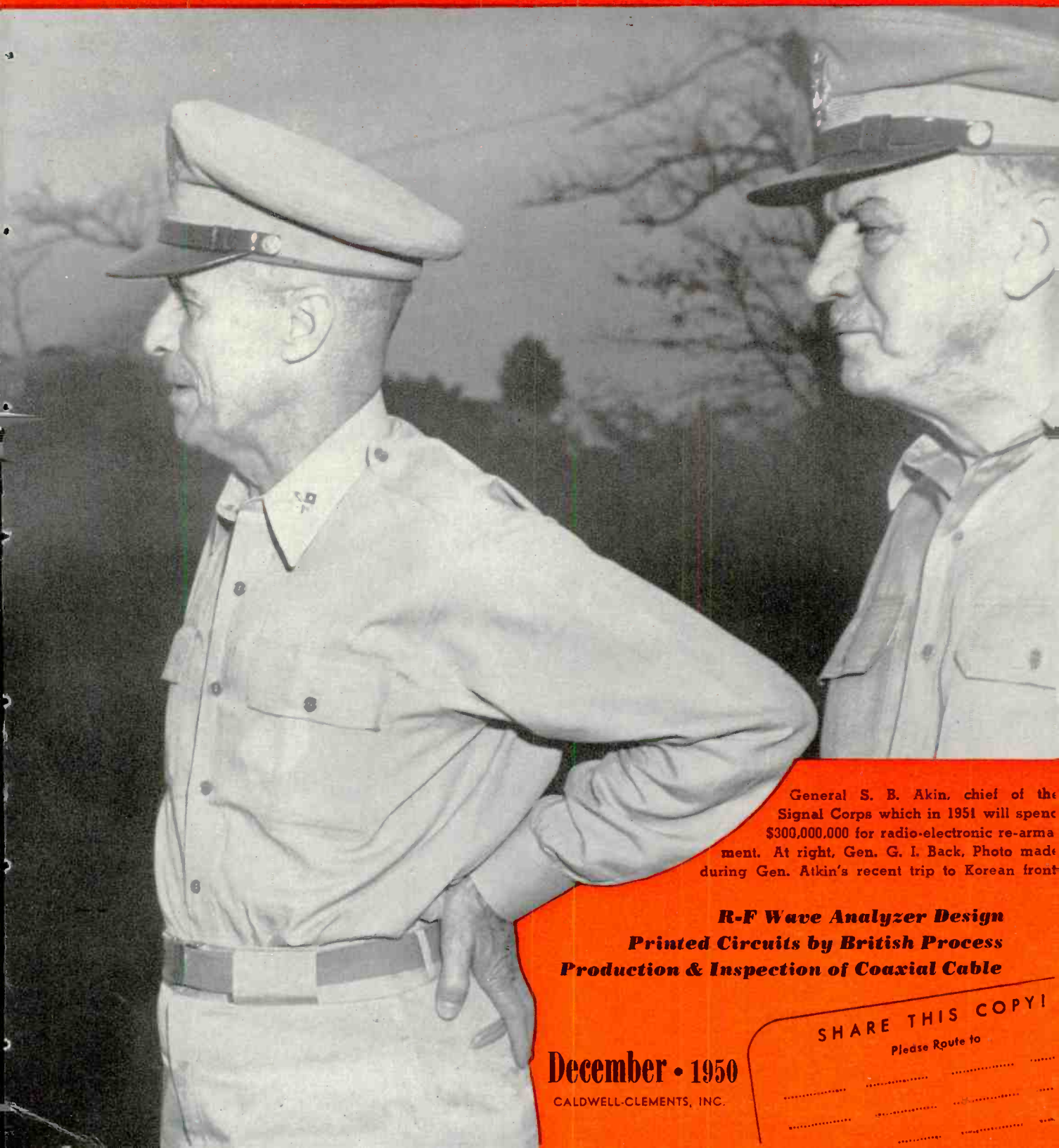
TELE-TECH

Formerly ELECTRONIC INDUSTRIES

TELEVISION • TELECOMMUNICATIONS • RADIO



General S. B. Akin, chief of the Signal Corps which in 1951 will spend $300,000,000 for radio-electronic re-armament. At right, Gen. G. I. Back. Photo made during Gen. Atkin's recent trip to Korean front

R-F Wave Analyzer Design

Printed Circuits by British Process

Production & Inspection of Coaxial Cable

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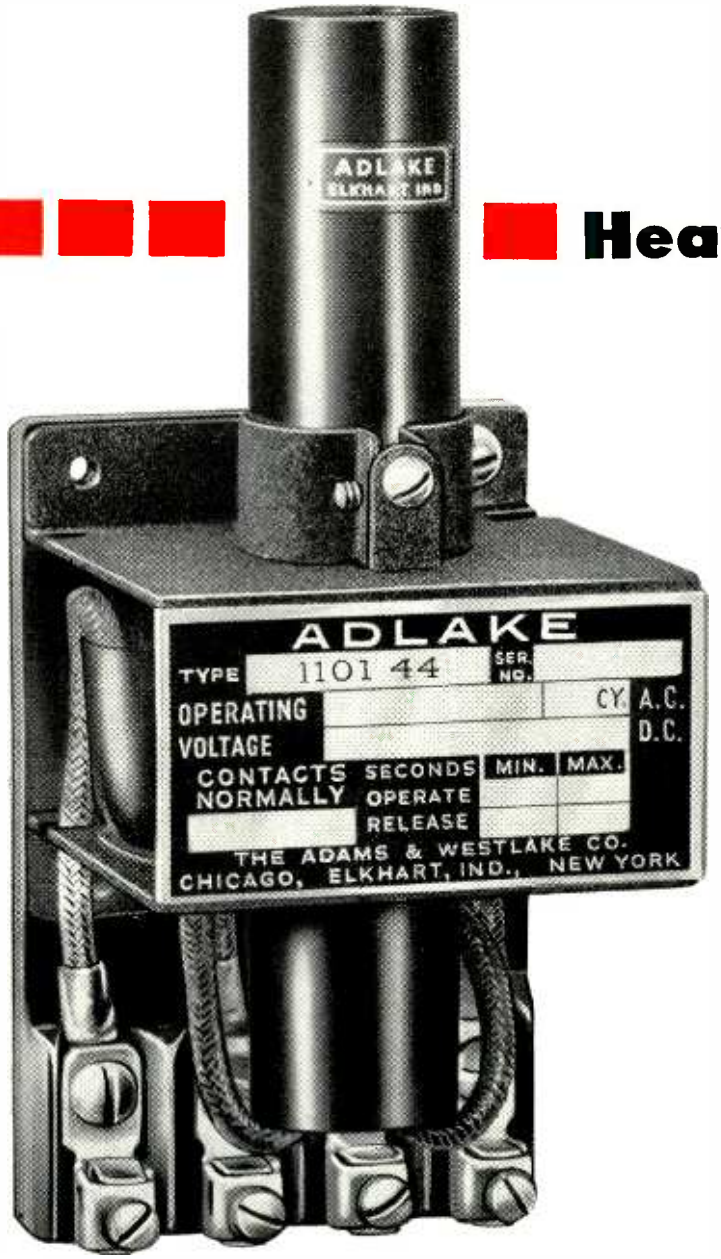
December • 1950

CALDWELL-CLEMENTS, INC.



Adlake
TRADE MARK

Heavy-Duty Relay No. 1101

Now Available with or without Compression-Type Terminal Block

For the first time, the rugged and versatile ADLAKE No. 1101 Mercury Relay may be had with or without a compression-type terminal block. Either style is available as a time delay or a load relay, with contact normally open or closed, for A.C. energization.

The No. 1101 Relay offers a time range of from .15 of a second to 20 minutes. Time characteristics are fixed and non-adjustable, and each relay is tamperproof. The standard finish is black enamel, wrinkled, and construction is sturdy, to withstand heavy shocks and vibrations.

The No. 1101 proved its value in such varied applications as radio transmission, timing power circuits, production line time control, voltage regulation, liquid level controls and solenoid valves. Every day, new applications for this economical relay are being discovered.

For the full story on the No. 1101 Relay, as well as the many other important Adlake Relays, drop a card to The Adams & Westlake Company, 1117 N. Michigan, Elkhart, Indiana. No obligation, of course.

Every Adlake Relay Offers You These Advantages:

HERMETICALLY SEALED — dust, dirt, moisture, oxidation and temperature changes can't interfere with operation.

SILENT AND CHATTERLESS

REQUIRES NO MAINTENANCE

ABSOLUTELY SAFE

The Adams & Westlake COMPANY

Established 1857 ELKHART, INDIANA New York • Chicago

Manufacturers of Hermetically Sealed Mercury Relays for Timing, Load and Control Circuits

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Edited for the 15,000 top influential engineers in the Tele-communications industry, TELE-TECH each month brings clearly written, compact, and authoritative articles and summaries of the latest technological developments to the busy executive. Aside from its engineering articles dealing with manufacture and operation of new communications equipment, TELE-TECH is widely recognized for comprehensive analyses and statistical surveys of trends in the industry. Its timely reports and interpretations of governmental activity with regard to regulation, purchasing, research, and development are sought by the leaders in the many engineering fields listed below

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LONG & SHORT WAVE RADIO
AUDIO AMPLIFYING EQUIPMENT
SOUND RECORDERS & REPRODUCERS
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Research, design and production of special types
TUBES, AMPLIFIERS, OSCILLATORS, RECTIFIERS, TIMERS, COUNTERS, ETC. FOR
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Installation, operation and maintenance of telecommunications equipment in the fields of

BROADCASTING • RECORDING
AUDIO & SOUND • MUNICIPAL
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DECEMBER, 1950

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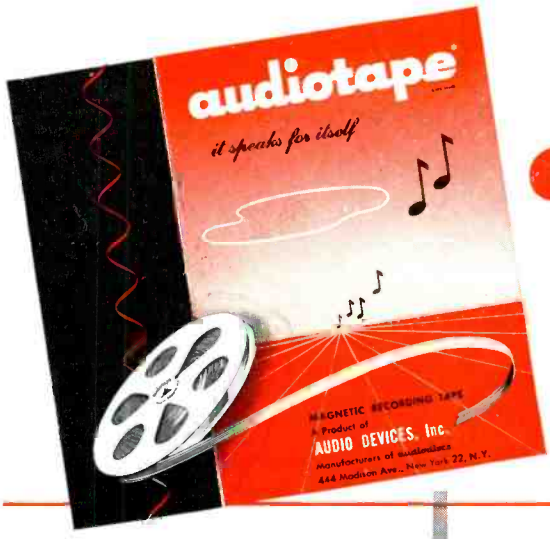
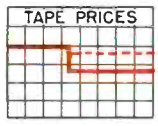


Here's What These audio "Firsts" Have Done for You

. . . to lower the cost and improve the quality of magnetic recording tape

First **with liberal discounts to professional users**



—enabling radio stations, recording studios and educational institutions to save as much as 33⅓% on the cost of magnetic tape.

First **with attractive resale discounts**

—and a nation-wide network of helpful, cooperative sound-equipment distributors in principal cities from coast to coast.

First **with red oxide tape on paper base**

—offering recordists a high-quality tape designed to match the characteristics of the vast majority of recorders, at *lowest possible cost.*

First **with supercalendered kraft paper base**

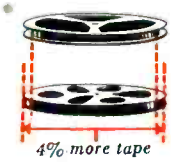
—providing maximum smoothness of texture and minimum noise, without the use of fillers which tend to come out or stiffen the paper.

First **with all-aluminum 7-inch reels**

—mechanically strong, light in weight, and permanently free from warping or twisting even under adverse conditions.

First **to give extra footage on standard size reels**

Audio's "full measure" of 1250 ft., 2500 ft., and 5000 ft. give *4% more tape* on every reel.

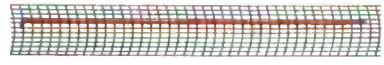


First **with black oxide tape on plastic base**

—offering highest fidelity of recording and reproduction for machines designed to use a high coercive-force oxide.

First **to offer paper base tape in 2500 and 5000 foot rolls**

—permitting maximum economy for professional applications where premium quality recordings are not required.



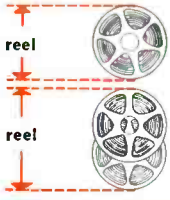
First **to produce a constant output tape**

—made possible by Audio's specially designed coating machinery which controls coating thickness to within 5 *millionths* of an inch.

First **to guarantee output uniformity of**

± ¼ db for 2500 ft. reel

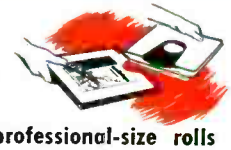
± ½ db from reel to reel in 2500 ft. size



First **to produce a splice-free 2500 ft. roll**

—to *guarantee* that the tape is all one piece, with absolutely no splices in the entire length.

First **to develop the safe-handling package for professional-size rolls**



—permitting tape on hub to be transferred to or from turntable without danger of spilling—and simplifying the attachment of side flanges.

These "Firsts" are proof of the continuous research and development that keeps Audiotape foremost in the field. They are the result of more than a decade of experience — by the only company specializing solely in the manufacture of fine recording materials — both tape and discs.

That's why you can always look to Audio for the latest developments in the recording art. A trial order of Audiotape will speak for itself. Or send today for a free 300-foot sample.

**Trade Mark*

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Please send me a free 300-foot sample reel of ☐ plastic base or ☐ paper base Audiotape.

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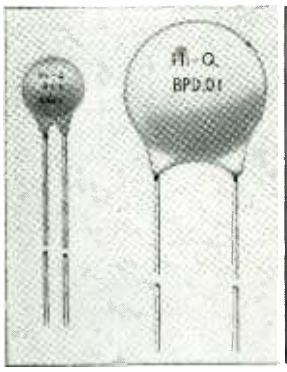
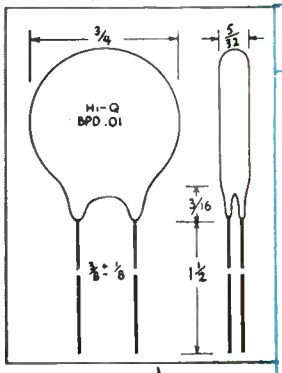
Unit cost, time and labor may be saved by using several of the multiple capacity **Hi-Q** Disks where applicable in your television circuit. Multiple capacities having a common ground are available in standard units as shown in the chart below. **Hi-Q** Disks are coated with a non-hydroscopic phenolic to insure protection against moisture and high humidities. **Hi-Q** Disks like all other **Hi-Q** components assure you of the highest quality workmanship at the lowest possible cost.

Our Engineers are ready and willing to discuss the application of these highly efficient, dependable capacitors in your circuits. Write today for your FREE copy of the new **Hi-Q** Datalog.





Type	A Diameter	B Lead Width	C Thickness
B.P.D. .00047	5/16" max.	3/16" ± 1/16"	5/32" max.
B.P.D. .0008	5/16" max.	3/16" ± 1/16"	5/32" max.
B.P.D. .001	3/8" max.	1/4" ± 1/16"	5/32" max.
B.P.D. .0015	3/8" max.	1/4" ± 1/16"	5/32" max.
B.P.D. .002	7/16" max.	1/4" + 1/8" − 0	5/32" max.
B.P.D. .004	19/32" max.	1/4" + 1/8" − 0	5/32" max.
B.P.D. .005	19/32" max.	1/4" + 1/8" − 0	5/32" max.
B.P.D. .01	3/4" max.	3/8" ± 1/8"	5/32" max.
B.P.D. 2x.001	19/32" max.	3/8" ± 1/8"	5/32" max.
B.P.D. 2x.0015	19/32" max.	3/8" ± 1/8"	5/32" max.
B.P.D. 2x.002	19/32" max.	3/8" ± 1/8"	5/32" max.
B.P.D. 2x.003	3/4" max.	3/8" ± 1/8"	5/32" max.
B.P.D. 2x.004	3/4" max.	3/8" ± 1/8"	5/32" max.
B.P.D. 3x.0015	3/4" max.	3/8" ± 1/8"	5/32" max.
B.P.D. 3x.002	3/4" max.	3/8" ± 1/8"	5/32" max.

Insulation: Durez and Wax impregnated.
Leads: 22 gauge pure tinned dead soft copper.
Capacity: Guaranteed mininum as stamped.
All capacitance measurements made at 25°C at 1 KC at a test voltage not over 5 volts RMS.

Insulation Resistance: 7500 megohms min.
Power Factor: Max. 2.5% at 1 KC at not over 5 volts RMS.
Test Voltage: 1500 volts D. C.

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Testing for sound lost between telephone receiver and ear. Many subjects were used in these tests.

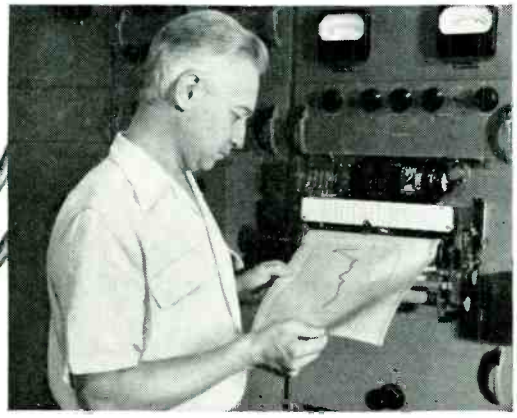
How to compensate for a curl . . . and add to your telephone value

Bell scientists know that the telephone is not used under ideal laboratory conditions. There is never a perfect seal between receiver and user's ear. A curl may get in the way, or the hand relax a trifle. And ears come in many shapes and sizes. So some sound escapes.

Now, sound costs money. To deliver more of it to your ear means bigger wires, more amplifiers. So Bell Laboratories engineers, intent on a thrifty telephone plant, must know how much sound reaches the ear, how much leaks away. They mounted a narrow "sampling tube" on an ordinary handset. The tube extended through the receiver cap into the ear canal. As sounds of many frequencies were sent through the receiver, the tube picked up a portion, and sent it through a condenser microphone to an amplifier. That sampling showed what the ear received.

As a result, Bell scientists can compensate in advance for sound losses—build receivers that give *enough* sound, yet with no waste. That makes telephone listening always easy and pleasant.

