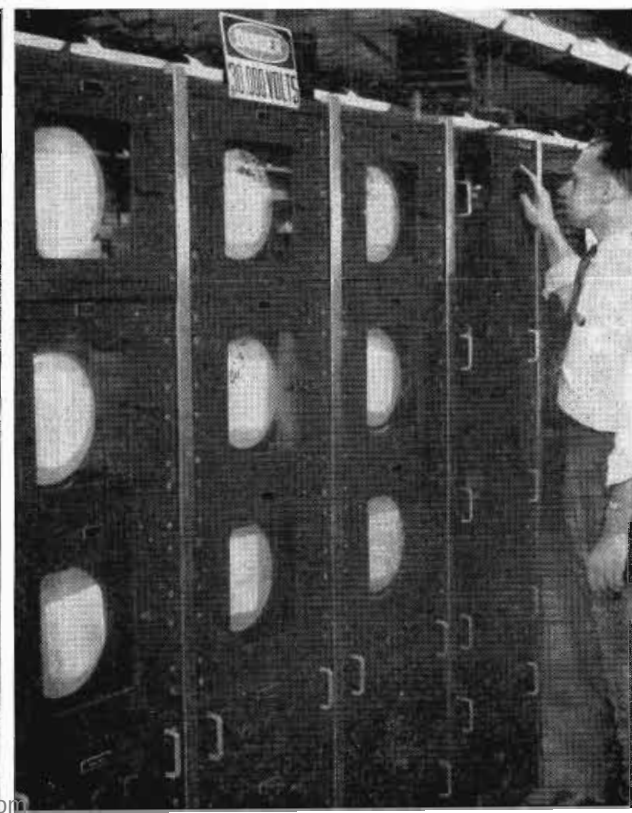
TV Tube Manufacturing

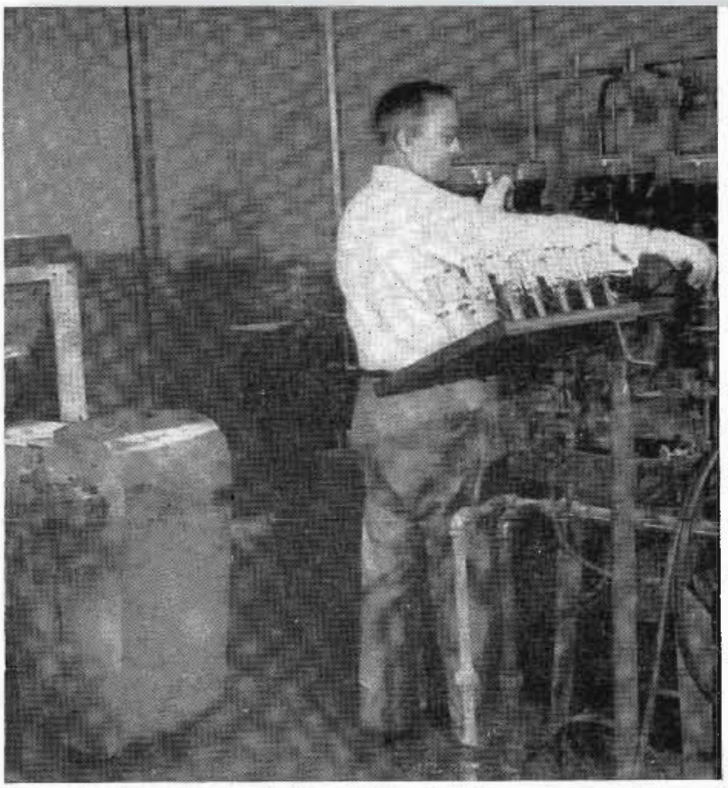
Modernization and mechanization plans now underway will result in lower

In order to assure good black-and-white pictures the color content and screen coating of cathode ray tubes must be uniform. Here the operator checks the ratio of green, blue and amber against a standard illuminant



Samples of each production lot of picture tubes are life tested as long as 1000 hours at maximum voltage. Frequent readings indicate life expectancy





Carefully pre-heated tube gun stems and bulb necks melt together at proper sealing temperature. In the annealing furnace, at left, tubes are cooled gradually to prevent strain patterns in the seal

50 trolleyed evacuation pumps are pulled through temperature controlled ovens to bake out bulb gases. Simultaneous RF heating of gun assembly removes occluded gases in metal components

Operations at Lansdale

production costs of cathode-ray "picture tubes", 90% of which are of 10-inch type

Typical of performance testing on miniature tubes used in television receivers are the measurements for diode balance and hum. Tubes are used in discriminator circuits of the audio section.

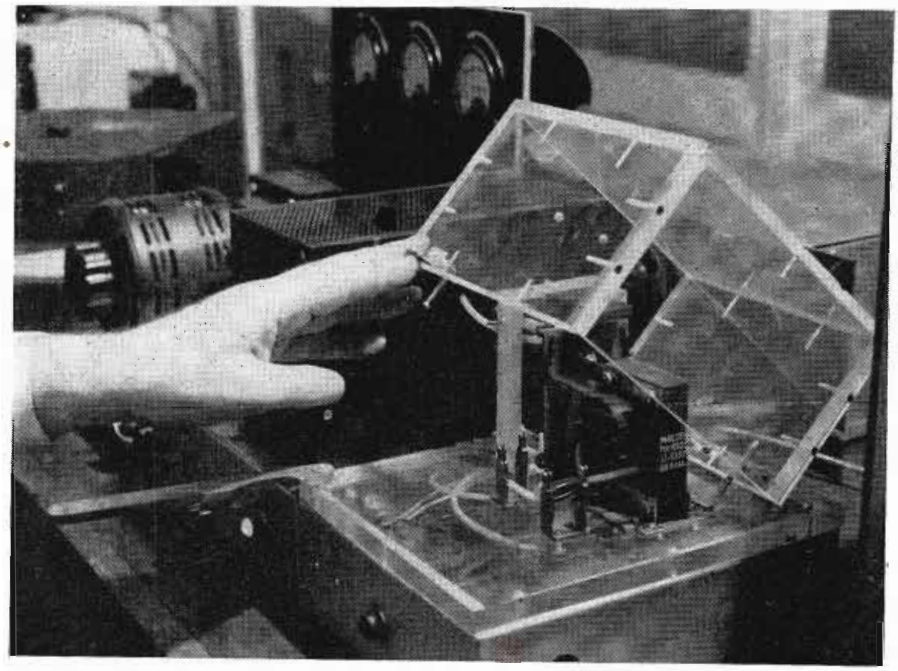
THE Lansdale Tube Corp., at Lansdale, Pa., as a subsidiary of the Philco Corp., is one of the important sources of the company's supply of television tubes, including picture tubes and other tubes, and a vital link in Philco's television operations of the future.

Extensive modernization and mechanization plans now under way will make it one of the most up-to-date television tube production facilities in the country. The new mechanization planned will result in a substantial reduction in the manufacturing costs of cathode ray tubes.

The plant with its present facilities is turning out many thousands of cathode ray tubes per month ranging in size from four to 12½-in. in diameter, and of these approximately 90% are of the 10BP4 type (10 in.). Some 35 other tube types, totalling 40,000 per day, are also manufactured in Lansdale and one half of these are used in television sets.

By April, 1949, present facilities will be increased to provide greater cathode ray tube production capacity. These extensive improvements, as already pointed out, will result in important reductions in the production costs of picture tubes for Philco television receivers, some 600,000 of which receivers are scheduled for 1949 production.

Unusual Test Equipment



High-voltage TV transformer test equipment typifies precautionary design practice. Unit is powered when lower plastic cover screws actuate interlocking switches beneath chassis

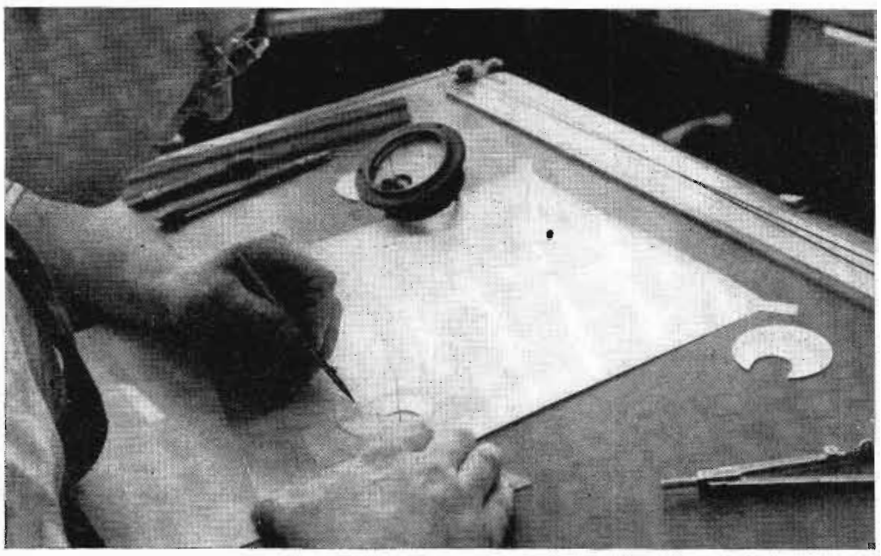
PROBABLY the most important phase in the manufacture of a television receiver, aside from actual assembly operations, is that of testing the various sub-assemblies that go into the finished product, and testing to see that the new receiver performs within the engineering specifications. Commercial test equipment for the most part is extremely expensive and not always adaptable for use on assembly production lines. At Philco test problems are divided between two engineering groups, the first of which is concerned with the design of production test equipment while the second builds and maintains the required number of equipment units.

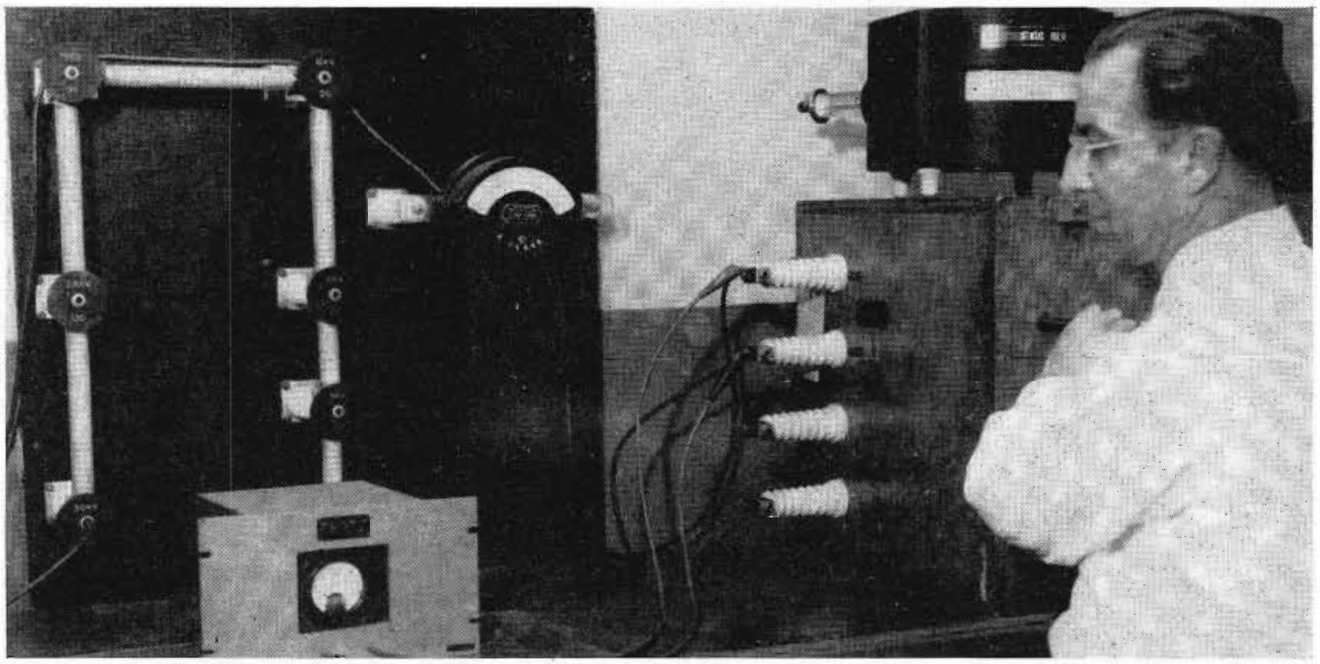
The design group, composed of approximately 25 engineers, prepares the detailed drawings of the equipment to be used in the various test operations. The basic design information is furnished to this group by the Factory Engineering Section who in turn compile the data from the various laboratory tests performed on the engineering samples. On a television receiver, test operations begin with simple circuit resistance checks that are made on the chassis before the tubes are inserted and before any power is applied. When a receiver has successfully passed this point, the tubes are inserted and power applied. In the absence of any obvious defects such as "smoking" or "burning", the set then progresses through the various alignment positions, and after the chassis has been installed in its cabinet, final checks are made using both artificial and transmitted signals.

Since television transmission standards have been established by the FCC and since all television receivers will be operating within those standards, Philco has found it expedient to install a central signal cage which houses all the signal generators required for testing. Coaxial transmission lines carry the signals from the central signal cage to test points on the main production line and to operators in trouble shooting areas. This practice eliminates duplication of equipment and offers greater flexibility for extending any test signal to another position.

With a central signal generating system in operation, it becomes possible to minimize the required number of new test equipment designs by re-designing portions of existing equipments or by re-setting the signal levels in the transmission lines. New test equipment, aside from having to fulfill a test requirement, must also include other considerations. In the case of television this sometimes involves designing intricate power interlocking systems because of the high voltages employed, and because of the non-technical or semi-technical personnel operating the equipment. Production schedules and non-technical personnel also make simplicity

Preparing new meter dial scales in Philco's meter laboratory. Use of the instrument in production is simplified when direct readings of the desired measurements are obtained





Calibrating a production kilovoltmeter. Calibration equipment was designed to produce known high voltages ranging from 3 to 30 kilovolts and consequently can be employed to test instruments used on production lines manufacturing both direct view and projection TV receivers

in all designs a key-note.

In general all production test equipment, including the signal generators for the central distribution system, is designed and built at the Philco plant. Occasionally a requirement for a piece of standard commercial test equipment is established, and under these circumstances the Test Equipment Design Section determines which of the available models shall be purchased from outside sources.

Philco test design engineers devote a great many hours to the development of specialized production-test equipment because of the need for specific types of precision tests to maintain high quality standards of performance and to achieve large-scale production efficiently on moving test conveyors.

Construction and Maintenance

The construction and maintenance shops and laboratories for production test equipment operate as six separate sub-groups. The first of these, called the metal group, constructs the metal cabinets and sub-bases needed to house the test equipment. The units are made from sheet metal stock and all processing equipment necessary is at hand. Raw material is cut to size in a squaring shear and the resulting blank is punched with the required mounting holes on a power press. Several different types of hand operated brakes are available to bend the metal into the desired shape and drill presses are used to bore the mounting holes for the front panel and all of the necessary components.

After the sub-base has been formed it is forwarded to a second group for insertion of components and for wiring. Each unit is individually wired and checked and is then brought into the laboratory and calibrated for the job the unit was designed to perform on the precision signal generating and test equipment available. The completed instrument is then installed at desired points along the assembly line by members of the installation sub-groups.

A jig and fixture sub-group operating independently prepares the necessary cord ends and test jigs or fixtures required to operate in conjunction with each unit of test equipment. Primarily the group is concerned with the development of

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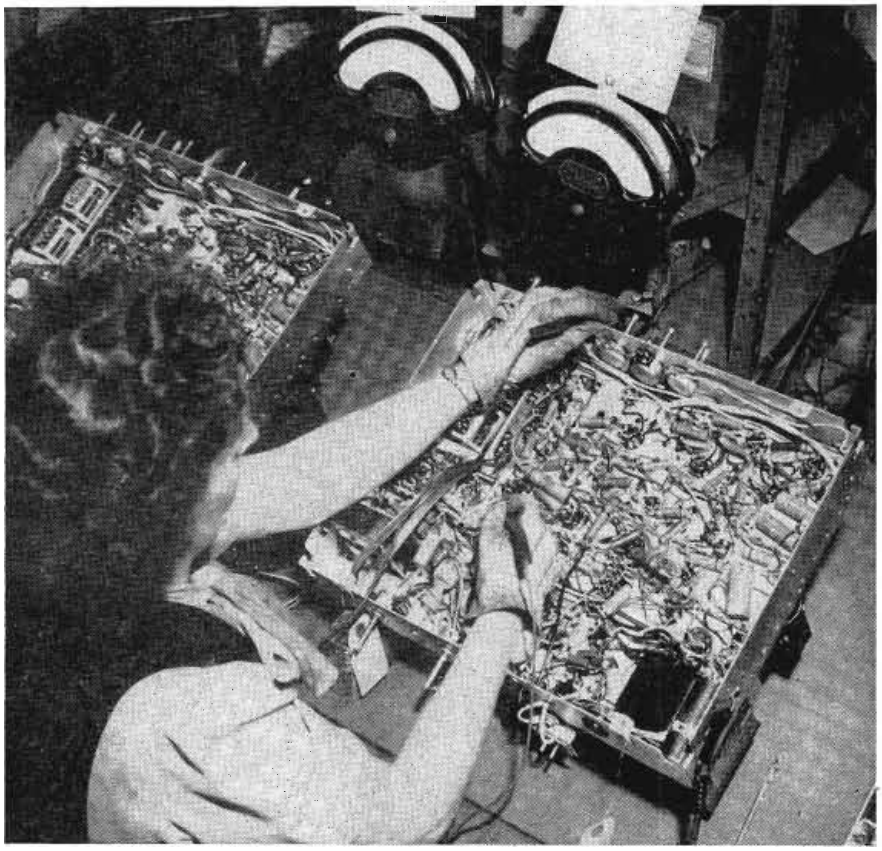
A complete stock of spare parts for all basic meter movements used is maintained so that necessary repairs can be effected promptly. Note jig for holding pointers, bottom right

UNUSUAL TEST EQUIPMENT (Continued)

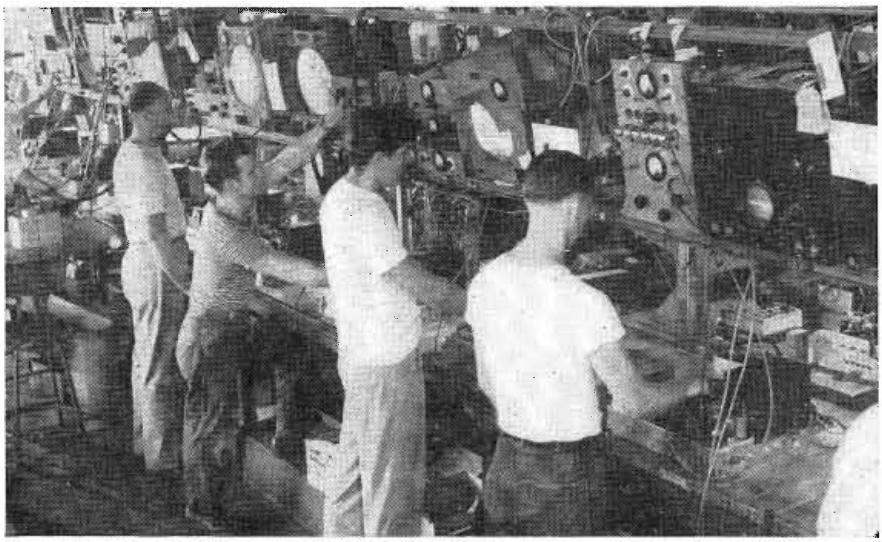


Using an ohmmeter on production line for checking continuity and resistance of various TV circuits. Removable meter scales show "Go" and "No-go" limits

cord ends to enable rapid connection of test equipment to points in the chassis where test signals have to be applied or where signal strength or frequency response measurements have to be made. The construction of these items must be such that the unit will withstand rugged treatment in production, maintain its accuracy, and permit connections to the chassis under test without undue handling of the assembly.

Broken items of test equipment are referred to a repair sub-group who effect the necessary repairs with a minimum delay to avoid production stoppages. Usually this involves installing a spare model of the equipment kept on hand for such eventualities.

Test equipment mounted at eye level above chassis conveyor facilitates set alignment. Celluloid masks on oscilloscope screens show desired curve shapes



Philco has standardized the size of test equipment as much as possible in order to minimize construction, installation and maintenance costs. All equipment is designed for rack mounting and a standard panel mounts on 12" centers. Larger units vary in height but not in the width dimension. Test equipment has a standard color throughout the plant and for this reason is readily identified. Vista green was chosen as the standard because tests have indicated it to have a beneficial psychological effect on the employees and also because it is easier to clean than some of the other colors, notably black.

There are two auxiliary groups which are connected with the Test equipment Construction and Maintenance Section. The first, called the transmission line group, is concerned with transmitting tests signals from a central signal cage to the various points along an assembly line. This group also maintains the equipment in the contral signal cages.

The second group, called the continuity group, studies circuit diagrams of new television receivers and determines the resistances which would be encountered in connecting a test voltage to different portions of the assembly. From these studies the group determines the various test points which would yield the maximum information on wiring continuity when using an ohmmeter as a test instrument. Preliminary resistance checking saves time and money in production since it serves to check on wiring, short circuits, and soldered joints before the chassis is sent along for final test and alignment operations.

The final auxiliary sub-group is the meter laboratory which maintains all the meters used for measurement throughout the plant and builds such special meter circuits as may be required. This laboratory also builds more complex equipment for basic meter movements. A set of electrical standards is maintained so that new instruments can be easily calibrated, and these standards are rechecked periodically by the Bureau of Standards in Wash ington. New dial scales for the various instruments are also constructed in the meter laboratory as are such special shunts or multipliers as may be required when building more complex instruments from basic meter movements.