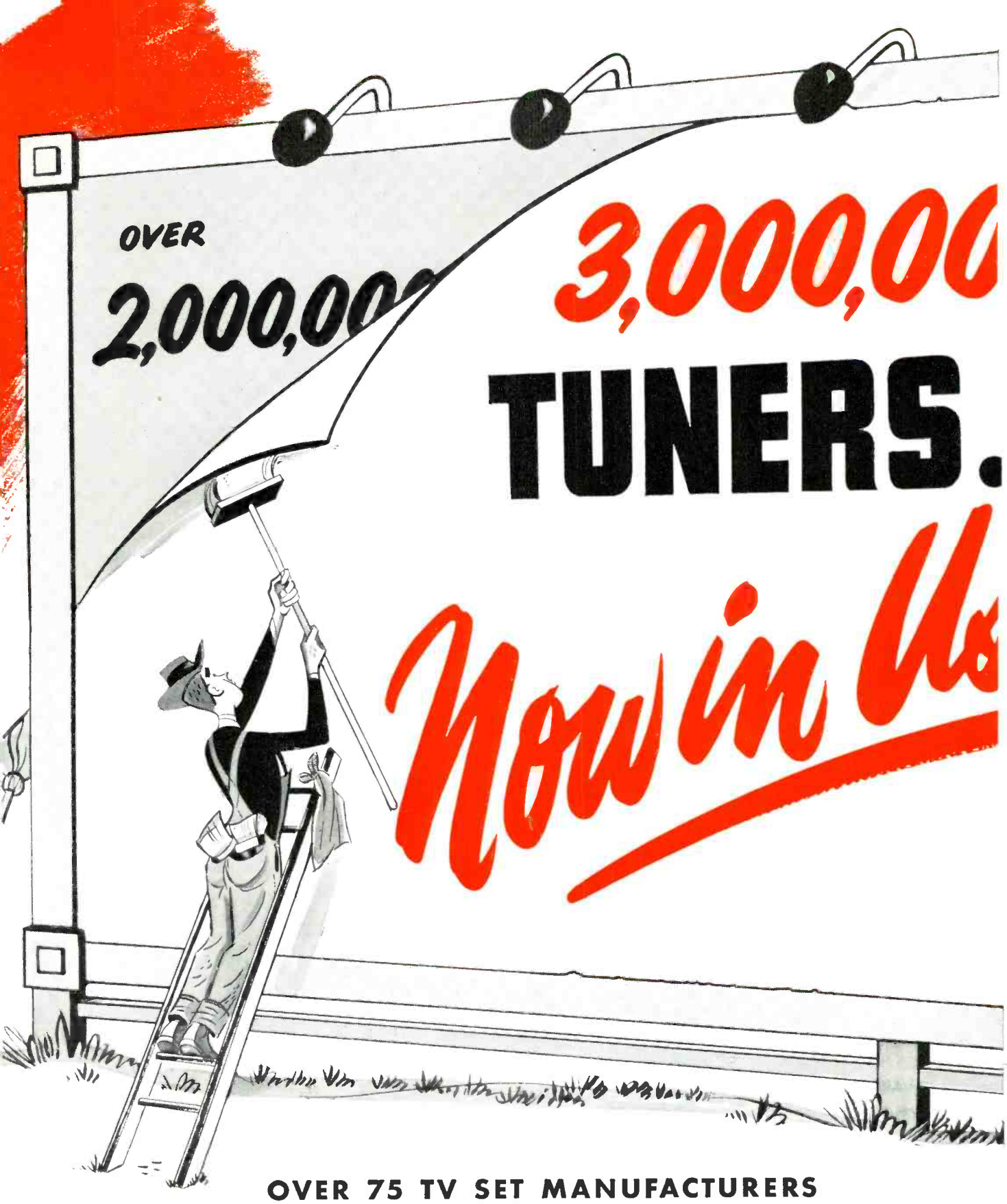
It's another example of the way Bell Telephone Laboratories work to keep your telephone service one of today's biggest bargains.



Automatic recorder plots sound pressures developed in the ear canal at different frequencies.

BELL TELEPHONE LABORATORIES

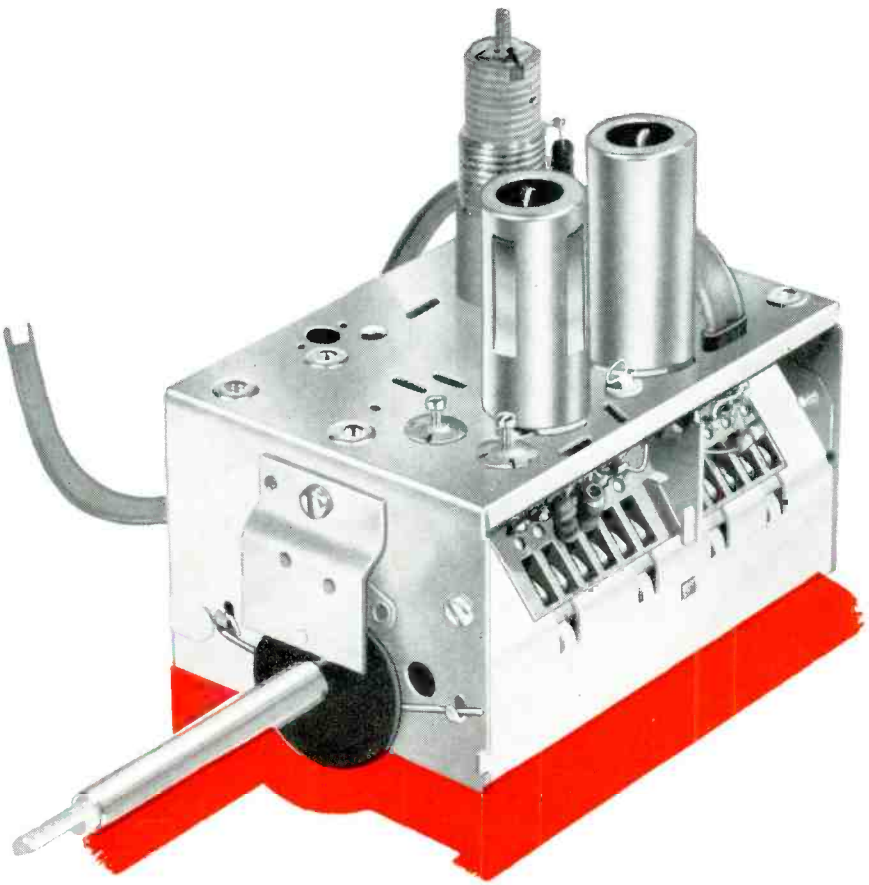
Working continually to keep your telephone service big in value and low in cost.



OVER 75 TV SET MANUFACTURERS
USE "THE STANDARD TUNER"

Standard COIL PRODUCTS CO.

"Standard"



"THE STANDARD BOOSTE
FOR FRINGE AREA RECEPTIO

INC.

Chicago
Los Angeles
Bangor, Michigan

TELE-TIPS

DAT OL' DEBBEL FCC—does it have something like this planned, to force color on John Q. Public, as say those who claim to "see through" the Commish's malevolent purposes? At present the FCC color-ruling is sweetly only "permissive",—that is, stations can broadcast color or not, as they wish. But will FCC's next step be to require all stations on renewing their licenses to (1) install color equipment and (2) broadcast color 20 to 30 hours weekly? And with second license-renewal period—will the ax really fall—will the iron fist be felt—will FCC order all TV stations, as condition of license, to broadcast incompatible *color exclusively?* In such case the 15 or 20 million black-white sets in hands of public will then become so many blank pieces of furniture unless their owners install adapters and/or converters! Anyhow, that's the shuddering tale the old wives foretell!

COLOR-TV ACTION was taken by FCC without any advance information to President Truman who was at the time absent from Washington—in Florida. Thus the President returned from one hurricane area to find a cyclone of color-TV protests bursting in upon him. Presidential Assistant John R. Steelman is reported also aroused at the awkward, ill-timed order of the Commission, focussing action on color gadgets when engineers and materials are sorely needed for military uses.

KOREAN STATISTICS—200,000 miles of field wire, 10,000 radio sets, thousands of batteries, 265 Signal Corps officers and 2514 enlisted specialists had been shipped into the Korean battleground, Major General S. B. Akin, the Army's Chief Signal Officer, told the Washington chapter, AFCA, Oct. 18.

WHIRLING DISCS—The public and even some engineers have forgotten that colored movies originally started with revolving discs—and got nowhere. Television itself started with revolving discs and television got precisely nowhere until it erased the mechanical whirling disc!

(*Continued on page* 10)

A complete line

for resistors too!

Unusual *combinations of characteristics* required in today's critical electronic circuits demand a complete range of resistor types. Specializing in resistors, IRC makes the widest line in the industry. This means ease of procurement—a single dependable source of supply for *all* your resistance needs. It also means unbiased recommendations—no substitution of units "just as good". IRC's complete line of products; complete research and testing facilities; complete network of licensees for emergency production—all add up to complete satisfaction for you.

CONTROLS

IRC Type W Wire Wound Controls are designed for long, dependable service and balanced performance in every characteristic. These 2-watt variable wire wound units provide maximum adaptability to most rheostat and potentiometer applications within their power rating. Catalog Bulletin A-2.

IRC New Type Q Controls feature small 15/16" size, rugged construction and superior performance. Increased arc of rotation permits same resistance ratios successful in larger IRC Controls. Catalog Bulletin A-4.

PRECISION RESISTORS

IRC Precision Wire Wounds offer a fine balance of accuracy and dependability for close-tolerance applications. Extensively used by leading instrument makers, they excel in every significant characteristic. Catalog Bulletin D-1.

IRC Deposited Carbon PRECISTORS combine accuracy and economy for close-tolerance applications, where carbon compositions are unsuitable and wire-wound precisions too expensive. Catalog Bulletin B-4.

IRC Matched Pairs provide a dependable low-cost solution to close-tolerance requirements. Both Type BT and BW Resistors are available in matched pairs. Catalog Bulletin B-3.

IRC Sealed Precision Voltmeter Multipliers are suitable and dependable for use under the most severe humidity conditions. Each consists of several IRC Precisions mounted and interconnected, encased in a glazed ceramic tube. Catalog Bulletin D-2.

is essential

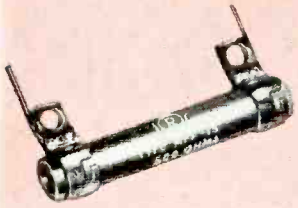
INSULATED COMPOSITION and WIRE WOUND RESISTORS

IRC Advanced Type BT Resistors meet and beat JAN-R-11 Specifications at ⅓, ½, 1 and 2 watts—combine extremely low operating temperature with excellent power dissipation. Catalog Bulletin B-1

IRC Type BW Wire Wound Resistors are exceptionally stable, inexpensive units for low range requirements. Have excellent performance records in TV circuits, meters, analyzers, etc. Catalog Bulletin B-5.

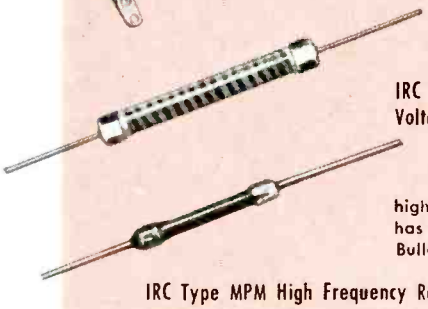
IRC Type BTAV High Voltage Resistors, developed for use as discharge resistors in fluorescent "Quick Start" ballasts, withstand momentary peak surges of 6000 volts. Also suited to TV bleeder circuits. Catalog Bulletin B-1.

HIGH FREQUENCY and HIGH POWER RESISTORS



IRC Type MP High Frequency Resistors afford stability with low inherent inductance and capacity in circuits involving steep wave fronts, high frequency measuring circuits and radar pulse equipment. Available in sizes from ¼ to 90 watts. Catalog Bulletin F-1.

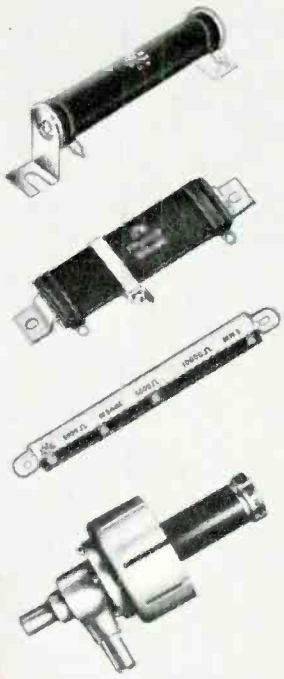
Type MV High Voltage Resistors utilize IRC's famous filament resistance coating in helical turns on a ceramic tube to provide a conducting path of long, effective length. Result: Exceptional stability even in very high resistance values. Catalog Bulletin G-1.



IRC Type MVX High Ohmic, High Voltage Resistors meet requirements for a small high range unit with axial leads. Engineered for high voltage applications, MVX has exceptional stability. Catalog Bulletin G-2.

IRC Type MPM High Frequency Resistors are miniature units suitable for high frequency receiver and similar applications. Stable resistors with low inherent inductance and capacity. Body only ⅜" long. Catalog Bulletin F-1.

POWER RESISTORS



IRC Fixed and Adjustable Power Wire Wounds give balanced performance in every characteristic—are available in a full range of sizes, types and terminals for exacting, heavy-duty applications. Catalog Bulletin C-2.

IRC Type FRW Flat Wire Wound Resistors fulfill requirements of high wattage dissipation in limited space—may be mounted vertically or horizontally, singly or in stacks. Catalog Bulletin C-1.

IRC Type MW Wire Wound Resistors offer low initial cost, lower mounting cost, flexibility in providing taps, and saving in space. Completely insulated against moisture. Catalog Bulletin B-2.

IRC Type LP Water-Cooled Resistors for TV, FM and Dielectric Heating Applications. Cooled internally by high velocity stream of water; adjustable to local water pressure and power dissipation up to 5 K.W.A.C. Catalog Bulletin F-2.

Wherever the Circuit Says —WW—

Power Resistors • Voltmeter Multipliers • Insulated Composition Resistors • Low Wattage Wire Wounds • Volume Controls • Voltage Dividers • Precision Wire Wounds • Deposited Carbon Precistors • Ultra-HF and High Voltage Resistors • Insulated Chokes

25 YEARS YOUNG IN 1950!

IRC

INTERNATIONAL RESISTANCE COMPANY

PHILADELPHIA 8, PENNSYLVANIA

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- ☐ Bulletin A-2 (W)
- ☐ Bulletin A-4 (Q)
- ☐ Bulletin B-1 (BT)
- ☐ Bulletin B-1 (BTAV)
- ☐ Bulletin B-2 (MW)
- ☐ Bulletin B-3 (M/P)
- ☐ Bulletin B-4 (DC)
- ☐ Bulletin B-5 (BW)
- ☐ Bulletin C-1 (FRW)
- ☐ Bulletin C-2 (PWW)
- ☐ Bulletin D-1 (WW)
- ☐ Bulletin D-2 (MF)
- ☐ Bulletin F-1 (MP)
- ☐ Bulletin F-1 (MPM)
- ☐ Bulletin F-2 (LP)
- ☐ Bulletin G-1 (MV)
- ☐ Bulletin G-2 (MVX)

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TITLE .....

COMPANY .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

J. F. ARNDT & CO., ADV. AGENCY

TELE-TIPS (Continued)

STORMS ARE LOSING their sting. New radar sets capable of tracking and identifying storms as far away as 250 miles, are now helping to provide early storm warnings and probe secrets of how and why storms brew. The earlier radar models used at airports were on the whole only capable of indicating storms in the immediate vicinity. This new equipment is a derivative of early warning radar.

SHORT-WAVE TO BC—During the recent celebration of the first short-wave message to cross the Atlantic, Dec. 12, 1921, transmitted from Greenwich, Conn., by E. V. Amy, Maj. E. H. Armstrong, George Burghard and others, and received by Paul Godley in Scotland. Someone pointed out that the wavelength used in 1921, 230 meters, is approximately the same as used today by local broadcast stations in Stamford and Norwalk, Conn., both a few miles from the historic IBCG site.

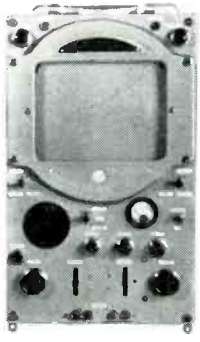
SELLING POINTS—"Everybody loves flowers, because of their color and perfume", declares W. A. Blees, Crosley general sales manager, adding: "Our experience with radios in colors shows how color helps sell sets. And if we could get plastic cabinets that are also perfumed, I am sure we would sell even more radio!"

PICTURES AND MUSIC are available to riders of the London, England, area buses on evening journeys. Two 9-in. TV screens are used to entertain the passengers, and are placed behind the driver. To overcome the effects of standing waves, six antennas are used along the roof of the bus. One wonders which is worse, being a captive television audience minus singing commercials, or being a captive sound radio audience plus commercials?

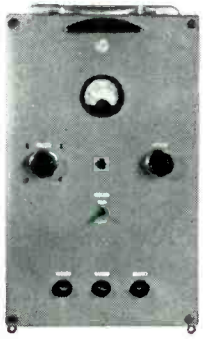
SOUND CONTROL — Operadio Manufacturing Co., of St. Charles, Ill., has acquired exclusive rights together with sublicensing rights under the group of Jenkins and Adair patents from Bendix Aviation Corp. These patents relate to present-day automatic sound-slide systems controlled by signals on record or tape.

FCC—We nowadays hear it called "The Federal Confusion Commission". And again "The Fumbling Communications Commission". Any other nominations?

GPL Introduces First TV Camera Chain Designed from Start to Finish for Compactness and Ease of Operation



Compact GPL camera and control unit have been "human engineered" for easy, efficient use. Camera provides uniform focus adjustment for all lenses; iris is motor-controlled from rear of camera or from control unit, with lens opening shown on dials at both locations. Control unit has 8½" monitor tube.



IMPROVED SYNC GENERATOR

The sync generator, with its power supply, is a single unit, packaged for field use. Because binary counting circuits are used, and pulse width is controlled by delay lines, it provides circuit reliability better than present studio equipment. With this circuitry, all operator adjustments are eliminated.

Built with the compact precision which distinguishes a quality watch from an alarm clock, GPL's new image orthicon camera chain is smaller, lighter, easier to use. It is the first camera chain that has been "human engineered" – designed from motion studies of cameramen and control personnel. It is the first with type and location of controls based on minimum movement and maximum ease and efficiency.

This simplification, together with size and weight reduction has been accomplished without any sacrifice or limitation whatever in performance or accessibility. Superior GPL circuit design provides a better picture than normally obtainable with image orthicon equipment. Complete control is provided for every studio or field requirement.

Logical components have been combined . . . fewer units make up a chain. A single chain consists of only 4 units; a triple chain, 12 including switching unit and master monitor. The camera, *with integral view finder,* is only 10¾" x 12½" x 22", weighs 75 lbs. instead of 100-105 lbs. The sync generator is a single portable unit including its own power supply. It may be easily removed from its case to go into a standard relay rack.

SIMPLIFIED CONTROL

All controls are at the finger-tips of cameramen and camera control operators. Focus adjustment of all lenses is uniform; a given rotation of focus control produces the same shift in plane of focus for all lenses. The iris is motor-controlled, either from the rear of the camera or from the camera control unit. Dials on both camera and control unit indicate the lens opening. Negative feedback is used to stabilize video frequency response, eliminating an adjustment. Target and beam are controlled by thumbwheels next to convenient knobs for pedestal and gain.

READILY ADAPTABLE

GPL Camera Chains completely meet all studio and field requirements or may be readily adapted to supplement existing installations. *Before you make any camera chain investment, get all the facts on this new addition to GPL's outstanding line of TV studio equipment.*

Write, Wire or Phone for Details

TV Camera Chains • TV Film Chains
TV Field and Studio Equipment
Theatre TV Equipment

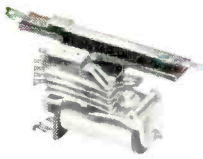
GENERAL PRECISION LABORATORY • INCORPORATED • GPL

General Precision Laboratory
INCORPORATED
PLEASANTVILLE NEW YORK

New Era in Video -via REMOTE

Complex TV program continuity is reduced to a simple push-button operation with an RCA TS-20A System.

This Relay Switching System does what RCA's Audio Relay Systems have



This video relay system removes all switching restrictions from equipment operations. It imposes no limitation on equipment installation—no matter where you set up your units. It provides unlimited flexibility—enables you to add facilities as your station grows, *without losing a penny's worth of your original equipment investment.*

Actual switching in the RCA TS-20A system is done by d-c operated relays *located in the video line itself!* Designed by RCA for this special service, these relays are controlled by simple d-c lines from any point you choose. No expensive coaxial line required to and from control points. No extra cable connectors needed. You can rack-mount the relays wherever you want them. You can set up your control positions wherever you like. There are circuit provisions for sync interlocks and for tally lights.

The RCA TS-20 System provides complete master or studio facilities for program monitoring, production talk-back, and video switching between studio camera, film camera, remote pick-up and network programs. For example, you can fade or lap

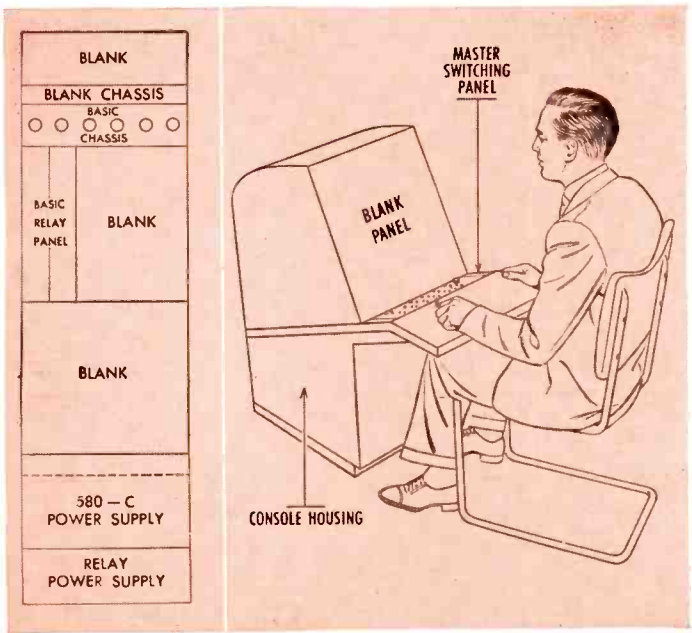
TELEVISION BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

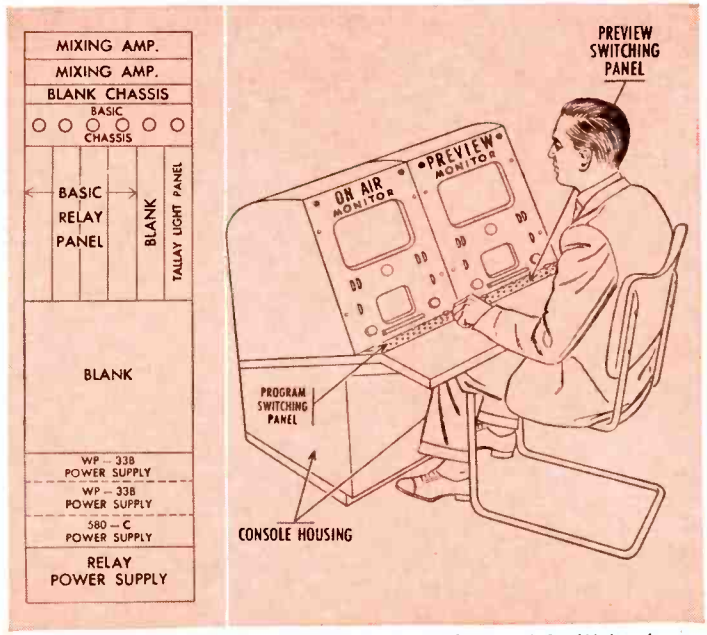
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

3 OF THE MANY ADD-A-UNIT SET-UPS POSSIBLE WITH



1. Minimum Master Control arrangement. Combines simple operation with economy. Provides switching of 6 inputs to either of 2 outputs.



2. Simple Studio Control layout. Additional facilities include: Preview monitoring and line monitoring, fades, lap dissolves, and superimposition.

Switching RELAYS!

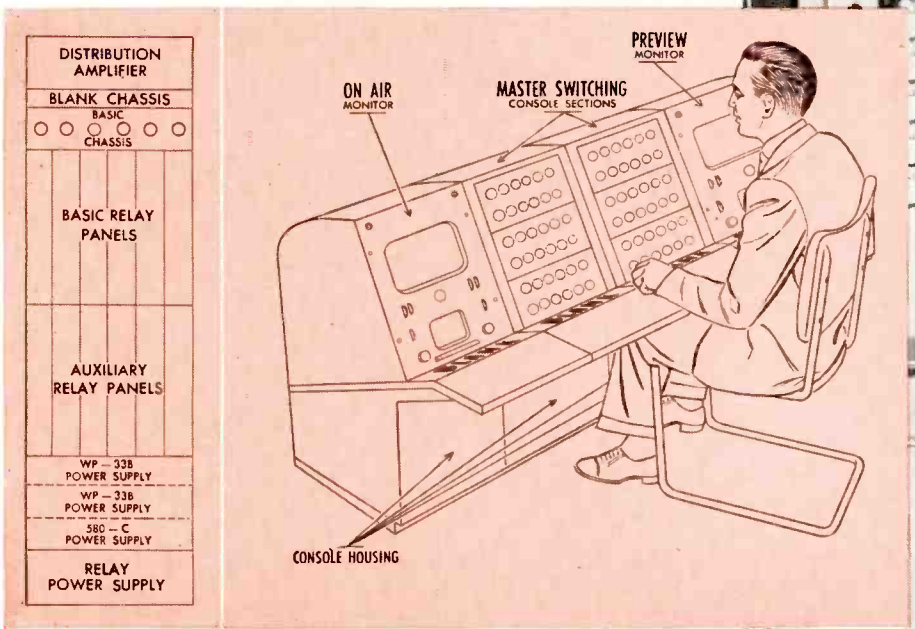
for TV master or studio control done for aural broadcasting.

dissolve between studios. You can set up for program previewing and other monitoring functions (up to 5 program monitors available). You can combine the TS-20A System with audio switching *and presetting*, so that the sound switches with the picture *automatically!*

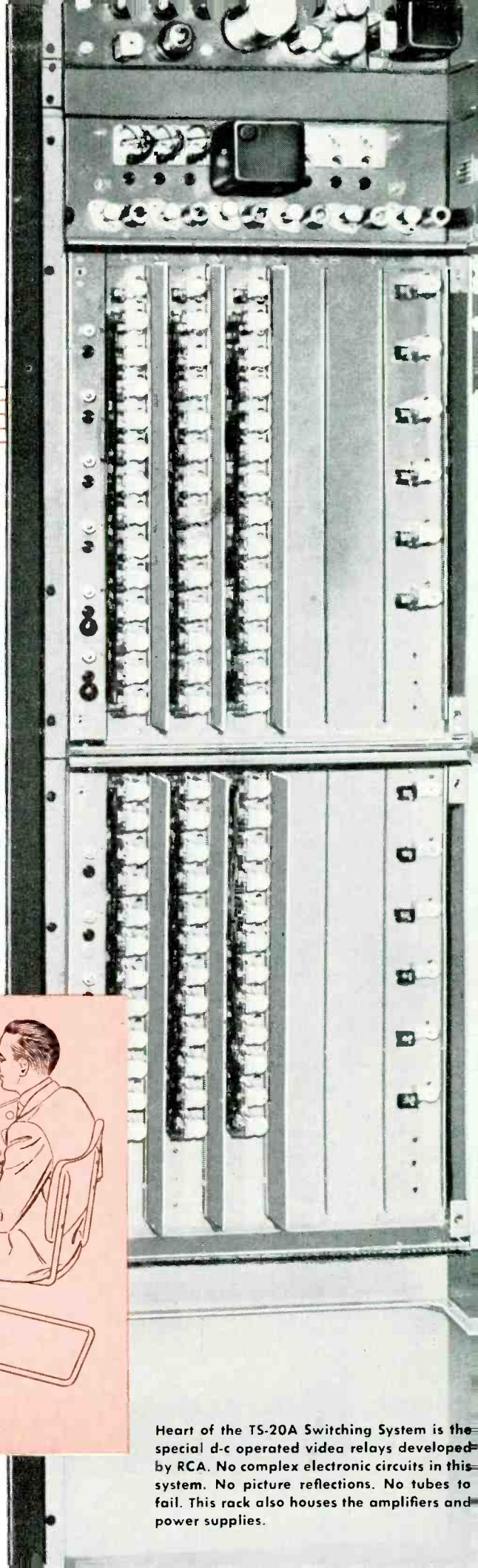
• • •

For long-range planning of your TV programming facilities, overlook none of the advantages of this revolutionary new relay switching system. Ask your RCA Broadcast Sales Engineer about it. Or write Dept. 87 D, RCA Engineering Products, Camden, N. J.

RCA'S TS-20A SYSTEM.



3. A more elaborate master control room set-up than shown in No. 1. Switches any of 12 inputs to any of 5 outgoing lines. Includes preview and line monitoring.



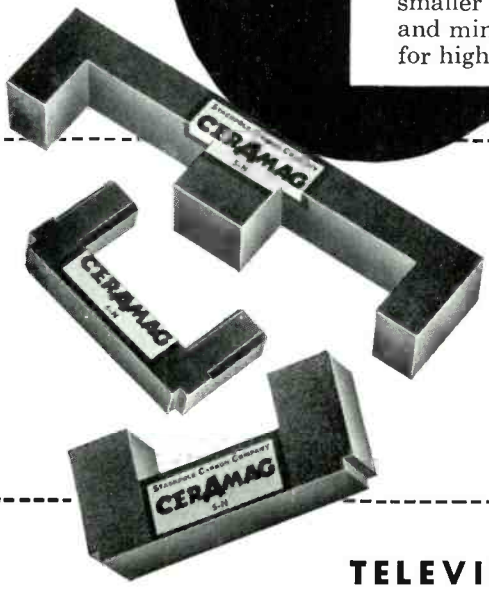
Heart of the TS-20A Switching System is the special d-c operated video relays developed by RCA. No complex electronic circuits in this system. No picture reflections. No tubes to fail. This rack also houses the amplifiers and power supplies.

SEGMENTED DEFLECTION YOKE CORES

This popular 4-segment design is highly efficient. It is easy to handle in TV production work and assures a minimum of breakage. 2-segment types are also available.

STACKPOLE Ceramag® ... THE CERAMIC CORES THAT SET THE QUALITY STANDARDS

The tremendous advance in the use of metallic oxide (non-metallic) cores has been due in large part to Stackpole powder molding experience which paved the way to fully dependable units in production quantities. Stackpole Ceramag Cores assure lower losses with higher operating efficiency, lower operating temperatures, lighter weight, smaller sizes, maximum permeability, less corona effect and minimum cost. Ceramag cores are made in two grades for high and low flux densities.



"U" and "E" CORES FOR FLYBACK TRANSFORMERS

Permeability of these Stackpole Ceramag Cores is of the order of 10 to 1 by comparison with conventional iron cores. They are materially smaller, have higher resistance and operate much cooler due to the absence of eddy current losses. Many special types are regularly produced.

TELEVISION IMAGE W-I-D-T-H CONTROL TYPES

These Stackpole Ceramag Cores assure remarkably higher standards of efficiency for TV horizontal image deflection circuits. In areas where there is a low line voltage, they give ratios of from 1 to 8 or more compared with 1-5 for previous high permeability types.

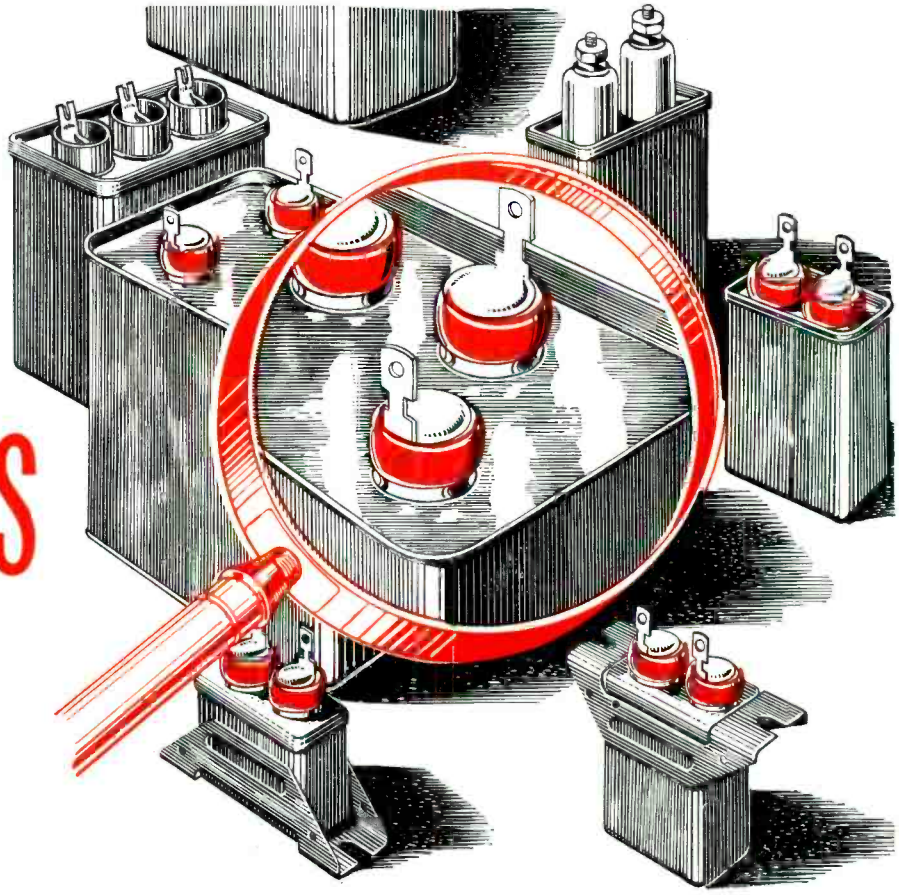
Electronic Components Division

STACKPOLE CARBON COMPANY, St. Marys, Pa.

HPB-617

Capacitors

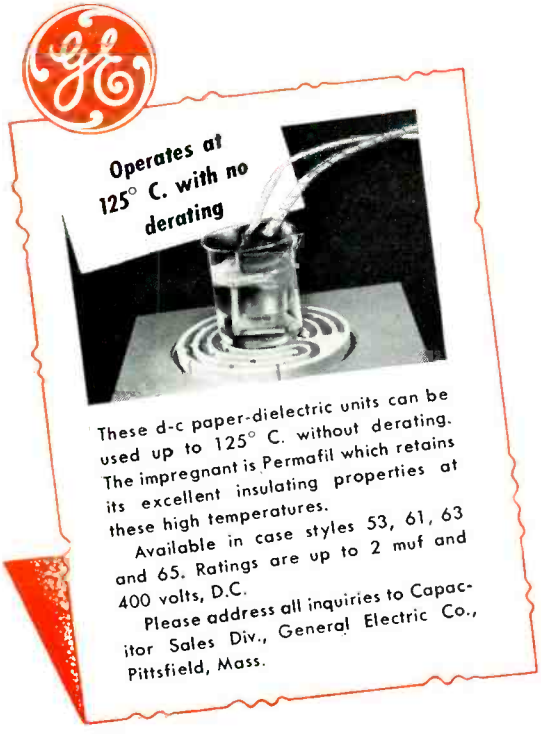
sealed for Life with G-E silicone rubber



SILICONE—the amazing new synthetic that made headlines when General Electric brought it out—is back in the news again. For today, G-E small capacitors, up through 5000 volts, are hermetically sealed with G-E silicone rubber bushings or gaskets.

This means that your new G-E capacitor is sealed positively, permanently—for maximum life. For silicone seals by compression alone, without the use of adhesives. It will never shrink, loosen or pull away—it remains elastic at any operating temperature a capacitor will ever meet. It is impervious to oils, alkalies and acids. Its dielectric strength is permanently high and it is not easily damaged during installation for it has a flexibility that withstands mechanical and thermal shock.

This exclusive G-E feature—designed to surpass established installation requirements—makes General Electric capacitors finer and more dependable than ever before. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



These d-c paper-dielectric units can be used up to 125° C. without derating. The impregnant is Permafil which retains its excellent insulating properties at these high temperatures.

Available in case styles 53, 61, 63 and 65. Ratings are up to 2 muf and 400 volts, D.C.

Please address all inquiries to Capacitor Sales Div., General Electric Co., Pittsfield, Mass.

Silicone-rubber bushings, permanently elastic and formed to close tolerances, seal themselves by compression to the capacitor cover. They are used with capacitors 1500-v d-c, or 660-v a-c, and lower. Silicone rubber gaskets with plastic or porcelain stand-offs are used for higher voltages.

GENERAL ELECTRIC

407-172

SYLVANIA TV Picture Tubes are natural-born leaders because . . . they come from a leading family

This unique combination of experience naturally fits Sylvania for top position in the TV Picture Tube field.

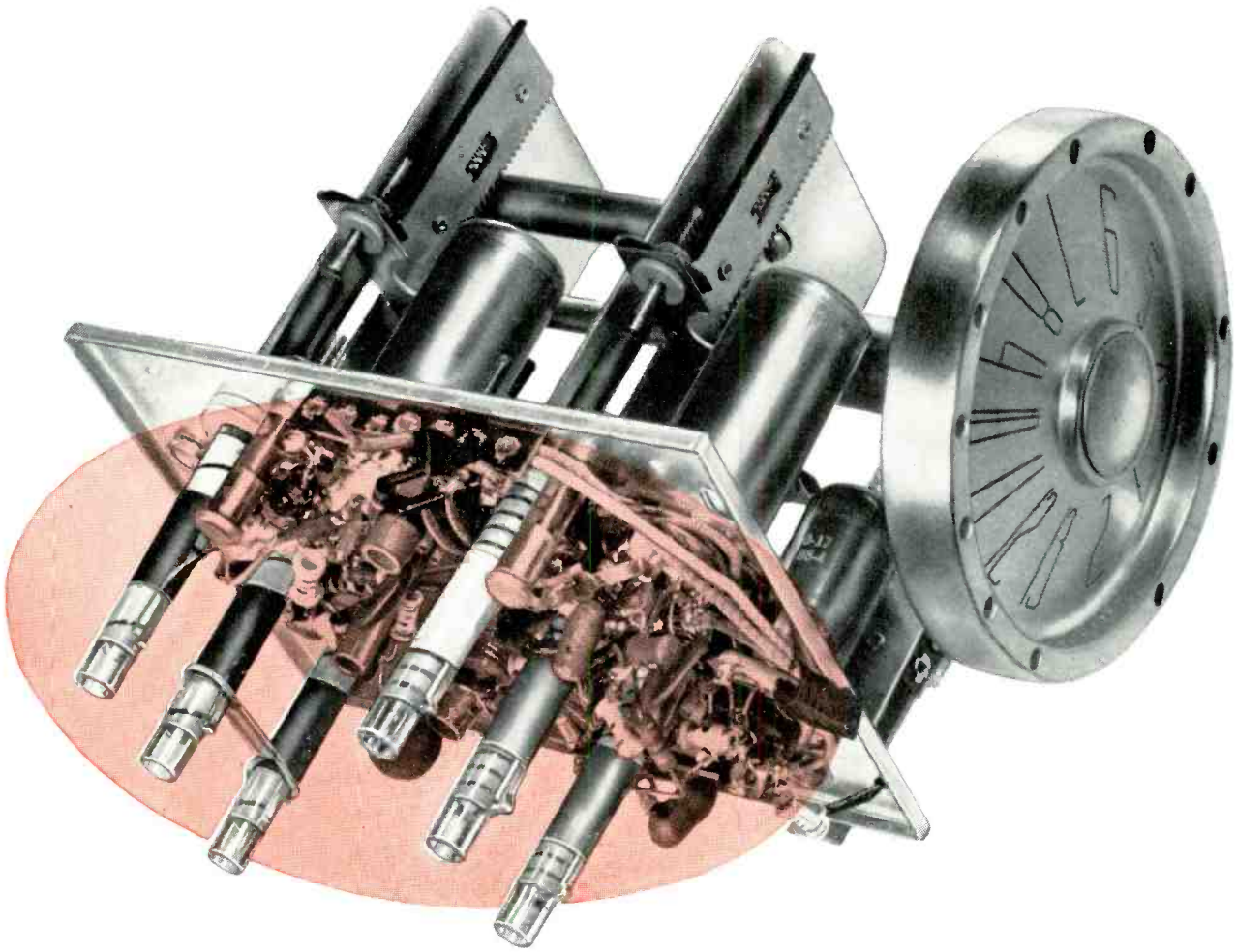
Maintaining this leadership is a continuing program of research and engineering. A Sylvania engineer, for example, invented the famous "Ion Trap," now licensed to numerous other picture tube makers.