Cathode ray tubes, ready for mounting in new television receiver cabinets, being tested enroute to the main production lines.

Television Receiver Production

Efficient plant layout and coordination of activities assure scheduled outputs

PRODUCTION-LINE operations are so scheduled that each worker performs a separate operation. These operations are flexible so that the line and output can be contracted or enlarged on short notice without loss of assembly or production time.

In general, all processes involving the manufacture of the receiver from component parts and bare chassis to the packing and shipping are determined and specified by the Industrial Engineering Department. Meanwhile, the Production departments are consulted and are eventually given complete operational layouts, with the associated facilities, to do the job. Changes in the basic design, with a view toward reducing costs, are studied; and the various departments affected, such as Engineering or Purchasing, are consulted to consider the feasibility of the suggestions.

A close study of all the factors involved in the mass production of an intricate television receiver entails such items as: allocation of production areas; the determining of plant facilities; type and dimensions of moving conveyors and other specialized equipment needed. Plant revision costs must be kept as low as possible by utilizing the area most adaptable to the manufacture of a specific receiver. If the receiver is a new model which supplements or follows an existing model, relatively few major changes are needed; however, an entirely new receiver requires complete facilities of its own.

In processing a new model for production the Factory Staff Organization, Design, Engineering, Purchasing, Material Control, Operations Planning and other interested departments will confer to establish actual production dates and schedules. Such matters as the release of engineering specifications, completion of tools and fixtures, comple-

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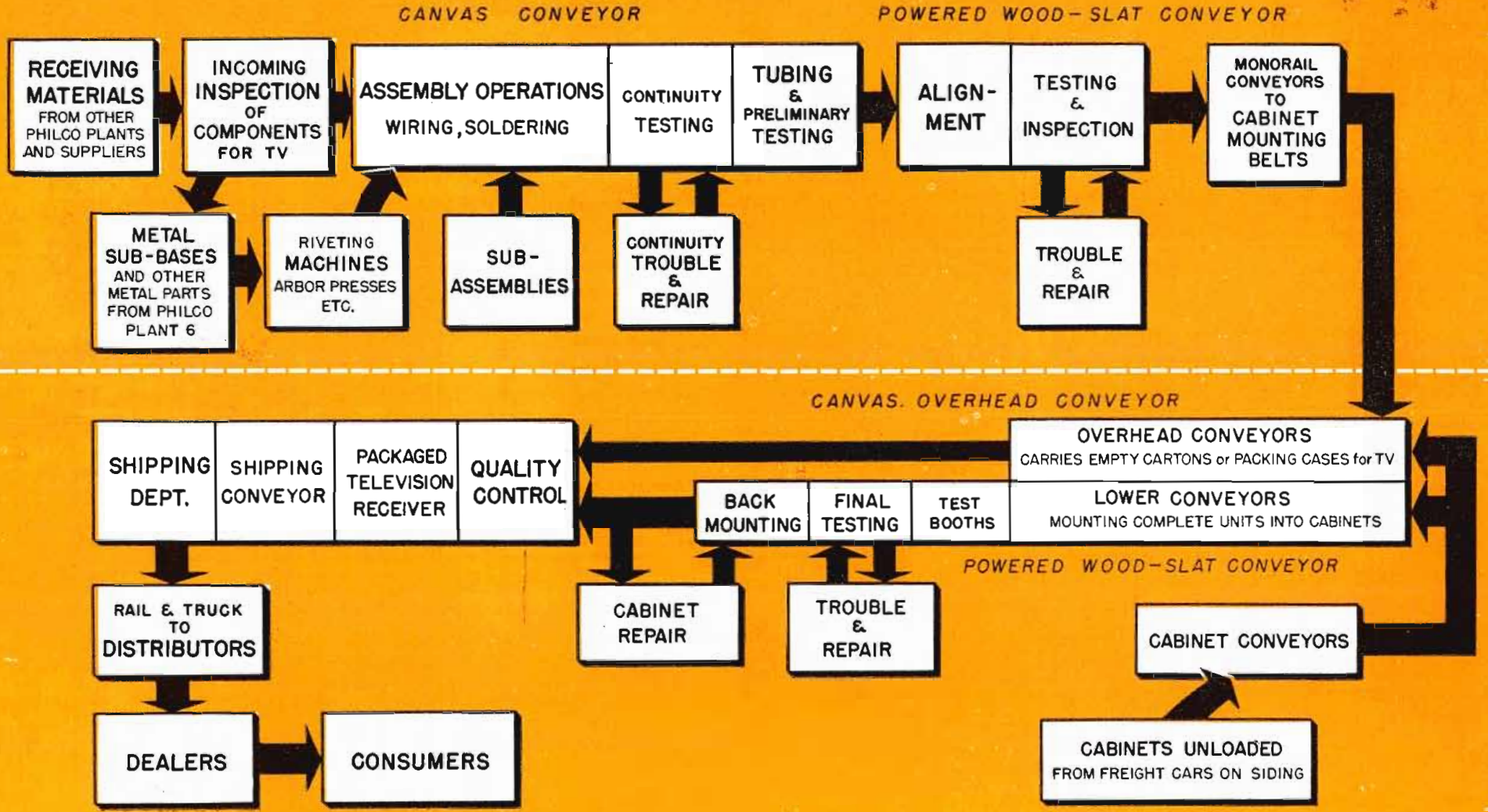
PHILCO TELEVISION RECEIVER PRODUCTION — Flow Diagram — PLANT #3



tion of plant re-arrangements and layouts, personnel requirements, and supplier dates for receiving cabinets and other materials, are discussed and considered.

The next major step is the submitting of an approved Factory Engineering sample of the receiver to the Industrial Engineering Department. The sample is used as a guide for making out the operational layouts to be followed by Production in the manufacturing of the receiver. The most efficient sequence of operations, which includes assembly, wiring, inspection, testing, and mounting, is strived for. This involves establishing a precise running rate for each moving conveyor and determining the proper station time from time-study data developed over a period of years, complemented by continued time studies for each new product.

The main Philco final production areas comprise the second and third floors of Plant 3. The first floor is utilized for storage and incoming inspection of components from suppliers, the second floor for mounting chassis in cabinets and packing, while the entire third floor is devoted to the assembling, wiring, and testing of receiver chassis and various sub-assemblies. This plant, which covers an entire city block, was designed and constructed especially for mass production of television receivers.

At the present time, nearly two-thirds of this plant is being utilized for television receiver production. Schedules exceeding eight thousand completed receivers per week are planned for the immediate future, with further expansion being contemplated for 1949.

The third floor, or chassis floor, contains eleven long belt conveyors, eight of which are each over 450 feet long. Each long conveyor is divided into three parts for assembly and wiring, visual inspection and continuity tests, and finally electrical tests and alignment. The chassis. on which the riveting operations have been performed previously by a progressive riveting line, are loaded at the beginning of the conveyor. Usually the large bulky components, such as power transformers, choke coils, I. F. transformers, etc., are mounted to the chassis first, with the multitude of resistors, condensers, wires, and numerous other components installed progressively later on.

Sub-assemblies, which are part of the main chassis, are assembled on separate conveyors while the whole receiver chassis is manufactured on sets of two conveyors operated in tandem. This makes possible effectively doubled belt length and hence a greater number of relatively simple operations, resulting in speedier production and better quality.

Banks of materials are stored adjacent to the respective conveyors, with each assembly operator supplied with a quantity of parts in trays or pans located conveniently near her. Large inventories of material are not stored on production floors to avoid waste of working space. Quantities sufficing for several hours to several days' production are supplied, and are replenished periodically as required, from the central "holdrooms".

When the television receiver has been completely assembled and wired, it is transferred from the wiring conveyor to a visual inspection and continuity conveyor. Here it is given a thorough visual inspection, where the workmanship of each operator is carefully scrutinized and where the receiver undergoes a point-to-point resistance continuity test. To pass these tests correctly, each circuit must conform to the wiring diagram of the receiver.

Each receiver is now completely tubed and the chassis then undergoes an additional visual inspection for loose, missing, or damaged parts. As a supplementary aid to the inspection and continuity operation, a completed chassis is given a preliminary "hot" or signal test, where any other faulty circuit constants are intercepted before the chassis

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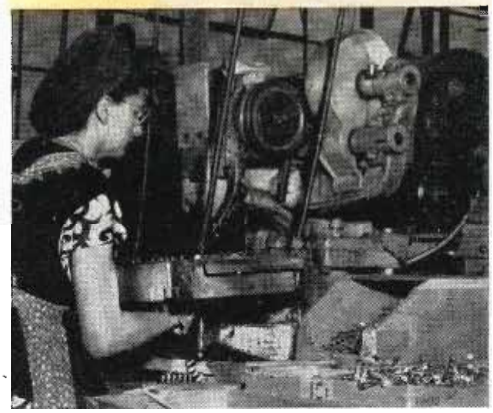
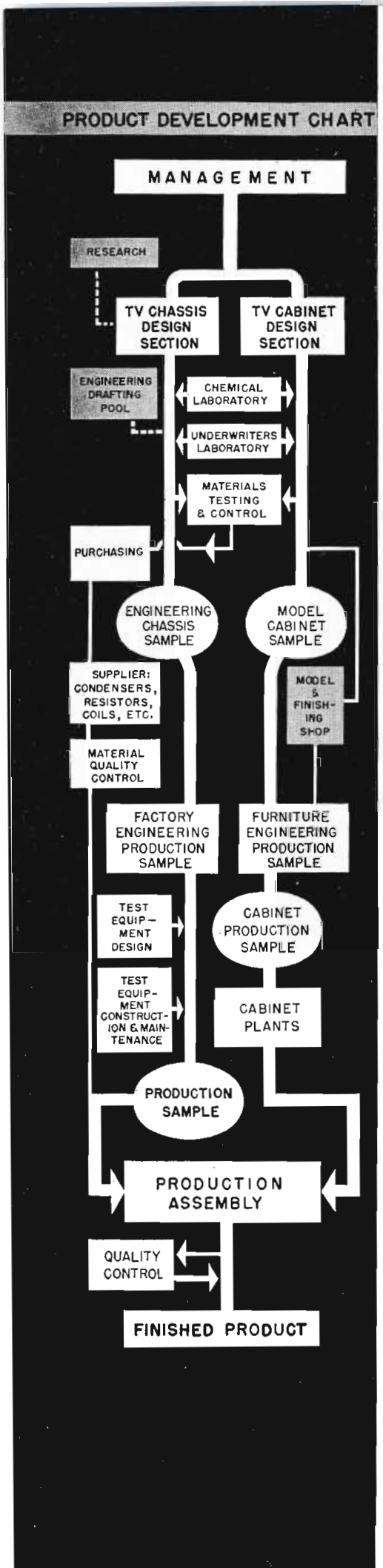
Platform conveyor transports new TV cabinets in final shipping cartons directly into plant

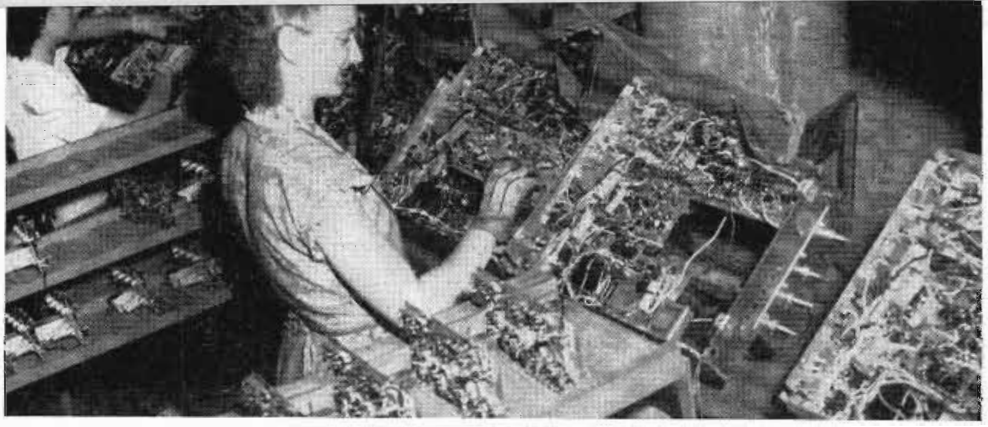
TV components that are sub-assemblies are constructed on auxiliary production lines

Riveting tube sockets and terminal strips onto the main chassis is primary operation



Larger components, such as chokes, power transformers and electrolytics, are then mounted. Small risistors and coupling capacitors are added during the various wiring operations.





Installation of IF amplifier strips (at operator's right) and tuner assembly completes chassis construction. After wiring continuity tests, tubes are inserted and power applied

Trouble shooting area located near preliminary "hot" or signal test point. Chassis with any faulty circuit constants are intercepted before proceeding for final test operations

is loaded on the test conveyor.

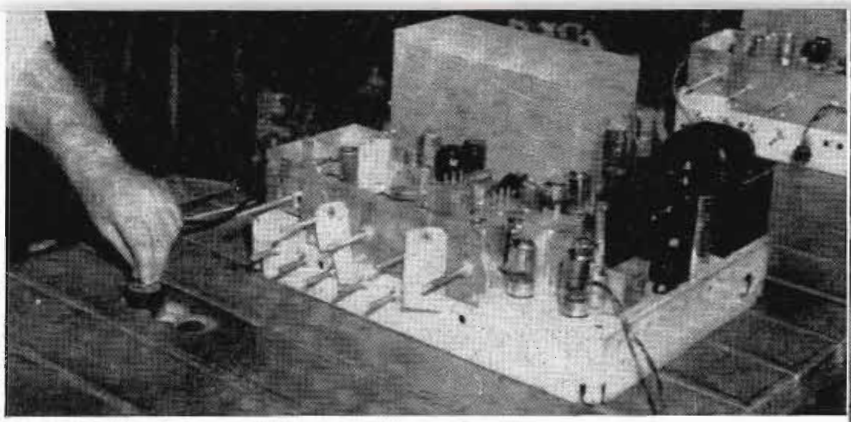
The flexible test conveyor, which is separate from either the wiring or inspection conveyors, but in direct line, consists of a series of hardwood panels fastened to endless chain couplings. Each panel contains a fused electrical receptacle that supplies power to the receiver while it moves along the conveyor.

The alignment and test operations are broken down as efficiently as possible to include all the adjustments and tests specified by the Factory Engineering Department. The sequence of operations, test equipment, test jigs, and fixtures are laid out to accomplish all alignment and testing with a minimum of time and expense. Electrical test equipment is mounted on a superstructure situated in front of the operator at eye level, and controls are placed so as to be within easy reach of the tester.

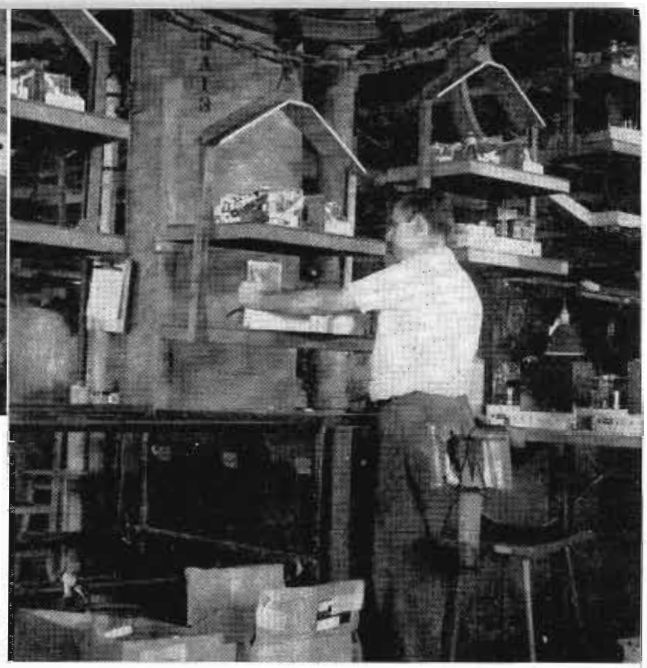
Oscilloscopes are used in nearly every position as visual alignment indicators to supplement the readings on various meters. Fastened to the face of each oscilloscope is a transparent celluloid mask, on which is inscribed a number of curve shapes and patterns. A radio frequency sweep test signal, applied to the receiver by means of specially designed test fixtures which contact the proper input and output terminals, causes an output wave form to appear on the oscilloscope screen. The tester then adjusts the various stage alignments specified and in order to meet the required curve shapes on the mask. Test standards, such as band pass characteristics, amplitude, rejection trap attenuation, and relative responses of different peaks, etc., are charted on the mask, enabling the tester to determine whether the set is up to specifications.

Receivers, after successfully passing all the rigid tests, are re-inspected at the end of the conveyor for possible damage to components during the testing and alignment process. They are then unloaded from the test conveyor and placed on an overhead tray attached to a monorail conveyor, which tranports the chassis to the next lower floor for the final mounting operations.

Cabinets arrive in railroad cars on a siding adjacent to the plant. The cartons containing the cabinets



TV chassis, connected to receptacles in wooden conveyor slats, receive power while moving through copper brushes which contact bus-bars beneath belt



After alignment, chassis are loaded on a monorail conveyor that transports them to second floor for cabinet mounting

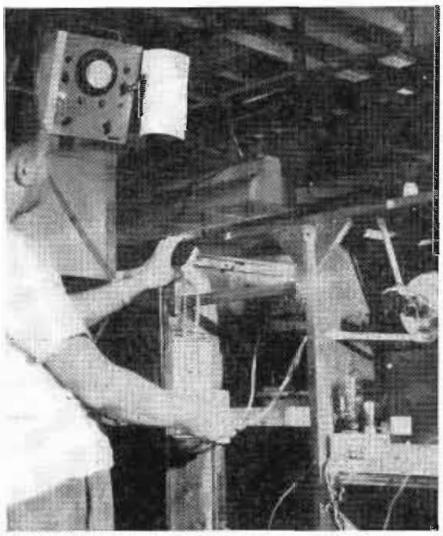
are transported by means of moving conveyors to one end of the building. Here the cartons are transferred to and conveyed by a moving belt to a position close to the beginning of the mounting conveyors.

The cabinets are carefully removed from the cartons and loaded on a low, wooden panelled mounting conveyor. The empty carton is simultaneously placed on an overhead canvas conveyor, which runs just above and parallel to the mounting conveyor. At the conveyor's end, the empty carton is unloaded and used again to store the same cabinet, which now contains the finished television receiver. The cabinet is conveyed down the mounting line where the various mounting operations are performed. These include installation of the receiver chassis, cathode ray tube and assembly, speaker, and automatic record changers or radio chassis in the case of combination receivers.

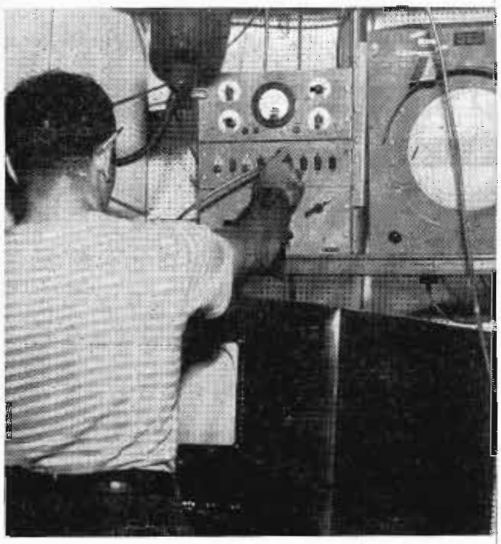
After all the parts have been installed and the associated cables and wires attached, the cabinet undergoes a rigid visual inspection to check mechanical operation. Then each set undergoes a series of electrical tests, during which time the various television controls are adjusted and the receiver double-checked for video performance. Next, thorough listening tests are made in soundproof booths to insure adherence to the highest standards of audio performance.

The final assembly operations, such as installation of various instruction and warranty labels, tying of cables, positioning of back cover, etc., are now performed. The completed receiver is again thoroughly inspected, and the cabinet is cleaned and polished to a high lustre.

The completed instrument is now ready for careful packing, which is the last in the series of operations on the mounting conveyors. After being sealed in a carton or "shook", the receiver is conveyed directly to the shipping room.



Complete operational checks are made after the chassis has been mounted in the cabinet



Quality Control uses both transmitted and artificial signals in retesting finished sets

Shipping cartons traveling on an overhead conveyor, meet the finished instruments at the end of the production line. With sealing of the carton, set is ready for shipment

QUALITY CONTROL

Visual, mechanical and electrical testing systems, applied to both components and finished products, assure quality performance of TV receivers

THE final appearance and performance qualities of a television receiver are dependent on the amount of control exercised in the selection and purchase of materials and in the care exercised in processing these materials to become the end product. At Philco two distinct organizations are in operation to maintain a maximum of quality on all models being produced at all times. The first group insures the receipt of materials from outside vendors or subsidiary plants that are in accordance with prescribed engineering specifications. The second group concerns itself with the quality of the finished product, using the customer's point of view as its yardstick.