Sylvania achievements in fluorescent powders, tungsten wire, and precision parts are some of the other reasons which lie behind the consistent color, greater clarity, and longer life of all Sylvania TV Picture Tubes.

Backing up each Sylvania advance is a rigid system of quality control . . . of checking and rechecking every step of every process . . . so that TV set owners everywhere will continue to look to Sylvania for the finest performance possible. New booklet gives information concerning the complete line of Sylvania Picture Tubes. Write for your copy today. Address Sylvania Electric Products Inc., Dept. R-2412, Emporium, Pa.

SYLVANIA ELECTRIC

TELEVISION PICTURE TUBES; RADIO TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT, FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES, LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS



WHY A LEADING TELEVISION MANUFACTURER SPECIFIES CORNING METALLIZED GLASS INDUCTANCES

In high frequency tuning applications, stability is extremely important, both for ease of alignment and customer satisfaction. That is one of the reasons why the Stromberg-Carlson Company specifies Corning Metallized Glass Inductances. With Corning Inductances drift is negligible even under unusually variable ambient temperatures. Why? Because the integral contact of the fired-on metallizing with the dimensionally stable glass coil forms results in high temperature stability. High Q is inherent.

The inductance characteristics of the coils cannot be changed by rough handling or vibration. This is because the integral contact between the fired-on metallizing and the glass coil form eliminates voids between conductor and form. When used with powdered iron cores, the accuracy and rigidity of the glass insures stable, noiseless tuning.

Corning Inductances of any given type can be accurately duplicated in quantity on a production basis. That means no assembly time wasted on coil adjustments. They are easily installed by conventional methods and can be supplied with terminals or solder spots as required.

Design versatility is another characteristic of Corning Inductances. They can be manufactured to the most exacting specifications in uniform, variable or double pitch windings. Fixed tuned, permeability tuned or permeability tuned inductance-trimmer combinations are available with standard cores and fittings. Let Corning help you increase performance at lower costs. Our engineers will be glad to discuss your inductance problems with you.

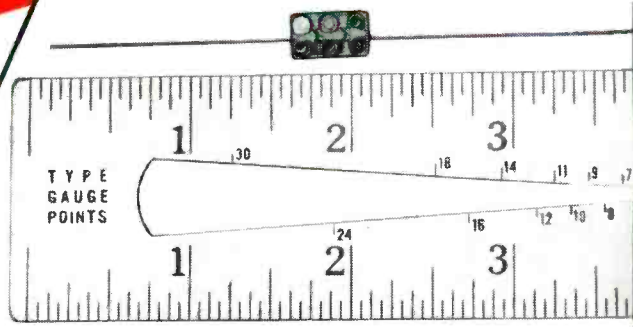
CORNING GLASS WORKS
ELECTRONIC SALES DEPARTMENT

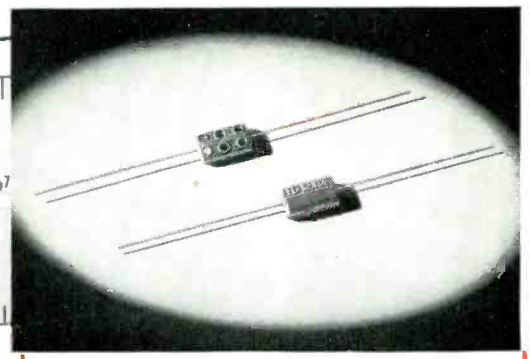
PYREX REG. U.S. PAT. OFF.

CORNING, N. Y.
Corning means research in Glass

METALLIZED GLASSWARE: INDUCTANCES • CAPACITORS • BUSHINGS • ALSO A COMPLETE LINE OF TELEVISION TUBE BLANKS

Performance PROTECTION





EL-MENCO CAPACITORS

Small, high-capacity fixed mica El-Menco capacitors are made to protect the performance of your products under severest operating conditions. They give long, dependable service because they must meet exacting conditions of Quality Test *before* they can be incorporated in your product. Tested at double their working voltage for dielectric strength, for insulation resistance and capacity value, El-Menco condensers can be depended upon for the utmost in performance protection.

CM-15

Actual Size 9/32" x 1/2" x 3/16"
For Television, Radio and other Electronic Applications.
2 mmf. — 420 mmf. cap. at 500v DCw.
2 mmf. — 525 mmf. cap. at 300v DCw.
Temp. Co-efficient 50 parts per million per degree C for most capacity values.
6-dot Color Coded.

SPECIFY EL-MENCO —

First Choice For Long Life and Dependability

THE ELECTRO MOTIVE MFG. CO., Inc.
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Write on your firm letterhead for Catalog and Samples.

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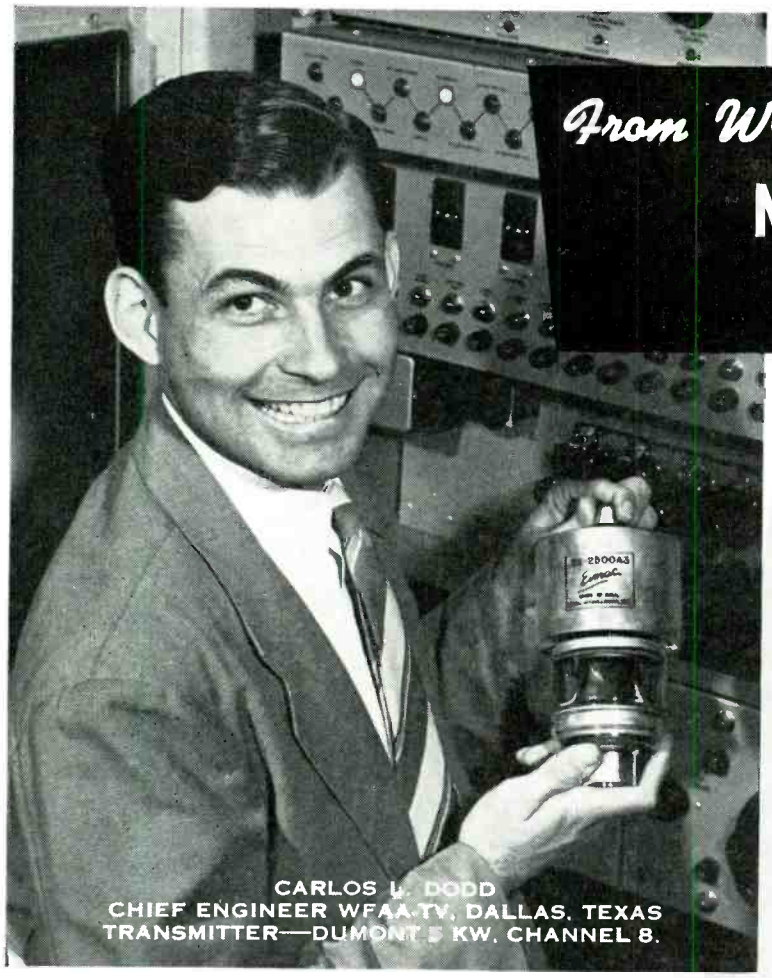
ARCO ELECTRONICS, INC. 103 Lafayette St., New York, N. Y. —Sole Agent for Jobbers and Distributors in U.S. and Canada

From WFAA-TV, More Proven Performance of the Eimac 3X2500A3



Station WFAA

RADIO SERVICE OF THE DALLAS MORNING NEWS

September 18, 1950

Eitel-McCullough, Inc.
San Bruno, California

Gentlemen:

I thought you might be interested in knowing that we are using EIMAC 3X2500A3 tubes in the finals of our high channel TV transmittor and we are very happy with their performance. In fact, we have yet to experience a tube failure since we went on the air. Tube cost is low and maintenance problems are minimized when using this dependable air cooled tube.

It is a pleasure for me to recommend your fine product.

Sincerely yours,
Carlos L. Dodd
Carlos L. Dodd,
Chief Engineer
WFAA-TV

The Eimac 3X2500A3 is one of the outstanding vacuum tube developments made during recent years. Consistent performance, long life, and low cost account for its filling the key socket positions in many important recently designed equipments.

The 3X2500A3 is a compact, air-cooled triode. Its coaxial construction results in minimum lead inductance, excellent circuit isolation, and convenience of use with coaxial plate and filament tank circuits. For AM service it is FCC rated for 5000 watts per tube as a high-level modulated amplifier. It has comparatively low plate-resistance, high transconductance, and will provide effective performance over a wide range of plate voltages at frequencies extending well into the VHF.

Reports from many engineers, like Mr. Dodd of WFAA-TV, confirm the outstanding transmitter performance, simplified maintenance, and low tube replacement cost made possible through the use of the Eimac 3X2500A3. Consider this unequalled triode for your applications . . . complete data are free for the asking.

Eimac 3X2500A3

GENERAL CHARACTERISTICS

ELECTRICAL	
Filament: Thoriated tungsten	
Voltage	7.5 volts
Current	48 amperes
Maximum starting current	100 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	20 uufd
Grid-Filament	48 uufd
Plate-Filament	1.2 uufd
Transconductance (i_b = 830 ma., E_b = 3000 v.)	20,000 umhos
MECHANICAL	
Cooling	Forced air
Maximum Overall Dimensions:	
Length	9.0 inches
Diameter	4.25 inches
Net Weight	5.8 pounds

RADIO FREQUENCY POWER AMPLIFIER
Ground-Grid Circuit
Class-C FM Telephony
TYPICAL OPERATION (110 Mc., per tube)

D-C Plate Voltage	3700	4000 volts
D-C Grid Voltage	—450	—550 volts
D-C Plate Current	1.8	1.85 amps.
D-C Grid Current	225	275 ma.
Driving Power (Approx.)	1600	1900 watts
Useful Power Output	6850	7500 watts

*COMPLETE DATA AVAILABLE FREE

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

Export Agents: Frazar & Hansen, 301 Clay St., San Francisco, California

Follow the Leaders to Eimac TUBES The Power for R-F

the 3X2500A3 is another Eimac contribution to electronic progress.

269

IT'S A TAPE RECORDER

IT'S A DISC RECORDER

It's *GENERAL INDUSTRIES'* latest sound reproduction triumph

MODEL 250

TAPE-DISC RECORDER ASSEMBLY

***Records on Tape**

*** Records on discs**

*** Plays back both**

*** Plays any 78 R. P. M. Record**

(*) When connected with the proper amplifier.

Here's a fast-moving money-maker that's loaded with all the features a home-recording enthusiast could ask for. It records on tape or disc . . . records from tape to disc or disc to tape . . . makes possible a solid hour of selected uninterrupted entertainment.

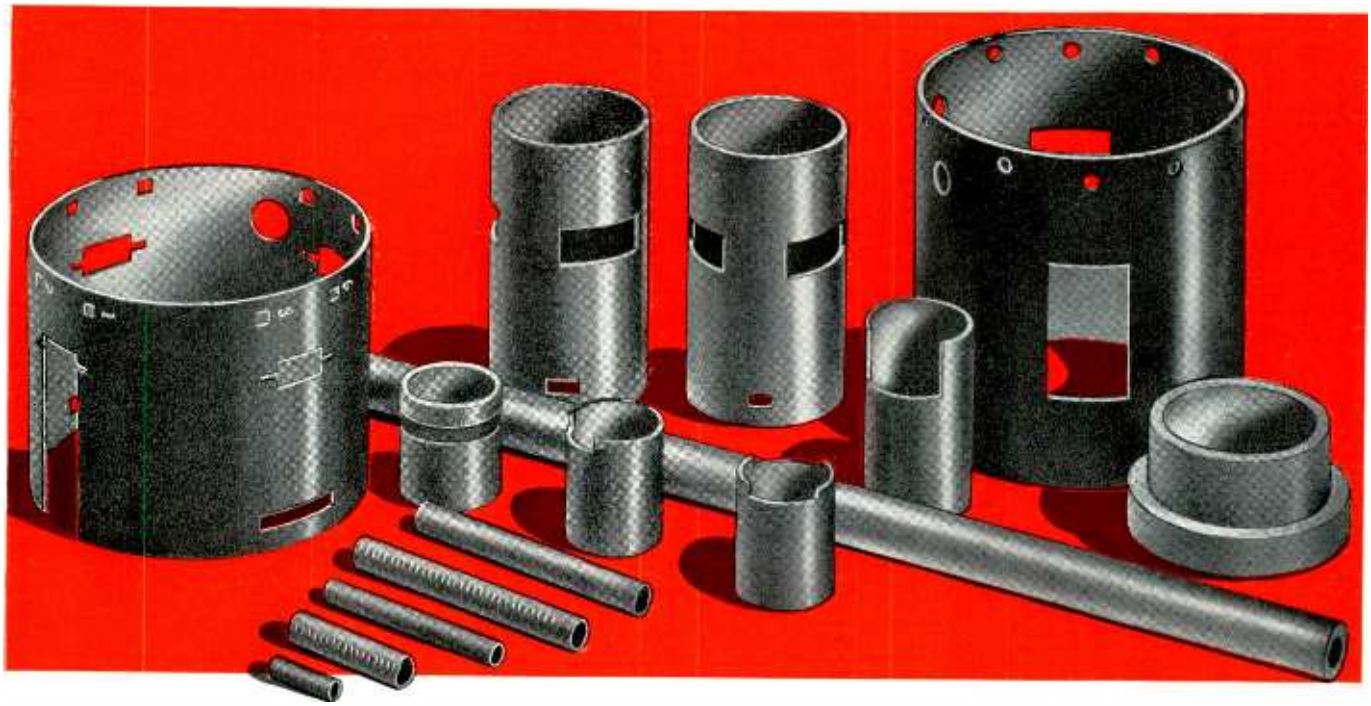
Representing years of development by General Industries—oldest name in the phonomotor field—the Model 250 contains many design innovations, including foolproof operating features that anyone can understand.

Comprehensive, easy-to-understand service manual is included with each Model 250 unit. Included in manual is a suggested amplifier circuit as well as a complete amplifier parts list.

New catalog sheet, describing all of the Model 250 recording and playback features will be sent upon request. Write for your copy *today*.

The GENERAL INDUSTRIES Co.

DEPARTMENT L • ELYRIA, OHIO



MANY MANUFACTURERS of ELECTRICAL EQUIPMENT are finding our CLEVELITE* and COSMALITE* . . . spirally laminated paper base phenolic tubing meets their most exacting requirements.

Available in diameters, wall thicknesses and lengths to meet endless adaptations.

What are your requirements?

*TRADE MARKS

Cleveland

PHENOLIC TUBES

are the first choice of the Radio and Television Industries! For example, CLEVELITE* is the proper choice for Fly-back and High Voltage Transformers.

It insures perfect satisfaction.

Furthermore, CLEVELITE'S high dielectric strength . . . low moisture absorption . . . strength, low loss and good machineability meet widely varied requirements and give fine performance.

PROMPT DELIVERIES are available through our large production capacity.

Inquiries invited . . . Samples gladly sent.

The CLEVELAND CONTAINER Co.
6201 BARBERTON AVE. CLEVELAND 2, OHIO

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CANADIAN PLANT: The Cleveland Container, Canada, Ltd., Prescott, Ontario

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TELE-TECH
Formerly ELECTRONIC INDUSTRIES
TELEVISION • TELECOMMUNICATIONS • RADIO

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

The Voters and FCC's Color-TV Order

(An Open Letter to the Members of Congress)

Dear Congressman:

When the people back in your home-state comprehend the way they have been personally mulcted by the October 10 color-television order of the FCC, an uproar is going to be heard all across the U.S.A. And Washington will be called to account, in view of this outrage against the public interest.

Just to give you the background, so you will be prepared when the blast from your constituents starts pouring in on you, here's the low-down:

Despite the fact that good color-television systems are already well developed and will soon be available—systems which will deliver a good black-white picture to each of the ten million television sets now in use by the public—the FCC has ruled these improved systems "out", and instead has ordered into operation an archaic mechanical system which—

Will not produce any picture whatever on the 10,000,000 sets now in use (and the many millions to be built) without an expenditure by each owner of $30 to $130 for an "adapter". This "adapter" will bring in only a black-and-white picture when a color picture is being broadcast.

Useless Expense of $100 to $250

Then *to receive color-pictures*, each owner (after he has made above outlay for the adapter) will *have to spend another $75 to $125* for a color-wheel "converter"! But these color-wheel converters will work only on the small picture-sizes, up to 10 to 12 inches, now *obsolete*. (In fact, 87% of the picture-tubes made this month are 16 inches and larger! And manufacturers are now tooling up for 21-inch and 24-inch picture sizes.) The result of the public's demand for larger picture sizes will mean that one-half to four-fifths of all TV-set owners will never be able to get color-pictures with the present authorized CBS system.

And the few set-owners who do make the above double outlays of $100 to $250 for "adapters" and "converters", will receive only a *small* color picture of *degraded quality*, subject to *"rainbow" color fringes* trailing moving white objects.

In the "public interest"—the consumer's interest—which the Radio Law requires the FCC to protect, the present absurd color-television order should be immediately rescinded, and color-TV proceedings postponed until a color system can be adopted which will *bring satisfactory pictures to all the millions of TV sets now in use, without any change or additional expense* whatever.

Independent Television Experts Oppose CBS System

Nearly every qualified television engineer and television authority (outside of CBS) agrees with this view. The television industry almost unitedly supports this position.

FCC Engineer-Commissioner George Sterling and Lawyer-Commissioner Frieda Hennock dissented and voted against the ruling by their associate commissioners. And many of the Commission's own technical staff have themselves privately expressed their violent disagreement with the absurd situation set up by the non-technical majority of the Commission.

I urge that you bring your influence to bear to *delay the present FCC color-TV ruling* until the recommendations of a competent committee of radio scientists, such as the President's Communications Policy Board, the Condon Committee, or other qualified, disinterested group, can be obtained—this in the interest of your constituents and the great services which unfettered television can in future bring them.

Respectfully,

ORESTES H. CALDWELL
Editor of Caldwell-Clements magazines,
TELE-TECH and RADIO & TELEVISION RETAILING
Former Federal Radio Commissioner
Fellow, Institute of Radio Engineers; AIEE.
First Vice-president Radio Pioneers

The RADARSCOPE

Revealing at a Glance

MOBILE

RADIO HAS TAKEN TO THE ROAD in many forms. Railroads, trucks, private planes, autos, boats, tugs, even fishermen, have discovered radio's great usefulness and the additional safety it offers. The Rock Island Railroad was the first to use microwaves for communication purposes. Now the Erie is planning its use over a twenty-mile stretch to eliminate wire costs and maintenance. The latter road already has the most extensive VHF installation in the country. In 1951 many more organizations will discover radio and turn to it. Doctors in New York now have more free time since they can carry a miniature receiver and be paged instead of having to stay near a telephone. Fishermen use it to tell others of good fishing spots. The National Mobile Radio Service has a large interconnected network whereby any subscriber can be contacted over a distance of up to 1000 miles. In 1951 watch for three major railroads to turn to radio—probably microwaves.

AVIATION

THIS YEAR HAS SEEN a great increase in the number of ILS and GCS installations in airfields in the United States. However, in 1951 it is expected that the first real application of the DME (distance measuring equipment) principles will be made. The use of DME plus the Offset Course Computer will become more and more necessary as we gear up more rapidly for war. Then, more than ever, will all-weather flying become essential. The latest idea in aeronavigation is the little black-box which takes all the information sources in the aircraft such as outside temperature, airspeed, altitude, etc. and plots for the pilot/navigator his true course and true airspeed, thus relieving the navigator of the need to keep watching these routine instruments. A similar black-box was developed by the RAF toward the end of World War II, but on a less ambitious scale.

First short-wave message across Atlantic was transmitted from 230-meter 990-watt station near this site in Greenwich, Conn., December 12, 1921, and received at Ardrossan, Scotland, by Paul Godley (left). Dr. E. H. Armstrong (second left), designed the transmitter, others of the original station crew being George Burghard (third left), and E. V. Amy (extreme right). Others are Mayor Peck of Greenwich, and O. H. Caldwell, editorial director of TELE-TECH, who spoke at the Oct. 21 ceremonies dedicating this granite marker.

PROPAGATION

THE OLD ARGUMENT of VHF versus UHF for television is again making headlines in engineering circles. Current FCC hearings are bringing out the fact that UHF propagation is NOT as good as VHF, and is not as good as the FCC's advisors would have the industry believe. The progenitors of the most comprehensive UHF tests made so far—NBC—attest that coverage via UHF is not good, except at short range. Shades of the FM controversy of 1945! If television is pushed up to UHF the results will be even worse than they were with FM! Now is the time for strong efforts to extend the VHF band for television, along the lines TELE-TECH has been advocating.

COLOR-TV

DOT VS FIELD SEQUENTIAL QUALITY—In the October issue of TELE-TECH on page 27, in connection with the FCC Report on Color TV there appears the statement: "They (capable television engineers) have testified under oath that Dot Sequential standards can produce better performance than Field Sequential standards. Some have proven this in their laboratories."

CBS questions this statement.

We are glad to cite the facts upon which it was made. During the FCC color hearing a number of capable television engineers were on the witness stand. After eliminating the engineers employed by either RCA or CBS as possibly biased, there come to mind, without searching the 10,000-page record, the names of Dr. Baker (RTMA and GE), David B. Smith (RTMA and Philco) and Jensen (BTL) as to comparative resolution. The substance of the testimony of these, and other engineers, was that the Field Sequential system, under the practical limitations of a 6-mc channel, produced an inferior picture compared to that which could be produced under the same limitations by the Dot Sequential system.

To be specific as to the exact statement we refer to the conclusions of the engineers composing JTAC, who presented testimony in which the two systems were compared and as to picture quality CBS was marked "Inferior". This is given in tabular form in TELE-TECH for March 1950 on page 39.

Regarding the proof of superiority of the Dot Sequential system in the laboratories, only three laboratories, as far as we know, have gone through the development work necessary to demonstrate the Dot Sequential system, (although it is possible that CBS, in using horizontal dot interlace should be counted as a fourth laboratory). The earlier laboratories to use this method of securing the maximum resolution in a given bandwidth were: RCA and Philco, followed by Hazeltine. All three agree that the Dot Sequential system produces the better performance.

MANUFACTURERS

SOME CRITICS have questioned whether the TV makers "really want compatibility". The answer is that the manufacturers are almost unanimous in resisting a non-compatible system.

It would be very easy for the manufacturers to sit back comfortably and approve the adoption of the inadequate CBS color system. In fact, it would be more than easy because the result of such an attitude would mean greatly increased sales volume for all manufacturers who could load the public with converters and adapters and unsatisfactory color receivers, and then later, after a satisfactory color system has been developed, sell them new equipment all over again.

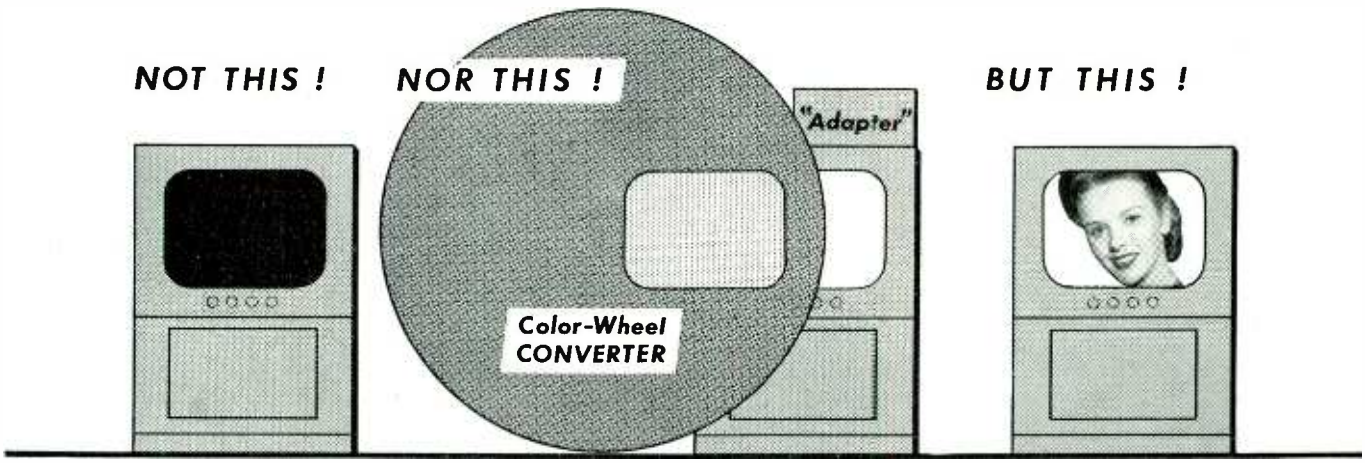
Don't forget that this happened once before, although on a limited scale, when, twenty years ago, hundreds of people paid high prices for television receivers that depended upon a revolving disc to reproduce black-white pictures. Those receivers became useless junk with the development of a fully electronic system, and if any of their owners want to see today's black-white television they need new sets.

Instead of taking this easy way of acquiescence that would lead to double sales, the television manufacturers are fighting for the best interests of the public. They are trying to make sure that when color comes, it will be a system that will preserve the investment of the public in existing black-white receivers without putting them to additional expense, and that will insure continued useful life and value in the color receivers they ultimately purchase.

SERENDIPITY*

AL SMITH'S GIFT TO TV—Readers studying our November cover and news report on the new 215-ft. Empire State tower extension, have wondered how the original 1251-ft. structure ever happened to comprise steelwork strong enough to carry the recent 50-ton afterthought. It came about this way: When the great 102-story structure was being planned, back in the late 1920s, there was talk of a competing superskyscraper being erected nearby. Whereupon the Empire State Building chief, ex-Gov. Al Smith, rushed to Washington and offered his tower as a "mooring mast" for the great Army dirigibles then at peak of their development. Accepting the offer, the Army declared a restricted National Defense area thereabouts, forbidding any lofty structures within a mile or two radius. The tower was then completed in good faith as a mooring mast, with extra steelwork designed to withstand a lateral force of 100,000 pounds. No dirigible was ever moored to the great mast, but its steel superstructure now provides a wide margin of safety to meet the most severe buffeting the great new TV extension will ever get from wind or weather.

* A word long in the dictionary, but recently exhumed and presented before radio-engineer audiences by GE's popular pioneer electronic investigator W. C. ("Bill") White. "Serendipity" means: "The ability of finding valuable things or producing valuable results unintentionally or unexpectedly".

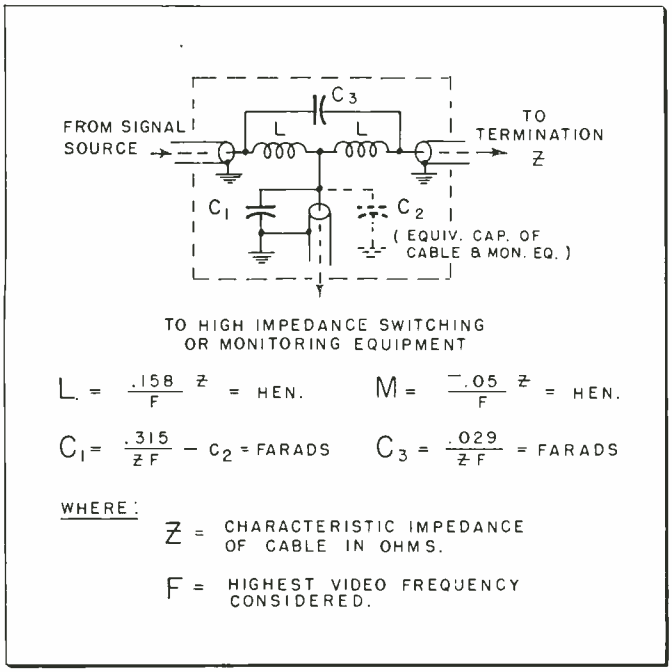


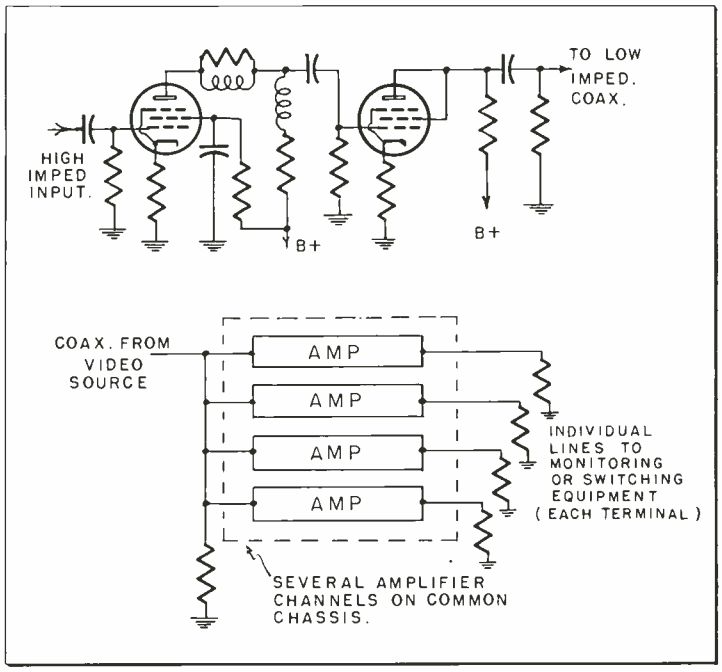
The public's present ten million TV sets — blind and pictureless when tuned to FCC-CBS color-TV programs

Comparatively few owners will add this mechanical monstrosity ("Adapter" and "Converter" needed to see in colors the few, limited, off-hour FCC-CBS color-TV programs)

Present ten million sets could right now get good black-white pictures from color programs if a compatible system were used, as TV industry demands

With compatible color programs, as TV industry recommends at right, most of present ten million sets could later also be converted to receive good color pictures, without change in external appearance





A New Video Distribution

Parallel pad isolation provides advantages of present methods while improving flexibility and economy of operation

WITH the trend toward greater facility flexibility, the layout of a modern television broadcasting station requires an extensive amount of video distribution equipment to feed picture signals to various switching and monitoring positions. It is the purpose of this article to review briefly the various types of video distribution equipments now in common use and to describe a new and improved system recently put into practice at WMAL-TV.

At the present time only two methods of video distribution are in extensive use. These shown in Figure 1 and Figure 2 are the "bridged-tee" and "parallel amplifier" arrangements, respectively.

The "bridged-tee" system employs a constant resistance network utilizing negative mutual inductance and provides a means of feeding one or more high-impedance low-capacity inputs from a low impedance video bus. Properly proportioned it is capable of giving zero attenuation and linear phase shift over the normal video range. In practice considerable care must be taken to limit the total shunt capacity on the bridging line to something in the neighborhood of 150 to 200 mmfd. This imposes a severe limitation on the distance of separation between the bridged-tee network and the switching or monitoring equipment it is to feed.

Furthermore, this system must be designed and adjusted for a particular cable set-up. It is not possible to change lengths of lines feeding the various switching and monitoring units without appropriate adjustment of the networks. In addition to this limitation on equipment flexibility, accidental shorting or opening of the bridging line will cause serious changes in level as well as upset the frequency response of the main video line. For this reason the "bridged-tee" type of video distribution system is best suited to certain specific applications where the separation between equipments is a few feet.

"Parallel Amplifier" System

The generally employed method of distributing video to a number of widely separated points is by means of the "parallel amplifier" scheme. However, this is not without its limitations. A typical commercial unit of this type has an input impedance of 560,000 ohms dc resistance shunted by approximately 60 mmfd. If it is desired to feed signal to four or five locations it is necessary to shunt the inputs of the individual amplifiers across the video line, terminating the input to the final amplifier. However, if more than three or four channels are connected in parallel, the cumulative effects of shunting the additional loads on the main video line becomes detectable as degradation of the picture. This situation becomes particularly aggravated if the parallel bridging amplifiers are separated from the point of final circuit termination. A second limitation of this equipment is the fact that the commercially obtainable units of this type generally have an output impedance of several thousand ohms even though they are designed to work into a 75 ohm load.

In general it will be found that no video line is perfectly terminated at all frequencies and some high frequency energy may be reflected back toward the input of the line. If the line is not fed from a source that approximately matches the characteristic impedance of the cable, this reflected energy is not absorbed but is largely re-directed toward the receiving end of the coax. It is for this reason that the common "par-

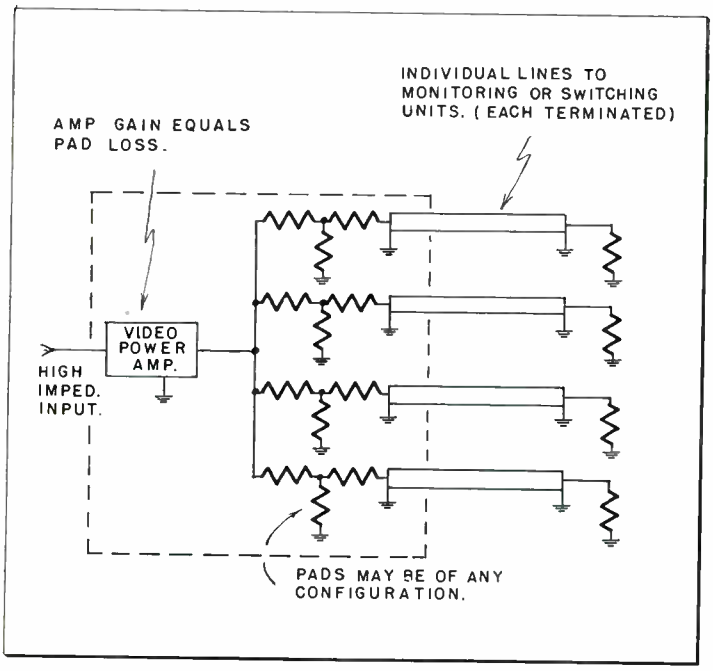


Fig. 1: (left) Bridged-tee distribution system — limited flexibility

Fig. 2: (center) Parallel amplifier distribution with one unit for each line is expensive and cumbersome

Fig. 3: (right) Parallel pads operated from one amplifier are economical and flexible

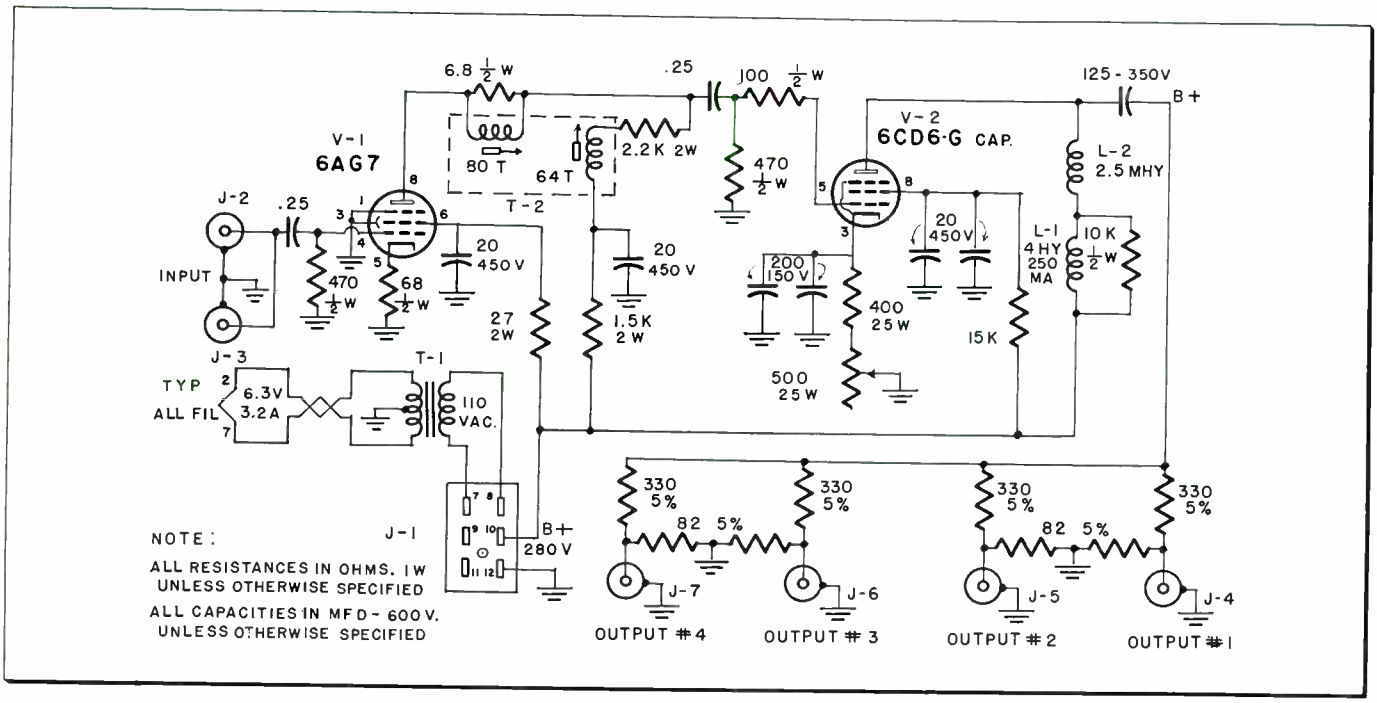
System

By EARL D. HILBURN, Assistant Chief Engineer, WMAL-TV, AM, and FM, Washington, D. C.

allel amplifier" type of distribution amplifier is prone to produce close-spaced reflections on long video runs. Of course, the cure for this difficulty is to place a termination at each end of the line. This absorbs the reflection, but drops the gain of the amplifier 50% by effectively working it into a load impedance of only 37.5 ohms. The reduction in gain is overcome by paralleling two channels of amplification and working the two into the doubly terminated line. However, this multiplies the equipment requirements, as well as contributes to further deterioration of the picture (due to the previously mentioned shunt loading of multi-channel circuits).