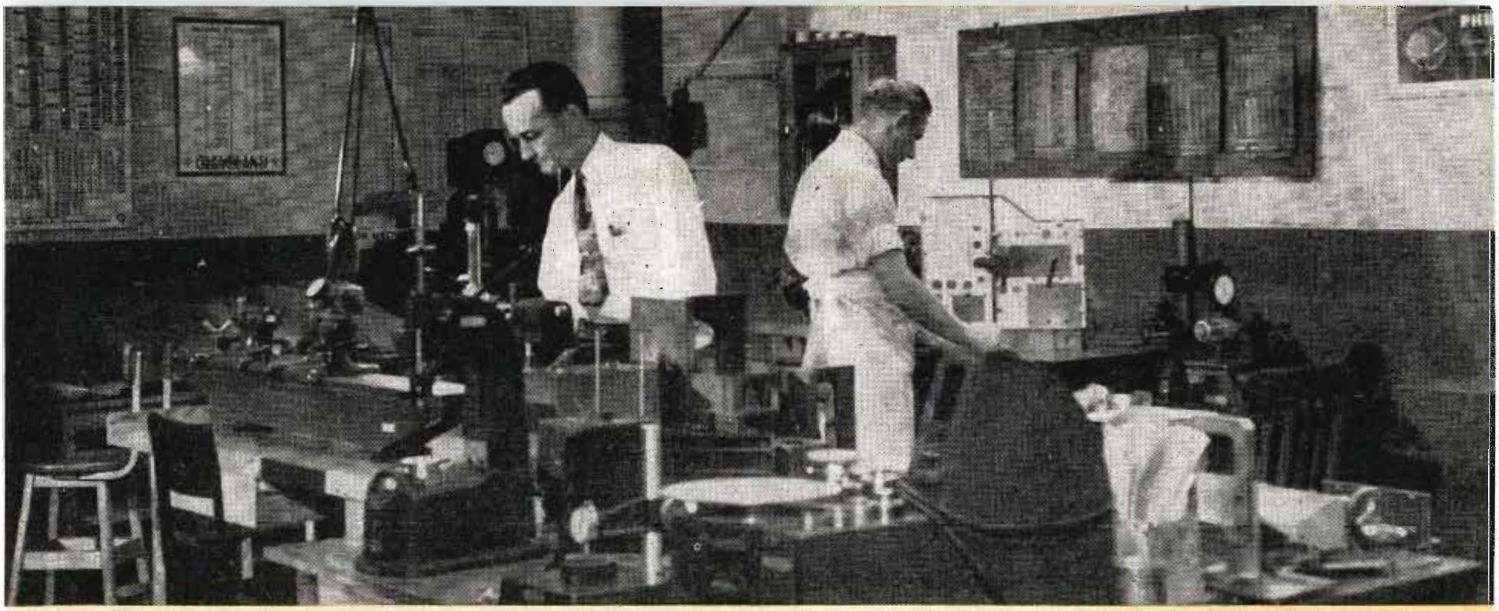
When a new television receiver chassis is designed, process sheets are forwarded to factory management where they are studied to determine which items will be produced in subsidiary plants, such as metal parts, coils, etc. and which parts will be purchased from outside suppliers, such as speakers, resistors, capacitors, etc. Drawings for these items to be procured from outside manufacturers are prepared and submitted to the suppliers who in turn develop and submit a finished sample of the desired item. These samples are thoroughly checked against the engineering specifications, and where the item meets the specification, approval to manufacture is forwarded. If the sample fails to meet specifications, the item is returned to the supplier with an explanation as to why the sample was rejected, and the supplier in turn must submit a new and satisfactory sample.

Incoming products from outside suppliers may be checked statistically or completely depending on the past records of the supplier concerned. When a new or unknown supplier is involved, a Philco field engineer contacts the plant that will manufacture the desired item to review its manufacturing processes and the provisions employed for quality control. If necessary the existing quality control system is modified to assure the receipt of products that are within Philco specifications. In some cases special test equipment will be made available to the supplier to assist him in carrying out the necessary quality checks. In special cases, field engineers will be on continuous duty with supplier plants because of the critical nature of the components being manufactured.

The type of inspection performed on incoming components at the main assembly plant depends, of course,

Production type comparator test equipment checks RF turret tuner switch contacts before mounting sub-assembly on receiver chassis

Incoming shipment of IF transformers for TV receivers being checked for frequency response and output by correctly pre-tuning each unit



Mechanical testing laboratory makes precision measurements on components and develops modified precision measuring equipments

on the function of the item involved. In general, however, the tests are either visual, mechanical or electrical, or a combination thereof. When the statistical method of check is employed, measurements are ordinarily made with precision equipment but when greater sampling percentages are involved modified versions of the equipment are constructed to facilitate checking operations.

With the development of television many new quality control problems have been encountered and overcome. Components not employed in radio (cathode ray picture tubes, deflection and focusing coils, and high voltage transformers) have presented problems not known in radio production.

In manufacturing television receivers, it must be kept in mind that since the consumer can see as well as hear the program material, a close examination of all cathode ray tubes must be made to be sure that there is no astigmatism and that there are no face plate marks or blemishes in the viewing surface of the tube.

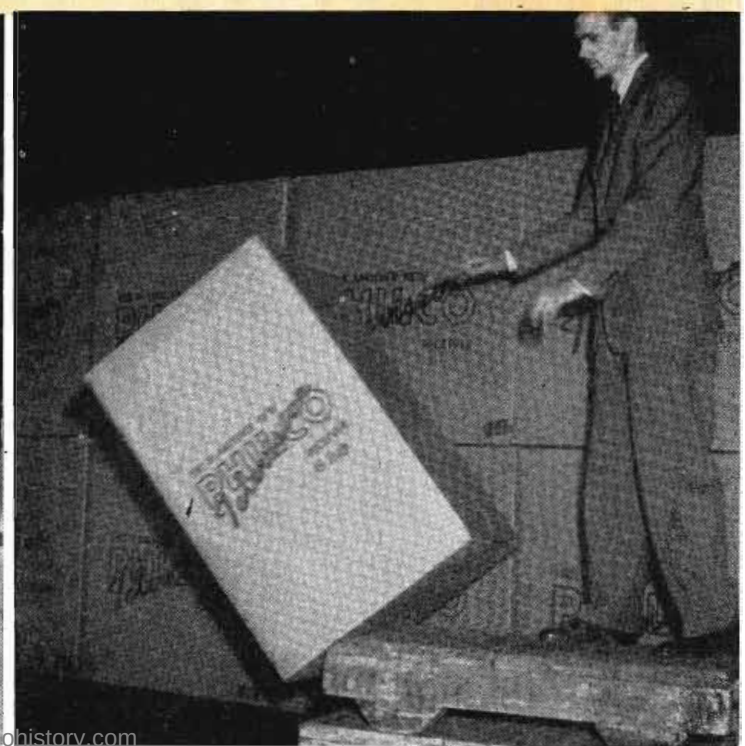
Considering quality control from a customer's point of view, when production starts on a given model, two main check-points are set up on the production line. The first of these points follows the last wiring operation while the second succeeds the final test point on the line.

At the first point the wiring of each chassis is carefully examined before the tubes are inserted. At the final quality control check point, the statistical method of checking is again employed. This means that a good percentage of the sets receive an extra quality check in addition to the normal line inspection and final test operations. Where production difficulties are encountered,

(*Continued on page* 90)

New tubes undergo an actual operation test in radio receiver chassis before they are released as production components

Drop tests performed on new and completely packed TV receivers, simulates abuse instrument may receive in shipment



DESIGNING & ENGINEERING TV CHASSIS

(*Continued from page 63*)

these design specialists and systems experts have been sifted and refined into the tentative outline of a promising new chassis, the concept is presented to Philco engineering executives for further discussion. If they like this new approach to the problem, they will present the new idea to management for further consideration. If it is accepted by management, production of the new model is promptly authorized, and arrangements are made for purchasing materials, for tooling and other planning of production facilities.

As an example of how the various elements in this process of evolution of a design function, consider briefly the Philco projection television receiver, Model 2500. An entirely new optical system, including a new 4-inch projection picture tube, a "keystone" optical design for front projection, and a "microlens" screen, was conceived by groups in the Philco Research Division. Several models were constructed with the help of Design Engineering. After months of testing, the performance of this entirely new type of television receiver was accepted by engineering executives and then demonstrated to management. A favorable decision was reached as to probable acceptance of this large-screen receiver with its special brightness, contrast and clarity of picture. Plans for production were therefore authorized.

It must be emphasized that after management approves of the basic idea of a television model, the responsibility of making the design functionally sound so that it delivers excellent performance for the customer is placed squarely on Design Engineering. Most of the decisions as to the ways in which this performance is to be achieved are made by project engineers within the section. Thus the Philco design engineers have great freedom in their approach to solving the variety of problems encountered in developing a television chassis; they can call on many groups of other engineers and research scientists for help in solving these problems; but the ultimate responsibility for performance is theirs. Other work of the group is in liaison with Factory Engineering to assure efficient production, and with Field Engineering to assure customer satisfaction; and this liaison contributes ideas in both directions, toward making design improvements within the laboratories and toward making new design ideas effective in the factory and in the field.

The flexibility and teamwork of the Philco engineering organization and their close liaison with engineering in the factory and field may also be illustrated by the fact that minor changes are frequently made during the production of various television receiver models to improve their functioning and reduce their cost; major revisions, requiring a complete chassis modification, are also made without waiting for a change in models. Thus Design Engineering is continuously responsible for improvements, from the inception of the basic idea until the final unit of a given model rolls off the production lines.

TV vs Radio Manufacture

In order to build a Philco model 49-1001 television receiver, 692 mechanical components, including hardware, 280 electrical components, 27 tubes (including CR tube), and 10,392 ft. (almost 2 miles) of wire are required. In contrast, an average table-model radio set needs 87 mechanical components, 37 electrical components and 6 tubes.

With this responsibility, the first consideration of Design Engineering is always to achieve performance of high quality. The secondary consideration is to develop the desired performance at reasonable cost. In so doing in the case of each model, the design engineers develop sample chassis for Cabinet Design and for planning by other departments of the company, including Factory and Industrial Engineering.

Factory Engineering

It might be supposed that when the basic design features of a television receiver chassis have been completed all that remains is for the factory to start duplicating the sample submitted. Actually, however, mass production practices impose many limitations which reflect themselves as changes in component and wiring layout and in performance modifications of the finished product. It is the function of the Factory Engineering Section to adapt each new television receiver chassis for mass production, and to insure that each final product performs within the range of test specifications established by this section.

Normally the Television Receiver Design Section provides Factory Engineering with two working samples of each new chassis. One of these, termed the "electrical" sample, is turned over to the factory test laboratory where its electrical operating characteristics are measured. The "mechanical" sample is used to study production layout problems.

The electrical tests are made with precision laboratory test equipment and aside from the usual voltage, current, and resistance checks, the various portions or sub-assemblies of the chassis are subjected to extensive performance measurements. For example, the sound and video IF channels are checked for gain, bandwidth and stability. Measurements are made on all channels in the RF system and tests similar to those used in conjunction with the IF portions of the receiver are performed. The sample is then rechecked in exhaustive field tests for overall performance.

Meanwhile the mechanical sample is studied by the factory production group from the standpoint of developing a component layout that will speed unit construction. At a meeting attended by the chiefs of the various sections concerned with the actual production, layouts and recommended changes in design are discussed and recorded. Such problems as changes in tube layouts to avoid breakage when chassis are stacked for transport or for temporary storage; repositioning of components to speed wiring operations; redesign or relocation of components to permit the use of time-saving jigs or fixtures, are studied and solutions are mutually agreed upon.

The completion of these tests on the electrical and mechanical samples enables the Factory Engineering Section to originate a request for design changes. The Television Receiver Design Section authorizes such changes in the form of engineering change notices after both groups have agreed that the changes will not interfere with the performance and price considerations encompassed by the basic design and that the changes recommended will materially assist production.

A pre-production run of 10 to 25 additional samples is now made in-

corporating the approved design changes. These pilot samples are then retested in the factory engineering laboratory in exactly the same manner as was the original "electrical" engineering sample. Measurements of the same circuits on different chassis will yield varying results and it is the average of these results that establishes the test standards for use in actual manufacture. As the standards are developed it also becomes possible to determine the alignment procedure, and to create what is known as a master wiring standard. The latter is forwarded to production and all chassis being assembled are wired in strict accordance with this standard. With the issuance of a bulletin from Factory Engineering containing the Test Procedure and Specifications and the Test Standards, production is ready to start.

Cabinet Manufacture

(*Continued from page 73*)

cient utilization of the wood.

In the "assembly plant", parts such as end panels and posts, top panels, instrument panels and doors, tube baffles and frames are put together and then assembled as a complete cabinet, using a special jig which holds all the parts together during assembly. Each cabinet is carefully checked for dimensions, sanded where necessary, and then passed along to the "finishing plant".

Finishing a television cabinet includes two staining operations; a lacquer glaze and then sanding; filling, with the filler applied and padded into the wood by hand; lacquer sealing and sanding; trimming to decorate such parts as the instrument panel and tube frame; first and second coats of lacquer; hand rubbing; and polishing by hand. After hand rubbing, the cabinets are allowed additional drying overnight before packing.

While many operations throughout the Watsontown plants are mechanized, it is actually more efficient *not* to conveyorize such processes as the finishing of cabinets because of variations in the color and hardness of the woods which make it impossible to assign exact times for certain operations. A uniform quality of product may require more detail work on one cabinet than another.

The craftsmanship and precision work that go into the manufacture of the cabinet are important factors in the beauty and handsome appearance of the finished television receiver.

CABINET DESIGN & PRODUCT DEVELOPMENT

(*Continued from page 71*)

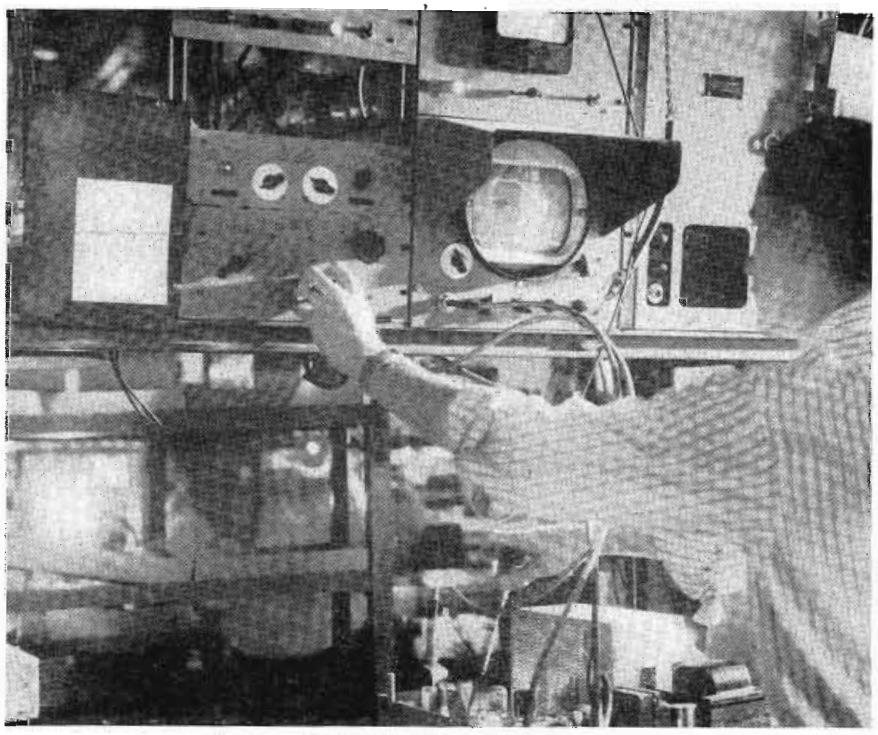
whereas others may desire to use two. As the production methods are decided upon, measurements are made for the exact sizes that will be involved. The sample receiver cabinet is ordinarily a close approximation to the required size but for exact measurements it becomes necessary to consult the chassis design group again to be sure that the chassis will fit in the cabinet. When the exact measurements are determined, production drawings are prepared and four engineering cabinet models are developed. The first of these, known as the "blue-line" sample, is scheduled in advance of the other samples. When received, an engineering chassis sample is mounted in the unit and the sample of the final product is examined by all concerned to see what changes, if any, have to be made.

When the blue-line sample has been thoroughly checked and the necessary changes have been incorporated, a "red-line" sample is built, which is made available to the servicing group. Following this, two other samples are built, one of these being a color sample which goes to the outside cabinet supplier, while the second becomes a sample for production design.

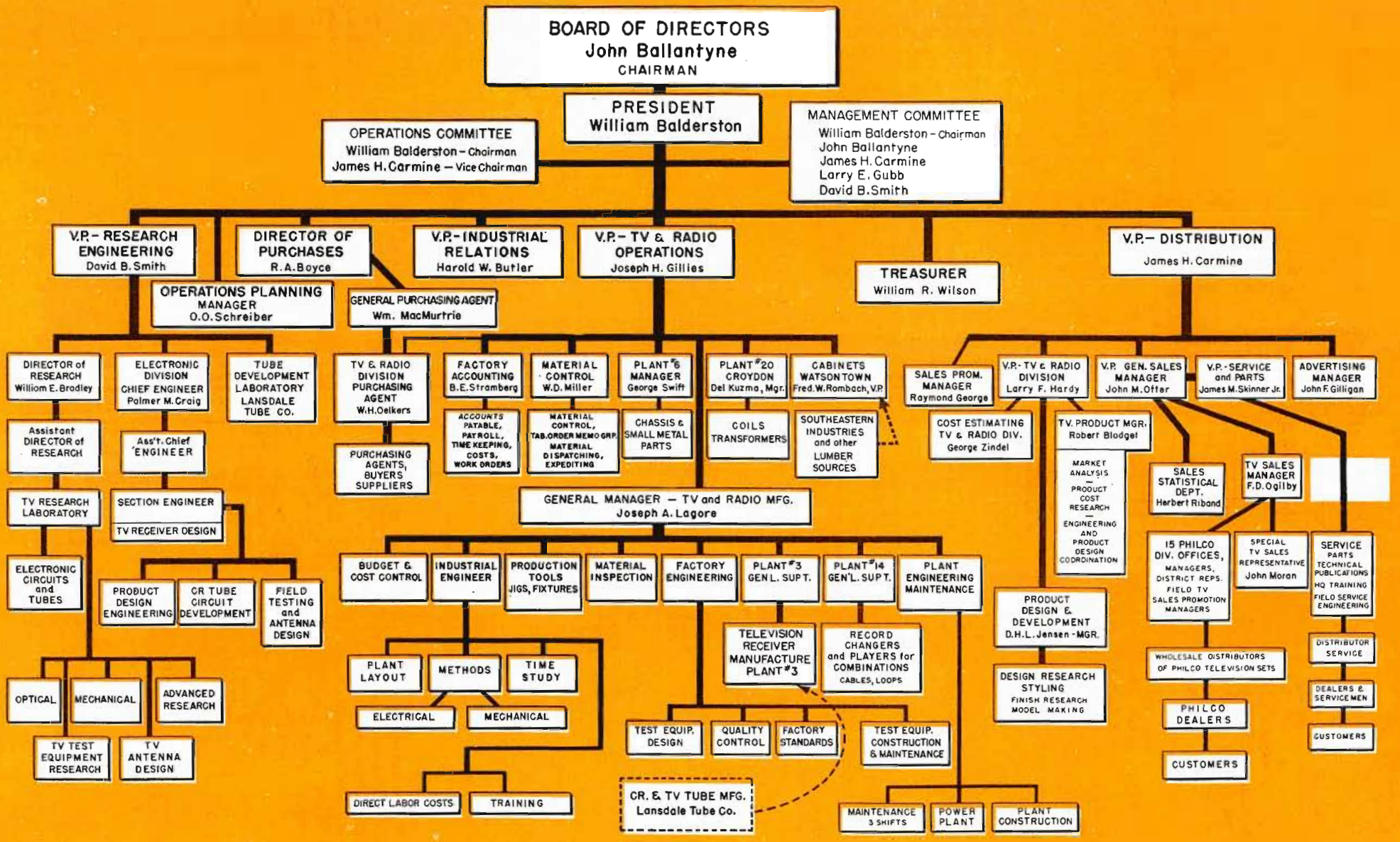
When a satisfactory production sample has been developed, the problem that remains is getting the cabinet suppliers tooled up for mass production. Since tooling involves time and since production dates are scheduled it is customary to issue a "see-release" at about the same time a "blue-line" sample is tested. This release does not permit the supplier to go ahead with any kind of production, but it does inform him as to what the new cabinet will look like so that he can go ahead and order the necessary materials. Also, the supplier may, as a result of reviewing the "see-release", make recommendations to the furniture engineering section for changes to facilitate production.

After the final drawings are issued, the supplier will prepare one unfinished sample only; and when this is available, a field engineer from the furniture engineering section calls to check the sample thoroughly against all drawing specifications. If the sample is mechanically satisfactory, the manufacturer can proceed to develop 25 additional finished samples from which the Philco representative chooses three as representative color samples. The first color sample chosen remains with the manufacturer as a guide for his future production. The other two are returned to the Philco plant where they are made available to factory engineering groups as desired color samples.

A receiver alignment operation showing the actual frequency response curve on oscilloscope screen. Superimposed celluloid mask shows the desired alignment characteristics.



TELEVISION ORGANIZATION CHART of PHILCO CORPORATION



Philco Operations Committee—The Men Responsible for TV Design, Production and Sales. From left to right: David B. Smith, Vice-President Research and Engineering; James H. Carmine, Vice-President Distribution; James M. Skinner, Jr. Vice-President Service and Parts; William Balderston, President and Chairman of Operations Committee; John M. Otter, Vice-President and General Sales Manager; Larry F. Hardy, Vice-President TV and Radio Division; Joseph H. Gillies, Vice-President TV and Radio Operations.

Management and Organization

AS shown by the organization chart opposite, operating authority for the Philco Corporation and its television activities stems from the Board of Directors, John Ballantyne, Chairman; the President, William Balderston; and the Operations Committee and Management Committee. Principal operating activities are under the supervision of vice presidents in charge of Research and Engineering, Television and Radio Operations, and Distribution.