To handle the video distribution problem without the disadvantages of the conventional systems, the WMAL-TV Engineering Department worked for close to a year on a slightly different type of video distribution system. The approach to this problem is to employ a single amplifier to feed a parallel pad arrangement (see Figure 3). Assuming for the moment that the amplifier has sufficient gain to overcome the loss through the pad, the distribution system will have unity gain. The isolation between channels will be approximately equal to twice the voltage attenuation in db of a single pad. (A disturbance at the end of one line must pass through two pads in series to reach the far end of any other video circuit.) The actual isolation is somewhat greater than this, as the parallel pad arrangement resolves itself into a ladder network when considered from one output to any other pad output. The central shunt leg of the network is represented by the parallel impedance of the remaining pads. It is to be realized of course that this "pad isolated" single amplifier system does not provide the infinite isolation provided by the

Fig. 4: Original circuit built to test parallel pad output system. Insufficient output was obtained when degeneration, to overcome low frequency discrimination in the output stage, was introduced. This design led to the improved three stage amplifier of Fig. 5



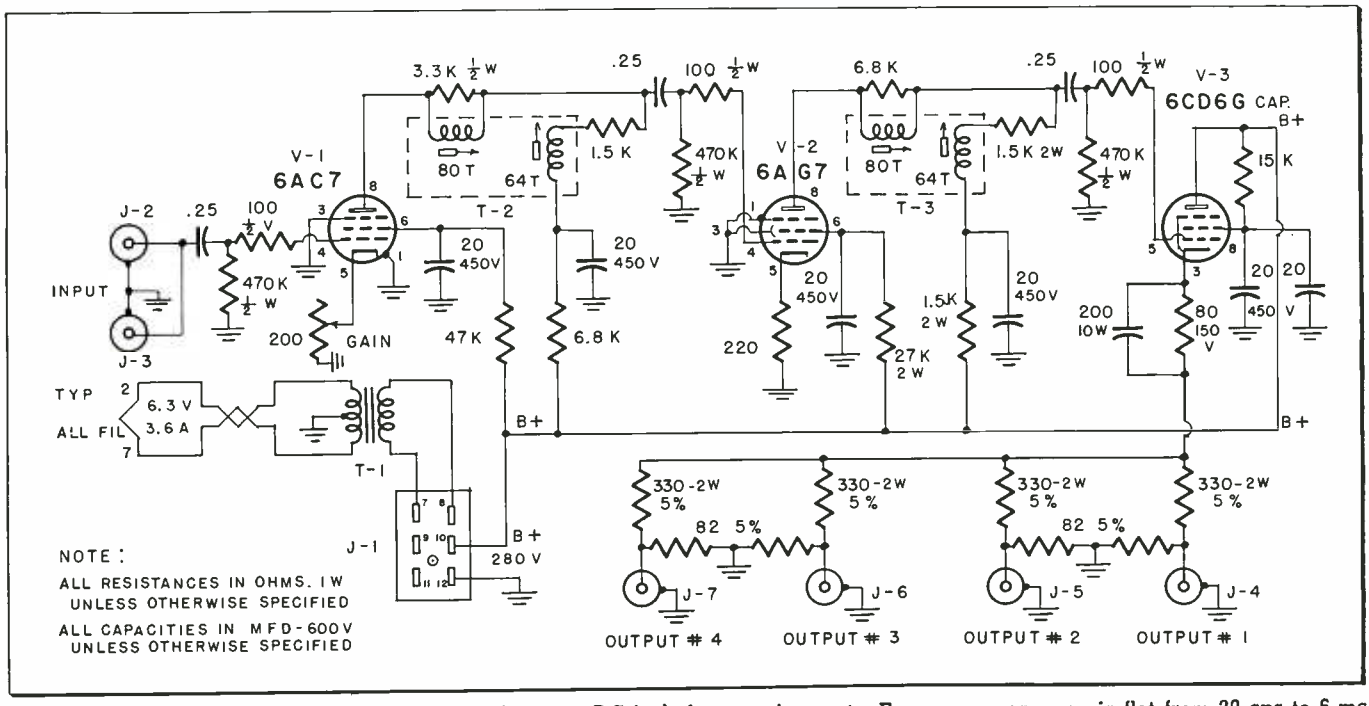


Fig. 5: Final circuit using cathode follower to eliminate DC isolation requirements. Frequency response is flat from 20 cps to 6 mc

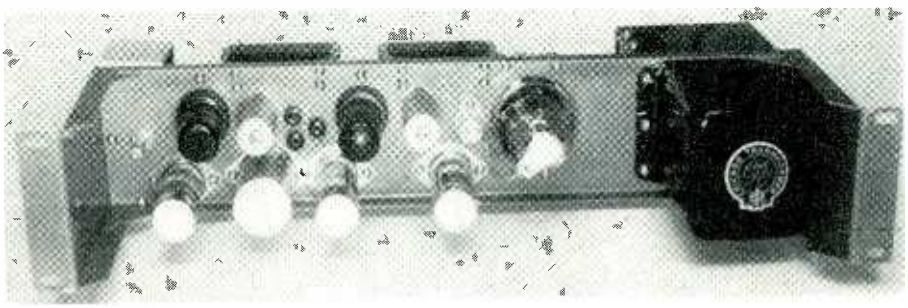
"parallel amplifier" scheme. However, it has been determined that a finite amount of isolation can be achieved that satisfied the practical requirements for most video distribution systems.

This "pad-isolated" distribution system overcomes the major disadvantage of the "parallel amplifier" system. That is to say, a single voltage amplifier may be used to feed a power amplifier driving a number of output circuits. Accordingly, only one bridging input is required which minimizes the reactive loading effects on the video line. Also, the parallel connected pads present a low impedance looking back into the output connections. Thus the design can be handled in such a way that the source impedance of the distribution system closely matches the line and it is not necessary to double-terminate to control reflections on long cable runs. Further practical advantages are provided by this system. Fewer tubes are used (for a given number of output channels) which lessens the likelihood of equipment failure, as well as reduces the operating costs of the system. Also, the amplifier can be constructed on a much smaller chassis thus saving valuable rack space.

In developing this unit, a number of tube types were considered in several circuit arrangements. The major requirement for the output tube is an ability to deliver some 15 to 45 volts peak-to-peak of signal (across the input impedance of the parallel pad combination) with a minimum of drive and with good output waveform. Low-mu power triodes will give good performance in this service but afford something of a bias problem in addition to requiring excessive grid drive. Pentodes in general solve the bias and drive problems presented by the triodes, but it is difficult to select a tube which has good transconductance and high output, and still is very linear over the desired operating swing. The best compromise in this regard seems to be the recently announced 6CD6-G beam power tetrode (primarily intended for use as a horizontal output amplifier in television receiver service). This tube has been used in several circuit arrangements. The two-stage amplifier (shown in Figure 4) was constructed and tested with 4, 5, and 6 output pads. This arrangement provided a close approximation to the desired results. It performed very well in distributing driving pulses, but due to low frequency discrimination in the output coupling network did not meet the specifications in handling blanking or video signals. Degeneration in the output stage rectified this difficulty but left the amplifier without sufficient overall gain. It had been hoped to investigate thoroughly the possibility of using a specially designed video frequency transformer to provide the desired dc isolation and at the same time effect a more favorable impedance match between the pad combination and the plate of the output tube. Preliminary calculations indicated that there was some hope of achieving a satisfactory design by employing a low-capacity toroidal winding on special low-loss high-permeability core material. A sample transformer was constructed using commercially obtainable magnetic ferrite material

(*Continued on page 74*)

Fig. 6: Appearance of the final layout and model as mounted in racks at WMAL-TV



Elargol Low-Cost Printed Circuits

Photographic type printing and fixation by heat and chemical change are used to set circuit connections on plastic

By P. P. HOPF,

Ward, Blenkinsop & Co. Ltd.
6 Henrietta Place, London, Eng.

Part One of Two Parts

WHEN considering printed circuits in the production of electronic apparatus, it is advisable to first list the specific performance requirements for the circuit. This usually influences the choice of both materials and methods. Usually no useful purpose is served by the literal translation of an orthodox circuit into a printed one, so a study of design possibilities must be undertaken. While printed circuitry ultimately leads to results in a finished product comparable with those obtained from orthodox circuits, designs must take into consideration entirely different problems.

Consideration must first be given to suitable materials. A listing of the three main classes of materials on which circuitry can be printed is given in Table I. Then one can list the methods available, and to distinguish between these methods as to suitability for the selected type of chassis material. This has been done in Table II.

In considering the choice of a process the requirements are: that the process must be cheap, must lend itself to mass production at a standard quality which does not vary, must not incur undue inspection costs, and be absolutely stable under climatic and mechanical strain.

TABLE I

CLASS	TYPICAL MATERIALS
I Heat Resistant	Glass, Ceramics, Mica
II Thermo-Set Plastics	Bakelite, Aniline Formaldehyde
III Thermo-Plastics	Plexiglass, Cellulose Acetate
IV Flexible Films	Paper, Fabrics, Polythene Films, Polystyrene Films

TABLE II

PROCESS	RECOMMENDED MATERIALS (TABLE I)
Silk Screen	Class I } (Where flux is
Offset Printing	" I } fired at a temp.
Stencil Spray	" I } around 500°C)
Metal Spraying	" II, III
Die Stamping	" II, III
Etching on Foil	" II, III, IV
Direct Printing	" II, III, IV
Plating	" II, III
Vaporization	" IV
Elargol Printed Circuit	

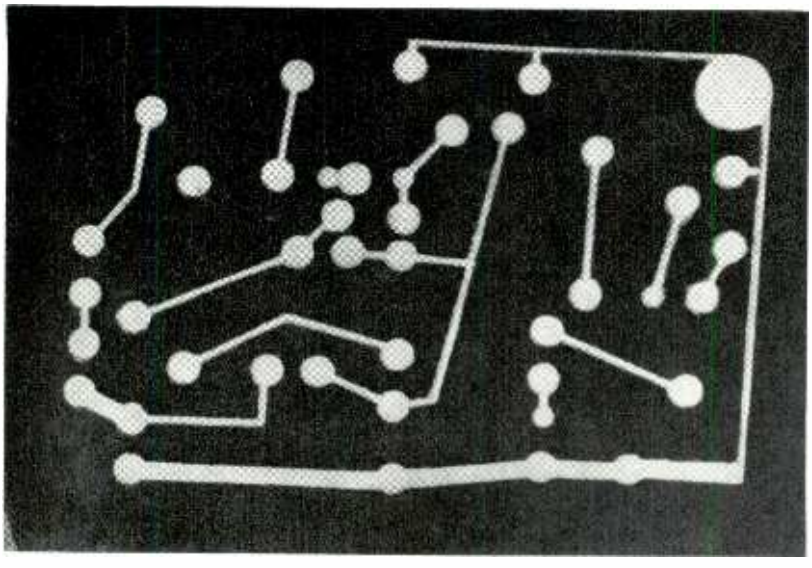
Features to Consider: Insulating Strength; Surface; Resistivity; Dielectric Constant; Loss Factor or Power Factor; and in Certain Cases—Decorative Appearance.

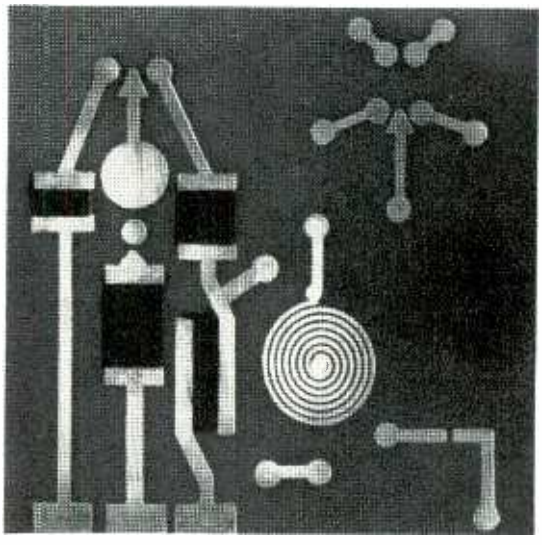
It should also be possible for a designer to try out his ideas on one or two experimental models even though he may never wish to use a particular design on a large scale. Methods that involve the use of expensive tools are therefore unsuitable for development work, if the designer is to have a chance to experiment with printed circuits just as he experiments in orthodox circuitry with mock-up assemblies.

The process must in no way damage the plastic. Plastic materials have narrow limits of specified surface resistance, lamination strength, permitivity, etc. Every printing process involves a handling or processing of the plastic during which certain mechanical or electrical properties may be impaired. This requirement ruled out foil etching techniques in the author's study, as the bonding of the foil to the plastic involves a resurfacing of the plastic, invariably accompanied by loss of dielectric strength. The same conclusions were reached regarding methods involving subsequent electroplating. Also, the conductor must be of known standard conductivity, noise value, etc. and is preferably a chemically pure non-porous uniform layer of metal.

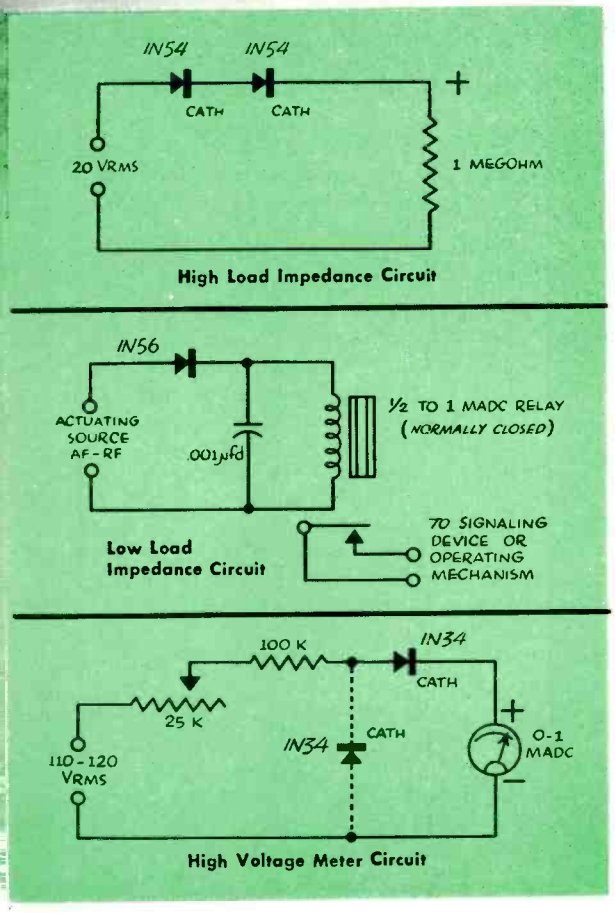
Most methods not involving foil rely on a conducting powder mixed with a binder. While this often

Fig. 1: Printed circuit enlarged nine times showing clean cut edges. Fig. 2: Sample circuits with various components





CY with SYLVANIA Germanium Diodes



HIGH IMPEDANCE LOADS

The higher the value of the load resistance in ordinary series circuits, the more important it is to use a germanium diode with a high reverse resistance, and to use it where its reverse resistance is at a maximum.

In the case of relatively low signal levels it is often possible to increase the level to approximately ten volts. To get the effective signal to the ten volt range in cases where signal levels are 20 volts or more, it is possible to put two or more diodes in series. By splitting up the signal voltage the diodes are then made to present their maximum resistances to the circuit. Because they are in series, the resistances will also be additive, thus producing a composite back resistance which will be relatively high even in comparison with loads in the megohm range. The increased total forward resistance which is produced by the extra few hundred ohms will have no effect because of the high value of load resistance.

LOW IMPEDANCE LOADS

Sometimes it is necessary for a germanium diode to operate into very low impedance loads. They are admirably suited for this kind of work because of their relatively low forward resistance.

Sylvania however, has developed the Type 1N56 which possesses this characteristic to an unusually high degree. This diode has an average resistance of less than 60 ohms with one volt applied across its terminals. Because of this ability to pass heavy currents with relatively low signal voltages, Type 1N56 is especially good for *activating relays, charging condensers, and driving other low impedance networks.*

HIGH VOLTAGE METER CIRCUITS

Once the idea of the relationship between forward and reverse resistances of Germanium Diodes is understood it is possible to devise many interesting special circuits.

A meter circuit constructed from a Germanium Diode, a resistor, and a microammeter or milliammeter movement is a good example. This will work quite well and can easily be calibrated for any combination of components used. The only problem is that in reading ac voltages of more than 60 or 70 volts peak there is a danger that the back voltage limit of the diode will be exceeded with consequent damage to the crystal.

This danger may be eliminated and the useful range of this type of meter circuit increased to many hundred volts, by adding a second diode as shown by the dotted connections. The function of this diode is to by-pass the negative half cycle which might otherwise damage the first diode.

SEND THE COUPON TODAY!

See your Sylvania distributor or send in the coupon for your free copy of our new 8-page Germanium Diode catalog giving information on the entire line of Sylvania Germanium Diodes including both ceramic and glass types and four varistors.

Engineering News Letters are also available giving interesting and valuable information on the following subjects:

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Also available is the book "40 Uses for Germanium Diodes," the most complete collection of Germanium Diode applications ever published. Cost of this book is only $1.00.