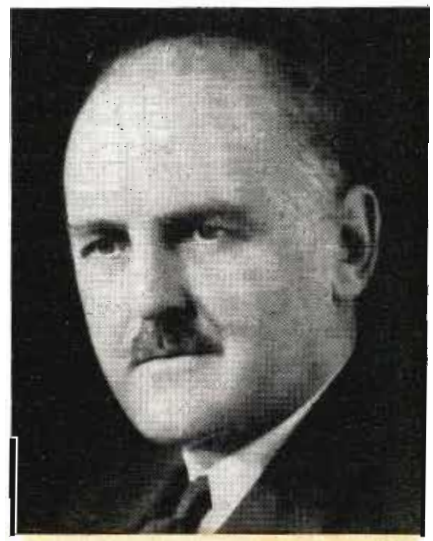
Aiding Vice President David B. Smith, in charge of Research and Engineering, are Director of Research William E. Bradley and Chief Engineer Palmer M. Craig, with their staffs and large technical organizations of engineers, researchers, scientific specialists, and technicians.

Joseph H. Gillies, Vice President —Television and Radio Operations, is assisted by Joseph A. Lagore, General Manager, Television and Radio Manufacturing, who heads an outstanding team of experts in all phases of production.

James H. Carmine, Vice President —Distribution, has the responsibility for the development and distribution of all the Company's television receivers. Directly responsible for the creation of the line, under Carmine's direction, is Larry F. Hardy, Vice President Television and Radio Division. Heading sales is John M. Otter, Vice President and General Sales Manager, with James M. Skinner, Jr., Vice President in charge of Service and Parts. John F. Gilligan is Philco advertising manager and Raymond George, sales promotion manager.

Principal executives and managers in the Philco organization are all veterans with many years in the employ of the Corporation. Throughout, the organization has been carefully streamlined for most effective and smooth-working operation. And there is close coordination and pooling of ideas between Engineering, Manufacturing and Sales, so that Philco designs and products may incorporate newest technical advancements and production economies, while keeping in closest possible touch with the demands of the purchasing public.

John Ballantyne,
Chairman of the Board



William Balderston,
President

TV Research

(*Continued from page 65*)

are made available to research scientists and engineers working on all allied subjects, to keep them informed on progress in the Philco laboratories. The staff is also encouraged to keep abreast of technical developments by others in industry, the universities and in Government laboratories, and the Division maintains an extensive library of reference books and subscribes to some 80 technical journals. As still another method for stimulating teamwork in ideas and the spread of useful information, special conference rooms are used for seminars where senior scientists or engineers lecture on their fields.

Beyond well-equipped physical facilities, and the assistance of a fully staffed drafting room, machine shop and model shop, engineers of the Research Division are aided in their projects by a number of special groups acting in a consultant capacity. Among these groups are the sections working on test equipment, vacuum tube research and applied mathematics. This latter group is given increasing prominence since Philco is making highly successful use of advanced mathematical theory in such fields as the design of wideband amplifiers, where the development of the "pole-and-zero" theory has made it possible to design on paper amplifiers with optimum performance, as just one example applicable to television.

To develop new research talent, Philco has been expanding its Research Division for some time, and this process is still under way. One aspect of this "talent hunt" is the successful college cooperative program whereby students at M.I.T., Cornell and Drexel spend a part of their academic years working in the Philco laboratories. For example, a typical M.I.T. undergraduate in electrical engineering will spend 18 months or one-half of the final three years of his five-year course at Philco. His time with the company will be divided into four periods: the first spent in design engineering, the second in factory and industrial engineering, and the third in research, while during the fourth he selects, with help from the employer, the type of work for which he is best suited. Students demonstrating aptitude for research thus have two full periods or about nine months of work in the Research Division; and then may be assigned to this work, if they choose and prove suitable, upon graduation. Meanwhile they also receive instruction in theory while at Philco by senior scientists and engineers on subjects assigned by the university.

Philco research in television is, like the television industry itself, a dynamic thing. The spirit of the company is to encourage research in every possible way.

Quality Control

(*Continued from page 85*)

double quality control points may be set up in order to raise the check rate.

The tests that a receiver must undergo at a quality control check point require the use of both artificial and natural signals. On the production line the alignment points and the final test operational points are supplied with signals coming from a central signal generator room. In order to avoid any irregularities which might be the fault of the central signal distribution system, quality control check points are equipped with individual sets of precision test equipment. The receivers are first given an overall instrument performance test to determine the frequency response, selectivity and sensitivity, and when the measured results are within specifications they are rechecked for performance, using the transmitted signals from local stations. All these tests are conducted from the consumer's point of view and gauge the acceptability of the product.

In addition to its duties on the assembly line, Quality Control is concerned with several other activities. The first concerns packing and shipping. Quality Control personnel who are thoroughly familiar with the regulations of shipping carriers determine if the packing is in conformity with existing requirements. Drop tests are also performed to simulate the abuse the finished product will undergo during the shipping process.

Quality Control also conducts very extensive field tests on finished products. These tests may involve sending trial production sets to different executives' and engineers' homes for operation under normal conditions. Another type of field test may request field service engineers to spot check a group of receivers arriving at any distributor's warehouse. Such checks are performed in lots that involve as many as 400 sets at one time and are very valuable in maintaining the high quality standards of the products.

Sub-Base Manufacture

(*Continued from page 67*)

bent up and the finished operation results in a semi-rigid sub-base, the rigidity being created by the reinforcing indentations that have been simultaneously forced into each of the bends. Spot welding the corners completes making the sub-base a single rigid component.

Before the sub-base can be spot-welded, however, a washing operation must be performed so that the joints formed will remain bonded. During the punching and forming operations, the blank was coated with oil to minimize premature wear on the various punches, and also, since the steel is not plated when received, rust and other foreign particles may be present. After a water wash the sub-bases are fed to one of three spot welders. The final production step before the sub-base appears on the main assembly line is that of electro-plating to prevent rust and consequent weakening of the chassis assembly after the receiver has left the plant.

For these relatively large television sub-bases, Philco operates two automatic, conveyorized plating units. The first, a cleaning, pickling and plating unit has a duty cycle of 14 minutes with 27 carrier bars each of which can be loaded with five square feet surface area of parts. Adjacent to this equipment is a fully automatic unit which has a 19 minute duty cycle and in addition incorporates a hot air dryer at the unloading end. Those items of equipment that are heavy enough to dry from residual heat are fed through the first machine while lighter units are fed through the dryer on the second machine. Philco has standardized on plating all sub-bases with zinc although by changing the chemical solution in the machines and by changing the plating elements, cadmium, copper, silver and other metals can be used for plating purposes. The thickness of the plating depends upon the anticipated use of the finished product.

As the plated sub-bases are removed from the plating machines they are loaded into castered tote bins and rolled into waiting trucks for transport to the main television manufacturing plant across the street. At this stage, the Metalworking Division, which maintains its own quality check-point for finished items, takes samples from a group ready for shipment and checks them on all counts.

How Philco Buys

Purchasing Department studies competitive sources, evaluating plants, personnel, products and resourcefulness. Advice offered to aid suppliers

THE problems of the Purchasing Department in buying materials, parts and tools as required for production of Philco television receivers range from aiding the design engineers in making component changes to improve performance at lower cost, to making careful comparisons of competitive parts on the basis of many considerations important to the manufacturer.

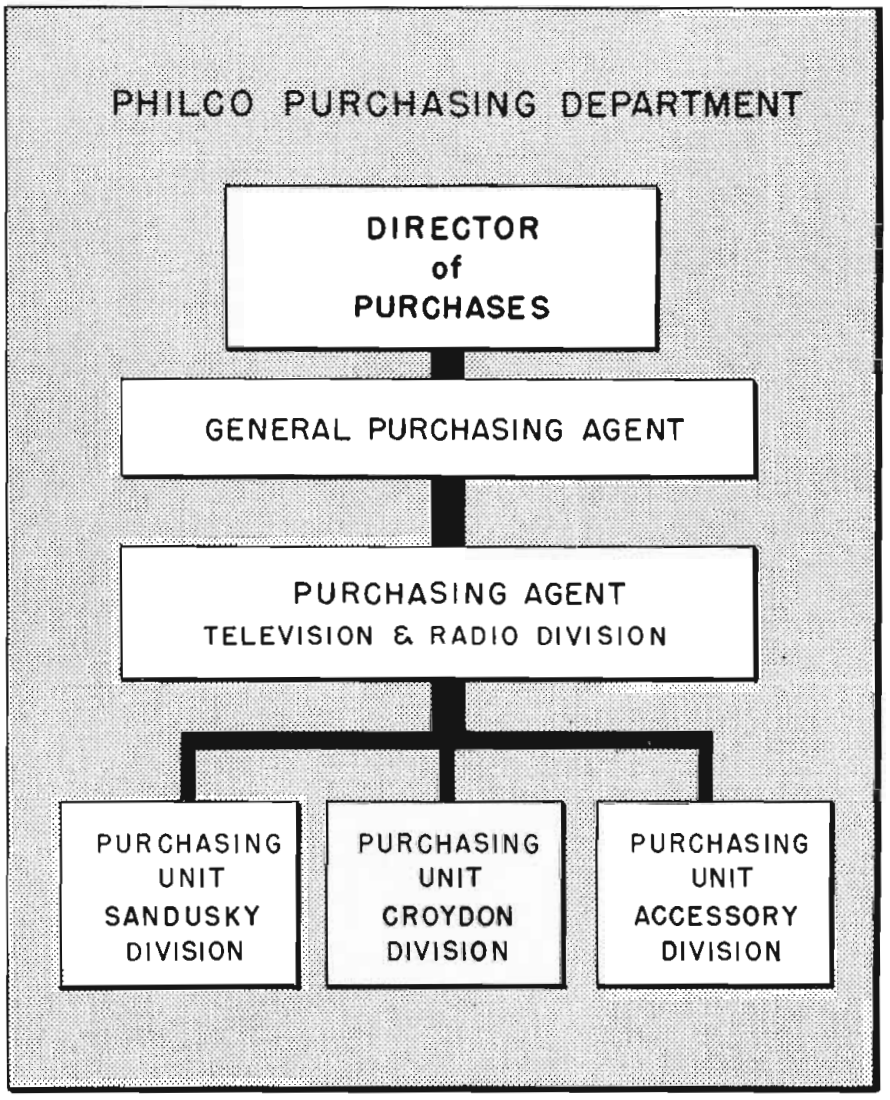
A Philco buyer becomes thoroughly familiar with the operations of numerous competitive sources of supply before making purchases of any given part. He studies each supplier's production equipment and methods; his personnel, including management, engineering ability and labor force; his utilization of materials and transportation facilities. Philco buyers frequently visit suppliers' plants to study not only the products made there but also to gauge the imagination applied to helping Philco in solving specific problems.

Such constant checking of available sources of supply means that these buyers for television, being constantly on the alert for new materials and new components designs, can frequently aid design engineers in their planning of new models. Often buyers are able to suggest modifications which will both improve performance and result in lower costs, or will give equivalent performance at a substantial saving measured in terms of mass production.

Buyers have learned to seek many competitive sources of supply and yet evaluate competitive prices warily. That is, an item which seems to be the lowest in price may require costly rework and added inspection in the factory, or perhaps excessive replacement in the field. Thus cost comparisons by Philco buyers involve the consideration of the performance of any item during the manufacturing process as well as throughout its useful life in the customer's home.

Because of the many years of Philco leadership in the radio manufacturing industry and the company's consequent continuous demand for huge quantities of parts, numerous suppliers have developed through the years with Philco aid and encouragement. In many cases, Philco has provided engineering assistance, as well as the advice of its quality control experts, to enable suppliers to meet specifications for performance and to manufacture in quantities sufficient to keep pace with Philco production schedules. The company has also frequently afforded suppliers with advice on financial and other operational matters, thus contributing to their efficiency.

Purchasing for Philco television manufacturing is a function which has grown, and is continuing to grow, at tremendous pace. This growth is proceeding in an orderly fashion because of the wide experience of buyers in acting as a liaison and guide between Engineering and Quality Control at the factory and the individual operations of many hundreds of suppliers.



Atomized, 20% NaCl solution, injected into this chamber at 95° F. determines the salt spray hours required to breakdown a given finish on these samples

Auxiliary Engineering Services

Special mechanical, electrical and chemical tests on new components and designs assure the performance quality of the new product

COMPONENT CONTROL

THE Component and Materials Section is in reality a quality control section, that operates at engineering design level. It is a separate laboratory, a principal object of which is to protect the consumer by type testing and life testing every component going into each model under conditions that simulate consumer usage.

No component can be purchased from an outside supplier until the Components and Materials Section as well as the Design Engineering Section has approved the item.

Items that are used recurrently from model to model such as resistors, coupling capacitors, coils and transformers have a specification sheet in the Standards Manual circulated by this Section to all interested staff engineering groups. As new components become available their specifications are added to this manual. Design engineers, when designing new equipment, try to confine component specifications to those listed since they have already been tried and proved.

In testing the various components, the section endeavors to duplicate all possible conditions of consumer usage, i.e., parts used in receivers for domestic use are given life tests that last from 500 to 1000 hours and humidity tests for as long as 200 hours. In special cases tests may range from 200 to 2500 hours. For the most part, these tests are run for the full periods of time, although on some of the components the test time can be shortened or accelerated by cycling (continuously varying operating condition between component specification extremes) the test operation. In humidity tests, components are placed in a chamber at a temperature of 40° C. with 98% relative humidity and kept there for 24 hours. At the end of that time they are removed and examined

Metal samples undergo a plating test in the Chemical Laboratory. Data obtained from tests is used to control Philco's two 5000 gal. automatic plating machines in Plant 6

visually and electrically. If any component fails to operate, the reasons for failure are determined and the appropriate recommendations for changes are forwarded to suppliers. Mechanical life tests on volume controls, switches, etc., are performed while the unit is under electrical load. Such items are not considered satisfactory unless they can be turned back and forth, or switched on and off at least 25,000 times before signs of appreciable wear begin to show.

Corona tests are performed on all high-voltage units and special tests are devised for equipments which will be subjected to unusual operating conditions. For example there is an altitude test for all types of airborne equipment, and a vibration test for equipment subject to continuous vibration shocks as when used in a manufacturing plant or on a moving vehicle.

An engineering sample report is made up on each item tested, and as mentioned previously, no vendor is released to produce such an item unless a satisfactory report has been obtained. Each sample of a new component must be tested and provision is made on the report form to indicate the nature of the sample and the degree to which it is to be tested. A hand-made sample might originate in an engineering laboratory and be submitted for certain tests. The tests performed might involve all specifications or mechanical, electrical, material or finish specifications only. If the sample has progressed further than the hand-made stage, it might represent a sample prepared from temporary tools or be part of a trial production run. Again, the degree of check for each sample is indicated on the sample report. Occasionally a vendor will suggest changes or new ideas in manufacture of a component and provision for checking such items is also included.

UNDERWRITERS LAB

A new model television receiver that has been designed within the desired price and performance specifications must also withstand safety tests and obtain approval from the Underwriters Laboratories, Inc. The latter is a non-profit testing organization operating under the sponsorship of the National Board of Fire Underwriters, and its function is to test electrical appliances to assure a minimum electrical shock and fire hazard to the consumer when the appliance is used in the home.

Chemist preparing a new phosphor solution for coating viewing screen of an experimental cathode ray tube. 4-in. projection tubes at left are in various stages of development

Philco has found it expedient to operate its own Underwriters Laboratory at the design level in order to have the required safety provisions incorporated before a particular model goes into production. This laboratory reviews each new design in the light of existing regulations and duplicates those safety tests that the receiver later experiences in the Underwriters Laboratories.

The service charge for obtaining UL approval on any model is practically negligible. However, the cost of producing models incorporating UL safety requirements is considerable, and this in turn becomes a merchandising problem in a competitive market since the non-UL approved receivers may retail at lower prices. Underwriters requirements for television receivers are based on past radio receiver manufacturing specifications with additional considerations given to the high voltages, and to the special tubes and circuits employed. For example, in order to protect the user from dangerous voltages, the back of the television receiver must be equipped with interlocking power switches that disconnect the appliance when the back is removed. Cathode ray tubes are high vacuum devices subject to high external pressures and might seriously injure bystanders if they were not implosion-proofed. For this reason a safety glass window is usually placed before the tube viewing surface while the cabinet and the back of the set provide the added necessary protection.

By the time a particular television receiver is ready for production the UL requirements have been incorporated in the design. Usually an engineering sample requires only minor design changes, which are effected while the set progresses through Factory Engineering. Visiting UL inspectors call at the plant periodically and issue approvals after reviewing the pre-production run for the necessary changes.

CHEMICAL LAB

In designing television receiver chassis and cabinets, various components and manufacturing processes offer unusual chemical problems from time to time. To solve these problems, Philco maintains a fully equipped chemical laboratory at the main plant which operates primarily in an advisory capacity to Research, Design and Factory Engineering.

The types of chemical problems presented to the laboratory for solution are quite varied and may range from recommending the best screen coatings for cathode ray tubes to an exact determination of the various types of powders used in certain bakelite cabinets. In general the chemical laboratory in making recommendations as to which product should be used for any specific

(*Continued on page* 94)

Receiver Cost Estimating

How Philco Cost-Engineering Department works closely with the research, engineer, and purchasing groups

THE approximate selling price and styling of a new television receiver are factors that are governed by existing conditions in a competitive market and by the anticipated sales volume of the item. All the design, development and production facilities are geared towards producing a model within the price range specified. The determination of the final factory cost of a new receiver, however, is complicated by a number of different elements that enter into the cost budget.

In general, the cost engineering department, in establishing the final factory cost of a new receiver, takes four major elements into consideration. These are: a—Chassis components; b—Cabinets; c—Labor; d—Burden.

The chassis components include each item on the sub-base down to the last lock washer and the sub-base itself. Cabinets are shipped in from outside plants and their cost includes the packing and the outside containers which are re-used when the completed set is ready to leave the factory. Labor costs are estimated on the basis of weighted average cost for previous models of comparable electrical design and mechanical construction. "Burden" represents an overhead cost figure and includes expenses involved for supervision, test equipment, heat, light and power etc.

The Cost Engineering Department maintains close coordination with the Engineering, Research and Purchasing Departments of the company to keep itself "calibrated" to current conditions in the factory, and to outside sources of supply.

The first conception of a television receiver appears in the form of a statement covering the services and features to be incorporated. As Engineering tackles the problem, Cost Engineering makes numerous cost analyses of proposals and designs as they come out of the laboratory in an effort to guide the receiver within the original cost goal or budget.

When the basic design of the receiver has been established, Cost Engineering consults with the Industrial Engineering Department on matters pertaining to plant layout and labor costs, and with the Planning Department as to the production schedules and running rates. By the time the Sales Department is ready to announce the actual selling price of the new model, the Purchasing Department has supplemented cost engineering estimates with last-minute quotations from suppliers. These figures permit a firm cost figure to be established in each case.

It will be noted that the major elements of the factory cost budget do not include engineering, new tooling, and service manuals. Engineering and manual costs are lumped and budgeted against sales. Research, as distinguished from the engineering of a specified product, is likewise budgeted against sales.

Auxiliary Engineering Services

(*Continued from page* 93)

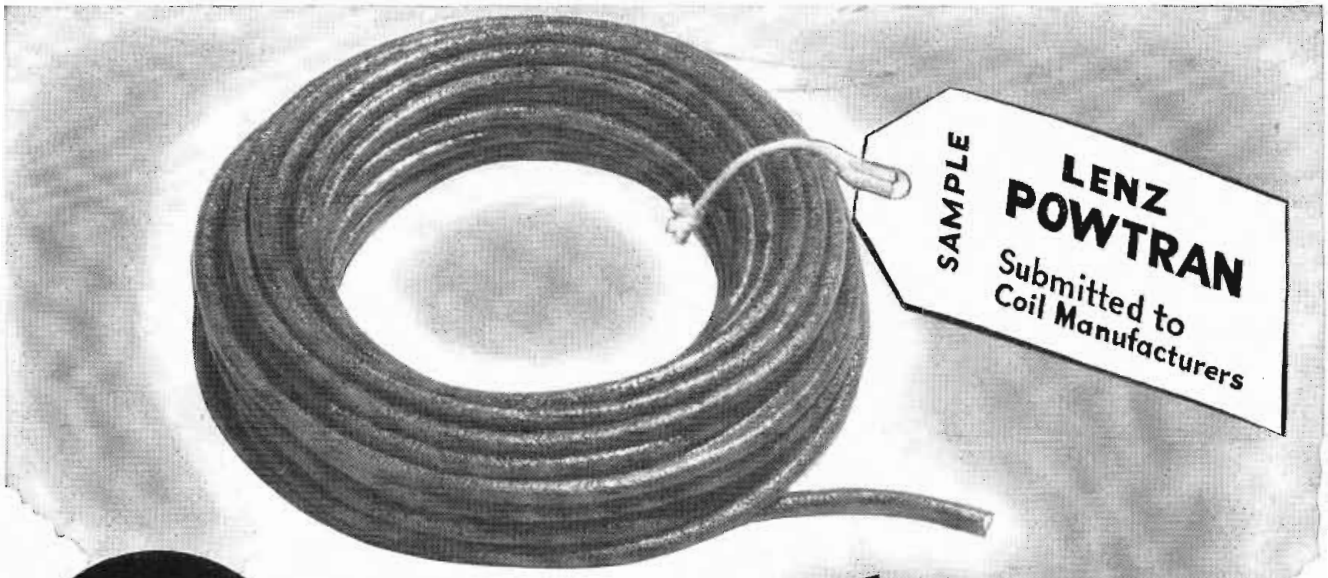
assignment, tries to approve only those products which are readily available on the open market. Special chemical preparations are usually more expensive and are likely to create an undesirable purchasing problem.

One of the chief functions of the laboratory is to supervise the control of plating solutions and materials used in Philco's two 5000 gallon automatic electro-plating machines. These machines are used to zinc plate all the metal sub-bases used in the various plants. In order to achieve uniform platings on irregular shaped pieces, the duty time cycle of the machines, the plating solution, and the purity of plating materials are important control factors.

Occasionally the laboratory lends a hand to purchasing activities by issuing chemical formulas or specifications to outside vendors for some of the special component items desired and assists the Components and Materials Section by issuing specifications on items in common use throughout the plant such as lubricants, soldering fluxes, washing solutions, etc. for inclusion in Philco's Standards Manual.

The laboratory also conducts chemical research experiments where required in connection with electronic development projects. For example, in television, screen coatings on cathode ray tubes still present a major problem to the industry. Uniform screen coatings are difficult to achieve, and the method of applying the coating leaves much to be desired productionwise. Improvements in the color content and in the light intensity of tube screens are also desirable. The Chemical laboratory prepares new phosphor solutions and new experimental cathode ray tubes daily in the continual search for an answer to these problems.

The various finishes used in cabinet manufacture form another important activity that concerns the Chemical laboratory. Each material to be used, whether for wood or for plastic cabinets, must be analyzed and surveyed to determine its suitability for production. Time is the important element in production and consequently the finishes employed must dry quickly to avoid handling and storage problems. They must also be adaptable for use in production spray equipment and present a uniform, hard, long-lasting surface when dry, so that the finished item not only presents a satisfying appearance when sold but also maintains that appearance in the consumer's home for many years after.



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WASHINGTON NEWS LETTER

MILITARY PURCHASES ACCELERATING—Orders for the expanded Armed Services' electronic-radar-radio equipment are slated to be placed at an accelerated rate during the remaining eight months of the current government fiscal year which ends next June 30. And there is definite likelihood of substantially larger appropriations for the next fiscal year for such purchases not only for the United States Air Force, Army and Navy but also for "lend-lease" strengthening of the Western European nations. While secrecy naturally cloaks details of the military procurement plans, the purchases in the immediate offing from the Armed Services are estimated to aggregate approximately $200 million with the Air Forces now swinging into the mobilizing of its 70-group airplane strength which will mean buying a large bulk of electronic-radio equipment, the Signal Corps completing some $55 million worth of buying, and the Navy taking up the remainder for the modernization of its fleet and shore stations with the latest types of radio and radar.

MOBILIZATION-DEFENSE BLUEPRINTING—Just as in World War II, the electronic-radio manufacturing industry has been responding speedily to the needs of the nation and has been gearing its production for expeditious deliveries of apparatus and equipment to the Armed Services. To ready the industry for the current military requirements and for an all-out mobilization in event of war, there has been formed a committee of 28 topflight executives from the industry which has been assigned the role of coordinating with and advising the Munitions Board and the National Security Resources Board on the planning for materials and manpower needs of the manufacturers to fulfill their national defense obligations.

TWO MAJOR ASSIGNMENTS have been placed before the foregoing industry advisory body. One was the "contingent contract" plan, devised by the Signal Corps with the cooperation of the Air Force and the Navy, under which end-equipment and component manufacturers would be allotted by the Armed Services assignments of contracts and time tables of deliveries for "phantom" orders to be implemented into action when "M" Day comes. This is done so the manufacturers can set their production machinery in motion at once. The other was the planning for a prospective "M" Day government agency to come into being in event of an emergency to administer manpower and materials controls. It is projected that this agency would be staffed by expert industry executives. This planning has just been completed by an outstanding array of industry executives who made up a small "task" committee. This body was headed by Ray Ellis, Raytheon Executive Vice President who was chief of the wartime WPB Radio and Radar Division; and had as members Motorola President Paul V. Galvin who was three-time RMA President during the war, RCA Executive Vice President Frank Folsom, Philco executive committee chairman and wartime president John Ballantyne, International Resistance Corp. president Ernest Searing and vice president Harry Ehle, while also on the committee were RCA-Victor Vice Presidents J. B. Elliott and J. S. Carter.

TELEVISION FREEZE—The FCC's plan to freeze for six or nine months or even longer its processing of television station licensing and hearings should not and *will not have any effect upon the existing video service and upon the sale of television receivers.* This was emphasized without any equivocation by able FCC Chairman Wayne Coy in announcing the "freeze" or halting of action on station applications until a definite policy is delineated on existing Video Engineering Standards. The television industry should widely disseminate the views of Mr. Coy that the revision of engineering standards in no way will affect the usefulness of TV sets so that sales will be retarded.

PRESENT 12 TV CHANNELS OK—There is also NO thought whatsoever that the present 12 TV channels will be abandoned. In fact, the plan of the Commission to hold the engineering conference early this month on tropospheric transmission and collateral questions such as directional antennas, power increases and channel separation demonstrates *the FCC is NOT planning to force television out of the present 12 channels in any immediate future.* Chairman Coy visualizes television as the greatest medium of mass communication ever dreamed of and so do his fellow Commissioners.

MOBILE RADIO ALLOCATIONS—The Mobile Radio industry and services, which are virtually still in an infancy stage, gave the FCC an "earful" literally during mid-October in the eight-day "marathon" oral argument before the regulatory agency on the proposed allocations of frequencies to the respective services. More than 50 hours of arguments by more than 100 parties were presented and even those mobile services like the power-gas utilities, petrolum and forestry products fields, which had received rather generous segments of frequencies in the proposed allocations, all seemed to have some ideas of revisions of the proposed allocations and rules. Therefore, the FCC has found the subject one terrific "headache."

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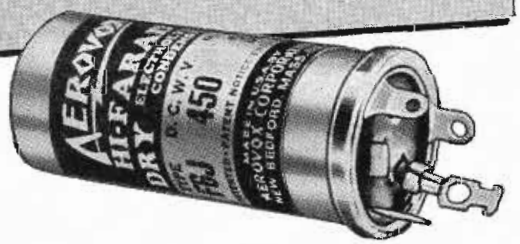
Many types of Aerovox electrolytics are available to meet the severe-service conditions encountered in television equipment. Especially where temperatures of 85° C may be reached in hour-after-hour use. The Type AF twist-prong base electrolytic here shown is typical of the Aerovox trend towards higher voltages.



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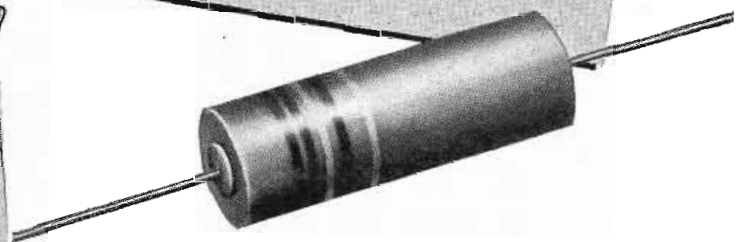

HIGHER-VOLTAGE OIL TUBULARS

Popular Type —89 midget-can oil tubulars. Ratings increased from 2500 to 6000 v. D.C.W. Capacitances to .1*. Higher voltage units with special terminals to provide necessary creepage distance without increasing diameter or length. Oil-impregnated paper section. Hermetically-sealed can. Insulated jacket. Center radial mounting strap.

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TELE-TECH's NEWSCAST

IRE Elects Fellows

The following members of The Institute of Radio Engineers have been elected to the grade of Fellow by the Board of Directors of the Institute at its September meeting:

H. A. Affel, Bell Telephone Laboratories, New York, N. Y.; K. C. Black, Aircraft Radio Corporation, Boonton, N. J.; J. E. Brown, Zenith Radio Corporation, Chicago, Ill.; Cledo Brunetti, National Bureau of Standards, Washington, D. C.; W. L. Carlson, RCA Laboratories, Princeton, N. J.; P. S. Carter, RCA Laboratories, Rocky Point, N. Y.; F. E. d'Humy, Western Union Telegraph Co., New York, N. Y.; John N. Dyer, Airborne Instruments Laboratory, Mineola, N. Y.; L. A. Gebhard, Naval Research Laboratory, Washington, D. C.; T. T. Goldsmith, Jr., Allen B. DuMont Laboratories, Passaic, N. J.; F. W. Grover, Union College, Schenectady, N. Y.; E. A. Guillemin, Massachusetts Institute of Technology, Cambridge, Mass.; Ross Gunn, United States Weather Bureau, Washington, D. C.; A. V. Haeff, Naval Research Laboratory, Washington, D. C.; L. C. Holmes, Stromberg-Carlson Co., Rochester, N. Y.; J. Kelly Johnson, Consulting Engineer, New York, N. Y. S. R. Kantebet, Government of India Overseas Communication Service, Bombay, India; W. B. Lodge, Columbia Broadcasting System, New York, N. Y.; K. A. Mackinnon, Consulting Engineer, Ottawa, Ontario, Canada; H. F. Olson, RCA Laboratories, Princeton, N. J.; G. D. O'Neill, Sylvania Electric Products, Inc., Flushing, N. Y.; L. S. Payne, Canadian Marconi Co., Ltd., Montreal, Canada; L. M. Price, Radio Valve Company of Canada, Toronto, Canada; H. J. Reich, Yale University, New Haven, Conn.; J. D. Reid, Crosley Division of Avco Manufacturing Corp., Cincinnati, Ohio; Karl Spangenberg, Stanford University, California; George Sterling, Federal Communications Commission, Washington, D. C.; C. E. Strong, Standard Telephones and Cables, Ltd., New Southgate, London, England; Franz Tank, Institut fur Hochfrequenz Technik, Zurich F, Switzerland; W. N. Tuttle, General Radio Company, Cambridge, Mass.; I. R. Weir, General Electric Company, Syracuse, N. Y.

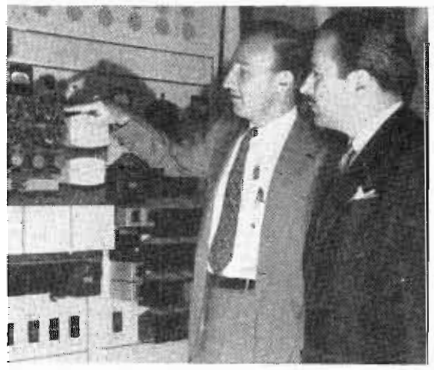
Army Orders Klystrons

The U. S. Army has placed an order for 1155 klystron tubes with the Sperry Gyroscope Co., Great Neck, N. Y. This purchase of model 2K41 reflex oscillators represents Sperry's largest single postwar order for a standard uhf tube.

TV Boom Predicted in '49

More than a million and a half television receivers will roll off production lines in 1949, according to a prediction by Frank M. Folsom, executive vice president of the Radio Corporation of America. According to Mr. Folsom, the industry should produce more than 850,000 receivers and more than 60 television broadcasting stations should be in operation by the end of this year. Currently, about 500,000 television receivers are in the hands of the public and 31 television stations are on the air.

"Complete coast-to-coast television networks are expected to be in operation by the end of 1952, but even before that time, regional links will connect San Francisco with its municipal neighbors," he said. "With the West and the East linked by networks, national advertisers, no longer restricted to individual local programs or shows on film, will present even finer talent in programs too costly for individual station showings."



Cesar Ladeira (right) and O. F. Walker, GE exporting engineer, inspect a 5 kw television transmitter. Equipment similar to this will be bought from GE by Mr. Ladeira for South America's first television station at Rio de Janeiro

New TV Chain in Midwest

The newly-formed midwest chain of television stations affiliated with the American Broadcasting Company televised the Notre Dame football game at South Bend, Indiana on Sept. 20. Originating with Chicago's WBKB, the telecast of the game was carried through coaxial cables to WBEN-TV, Buffalo, N. Y.; WEWS, Cleveland; WSPD, Toledo, Ohio; and WTMJ-TV, Milwaukee. One game in October and two in November are on the TV chain schedule with the addition of the facilities of WXYZ-TV, Detroit.

NEW NAMES AND ADDRESSES

Robert Finlay, wartime procurement engineering counsel for the Hallicrafters Co. in Washington, has announced the opening of his own offices at 104 Brookside Ave., Ridgewood, N. J. He will serve as liaison consultant between electronics manufacturers and government agencies.

* *

Fairchild Recording Equipment Corp. has been formed to combine the manufacture and sale of a new professional studio quality magnetic tape recorder with the line of disk recording sound equipment of Fairchild Camera and Instrument Corp. Offices of the new corporation are at 30 Rockefeller Plaza, New York City 20.

* *

Audio Equipment Sales, a division of F. Sumner Hall Inc., has moved its executive offices from 923 Eighth Ave., N. Y., N. Y., to larger and more convenient quarters at 153 West 33rd St.

* *

C. P. Clare & Co., Chicago Relay manufacturers, have announced the appointment of E. L. Berman Company, 1355 Market Street, San Francisco 3, California, as their representatives in Northern Cal. and Nevada.

Ware New FMA President

William E. Ware, manager of KFMX, Council Bluffs, Iowa has been elected president of the FMA for the coming year. He succeeds E. L. Dillard. E. Z. Jones, general manager of WBBB-FM was named vice president at the closing session of the Association's second annual convention, Sept. 27-29.

TVA Uses Kellogg Switchboard

A three-position turret-type switchboard, manufactured by the Kellogg Switchboard & Supply Co., Chicago, has been installed at the central load dispatcher's office of the Tennessee Valley Authority in Chattanooga. Almost half of the TVA telephone circuits are "power line carriers" — telephone conversations are carried over high-voltage power cables instead of the usual telephone lines.

BBC Freezes TV Standard

The British Broadcasting Co. has announced that the present operating standard of 405-line images for television stations in England will be frozen indefinitely. The BBC disclosed that recent design improvements are "not sufficient to justify a change of system which would make all the present receiving sets (estimated at 60,000) obsolete".

Awards to RCA Engineers

Loren F. Jones, manager of research and development projects of the RCA Engineering Products Dept., and Hugh H. Spencer, manager of RCA Teleran sales, were awarded Presidential Certificates of Merit at joint Army-Navy ceremonies in Wilmington, Del. on Sept. 20. Both were honored for their services while affiliated with the Office of Scientific Research and Development.

Coming Events

Nov. 4-6—National Electronics Conference, Annual Technical Forum, Edgewater Beach Hotel, Chicago.

Nov. 8-10—IRE and RMA Engineering Dept., Rochester Fall Meeting, Sheraton Hotel, Rochester, N. Y.

Nov. 14 - 20 — National Radio Week, sponsored by the RMA.

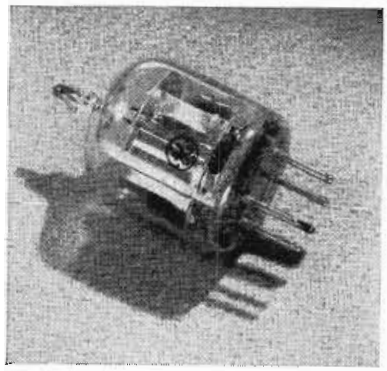
Nov. 29 - Dec. 1—Conference on Electronic Instrumentation in Nucleonics and Medicine, Engineering Society Bldg., 29 W. 39th St., N. Y., N. Y.

Dec. 10 - 11 — Southwestern IRE Conference, Baker Hotel, Dallas, Texas.

Jan. 10-12—Symposium on High Frequency Measurements, under sponsorship of AIEE, IRE and the National Bureau of Standards, Dept. of Interior Auditorium, Washington, D. C.

Midget Thyratron

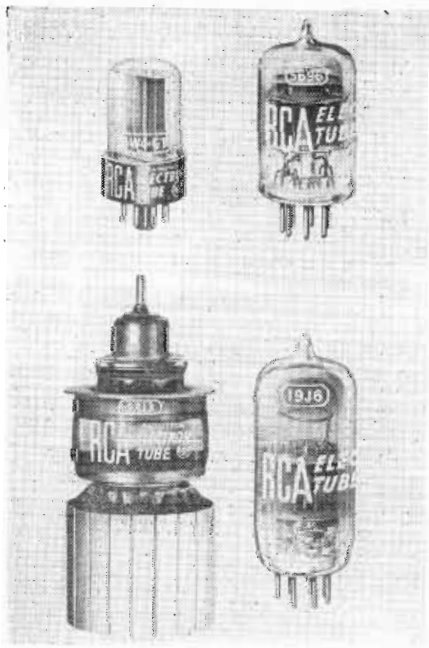
Low control-grid and shield-grid currents are maintained through the life of the GL-5663, an inert-gas-filled midget thyratron. Its small size and light weight construction



makes the tube adaptable to control and safety applications where compactness and weight are important factors. Peak inverse and peak forward voltage ratings are 500 volts. Anode current ratings are 60 ma instantaneous and 20 ma average.—**General Electric Corp., Syracuse, N. Y.**

Triodes, Thyratron and Half-Wave Rectifier

Four new tubes are being produced by RCA: a half-wave vacuum rectifier, a medium-mu twin triode, a thyratron, and a power triode. The 6W4-GT (upper left in illustr.) is a half-wave vacuum rectifier tube of the heater cathode type designed for use as a damper triode in television-receiver circuits. It may also be used as a rectifier in conventional power supplies. The 5696 (upper right) is a gas-tetrode type miniature thyratron, particularly useful in relay applications where low-heater-current drain and short deionization time are important. The 5713 (lower left) is a compact power triode of the forced-air-cooled type designed for vhf modulated class



C service. It has a maximum plate dissipation of 250 watts and can be operated with full ratings at frequencies as high as 220 mc. The 19J6 (lower right) is a medium-mu twin triode of the miniature type intended for converter service in ac-dc FM-AM receivers. It may also be used in oscillator, amplifier, or mixer circuits in television receivers of the transformerless type.—**RCA Victor Div., Tube Dept., Radio Corporation of America, Harrison, N. J.**

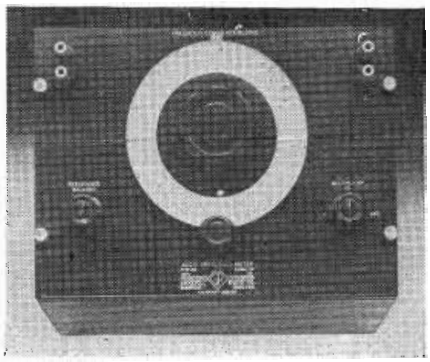
Test Equipment

Pulse Generators

Models P54 and P55 pulse generators supply rectangular pulses of variable frequency, width, amplitude and of either polarity simultaneously. Both units have internal circuits to provide the repetition frequency. An outside beat oscillator is not necessary to trigger the pulses. Hard tubes are used in both models. Pulse widths of 1.5 to 70 microseconds are available in either generator and the P54 has a low amplitude scale which produces pulse widths of 0.75 to 22 microseconds. Model P54, the larger of the two units, consumes 125 watts at 110 volts, 60 cycles. The P55 has the same power supply requirements and uses 44 watts.—**Raymond M. Willmotte, Inc., 1469 Church St., N. W., Washington 5, D. C.**

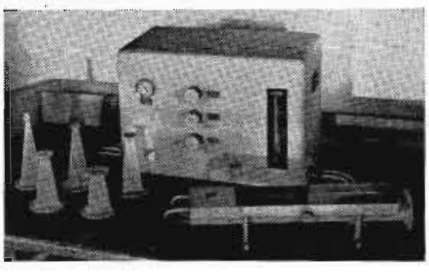
Audio-Frequency Meter

Wide range (20 to 20,000 cycles) and high accuracy (0.5%) are featured in the 1141-A bridge-type audio frequency meter. Null may be detected with a headset or vacuum tube voltmeter. The inherent frequency response characteristics of the Wien bridge circuit also enable the instrument to be used as an adjustable-frequency filter.—**General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.**



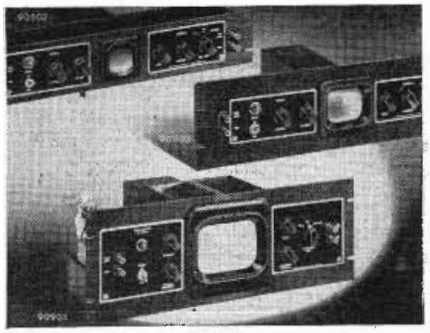
Calorimeter

Measurement of rf power in a series of frequency bands between 2600 and 26,500 mc is facilitated by a recently-developed calorimeter. The heart of the apparatus is a compartmented glass water load internally connected inside a waveguide section that absorbs the entire energy. Limit of power measurement is that amount which causes circulating water in the water load to release dissolved gases (about 60° C.). Although capable of measuring from about 5 watts upward, the percentage of accuracy increases, rather than decreases, with increase of power measured. Accuracy of approximately 2 watts is provided at average power readings of 100 to 500 watts.—**De Mornay Budd, Inc., 475 Grand Concourse, New York 51, N. Y.**



Basic Oscilloscopes

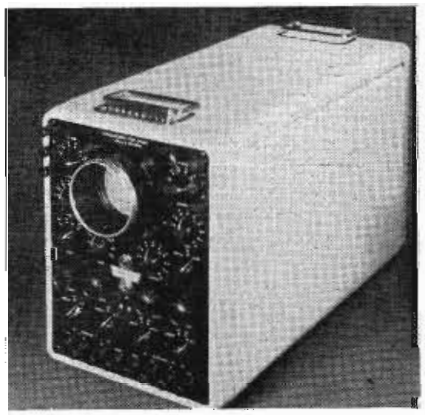
Rack panel oscilloscopes for two, three and five inch tubes, known as 90902, 90903, 90905 respectively, are inexpensive basic units incorporating power supply, brilliancy and cen-



tering controls, safety features, magnetic shielding, switches, etc. As a transmitter monitor, no additional equipment or accessories are necessary. Trapezoidal monitoring patterns are obtained by feeding modulated carrier voltage from a pick up loop directly to vertical plates of the CR tube and audio modulating voltage to horizontal plates. —**James Millen Manufacturing Co., Inc., 150 Exchange St., Malden 48, Mass.**