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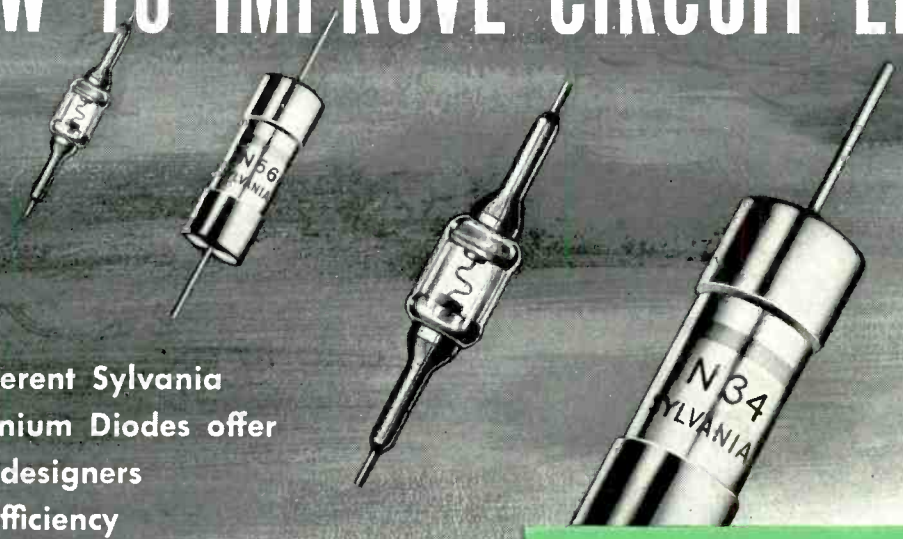
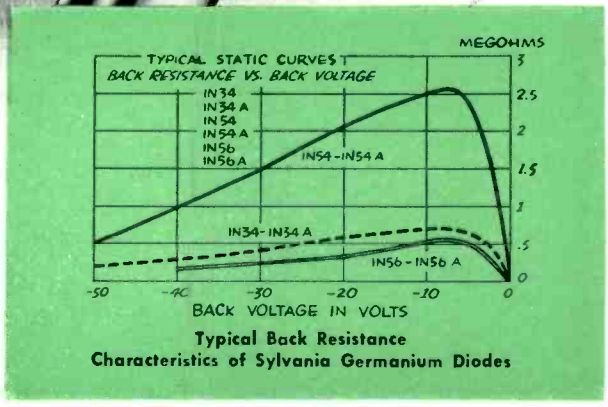
HOW TO IMPROVE CIRCUIT EFFICIEN



19 different Sylvania Germanium Diodes offer circuit designers peak efficiency in special applications.



Typical Back Resistance Characteristics of Sylvania Germanium Diodes

In 1945 the first commercial Germanium Crystal Diode was marketed—the Sylvania 1N34. Intended to serve as a general purpose rectifier, it quickly found its way into hundreds of applications in communications and industrial electronics.

Through the years Sylvania engineers have worked closely with equipment design engineers throughout the electronics industry to:

1. Develop new crystal diodes with special characteristics.
2. Assist in designing circuitry to extract maximum performance from crystal diodes.

Today Sylvania makes more Germanium Crystal Diodes than all other manufacturers combined.

A family of nineteen Sylvania Germanium Diodes stands ready to supply the circuit designer with the very best crystal diode for special applications.

WHICH DIODE FOR WHICH CIRCUIT?

To determine which Sylvania Germanium Diode is best suited to a particular application, it is useful to remember the important electrical difference between the tube diode and the *germanium* diode. It's simply this: the germanium diode's forward resistance is lower, and its back resistance is *not* infinite.

In other words a small amount of current will flow through a germanium diode when the cathode is made positive with respect to the anode. The circuit designer should keep in mind this reverse resistance of a germanium diode.

The Sylvania 1N54 is a good example of a diode type developed for specific circuit needs. This diode has unusually high reverse resistance. It is therefore useful when high efficiency is required in circuits involving high values of load resistance.

The magnitude of this reverse resistance varies depending upon the amount of voltage impressed across the diode. This resistance, for most of the low-voltage types, increases very rapidly as back voltage is increased from zero to about 10 volts. It reaches its maximum at approximately this voltage point. Resistance then tends to decline as voltages are increased, up to 60 volts—the safe operating maximum for the dc voltage in the back direction for such types as the 1N34, 1N34A, 1N54, and 1N54A.

A similar condition takes place in the 100, 150, and 200 volt diodes, except that the maximum value of reverse resistance is more likely to occur at 20 volts rather than at 10 volts.

A circuit designer must know then:

1. The average signal level at which the germanium diode will work and
2. The approximate resistance value of the various types of germanium diodes in this region.

The resistance value reached by the average 1N34 Sylvania Germanium Diode will be about 700,000 ohms at −10 volts, whereas the resistance reached by the average 1N54 will be approximately 2 megohms. Each diode in an average 1N35 pair will also reach 2 megohms.

wave shape are such the RMS current does not exceed the average rating and the frequency of application is at least 25 cps. The maximum forward surge current is the maximum current which may flow for one second without damage to the unit.

Minimum forward current is the smallest amount of current which may be expected to flow through the diode when a given d-c potential is applied across it, positive being connected to the anode. The corresponding forward resistance may be calculated by dividing the applied voltage by the current flow. The forward characteristic is non-linear with voltage and measurements are normally made at one volt. The maximum reverse current is the greatest amount of current that will flow through the diode with a given applied d-c potential, the anode being connected to the negative. By dividing the applied voltage by the current flow the value of back resistance can be calculated.

In present day commercial germanium diodes the "catswhisker" is the anode and the germanium pellet is the cathode. Electrically, the cathode provides positive d-c output. Fig. 1 shows how anode and cathode can be identified by the outer markings on a diode unit and presents a simplified sketch showing proper circuit connections. When inserted into a circuit these diodes offer approximately 0.8 to 1 uuf shunt capacity.

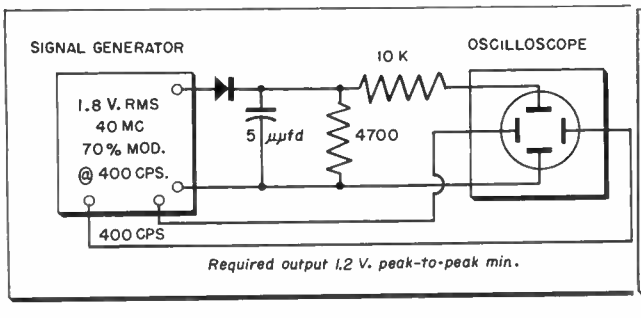
TELE-TECH

Germanium Diode Specifications

TELE-TECH

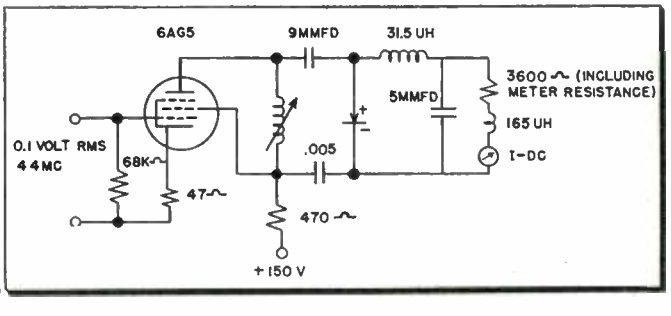
RTMA Type Number	Manufacturer Registered By RTMA	Description	Continuous Reverse Working Voltage (Volts. Max.)	Reverse Voltage for Zero Dynamic Resistance (Volts Min.)	Minimum Forward Current of + 1 Volt (MA)	Average Anode Current (MA)	Maximum Recurrent Peak Anode Current (MA)	Maximum Forward Surge Current (MA)	Maximum Reverse Current (MA)	Remarks
1N34	Sylvania	General Purpose Diode	60	75	5.0	50	150	500	.05@–10v., .8@–50v.	
1N34A	Sylvania	General Purpose Diode	60	75	5.0	50	150	500	.03@–10v., .5@–50v.	Sealed in Glass
1N35	Sylvania	Matched Duo-Diode	50	75	7.5	22.5	60	100	.01@–10v.	Ratings for each Diode
1N38	Sylvania	100 Volt Diode	100	120	3.0	50	150	500	.006@–3v., .625@–100v.	
1N38A	Sylvania	100 Volt Diode	100	120	4.0	50	150	500	.005@–3v., .5@–100v.	Sealed in Glass
1N39	Sylvania	200 Volt Diode	200	225	1.5	50	150	500	.2@–100v., .8@–200v.	
1N40	Sylvania	Plug-in Varistor	25	60	12.75*	22.5	60	100	.04@–10v.	*@ +1.5v., Ratings for each diode
1N41	Sylvania	Lug-type Varistor	25	60	12.75*	22.5	60	100	.04@–10v.	*@ +1.5v., Ratings for each diode
1N42	Sylvania	Plug-in 100 Volt Varistor	50	120	12.75*	22.5	60	100	.006@–3v., .625@–100v.	Ratings for each diode
1N43	Western Electric	General Purpose Diode		60	5.0	40	125	50	.9@–50v.	
1N44	Western Electric	General Purpose Diode		115	3.0	35	100	400	1@–50v.	
1N45	Western Electric	General Purpose Diode		75	3.0	35	100	400	.4@–50v.	
1N46	Western Electric	General Purpose Diode		60	3.0	40	125	500	1.5@–50v.	
1N47	Western Electric	General Purpose Diode		115	3.0	30	90	350	.004@–3v.	
1N48	General Electric	General Purpose Diode		85	4.0	50	150	400	.83@–50v.	
1N51	General Electric	General Purpose Diode	40	50	2.5	25	100	300	1.6@–50v.	
1N52	General Electric	General Purpose Diode	70	85	4.0	50	150	400	.25@–50v.	
1N54	Sylvania	High Back Resistance Diode	35	75	5.0	50	150	500	.01@–10v.	
1N54A	Sylvania	High Back Resistance Diode	50	75	5.0	50	150	500	.007@–10v., 1@50v.	Sealed in Glass
1N55	Sylvania	150 Volt Diode	150	170	3.0	50	150	500	.3@–100v., .8@–150v.	
1N55A	Sylvania	150 Volt Diode	150	170	4.0	50	150	500	.5@–150v.	Sealed in Glass
1N56	Sylvania	High Conduction Diode	40	50	15	60	200	1000	.3@–30v.	
1N56A	Sylvania	High Conduction Diode	40	50	15	60	200	1000	.3@–30v.	Sealed in Glass
1N58	Sylvania	100 Volt Diode	100	120	4.0	50	150	500	.8@–100v.	
1N58A	Sylvania	100 Volt Diode	100	120	5.0	50	150	500	.6@–100v.	Sealed in Glass
1N60	Sylvania	Video Detector Diode	25	30	*	40	150	500	.03@–1.5v.	See diagram below
1N63	General Electric	General Purpose Diode	100	125	4.0	50	150	400	.05@–50v.	
1N64	General Electric	Video Detector Diode		25	0.1*					*Special test circuit in diagram below
1N65	General Electric	High Back Resistance Diode		85	2.5	50	150	400	.2@–50v.	
1N69	General Electric	General Purpose Diode	60	75	5.0	40	125	400	.05@–10v., .85@–50v.	
1N70	General Electric	General Purpose Diode	100	125	3.0	30	90	350	.01@–10v., 41@–50v.	
1N71	Sylvania	Low Impedance Varistor	40	50	15	60	200	1000	.3@–30v.	Ratings for each diode
1N72	General Electric	UHF Diode		5		25	75			14–19d6 Noise Figure @ 500 MC
1N73	General Electric	Germanium Quad		75	12.75*	22.5	60	100	.05@–10v.	*@ +1.5v., Ratings for each diode
1N74	General Electric	Germanium Quad		75	12.75*	22.5	60	100	.05@–10v.	*@ +1.5v., Ratings for each diode
1N75	General Electric	Germanium Diode	100	125	2.5	50	150	400	.05@–50v.	

Special test circuit for 1N60



Required output 1.2 V. peak-to-peak min.

Special test circuit for 1N65



Radio-Frequency Wave Analyzer

The carrier and sideband components of a radio frequency wave are displayed on a cathode ray oscilloscope. Relative sideband power and spectrum occupancy are shown

By CHARLES H. BREDALL,
U.S. Naval Research Laboratory
Washington, D. C.

THE anaylsis of a complex r-f wave is most easily accomplished by examination of its fundamental frequency spectrum. Whereas a-f wave analysis is employed primarily for determining the amplitudes of harmonics relative to their fundamentals, r-f wave analysis is of greatest value in determining the type and degree of modulation present. Therefore, in order to separate individual side bands, the major requirement of an r-f wave analyzer becomes selectivity or resolution. As contrasted with a resolving power of about 1 part in 4,000 in the a-f analyzer, the r-f wave analyzer must separate frequency components in the ratio of perhaps 1 part in 2,000,000. Complex r-f wave spectra usually occupy relatively narrow channels. Thus simultaneous display of each spectrum on a CRT is practicable.

In order to be an all-purpose quantitative type of instrument, an r-f wave analyzer should be capable of separating, without distortion, the AM, FM, and p-m components of a complex wave, displaying each type separately in magnitude, frequency, and phase. Such an instrument covering a wide range of input frequencies could be developed but the complexity would not seem warranted. Since, in general, a transmitter or signal generator is not purposely modulated by more than one type of modulation at a time, it would seem not only permissible but highly desirable to develop a less complex analyzer which would provide quantitative displays of simply modulated r-f waves and qualitative displays of complex waves with "mixed" modulation.

With these requirements in mind the factors affecting development of such an instrument were considered. It was evident that the two requirements of extreme resolution and rapid scanning would conflict. Previous work on the subject of "ringing" indicated the necessity of slow excitation of high-Q selective circuits if "ringing" is to be avoided.* The distorting effect is shown for a typical case in Fig. 1. It is seen that the peak response is reduced in amplitude, broadened, and shifted to the right thus reducing the potential advantages of resolution offered by the high-Q circuits. In this work the situation is similar to that experienced when rapidly tuning a receiver with a highly selective i-f through a series of narrow-band closely spaced signals. Since spectrum presentations inherently require such sweeping through the entire frequency range under observation it was evident that the rate of change of frequency could be reduced only by a reduced sweep rate.

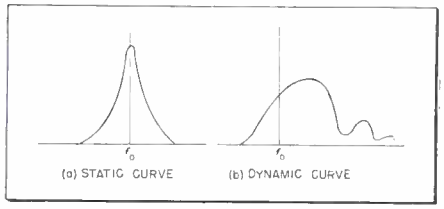


Fig. 1: Showing deterioration which occurs when high-Q circuits are swept rapidly

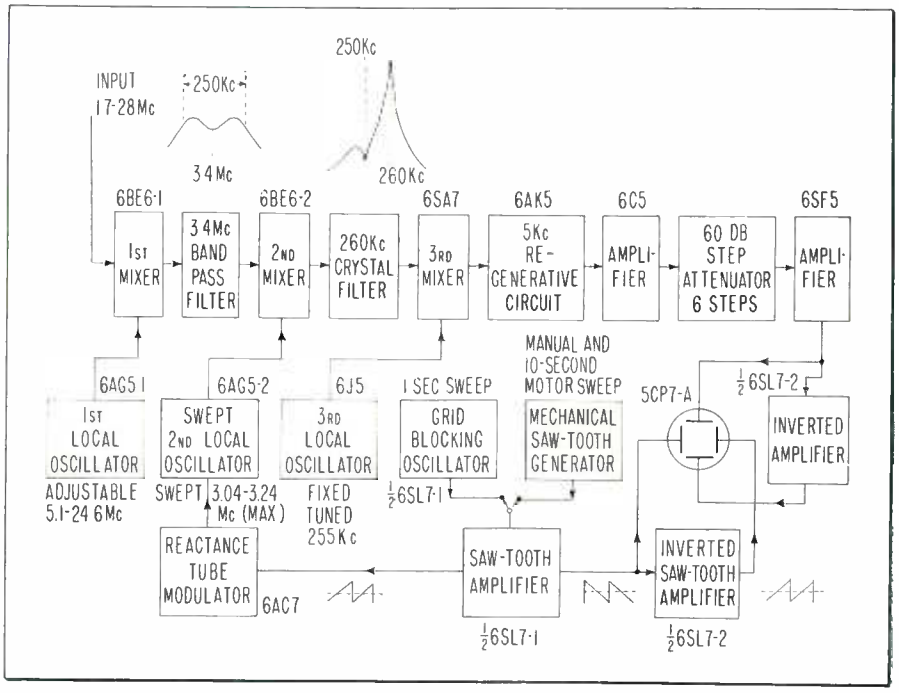
* Hok, Gunnar, "Response of Linear Resonant Systems to Excitation of a Frequency Varying Linearly with Time." Journal of Applied Physics, Vol. 19, No. 3, March 1948.

Analyzer Details

A block diagram of the experimental analyzer is shown in Fig. 2. The schematic circuit diagrams are shown in Figs. 3 and 4 and the panel layout in Fig. 5. The intermediate frequencies were selected, in general, to reduce the high input frequencies to 5 KC with steps sufficient to insure good stability and to permit adequate rejection of images and other spurious responses.

The input frequency range was selected to include the loran bands, 1.8 to 2.0 MC, as well as the military communication channels, 4 to 28 MC. No selective circuits were provided ahead of the first mixer since the analyzer ordinarily would be used at the signal source. For selecting signals at a remote location a receiver

Fig. 2: Block diagram of an experimental analyzer showing wave shapes at the different parts of the circuit referred to in the text. Compare with schematic



may be used with the analyzer in its present form or a pre-selector r-f amplifier could be added. It is evident that with input made directly as in Fig. 3 intermodulation effects are minimized and any non-linear selective circuits introduced ahead of this point would result in distortion.

First Local Oscillator

The first local oscillator was made adjustable to provide a first i-f centered at 3.4 MC. A 250-KC wide bandpass filter follows the first mixer thus providing resection of the first local oscillator fundamental and harmonic frequencies. This prevents their beating in the second mixer with the fundamental and harmonics of the second local oscillator. It is evident that care would have to be exercised if the input frequency approached 3.4 MC.

The band of frequencies centered at 3.4 MC beats in the second mixer with the second local oscillator. This oscillator is varied in frequency ± 100 KC from 3.14 MC by means of a reactance tube modulator at a sweep rate established by the CRT horizontal deflection saw-tooth voltage as shown in Fig. 2.

The output of the second mixer is introduced to a bridge-type crystal filter circuit which rejects sharply those frequencies above and below 260 KC, particularly at 250 KC, the frequency which would produce an image. The 260-KC signal is then introduced into the third mixer beating with a stable third local oscillator fixed at 255 KC to produce a 5-KC output signal. The 5-KC signal is fed into a special regenerative circuit which permits varying the effective Q by means of a panel controlled potentiometer.* The highly selected 5-KC signal is then amplified and applied to the CRT. Two saw-tooth generators provide choices of an electronically generated saw-tooth with a 1 second period and an electro-mechanically generated saw-tooth with a 10-second motor drive or manual drive. The relatively slow sweep rates are necessary to avoid the "ringing distortion" previously described. In order to present an intelligible picture a CRT with a long-persistence screen is employed.

A stable 1-second sweep with good linearity is achieved through use of a grid-blocking oscillator type of saw-tooth generator in conjunction with a non-linear amplifier which reduces the original saw-tooth curvature. The mechanical sweep is provided by a 7.5-volt "C" battery across a wire-wound potentiometer specially modified to give uni-directional rotation and a "ski-jump" gap for providing rapid spot return without short-circuiting the potentiometer terminals. A telechron Type C motor is used to provide the automatic mechanical sweep of approximately 10 seconds and provision is made to bring a crank out of the front panel to turn the potentiometer by hand when even slower sweeps are required.