DC Oscilloscope

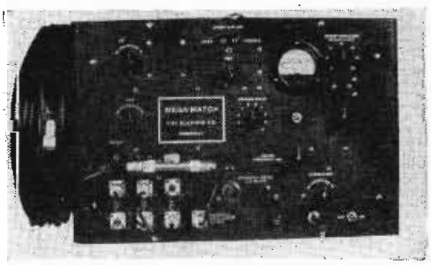
A new high-sensitivity model of the Furzehill 1684D oscilloscope has been developed with a stable gain approaching 10,000 times. Known as the 1684K, it employs the same direct-coupled circuiting as the 1684D and is designed to meet the needs of strain-gage work and other applications where a high



amplification factor is required. It has dc amplifiers on both axes with sensitivity of one millivolt/in. Frequency range is from zero (dc) to 300 kc. Phase distortion is zero from dc up to 60 kc. Sweep expansion up to five screen diameters is available, and the time base has automatic self-limiting synchronism from positive or negative pulses. The special fine-focus 3½-in. tube is fitted with a visor which retracts.—**American British Technology, Inc., 57 Park Avenue, New York 16, N. Y.**

Modified Mega-Match

A special coaxial detector and delay line have been incorporated in a modified model of the Mega-Match which displays reflected

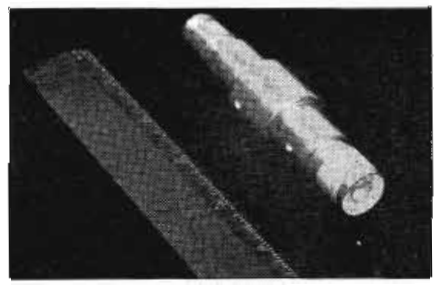


energy in bandwidths of 30 mc anywhere between 10 and 500 mc. The original model displayed reflected energy from an antenna or termination anywhere between 10 and 250 mc. Other performance specifications on the modified model are the same as the standard model.—**Kay Electric Co., Pine Brook, N. J.**

Parts for Designers

Coaxial Attenuator Pad

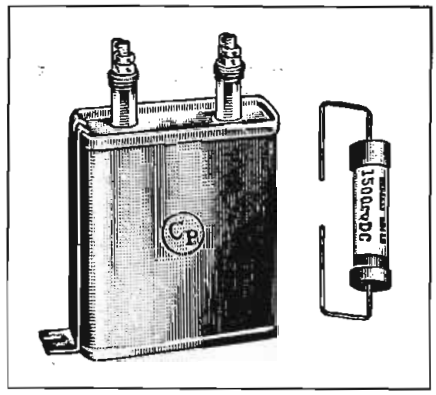
A symmetrical, unbalanced attenuator pad has been designed to form an integral part of a coaxial line producing a minimum of reflections. Each pad consists of two series elements and one shunt element. The series



elements are made of glass rods which are coated with a metal film about one millionth of an inch thick. A glass disc is employed as the shunt element which is also coated with a metal film.—**Weinschel Engineering Co., 123 William St., New York 7, N. Y.**

Capacitors

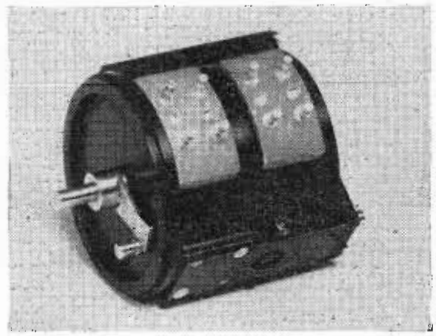
Recommended for ultra high temperature, rf bypassing, and dc applications, the new Plasticon TS capacitors have dielectrics of "Texlon" film and "Silicone" fluid. Both ma-



terials are unusually temperature-stable and have low dielectric losses. Type TSG103 is a .01 μfd., 500 volt dc capacitor whose dissipation factor at one mc is .0003 at 70° C. and .001 at 130° C. At 60 cycles, the dissipation factor is as low as .0002-.0003. The temperature coefficient is negative; 300-400 parts per million per degree C.—**Condenser Products Co., 1377 N. Branch, Chicago, Ill.**

Potentiometer

A special method of winding non-linear resistances provides high, uniform resolution in a recently designed, high-precision two-inch potentiometer. Linearity of linear wind-



ings may be obtained to an accuracy of 0.2% of total resistance and for non-linear function, the variation of resistance with shaft rotation may be made to conform to the desired function with 1% of total resistance. Rotor take-off assembly utilizes two brushes with precious metal contacts. Maximum electrical rotation is 320°.—**Technology Instrument Corp., 1058 Main Street, Waltham 54, Mass.**

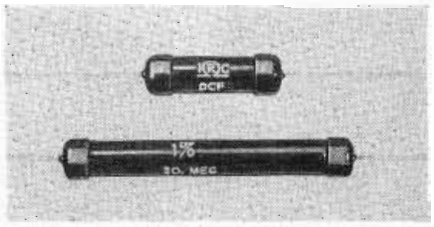
Filter Capacitors

Type NF-1A149 capacitor has been developed to control radio interference caused by fluorescent lamps and can also be used with considerable effectiveness on other types of electrical equipment. Connection is across the hot cathode of fluorescent lamps. It is wax-sealed and rated at 330 volts ac with a capacity of .006 mfd.

Another capacitor which is highly effective when connected across the power line of both hot and cold cathode fluorescent lamps can also be used with many electrical appliances such as fans, motors, drills and vacuum cleaners. Known as the NF-10135, it is rated at 250 volts ac. — **Cornell-Dubilier Electric Corp., South Plainfield, N. J.**

DC Carbon Resistors

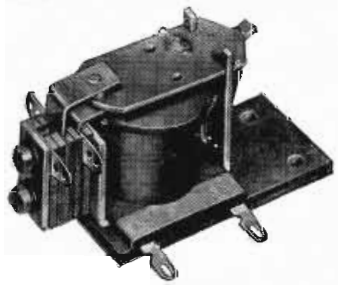
Deposited carbon resistors, DCF for applications up to one watt, and DCH for applications up to two watts, are being made by



depositing pure crystalline carbon film on specially compounded ceramic rods. Multiple layers of insulating varnish protect each unit, and soft copper leads securely anchored to silvered brass caps insure positive contact. These dc resistors are available in one, two, and five percent tolerances.—**International Resistance Co., 401 N. Broad St., Philadelphia, Pa.**

DC Relay

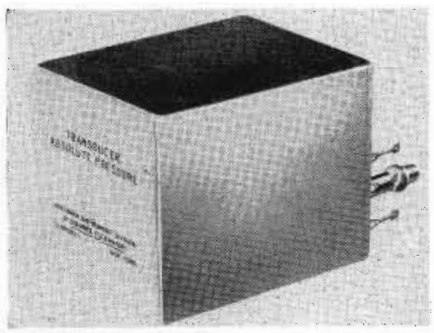
In assemblies where space is limited and control requirements do not exceed SPDT, the type E sensitive dc relay may be utilized. This unit, with an overall size of 2½ x 1¼ x



1½ in., has a contact capacity up to 5 amps. at 25 volts non-inductive load. Power consumption is 60 milliwatts.—**Comar Electric Co., 3148 N. Washtenaw Ave., Chicago 18, Ill.**

Transducer

Small and light weight, the new Kollsman Transducer provides a highly accurate and precise means of obtaining an electrical signal which is a function of air speed, altitude,

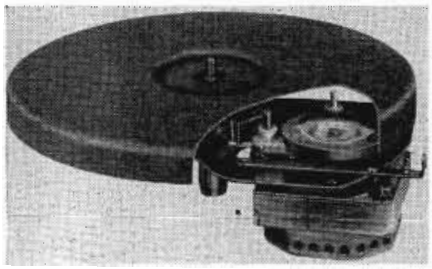


differential pressure and gage pressure. The use of jeweled bearings, spring pivots, light weight parts and precision gears, has kept mechanical friction to a minimum. Units are temperature-compensated for temperatures from—20° to +50° C.—**Kollsman Instrument Div., Square D Company, 80-08 45th Ave., Elmhurst, New York**

Sound Equipment

Turntable Motors

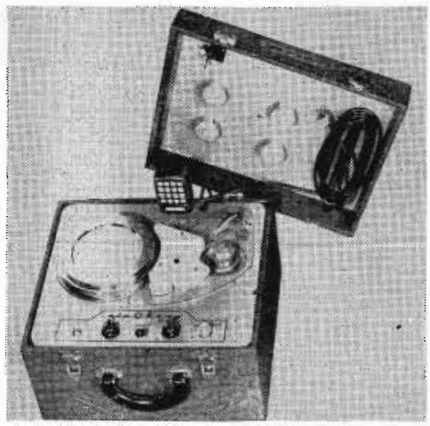
Two-rim drive, dual-speed turntable motors have been developed which will operate standard 9 and 10 in. turntables at 78 and 33 1/3 rpm. Model DR (illustr.) is a deluxe



rim drive four pole motor equipped with a simple mechanism for shifting from one speed to another. Model DM is a compact, low cost dual speed phonomotor with external speed change control, and is approximately the same size as present speed turntable motors.—**General Industries Co., Elyria, Ohio**

Portable Wire Recorder

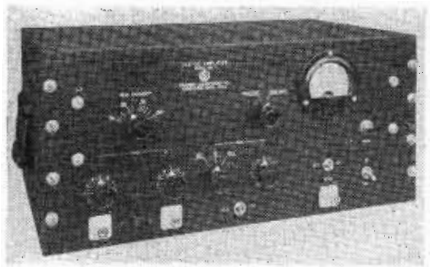
Model A-725 is the third addition to the Air King line of wire recorders. It is packaged as a unit, includes amplifier and speaker; has



immediate playback; records from microphone, radio phonograph or telephone; automatic shut-off at end of play or rewind of wire; crystal microphone; makes permauent recordings or erases automatically when recording over used wire; and has plug for cable to record from radio or phonograph.—**Air King Products Co., Inc., 170 53rd St., Brooklyn 32, N. Y.**

Amplifier

Standing wave voltage ratio when used in connection with square law detector probes and slotted waveguides may be determined with the TAA-16 amplifier, a unit with two



inputs, selectable by switch for rapid comparison. Operation can be wide band or highly selective; frequencies are from 500 to 5,000 cycles. Output meter is calibrated directly in standing wave voltage ratio. Full scale meter readings are obtained with 15 microvolts at the input under wide band operation, while 10 microvolts signal will produce this result under selective operation.—**Browning Laboratories, Inc., 750 Main St., Winchester, Mass.**

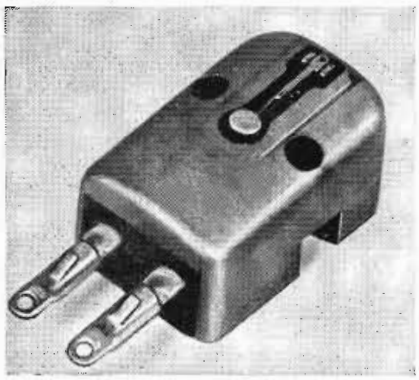
Portable Amplifier

A lightweight, portable remote amplifier (BN-2A) designed with a built-in power supply to operate from batteries or standard 115-volt, 60 cycles ac outlets is now available. The three amplifier channels use RCA type

1620 indirectly-heated tubes, shock mounted to insure low microphonics. Each channel offers an overall gain of 92.5 db. The amplifier has capacity for four microphone inputs, the third and fourth switchable to channel three.—**RCA Victor Div., Radio Corporation of America, Camden, N. J.**

LP Cartridge

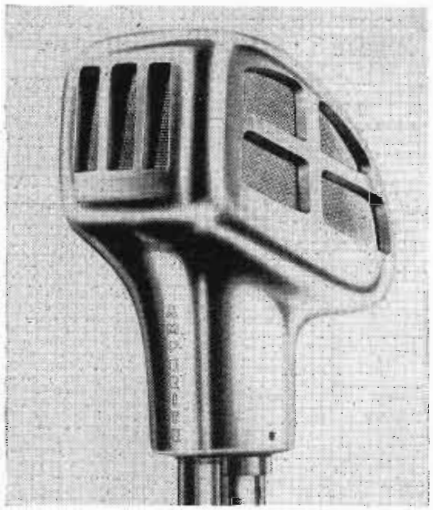
Featuring a low mass stylus assembly and high compliance for more faithful tracking,



the new variable reluctance cartridge has been designed especially for long-playing records. Stylus is a sapphire with a diameter of one mil. The new cartridge is one-third smaller than previous models.—**General Electric Company, Syracuse, New York.**

Studio Ribbon Microphone

Frequency range of a new studio ribbon microphone, currently in production, is 40 to 14,000 cps. The unit is shock-mounted in rub-

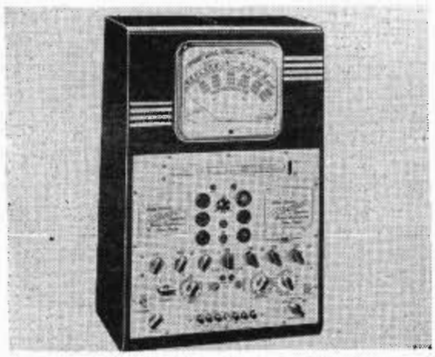


ber and will not be affected in any way by altitude moisture or temperature. Output is —56 db; harmonic distortion is less than 1%. Model R80L has a 200-ohm output; model R80H has high impedance output.—**Amperite Co., Inc., 561 Broadway, New York 12, N. Y.**

Test Equipment

Tube Tester

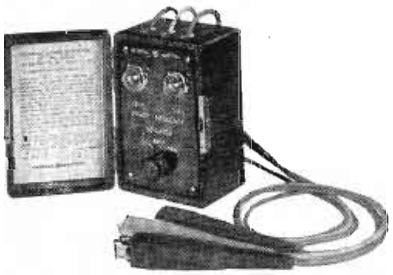
Model 553 DM tube tester incorporates the Hickok dynamic mutual conductance circuits and complete flexibility has been provided



in selector switches to take care of unusual base pin connections. It tests all present-day tubes and has provision for new tube designs so tester cannot soon become obsolete. Tube data is inscribed on roll chart in panel and micromho ranges 0-3000, 0-6000, and 0-15,000 are provided. Power supply requirements are 100-130 volts, 50-60 cycles.—**Hickok Electrical Instrument Co., 10606 Dupont Ave., Cleveland 8, Ohio**

Phase-Sequence Indicator

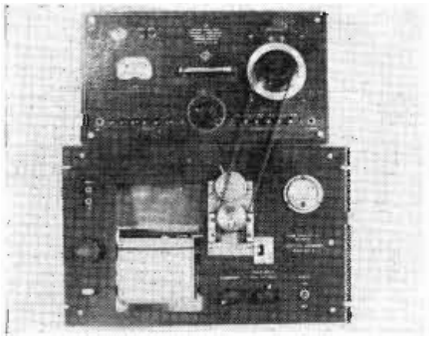
No moving parts, bearings, or pivots are features of the new phase-sequence indicator which may be used in 120-, 240-, or 480 volt



circuits at 25, 50, and 60 cycles. Housed in a leatherette-covered wooden case, the new unit is equipped with three 30-in. leads equipped with insulated clips. The indicator may be used to determine the proper connections for paralleling generators, transformer banks and power buses; to check vaeuum-tube, thyratron, reetifier, and inverter installations; and to study vector relations of polyphase circuits.—**General Electric Co., Schenectady 5, N. Y.**

Recording Sound Analyzer

Frequency analysis of a complex wave from 25 to 7500 cps can be recorded on a 4-in.-wide calibrated seale by models FR and FR-1 in conjunction with the General Radio Com-



pany's model 760-A sound analyzer. A mechanical link unit automatically drives the frequency-sweep dial of the analyzer in register with the calibrated chart movement. The full frequeney spectrum from 25 to 7500 cps can be recorded in a few seconds. The recorder may be used separately as a sound, power, or voltage level recorder.—**Sound Apparatus Co., 233 Broadway, New York 7, N. Y.**

New Parts for Designers

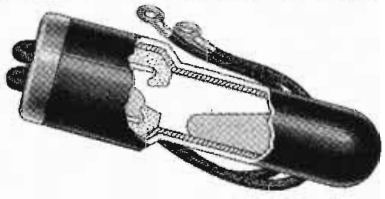
Electrolytic Capacitors

Supplied in two and three lug terminal assemblies, type KP electrolytic capacitors are produced in 2¼, 2¾, 3¼, 3¾, and 4¼-in.

assemblies. The two lug units are available from 15 μfds. at 100 working volts to 80 μfds. at 450 working volts. The three lug terminal assemblies are as suitable for dual capacity units as for the triple capacity arrangement.—**Cornell-Dubilier Electric Corp., South Plainfield, New Jersey.**

Mercury Switches

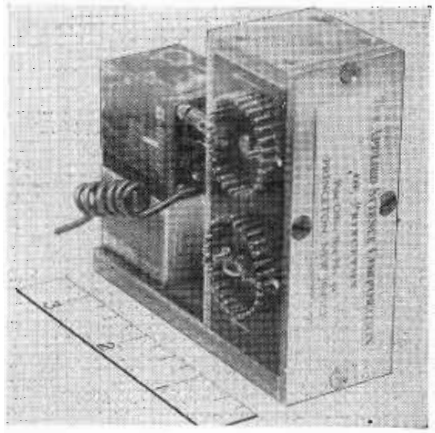
An electric weld, a recent technical development in the manufacture of Durakool



mercury switches, seals hydrogen gas under pressure within the metal case of the switch. This pressure remains intact whether the switch is in use or inactive on a machine or in stock. The metal case acts as one electrode and make and break contacts are made between two mercury pools in the "double flow" model, further reducing possibility of corrosion. Models range from one to 65 amps. in capacity and are made with or without plastic case. Rubber insulations are available on order.—**Durakool, Inc., Elkhart, Indiana.**

Subminiature Switch

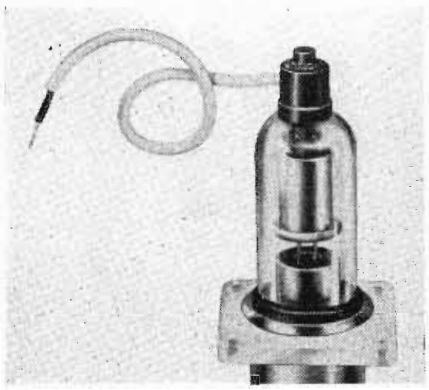
Relatively large currents may be handled by a new subminiature, multi-channel mechanical switch which is presently being



used in guided missiles, aircraft and balloons. Sampling rates up to 8000 rpm are available in two and four-pole switch models, each pole having 15 channels.—**The Applied Science Corporation of Princeton, Post Office Box No. 44, Princeton, New Jersey.**

RF Filament Transformers

A high-voltage, corona-shielded, tuned transformer assembly has been developed which includes an octal socket for use with



1B3-8016 type tube. Filament voltage is easily adjustable through a small access hole in bottom of the spun copper cup which permits tube use with voltages from 1 kilovolt to 20 kilovolts. To obtain 20, 30, 40 kilovolts, or higher voltages, doubler, tripler or quadrupler circuits may be attached.—**Spellman Television Co., Inc., 130 W. 24th St., New York 11, N. Y.**

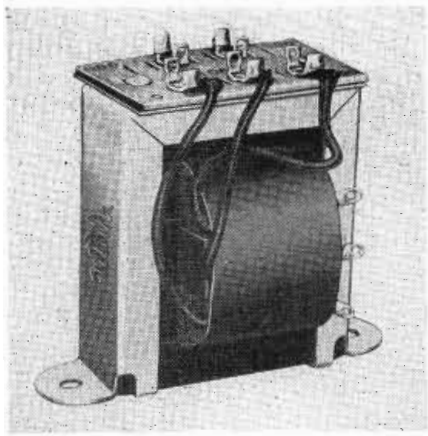
High Q Chokes

Although designed specifically for dynamic noise suppressor circuits, NSI-1 and NSI-2 reactors may be used in any tuned circuits

requiring the given inductances. Inductance values, 2.4 and .8 henrys respectively, are accurate within plus or minus 5% with up to 15 ma of dc. Units have a minimum Q of 20.—**Chicago Transformer, 3501 W. Addison Blvd., Chicago, Ill.**

Replacement Transformers

Three new types of replacement transformers, the Universal Output, Universal Line, and Single Output may be used in conjunction



with Utah's present speaker replacement line and match tubes in common use. Each transformer must pass moisture and operational tests, thus assuring complete waterproofing. The three types are available in eight sizes.—**Utah Radio Products, 1123 East Franklin St., Huntington, Ind.**

Military Production

(*Continued from page 53*)

5. When desired by industry, the Government Services, including the Army, Navy and the Air Force, to make available highly qualified officers, ready for retirement, who can head up the Government departments of individual companies, act as consultants to those departments, or otherwise be available to assist and participate with manufacturers in establishing and building up military-equipment divisions which can be operated on a profitable basis by industry.

As a prelude to setting up Service and industry committees and to implementing the above recommendations, the RMA strongly urges that the radio and wire communications manufacturing industries be divorced from each other for planning consideration, below top executive levels.

Aim of Plan

The aim of this Plan is to create as many prime contractors as possible, and get the industry, as a whole, back into Government business. Its object is to tie-in spreading of the production load with current procurement. This is the first and fundamental step. With the industry integrated as proposed above, then the other elements of mobilization planning can be undertaken with a much better chance of wholehearted industry cooperation and the ultimate successful implementation of such plans because the working relations between the Government and the contractors will be between experienced personnel having the necessary "know how" and facilities.

Because of the fact that Congress appropriates funds directly to procurement agencies, it may be desirable to eliminate competition among these agencies by allocation. From the experience of World War II such allocation, if strictly adhered to, might become a strait-jacket which could seriously hamper the radio-electronic industry. This industry probably will be concerned with production of military equipments useful to all three Services. The RMA Committee believes that a more practical approach would be to allocate the end product, leaving the individual units of the industry free to produce the items for which they have particular competence, regardless of their Service destination.

The RMA Committee believes

that the objective of one point of contact with the Services is desirable for many manufacturers. However, the appointment of a man in uniform who "is in effect an administrative representative of the National Military Establishment for the plants under his jurisdiction" might lead to serious misunderstandings and possible abuses. The Committee is concerned over the potential supply of officers competent to handle such assignments. The World War II experience of some manufacturers with over-zealous and ill-informed officers was unfortunate.

Although the Committee appreciates that contingent contracts may be necessary in isolated cases, the widespread use of such instruments is believed to be unsound.

Experience in Government contracting, including design and development, can be secured much better through actual production of equipment in connection with current procurement. Inevitably, tools have to be checked and remade, materials and components have to be cut and tried, the organization has to be trained and the Government must approve both the parts and finished product, all before production can start to roll.

For this reason, plans should be made by the Government to procure a pilot quantity of any piece of equipment that appears to have a good chance of military use.

The principal bottleneck in the production of radio equipment during World War II was the supply of certain critical parts. The above recommendations will serve to bring the parts manufacturers back into production of service-type components and should focus attention on the critical aspects of any new components that may have come into the picture since the last war.

At present, the Government is placing millions of dollars in contracts on the basis of competitive bids with all of the speculative hazards for both the Government and the contractor of that method of doing business. The Committee believes that the radio industry cannot be induced to participate wholeheartedly in current procurement under this method of procuring, nor are we convinced that this method will result in lower costs to the Government in the long run.

By the proposed closely-regulated, fully-coordinated activity, the RMA Committee believes that a degree of industrial stability could be

(*Continued on following page*)

(*Continued from preceding page*)

brought about that would be reflected in better apparatus and reduced costs. By developing a plan that embraces an industry rather than a selected few large companies on the one hand, and unknown quantities, sometimes dredged up by competitive bidding, on the other, the accumulated design and manufacturing knowledge of an industry is available for expanding production of equipment sufficient for peacetime use to great mass production for war use.

500 Watt TV Transmitter

(*Continued from page 60*)

exciter, the operation of which has already been described. This exciter is identical to that used in the low-band transmitter. In order to provide the proper carrier frequency, the exciter output, which is in the range of 29-36 mc, is tripled in a 4-65A stage, then doubled in a 4X150A stage. This latter stage drives the four paralleled 4X150A's as the power amplifier. The deviation frequency, of course, can be controlled in the exciter to produce the required carrier deviation of ±40 kc.

Transmitter Console

The control console for each transmitter contains the gain controls for both visual and aural inputs to the transmitter, plus complete monitoring facilities for both visual and aural signals. The picture monitor and oscilloscope input circuits can be switched to the input of the transmitter, or to the modulator output, or to the output of a special Type WM-12A detector which picks up a small amount of rf energy from the transmission line to provide an on-the-air monitor.

The aural signal can be monitored by a VU meter and speaker, the desired sound level being maintained at will. The monitoring speaker as well as the VU meter can be switched by pushbuttons to either the input or the output of the audio channel.

Since the power amplifier is the only broadband stage in the transmitter, all the preceding multiplier and driver stages can be simply meter-tuned just as straight class C amplifiers. For proof of performance, tuning of the final stage is accomplished by the use of a video frequency sweep generator and oscilloscope. However, entirely satisfactory results can be obtained by

meter tuning, using only the current indicating instruments in the transmitter.

Power output of either television transmitter is measured by means of a dummy load and wattmeter. The dummy load consists of a termination for the transmission line. Its internal resistance element immersed in liquid, the heat developed in the element is conducted to an external radiating fin structure. The wattmeter consists of a crystal detector and current indicating meter. This instrument, which is also coupled into the rf feed line, gives an indication of average power of a black television picture signal.

The "reflectometer" built into the visual section of the transmitter, and coupled to the transmission line, provides a means for continuous observation of transmitter output during program broadcasts. The reflectometer is basically a peak-reading, vacuum tube voltmeter. Once power output measurements are made using the dummy load and wattmeter, the indications obtained can be correlated with reflectometer meter readings on the transmitter. Any changes in power output will then be apparent by the reflectometer readings. This is useful for predetermining the maximum sync level for given output.

The vestigial sideband filter is a permanently tuned rf filter which effectively clips off a portion of the lower sideband of the 9-mc television signal, in accordance with RMA and FCC requirements, and passes on to the antenna signal which will occupy a bandwidth of no more than 6 mc. The filter, which has been described in previous literature, is connected between the transmitter and antenna.

One of the most important advantages offered by the filter is the insurance it gives against interference with television stations operating in adjacent channels. Another important advantage is that use of such a filter (between power amplifier and antenna) assures that the undesired sideband will be definitely suppressed without any possibility of its reinsertion. This is true because this system of sideband suppression does not depend upon the precise adjustment of tuned, low-level band-pass stages, as do low-level suppressing methods. Moreover, use of the vestigial sideband filter permits modulation of the final power amplifier. This simplifies adjustment of the entire transmitter, and provides better response in the picture channel.

TV in UHF (475-890mc)

(*Continued from page 55*)

mission on 600 mc, ERP 1 kw., antenna height 242 ft. Careful spot and running measurements of received signal were made. There was no point within a 30-mile radius where a signal could not be received. The UHF band therefore was judged suitable for TV. It was noted that shadows were more pronounced, trees caused much attenuation, but "noise" was lower and there were very few "ghosts."

Comparative Test Results

RCA reported comparative tests on a number of frequencies between 67.25 and 910 mc, and on Sept. 1 began operation of a picture and sound transmitter at WNBW in Washington. This station radiated 3,625 w. on 504-510 mc from a 563-ft. antenna. Two types of converters and four types of receiving antennas were available to install at a number of homes possessing standard TV receivers. A field survey has not yet been made but in 66 locations within nine miles of the transmitter, acceptable pictures were obtained on all but 14 receivers. There was surprisingly little ignition interference but there was interference from high fields from other transmitters, which, as a result of heterodyning, got through to the video circuits to cause annoyance. To obtain additional data applicable to allocation problems, RCA announced plans for the operation in a few months, of two high-power pulse transmitters on the same UHF, one in New York City and one in Washington.

Equipment for UHF TV Broadcasting. High-power tubes for the 475-890 mc are not in existence, but designers of transmitting tubes promise 50 kw tubes in one year if there is a commercial demand for them. The opinions on transmitters and receivers from various witnesses follow: TV California: Design of receivers is not too difficult, and 50 kw transmitters should be available in the near future. JTAC: Equipment will be ready in one to three years. DuMont: No insurmountable problems exist. Westinghouse: A converter has been designed (price $75.00), tubes and transmitters can be made available in one year. RCA: 10 kw tubes by 1950 and transmitters during 1951 was the estimate; two-band TV receivers can be ready in 2 years. Zenith predicts powers of 20 kw realizable in the near future; television receivers which operate on

When Should Commercial UHF Television Commence?

As answer to this question, DuMont, Cowles, Zenith and Paramount said "Immediately." Other replies were: one to three years, JTAC; as soon as standards are established, TV California; not until the use of UHF band has been experimentally proven, TBA; study the characteristics of the band first, then cautiously approach its commercial use for TV (apparently two years at least), RCA.

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both bands are now being produced to sell at competitive prices.

Conclusions drawn from the hearing are that the FCC will establish new rules for TV as soon as the necessary engineering conferences can be arranged. A decision regarding frequencies to be reserved for color may come as the next step. Many feel that if we ever have good color it will have to be in the upper 300 mc of the UHF band. This leaves for black-and-white pictures 19 channels, 6 mc wide, in the lower portion. These, with the present 12 channels, plus rural coverage by stratovision, might give a satisfactory national allocation plan.

If all of the new band is assigned to black-white TV, there is little chance that we will ever have high-quality color.

It is felt that once the FCC gives the "green light" to commercial TV in the UHF band, the timetable above will be accelerated, and equipment development will be at a rapid pace. We do not know the propagation headaches ahead of us in this new band; neither did we know them when broadcasting began in the VHF band.

Contemplated use of the UHF band should not disturb the TV set purchaser now, especially if he lives in a large city with established transmitters. His receiver will be usable for years.

The "freeze," while injuring some, is about the only way to prepare for an orderly and comprehensive national allocation plan based on the best and most recent engineering information.

TV in Cincinnati Hotel

Television receivers with 10-in. picture tubes have been installed in Cincinnati's new 400-room Terrace Plaza Hotel by the Crosley Division of the Avco Mfg. Co.

PERSONNEL

Daniel E. Harnett has joined the Emerson Radio & Phonograph Corp. as director of engineering. He was formerly president of the Harnett Electric Corp., Port Washington, N. Y.

Three district representatives have been appointed to supervise the nationwide television service organization of the Magnavox Co. They are: **Charles K. Krolek** for the western district; **Russell J. Weber** for the central district; and **Charles C. Kayhart** for the eastern seaboard.

C. Russell Cox

John S. Brown

C. Russell Cox, formerly the sales manager and chief engineer of the Andrew Corp., of Chicago, has become Andrew's director of sales and engineering. John S. Brown has been promoted from the post of assistant chief engineer to chief and Walter F. Keane has taken over the office of sales manager

Harry N. Kreitzer, formerly with Westinghouse Electric Corp., has joined Gawler-Knoop, Inc., sales engineers for the Eastern Seaboard. He will serve the Maryland, District of Columbia, and Virginia area from headquarters in Washington, D. C.

David H. Ross has been appointed manufacturer's representative for Air King Products Co., Inc., Brooklyn, N. Y. He will represent the company in Northern California and Nevada.

Duncan J. Morgan is the new director of human relations for ATF Inc., parent firm of Frederick Hart & Co., Inc., Poughkeepsie, N. Y., electronics equipment manufacturers.

William P. Lear has been elected to the newly created post of chairman of the board of Lear, Inc., Grand Rapids, Mich., and has been confirmed by the board as director of research and development. He is replaced as president of the company by **Richard M. Mock,** former executive vice president.

Hobart C. McDaniel has been named manager of the Technical Press Service, Westinghouse Electric Corp., Pittsburgh, Pa. He succeeds **Carl E. Nagel.**

John T. Lucas has been named superviser of quality control and customer service for the Huntington Radio Tube Plant of Sylvania Electric Products, Inc.

Timothy E. Shea, assistant engineer of manufacture of Western Electric Co. has been elected president, director of Teletype Corp.

Willis C. Toner has been named plant manager of Sylvania Electric's new TV tube plant at Ottowa, Ohio. He joined S. E. in 1930

Jay H. Quinn has become director of sales and advertising for the new Fairchild Recording Equipment Corp., with offices at 30 Rockefeller Plaza, New York City 20.

Will Whitmore has been named radio advertising manager of American Telephone & Telegraph Co. Since May, 1945, he has been advertising manager of Western Electric.

Phillips B. Patton has joined Lenkurt Electric Co. as field engineer in the carrier div. Formerly, he was West Coast sales and engineering representative for mobile communications div. of Farnsworth Television & Radio Corp.

Robert A. Stauffer has become assistant director of research of the National Corp., Cambridge, Mass. His former position, director of the metals dept., has been filled by **James H. Moore**.

Joshua Sieger has been named director of research and development of Freed Radio Corp. He was engineering chief of Britain's wartime radar program

Fred B. MacLaren has joined the Servo Corp. of America as head of the servo mechanisms lab. He is experienced in the development of control devices

German Manufacturing Methods

Mixing methods used by the AEG Company, Berlin, Germany, and an extrusion process developed by Siemens and Halske at Wernerwerk in the manufacture of high frequency iron cores for electronic equipment are described in a report by Frank R. Hensel, vice-president in charge of engineering for P. R. Mallory Co., Inc., Indianapolis. He made the report for the Office of Technical Services, Dept. of Commerce, following an investigation of eight German firms under OTS sponsorship.

NEWS . . .

Instrumentation Conference

The first comprehensive display of radiation detection instruments will be presented at a conference on electronic instrumentation in nucleonics and medicine in New York Nov. 29 through Dec. 1 under the sponsorship of the IRE and AIEE. Twenty-two types of basic instruments for radiation detection will be exhibited.

VHF System in Colombia

A vhf radiotelephone and radiotelegraph communications system between Bogota and Medellin, Colombia will be installed jointly by RCA and the L. M. Ericsson Co. The new system, scheduled for completion in May, 1949 will span 150 miles of mountainous terrain. Traffic will be handled by three RCA FM radio circuits, each carrying four telephone channels. Terminal equipment is to be supplied by the Ericsson Co.

FM Receiver for Buses

The Specialty Div. of the General Electric Co., has designed an FM receiver for buses which will operate up to eight speakers with low level operation of each one. The set, designed for fixed tuning, is crystal tuned to the frequency of any one FM station desired. Range depends on the signal strength of the transmitter.

Duffendack Receives Award

Dr. O. S. Duffendack has been awarded the President's Certificate of Merit for outstanding services to the armed forces as a member of the wartime Office of Scientific Research and Development. He is president, vice chairman of the board and director of research for Philips Laboratories, Inc., Irvington-On-Hudson, N. Y.

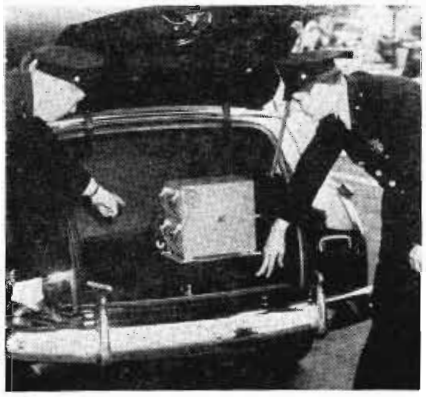
Tube Council Appointment

Dr. A. K. Wright, chief radio engineer of the Tungsol Lamp Works, Inc., Bloomfield, N. J. has been appointed a member of the Joint Electron Tube Engineering Council. He has been active in the Council's standardization program since its inception and was formerly chairman of the receiving tube committee.

Communications Industry Conversion

Rapid conversion of the communications industry to war production in case of an emergency is being studied by the Signal Corps and industry representatives, according to a recent announcement by Major General Spencer B. Akin, Chief Signal Officer of the U. S. Army. The announcement was followed after a conference in Philadelphia, attended by representatives of industry, the Munitions Board, and the Departments of the Army, Navy, and Air Force.

FM MOBILE RADIOTELEPHONE



One of 215 2-way FM mobile radiotelephone installations in Baltimore's public safety vehicles. Units are made by Federal Telephone & Radio Corp., Clifton, N. J.

Stewart-Warner Facsimile

A console which prints radio facsimile and provides conventional radio programs has been developed by the Stewart-Warner Corp. Samuel Insull, Jr., vice president of the company, said that the set can be retailed "somewhere in the $400 bracket" and that the instruments will be manufactured in volume as soon as demand makes mass production practical.

W. L. Everitt to Become Dean

Prof. William L. Everitt will succeed Dean Melvin L. Enger as dean of the university of Illinois's College of Engineering on Sept. 1, 1949. Prof. Everitt has been head of the University's department of electrical engineering since 1944.

Admiral Corp. Expands

A two-story brick annex to the television equipment manufacturing plant of Admiral Corp., 3800 Cortland St., Chicago, has been completed recently at a cost of $400,000. The new addition will allow an estimated 20% increase in production.

RMA Reports 3-Month Sales

Sales of radio and television equipment, including electron tubes, totalled $40,351,820 during the first quarter of 1948, according to the Radio Manufacturers Association. Almost half of these sales, or $18,053,969, were to the U. S. Government.

TV "Experiment" Lauded

The first test pattern to be transmitted by WJBK-TV, Detroit was interrupted by an unscheduled telecast of the studio's record turntables with an operator spinning and cueing-up platters. Public reaction was immediate and favorable, so station engineers turned television cameras on various pieces of studio equipment during test pattern operation. These unrehearsed shots were accompanied by brief, non-technical comments on the operation of each unit.

NEWS . . .

IRE Members Receive Awards

The President's Certificate of Merit has been presented to 30 members of the Institute of Radio Engineers as a testimonial to their outstanding services in technological research and development during World War II. They are:

Henry B. Abajian, L. H. Terpening Co.; George W. Bailey, The Institute of Radio Engineers; Wilmer L. Barrow, Sperry Gyroscope Co.; H. H. Benning, Aircraft Radio Corp.; Harold H. Beverage, Radio Corporation of America; K. C. Black, Aircraft Radio Corp; Hendrik W. Bode, Bell Telephone Laboratories; Ralph Bown, Bell Telephone Laboratories; Herbert E. Bragg, National Defense Research Committee; Henri Busignies, Federal Telecommunication Laboratories; John F. Byrne, Airborne Instruments Laboratory; F. C. Cahill, Airborne Instruments Laboratory; Howard A. Chinn, Columbia Broadcasting System; F. S. Cooper, Haskins Laboratories, Inc.; W. F. Davidson, Consolidated Edison Co.; H. D. Doolittle, Machlett Laboratories; O. S. Duffendack, Philips Laboratories, Inc.; John N. Dyer, Airborne Instruments Laboratory; Donald G. Fink, McGraw-Hill Publishing Co.; E. G. Fubini, Airborne Instruments Laboratory; Raymond L. Garman, General Precision Equipment Corp.; B. L. Havens, Watson Scientific Computing Laboratory; L. Grant Hector, Sonotone Corp.; William H. Martin, Bell Telephone Laboratories; James H. Moore, American Telephone and Telegraph Co.; Haraden Pratt, American Cable and Radio Corp.; J. C. Schelleng, Bell Telephone Laboratories; William P. Short, Federal Telecommunication Laboratories; Hector R. Skifter, Airborne Instruments Laboratory; Ernst Weber, Polytechnic Institute of Brooklyn.

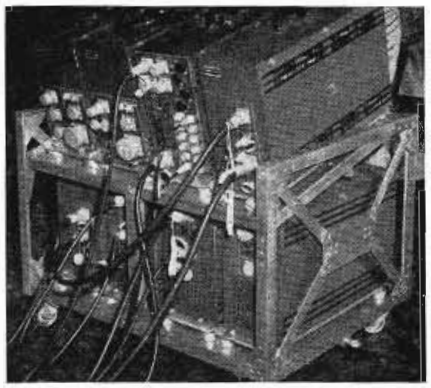
High-Frequency Symposium

The Subcommittee on High-Frequency Measurements of the Instruments and Measurements Committee is planning a two-day symposium on high frequency measurements. The IRE and National Bureau of Standards will be co-sponsors with the committee of the sessions to be held sometime in January.

KLEE-TV Signs GE Contract

A $235,000 contract has been signed by representatives of KLEE-TV, Houston, Tex., and the General Electric Co., for a GE low-channel transmitter, antenna, and studio and remote mobile equipment. KLEE's antenna is being designed for 50-lb. wind loading instead of the normal 30-lb. loading.

TV INSTRUMENT DOLLY



A television instrument dolly, built entirely of aluminum is being used by WAVE-TV, Louisville, Kentucky, for handling and transporting television equipment. Unit weighs 125 lbs. and supports equipment weighing 500 lbs. It was designed and constructed by P. A. Raible, WAVE-TV's maintenance head

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1B24	4.95	211	.98	852	14.95	HY65	2.49	1S5	.72	6Q7	.80	12SK7GT	.66
1B27	4.95	215A	3.00	860	3.00	HY69	2.49	1T4	.80	6Q7GT	.72	12SL7GT	.88
1B56	8.00	217C	7.50	861	49.95	HY75	1.25	1T5GT	1.06	6R7	1.06	12SN7GT	.80
1N21	.59	218	4.95	864	.69	HY114B	1.25	1U4	.80	6R7GT	1.06	12SQ7	.60
1N23	.59	221A	2.95	865	2.98	HY115	1.25	1U5	.72	6S7	1.28	12SQ7GT	.60
1P22	11.50	222A	120.00	866A	.99	HY615	1.25	1V	.88	6S7G	1.28	12SR7	.39
1P24	2.00	227A	3.95	866JR	1.25	HYE1148	.48	2A3	1.28	6S8GT	1.06	12SR7GT	.39
1S21	1.95	241B	90.00	868	1.95	HY1231Z	5.50	2A4G	1.28	6SA7	.66	12X3	.98
2AP1	3.95	242C	5.95	869B	75.00	HY1269	5.50	2A5	.88	6SA7GT	.66	12Z3	.88
2B22	5.35	249C	3.49	872A	2.95	KC4	105.00	2A6	1.06	6SF7	.72	14A7/12B7	.88
2B120	6.95	250R	7.95	874	2.49	KU676	22.00	2A7	1.06	6SD7GT	.49	14AF7/XXD	.88
2C22	.39	250TH	19.50	876	.98	ML100	105.00	2E5	.88	6SF5	.66	14B6	.88
2C26A	.75	250TL	10.50	878	2.49	ML101	150.00	2V3G	1.98	6SF5GT	.72	14B8	.88
2C34	.59	252A	4.95	879	.89	ML502	300.00	2X2A	1.25	6SF7	.80	14C5	.88
2C40	1.98	259A	4.95	884	1.49	MR4	90.00	3A4	.39	6SG7	.80	14C7	.88
2C43	7.50	274A	1.25	885	.98	QK59	39.50	3A5	1.39	6SH7	.39	14E6	.72
2C44	1.75	274B	1.25	902P1	7.95	QK60	39.50	3A8GT	1.98	6SJ7	.66	14E7	.88
2C46	7.50	282A	9.95	904	9.95	QK61	39.50	3B7	.36	6SJ7GT	.66	14F7	.88
2D21	1.69	301A	4.95	905	11.95	QK62	39.50	3D6	.36	6SK7	.66	14F8	1.06
2E22	1.50	304TH	6.95	920	2.95	REL21	4.25	3Q4	.88	6SK7GT	.66	14H7	.88
2E24	4.95	304TL	1.49	923	.98	RK12	1.95	3Q5GT	.96	6SL7GT	.96	14J7	1.06
2E25	4.25	305A	12.95	931A	4.05	RK21	3.95	3S4	.80	6SN7GT	.88	14N7	1.06
2E26	3.95	307A	4.95	950	1.06	RK22	4.95	3V4	.80	6SQ7	.60	14Q7	.88
2E30	2.49	310	4.95	953B	4.95	RK25	2.95	5AZ4	.50	6SQ7GT	.60	14R7	.88
2J21A	14.05	311A	1.98	954	.75	RK33	.98	5R4GY	1.15	6SR7	.72	14S7	1.06
2J26	14.95	316A	.69	955	.75	RK34	.59	5T4	1.28	6SR7GT	.72	14W7	1.06
2J31	24.95	322A	120.00	956	.75	RK59	3.95	5U4G	.60	6SS7	.66	14X7	1.06
2J32	24.95	327A	4.95	957	.75	RK65	24.95	5V4G	.96	6SV7	.88	14X4	.88
2J33	24.95	331A	4.95	958A	.75	RK60	.79	5W4	1.06	6U5/6G5	.72	14Y4	.88
2J34	24.95	338A	4.95	959	.75	RK69	49.50	5W4GT	.66	6U7G	.72	19	1.28
2J37	24.95	350AB	2.95	991	.69	RK72	1.95	5X4G	.72	6V6	1.28	19T8	1.06
2J38	37.50	353A	4.95	1000 SPEC.	24.95	RK73	3.95	5Y3GT	.42	6V6GT	.80	22	1.28
2JB51	4.95	354C/D	19.95	1000T	75.00	RK75	6.25	5Y4G	.60	6W7G	.88	24A	.88
2J54	25.00	368AS	4.95	1608	4.95	RX120	10.00	5Z3	.72	6X4	.60	25AC5GT	1.16
2K25	24.95	371A	2.95	1611	.99	SD809	4.95	5Z4	1.06	6X5GT	.60	25A7GT	1.16
3AP1	4.95	371B	2.95	1613	.75	TB35	1.98	6A3	1.28	6Y6G	.96	25L6GT	.66
3B22	4.05	388A	7.95	1614	1.75	TZ40	2.95	6A6	1.06	6ZY5G	.88	25Y5	1.16
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3B25	1.25	417A	24.95	1621	1.98	VR75	.98	6A8GT	.80	7A6	.72	26	.72
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3BP1	3.95	446A	1.95	1624	1.75	VR90	.75	6AC5GT	1.16	7A8	.72	28D7	.39
3C21	5.95	450TH	24.95	1625	.49	VR91	1.49	6AC7/1852	1.16	7AD7	1.06	30	.39
3C22	12.95	503	195.00	1626	.49	VR92	.75	6AD7G	1.28	7AF7	.72	31	.39
3C23	4.95	527	12.95	1627	7.95	VR105	.75	6AG5	1.06	7AG7	.88	32	1.28
3C24	.69	531	24.50	1628	4.95	VR150	.98	6AG7	1.28	7AH7	.88	32L7GT	1.28
3C30	1.50	575A	14.95	1629	.69	VT127A	3.00	6AH6	3.90	7B4	.72	33	.39
3CP1	3.00	632A	9.95	1630	7.50	VU111	1.19	6AJ5	.99	7B5	.72	34	.39
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4B24	4.95	709A	9.95	1665	.98	0A4G	1.06	6AT6	.60	7E7	.88	36	.39
4C35	19.05	710A	2.95	1851	1.25	0B2	2.05	6AU6	.80	7F7	.88	37	.39
4J26	110.00	713A	1.65	1852	1.06	0B3/VR90	.75	6AV6	.60	7F8	1.06	38	.39
4J33	49.50	714AY	14.95	1853	1.06	0C3/VR105	.75	6B4G	1.28	7G7/1232	1.06	39/44	.39
5AP1	4.95	715A/B	9.95	1963	.95	0D3/VR150	.75	6B5	1.56	7H7	.80	41	.66
5AP4	5.95	715C	24.95	2050	1.19	0Y4	.88	6B6G	.88	7J7	1.06	42	.66
5BP1	2.95	717A	.99	2051	.98	0Z4	.88	6B7	1.28	7K7	1.06	43	.66
5BP4	4.95	720CY	34.95	2140	20.00	0Z46	.88	6B8	1.28	7L7	.88	45	.66
5CP1	3.95	721A/B	4.35	5514	4.95	01A	.50	6B8G	1.28	7N7	.88	45Z5GT	.72
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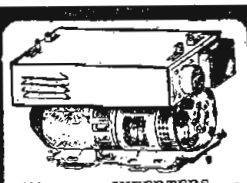

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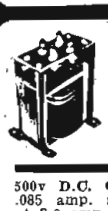

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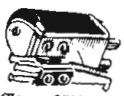

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AY101D, new with calibration curve. PRICE—WRITE OR CALL FOR SPECIAL QUANTITY PRICES
AY131D, new with calibration curve. PRICE $35.00 EACH NET

GENERAL ELECTRIC D. C. SELSYNS

8TJ9-PDN Transmitter, 24 volts. PRICE $3.00 EACH NET
8DJ11-PCY Indicator, 24 volts. Dial marked —10° to +65°. PRICE $4.00 EACH NET
8DJ11-PCY Indicator, 24 volts. Dial marked 0 to 360°. PRICE $6.50 EACH NET

PIONEER TORQUE UNITS

TYPE 12602-1-A. PRICE $30.00 EACH NET
TYPE 12606-1-A. PRICE $35.00 EACH NET
TYPE 12627-1-A. PRICE $70.00 EACH NET

PIONEER TORQUE UNIT AMPLIFIER

TYPE 12073-1-A. PRICE $17.50 EACH NET

RATE GENERATORS

PM2, Electric Indicator Company, .0175 V. per R. P. M. PRICE $7.25 EACH NET
F16, Electric Indicator Company, two-phase, 22 V. per phase at 1600 R. P. M. PRICE $12.00 EACH NET
B-68, Electric Indicator Company, Drag Cup, 110 volts, 60 cycle, one phase. PRICE $14.00 EACH NET

SPERRY PHASE ADAPTER

TYPE 661102, 115 volts, 400 cycle. Used for operating 3 phase equipment from a single phase source. PRICE $6.50 EACH NET

INVERTERS

12117-4, Pioneer. Input 24 volts D. C. Output 26 volts, 400 cycle. PRICE $12.00 EACH NET
12117, Pioneer. Input 12 volts D. C. Output 26 volts, 400 cycle. PRICE $15.00 EACH NET
12123-1-A, Pioneer. Input 24 volts D. C. Output 115 volts, 400 cycle, 3 phase. 100 V. A. Price $75.00 Ea.
153F, Holtzer Cabot. Input 24 volts D. C. Output 26 volts, 400 cycle, 250 V. A., and 115 volts, 400 cycle, 3 phase, 750 V. A. PRICE $150.00 Ea. Net
MG750, Wincharger, PU16. Input 24 volts D. C. Output 115 volts, 400 cycle, 1 phase, 6.5 amps. PRICE $35.00 EACH NET
149H, Holtzer Cabot. Input 28 volts at 44 amps. Output 26 volts at 250 V. A. 400 cycle and 115 volts at 500 V. A. 400 cycle. PRICE $39.00 EACH NET
149F, Holtzer Cabot. Input 28 volts at 36 amps. Output 26 volts at 250 V. A. 400 cycle and 115 volts at 500 V. A. 400 cycle PRICE $29.00 EACH NET

SINE-COSINE GENERATORS (Resolvers)

FJE 43-9, Diehl, 115 volts, 400 cycle. PRICE $20.00 EACH NET

D. C. ALNICO FIELD MOTORS

5067127, Delco, 27 V., 250 R. P. M. PRICE $2.90 EACH NET
5069600, Delco, 27 V., 250 R. P. M. PRICE $4.00 EACH NET
5069466, Delco, 27 V., 10,000 R. P. M. PRICE $3.00 EACH NET

D. C. MOTORS

5069625, Delco Constant Speed, 27 volts, 120 R. P. M. Built-in reduction gears and governor. PRICE $4.25 EACH NET
A-7155, Delco Constant Speed Shunt Motor, 27 volts, 2.4 amps., 3600 R. P. M., 1/30 H. P. Built-in governor. PRICE $6.25 EACH NET
5BA10J18D, General Electric, 27 volts, 0.7 amps., 110 R. P. M. PRICE $2.90 EACH NET
5066665, Delco Shunt Motor 27 volts, 4000 R. P. M. Reversible, flange mount. PRICE $4.50
C-28P-1A, John Oster Shunt Motor, 27 volts, 0.7 amps., 7000 R. P. M., 1/100 H. P. PRICE $3.75 EACH NET

A. C. MOTORS

5071930, Delco, 115 volts, 60 cycle, 7000 R.P.M. PRICE $4.50 EACH NET
36228, Hayden Timing Motor, 115 volts, 60 cycle, 1 R. P. M. PRICE $2.85 EACH NET

SERVO MOTORS
PIONEER
DIEHL
MINNEAPOLIS—HONEYWELL
IN STOCK

WRITE FOR OUR COMPLETE LISTING!

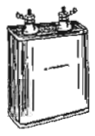
INSTRUMENT ASSOCIATES
147-57 41st AVENUE FLUSHING, NEW YORK Telephone INdependence 3-1919

Now! HIT BACK..
at HIGH PRICES the SENCO way!

Our policy of quantity buying, low overhead, cash sales — eliminating all *unnecessary* expenses that add to your price — enables us to pass along *large savings to you*. Just check these parts and convince yourself that the "SENCO WAY" is the smartest way!

OIL FILLED CONDENSERS

Standard Brand, Upright Type, Stand-Off Insulators



4 Mfd.	800 VDC	$ .45
6 Mfd.	600 VDC	.69
7 Mfd.	600 VDC	.74
8 Mfd.	600 VDC	.79
10 Mfd.	600 VDC	.89
8 Mfd.	1000 VDC	1.90

POWER TRANSFORMERS

All Fully Shielded, Flush Mount

50 mil—6.3V @ 2 amps—
5V @ 2 amps 580V C.T.. $1.79
100 mil—6.3V @ 3 amps—
5V @ 2 amps 750V C.T.. 2.95
150 mil—6.3V @ 4 amps—
5V @ 3 amps 750V C.T.. 3.39
200 mil—6.3V @ 3.3 amps—
5V @ 3 amps 815V C.T.. 4.45

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SPEAKER SPECIAL— For This Month Only!
12" P. M. ALNICO V. . . $3.95
limit 4 to a customer

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MINIMUM ORDER $1.00

WHEN ORDERING—Send 25% deposit for all C.O.D. Shipments Include sufficient postage—excess will be refunded. Orders without postage will be shipped express collect. All prices F.O.B., New York City.

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Dept. S, 73 West Broadway
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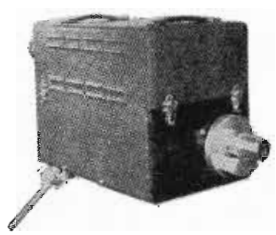
For Sale
TELEVISION CAMERAS



3 DUMONT type 5027A Image Orthicon Pickup Heads, with type 5047A Electronic Viewfinders. These cameras are complete with all tubes, including 2P23 Image Orthicons 90 M.M. f 3.5 EKTAR coated lens. Factory reconditioned — perfect operating condition. Immediate Delivery.

Also

Surplus Laboratory Test Equipment — General Radio, Boonton, Ferris, etc.

Subject to prior sale — F.O.B. N.Y.C.

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Cable Address — NATINSTRU, NEWYORK

BULLETINS

TV Floodlights

Century Lighting Co., 419 West 55th St., New York 19, N. Y., has issued a new brochure describing its lne of lighting equipment and accessories. TV floodlights, Fresnelites, beamlight projectors, striplights and special projectors are featured. (Mention T-T)

Die-Less Duplicating

The Di-Acro system of die-less duplicating is explained in catalog 48-14, issued by the O'Neil-Irwin Mfg. Co., 348 Eighth Ave., Lake City, Minn. Page 40 of this book describes the company's free engineering service. Drawings or sample parts may be sent for a complete "Die-Less Duplicating" report. (Mention T-T)

Co-Axial Cables

Publication No. 27 covers the complete line of electronic Co-Ax cables manufactured by Transradio Ltd., 138A Cromwell Rd., London S. W. 7, England. New types featured are: flexible high power transmission lines, very low capacitance cables and photocell lead. (Mention T-T)

High Power Solenoid

A new small alternating current solenoid that gives approximately 100% more power than other solenoids is the snbject of a new bulletin (SOL-2) released by B/W Controller Corp., Birmingham, Mich. (Mention T-T)

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946.

Of TELE-TECH, published monthly at Orange, Conn., for Oct. 1, 1948.

1. The names and addresses of the publisher, editor, managing editor, and business manager are: Publisher M. Clements, Rumson, N. J. Editor, Orestes H. Caldwell, Catrock Road and Bible St., Cos Cob, Conn. Managing Editor, Stanley Gerstin, 111-09 76th Rd., Forest Hills, N. Y. Business Manager, M. H. Newton, 583 W. 215th St., New York, N. Y.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership, or other unincorporated firm its name and address, as well as those of each individual member, must be given.) Caldwell-Clements, Inc., 480 Lexington Avenue, New York 17, N. Y. M. Clements, O. H. Caldwell, Charles A. Petersen, Trustees, 480 Lexington Ave., N. Y. C. M. Clements, Trustee, Rumson, N. J. O. H. Caldwell, Trustee, Catrock Rd. and Bible St., Cos Cob, Conn. Charles A. Petersen, Trustee, 474 Senator St., Brooklyn, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are not any, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) Orestes H. Caldwell

Sworn to and subscribed before me this 21st day of September, 1948.
W. Kenneth Reynolds.
Notary Public New York County.
(My commission expires March 30, 1949.)

BOOKS

Radio and Television Law

By Harry P. Warner. Published by Matthew Bender & Co., Inc., Albany, N. Y., Price $35.

All the guides to radio's technical and legal problems have been compiled in one book by a member of a Washington law firm who has specialized in radio law for many years. Published in a binder so that subscribers may add up-to-date material as it is issued twice a year, this volume (in its first chapter) traces the history of a radio station from the filing of a first application to the issuance of its regular license.

Legal, financial and technical qualifications necessary for ownership and operation are treated fully and a chapter on transfer and assignment of licenses explains FCC procedure, step by step, along with statutory provisions and reasons for their development. FM policies and standards are discussed and the FCC's allocation policy is explained. A chapter on facsimile is planned and will be available for insertion as soon as the FCC announces its commercial standards. The publishers are offering this volume for inspection with no obligation to buy.

Television Encyclopedia

By Stanley Kempner. Fairchild Publishing Company. Price: $6.50. 415 Pages.

The first, non-technical reference book ever compiled on television in all of its major aspects, entitled "Television Encyclopedia," by Stanley Kempner, has just been published by the Fairchild Publishing Co. Here, for the first time in one volume, can be found a comprehensive presentation of material which includes:

1. An historical survey of television in the form of a chronological record of its evolution.
2. Biographical sketches of pioneers and contemporaries who have helped to bring television to its present maturity.
3. A glossary of technical and trade terms.
4. An appendix on "The Urban Market for Television."
5. An extensive television bibliography.

Cathode Ray Tube Displays

Edited by Theodore Soller, Merle A. Starr, George E. Valley, Jr. Vol. 22 of the MIT Radiation Laboratory Series. Published by McGraw-Hill 1948. Price $10.

A practical discussion of their basic characteristics, principles of operation, and methods of application relating to the design of instruments employing cathode ray tubes. The design and construction of beam deflection and focusing devices, optical projection and measuring apparatus, and auxiliary mechanical equipment is explained. Television is not emphasized.

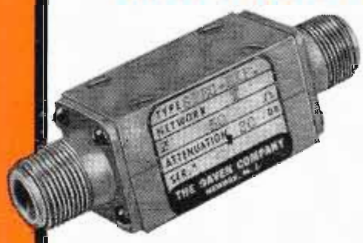
TELE-TECH

Advertisers October 1948

NEW!... R. F. AND VIDEO COMPONENTS FOR PRECISE CONTROL

In keeping with the Daven policy of continually developing new components to meet the electronic industry's new needs, we are once again first to offer video and radio frequency fixed and variable attenuators. These units embody the characteristics which have come to be synonymous with the name DAVEN . . . excellence of workmanship, top-notch design, finest materials and accurate, efficient performance.

R. F. FIXED ATTENUATORS



TYPE RF-155

CIRCUIT: π network.

IMPEDANCE: 50 ohms.

LOSS: 5 to 20 DB.

VIDEO FIXED ATTENUATORS

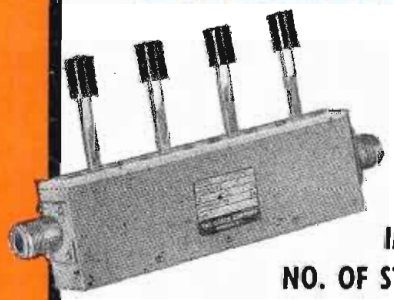
TYPE V-154

CIRCUIT: "T" network or equivalent.

IMPEDANCE: 75 ohms.

LOSS: 1 to 20 DB.

R. F. VARIABLE ATTENUATORS



SERIES RF-540

CIRCUIT: π network.

IMPEDANCE: 50 ohms.

NO. OF STEPS: 4 (push-buttons.)

RESISTOR ACCURACY: $\pm 2\%$ at D.C.

IMPEDANCE ACCURACY: Terminal impedance of loss network essentially flat from 0 to 225 MC.

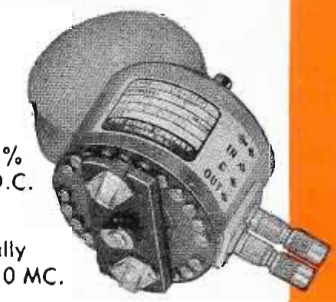
LOSS:
Type RF-540 — 1, 2, 3, 4 DB (10 DB total.)
Type RF-541 — 10, 20, 20, 20 DB (70 DB total.)

SUGGESTED APPLICATIONS

- In signal generators.
- In field strength measuring equipment.
- Nucleonic and atomic research.
- Television receiver testing.
- Wide-band amplifiers.
- Pulse amplifiers.
- Any application where attenuation of UHF is required.

VIDEO VARIABLE ATTENUATORS

SERIES V-250



CIRCUIT: "T" network.

IMPEDANCE: 75 ohms.

RESISTOR ACCURACY: $\pm 1\%$ at D.C.

FREQUENCY CHARACTERISTICS: Essentially flat to 10 MC.

TYPE	NO. OF STEPS	DB PER STEP	TOTAL DB
V-250	10	1	10
V-251	10	2	20
V-252	20	1	20
V-253	20	2	40

These units will be supplied with co-axial connectors or regular terminal boards with lugs.

NOTE: *The RS-540 series may be used for vidio applicotions where more than 40DB is required.*

SUGGESTED APPLICATIONS

- In television video circuits where a wide frequency range without change of impedance is of special importance.
- Wide-band amplifiers.
- Pulse amplifiers.

Patent applied for.

THE DAVEN CO.
191 CENTRAL AVENUE
NEWARK 4, NEW JERSEY

Representative RCA types standardized for future equipment designs

Tubes for today and tomorrow

HERE ARE power tubes, phototubes, and c-r tubes to serve the major requirements of equipment manufacturers for a long time to come. The tubes listed are those you can depend on now, and for your future designs.

These RCA types are especially recommended because their wide-spread application permits production to be concentrated on fewer types. Such longer manufacturing runs reduce costs—lead to improved quality and greater uniformity. Resultant benefits are shared alike by the equipment manufacturer and his customers.

RCA Application Engineers are ready to suggest suitable tube types for your design requirements. For further information write RCA, Commercial Engineering, Section KR-63, Harrison, N. J.

THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA

Preferred List of RCA Non-Receiving Types

CATHODE-RAY TUBES AND CAMERA TUBES

Kinescopes (Projection)	Camera Types	Oscillograph Types	Monoscope
5TP4	5527	2BP1	2F21
	2P23	3KP1	
(Directly Viewed)	5655	5UP1	
7DP4	1850-A		
7JP4			
10BP4			

PHOTOTUBES

Gas Types	1P41	921	927	930
Vacuum Types	922	929		
Multiplier	931-A			

GAS TUBES

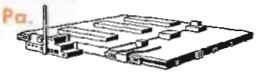
Thyratrons	2D21	3D22	884	2050	5563	
Ignitrons	5550	5551	5552	5553		
Rectifiers	3B25	673	816	857-B	866-A	869-B
	8008					
Voltage Regulators	0A2	0C3/VR105	0D3/VR150			

POWER AMPLIFIERS AND OSCILLATORS

(Air-Cooled)	TRIODES (Forced-Air-Cooled)	(Water-Cooled)
811	6C24	9C21
812-A	7C24	9C27
826	9C22	889-A
833-A	9C25	892
8000	889R-A	
8005	892-R	
8025-A	5588	
	5592	

TETRODES		BEAM TUBES	PENTODES
(Air-Cooled)	(Water-Cooled)	(Air-Cooled)	(Air-Cooled)
4-125A/4D21	8D21	2E24	802
		2E26	
		807	
		813	
		815	
		828	
		829-B	
		832-A	

The world's most modern tube plant . . .
RCA, Lancaster, Pa.



TUBE DEPARTMENT

RADIO CORPORATION of AMERICA

HARRISON, N. J.