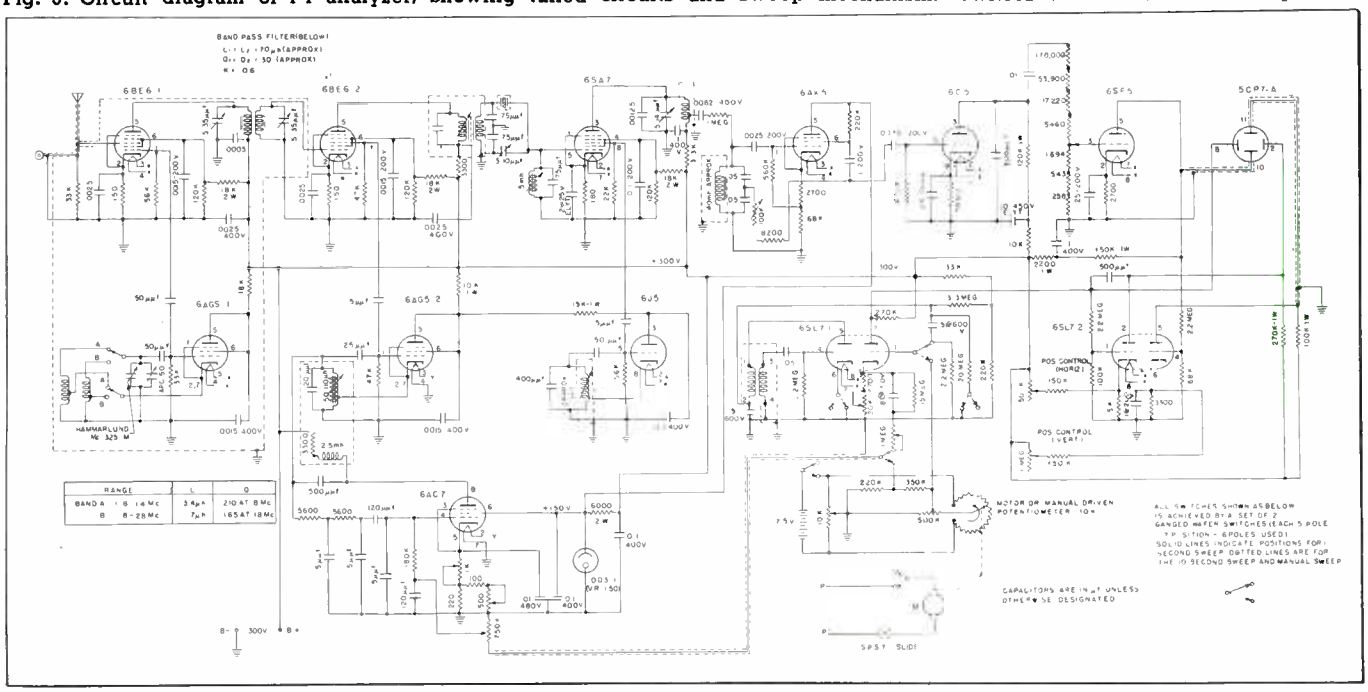
During the very rapid return sweep of the CRO df/dt is extreme and produces ringing in the high-Q tuned circuits. However, as apparent from Fig. 1(b), the voltage is slow in building up and reaches its maximum after the spot has returned to its extreme left position. Part of the CRT screen is masked so that, with proper Q adjustment, the ringing has dropped to a negligible level by the time the spot again appears on the exposed portion of the screen. Any ringing occurring during this return appears only faintly since the spot motion is so rapid.

Special Considerations

The first and second local oscillators have to be unusually free from power-frequency modulation. Since the presence of these modulations on the input signal is one of the properties to be observed, any self-generated hum modulation would be detrimental. This difficulty is overcome by proper design of the first local oscillator and by supplying dc filament power to the 6AC7 reactance tube and the second local oscillator. The considerations discussed thus far are necessary to achieve good qualitative results for complex waves containing low frequency modulating components. For simply modulated waves, such quantitative measurements as carrier frequency, band width, mod-

* Harris, Holton E. "Development of coils and circuits for highly selective Amplifiers", MIT Thesis, February 1947.

Fig. 3: Circuit diagram of r-f analyzer, showing tuned circuits and sweep mechanism. Switces are in 1.8 to 14 MC position



ulation frequency or pulse repetition rate, and degree of modulation impose additional requirements involving linearity and low distortion.

Saw-Tooth Voltage

A study of Fig. 2 shows that the saw-tooth voltage applied to the CRT horizontal plates and the reactance tube modulator must be identical in shape and length, but not necessarily in amplitude, in order that the frequency sweep versus spot sweep is a linear function. The saw-tooth voltage extends above and below the ground reference thus resulting in a variation of spot displacement to the extreme right and extreme left of screen center or zero position and a variation of second local oscillator frequency plus and minus a selected increment from the center frequency depending upon the saw-tooth voltage amplitude applied to the 6AC7. In actual practice the potentiometer which varies this saw-tooth input voltage is calibrated to provide total sweep indications. The saw-tooth should be nearly linear so that (1) the spot intensity does not vary, (2) the change of frequency versus time is fairly constant and as low as possible throughout the sweep, and (3) the average value of the saw-tooth voltage as illustrated is zero with respect to ground, thus assuring alignment of the center frequency with the zero or center screen position when a test signal is applied.

In order to assure linear relationship between the frequency sweep and the spot sweep, the reactance tube modulator and oscillator circuits must be designed to have a linear relationship between the 6AC7 grid voltage and the oscillator frequency over the widest range of operation. Fig. 6 illustrates the overall linearity of these circuits by the presentation of ten 20 KC sidebands which should appear equally spaced. This is the widest range of the instrument, ± 100 KC from the center frequency.

It is evident that a fairly accurate indication of carrier frequency is possible by comparison methods employing simultaneous presentation of standard frequency signals and the signal being measured. The usual receiver accuracy is possible without frequency standards.

Distortion in the earlier circuits is minimized by operating at low level and amplifying only in the narrow-band circuits. Distortion due to inter-modulation effects with complex waves is thus minimized by applying the input signal directly to the first mixer.

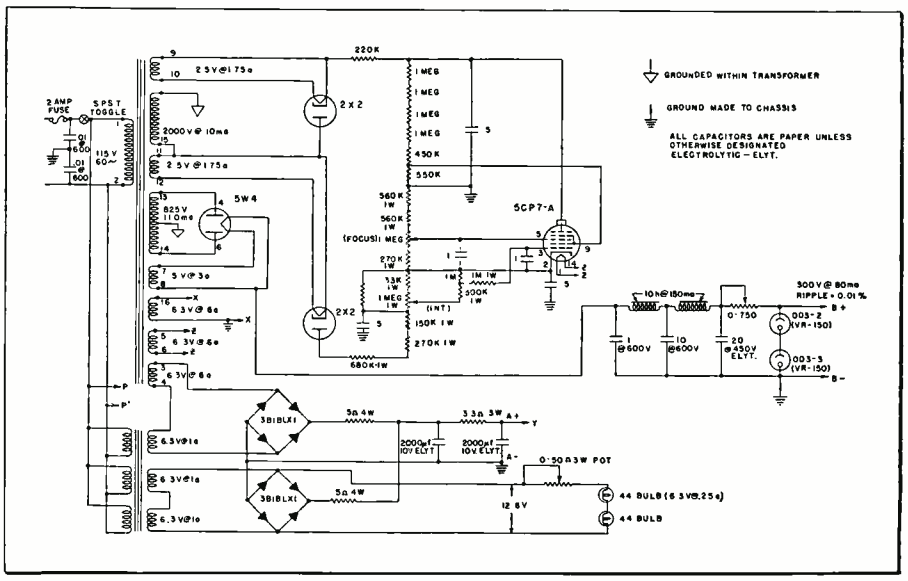


Fig. 4: Power supply. Note that reactance tube and swept-second local oscillators are heated by well filtered dc from a stabilised rectifier

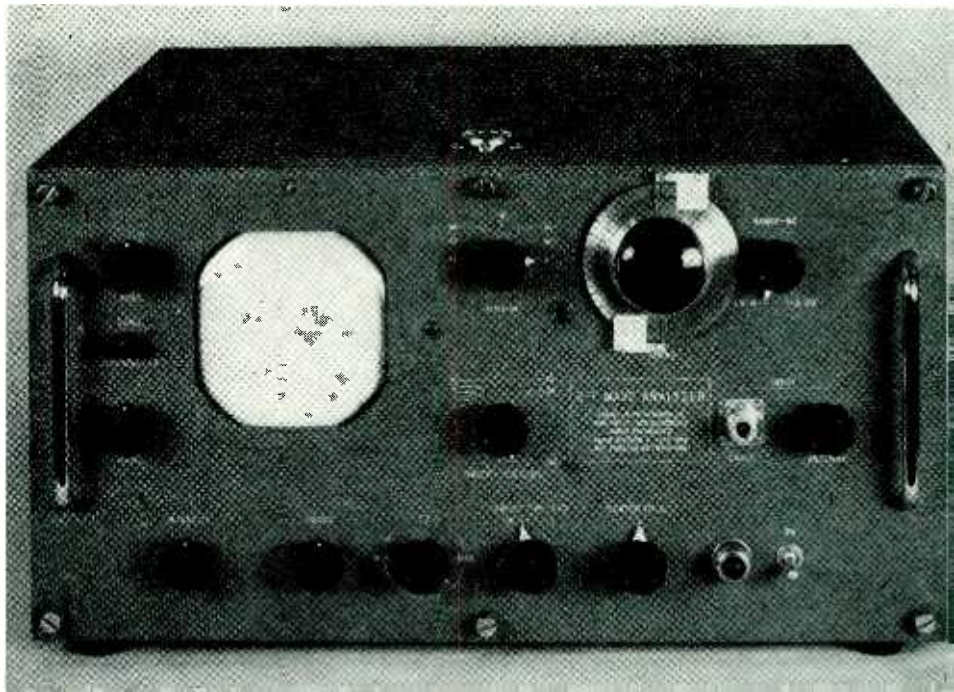
With the advent of increased demands for accuracy, the use of a flat face scale for the rounded CRT was found to be unsatisfactory because of parallax. A satisfactory face scale was made from $\frac{1}{16}$-in. lucite, dyed light amber to act as a filter. After reverse engraving on the back side, the face scale was heated and pressed out to the normal contour of the CRT face, thus reducing parallax. The scale distortion was negligible.

Applications

The technics and instrumentation described seem to be directly or indirectly applicable to three general fields of activity; (1) the field concerning spectrum economy; (2) the field concerning the interception and identification of unknown signals and (3) the field concerning the achievement of desired modulation and pulse characteristics of signal sources. An example of the first is the determination of the spectrum occupancy of a transmitter, such as loran. The effects of design factors and operating conditions on the transmitted spectrum may be readily observed, thus permitting rapid evaluation of these entities. The second field includes intercepting and identifying enemy signals by military units and monitoring and detecting signals by such groups as the Federal Communications Commission. The third application is primarily of value in development and research. For example, the investigation of factors producing FM in amplitude-modulated signal generators.

A spectrum of the type exhibited by loran transmitters is shown in Fig. 7. Sidebands with amplitudes

Fig. 5: View of front of instrument showing logical control arrangements



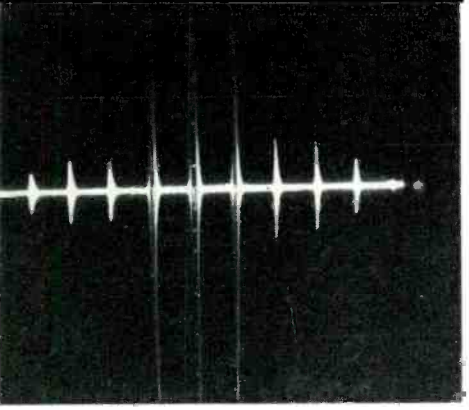


Fig. 6: Linearity shown by 20 kc sidebands

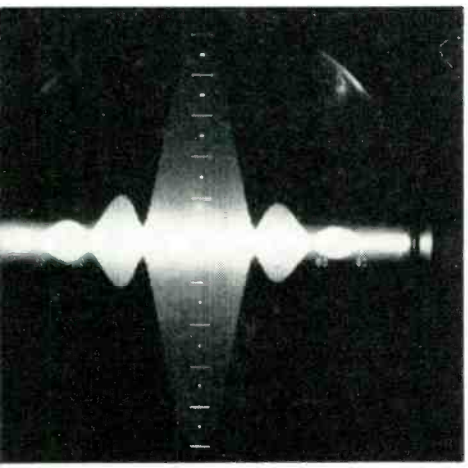


Fig. 7: Loran type of pulse transmission spectrum. Shows sidebands 60 dB down

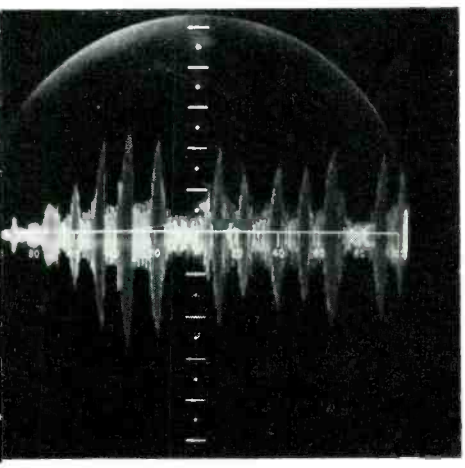
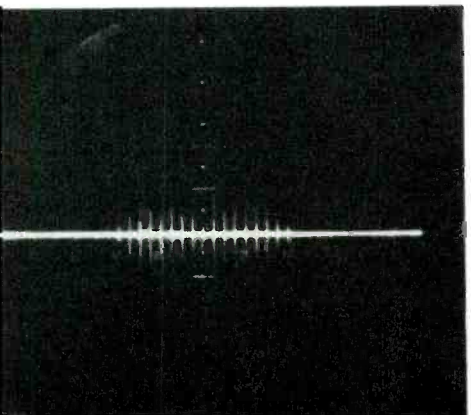


Fig. 8: 25 cps at only 10% modulation produces broad unbalanced spectrum

Fig. 9: Frequency spectra from good FM generator with modulation index of 6



as low as 60 db below the center frequency level may be observed with proper use of the built-in attenuator. The pulse repetition rate may be read by counting the number of pulses appearing during the one second sweep across the screen when the frequency sweep is reduced to zero. For this condition the analyzer is tuned to a frequency within the input signal spectrum and the instrument operates as a conventional cathode ray oscillograph with the sweep rate reduced to 1 cps. The pulse width may also be determined in this manner or from the spacing between nulls on the characteristic envelope in Fig. 7.

Presence of FM

R-F Wave Analyzer oscillograms of several high quality amplitude-modulated signal generators gave evidence indicating the presence of frequency modulation. The extent of the undesirable modulation is most evident by comparison with a nearly normal amplitude-modulation spectrum of a different type of generator. As shown in Fig. 8 with a very low modulating frequency, in this case 25 cps, the spectrum was many times its normal width, although there is only 10% modulation.

In general, the degree of improper modulation was found to be greatest for high carrier frequencies, high percentage modulation, and low modulating frequencies. The modulation was particularly poor at the high end of each frequency band of the signal generator under observation.

Oscillograms showing frequency spectra from a good quality f-m signal generator appear in Fig. 9. The modulation index shown is 6. Reference to Terman's "Engineering Handbook" (p. 581) provides an interesting comparison of theory and practice. The somewhat low magnitude of the left-hand sidebands, i.e., amplitude dissymmetry is due to maladjustment of the r-f wave analyzer.

The high degree of resolution, better than 20 cps, necessary for analyzing the common types of complex r-f waves was achieved with satisfactory accuracy, sweep speed, and scanning width. For certain relatively broad spectra with low frequency components for which individual sidebands do not have to be resolved, considerable information about spectral occupancy may be obtained if the sideband envelope is observed. This may be done when there are many sidebands and the adjacent sidebands are of approximately the same magnitude. Under these circumstances interference due to adjacent components may be tolerated and the integrated signal will produce a true indication of the sideband envelope. Fig. 7 was made in this manner since the spectrum shown was of this nature.

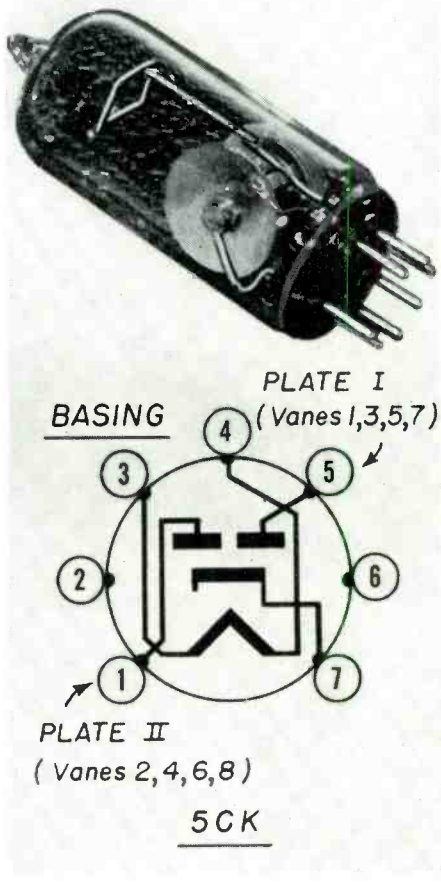
New UHF Magnetron

G. E. Laboratories and Tube Divisions have developed a new miniature magnetron tube for use in ultra-high-frequency television receivers as well as in other equipment in which a low power oscillator is required.

Up to this time, magnetrons have been used to generate the high power required for radar equipment and counter-radar equipment used extensively during World War II. During this period the magnetron was not generally thought of as a practical device for TV home receivers, but the operation principals have now been successively applied to make it a useful tube for the proposed UHF television band. In addition this type, Z-2061, is expected to

(*Continued on page* 76)

External appearance and socket diagram



Fluoroscopic Co-Axial Cable Test

R. M. KREUGER,
Cable Division
H. M. NEBEN,
Electrical Testing Lab
American Phenolic Corp.
1830 South 54th Ave.,
Chicago, Ill.

Fig. 1: Fluoroscopic coaxial cable eccentricity jig requires little training to operate

Micrometer and Vee Block combined with a fluorescent screen make unique eccentricity tester for solid dielectric cable

A RATHER unique device for making certain physical inspection on co-ax and twin-ax is now in use at American Phenolic Corp., Chicago. Due to the importance of the information revealed through these inspections it is believed that a short description of the processes involved, the equipment used and a little of the history behind the development of this equipment will be of considerable interest to those who work with co-axial cable.

The development of the Fluoroscopic Coaxial Eccentricity Jig was a direct outgrowth of the need for a more accurate and faster method of determining whether the inner conductor of the cable was in the exact center of its surrounding plastic jacket or, at least, within allowable percentages of deviation. This device, developed and used by Amphenol provides visible evidence of possible eccentricity.

During World War II the Army, Air Force and Navy each had inspectors at the plant whose job it was to make periodic inspections of the cable as it rolled off production and to determine whether the cable met the specifications of their particular service.

The common practice of checking coaxial cable for eccentricity was to slice carefully through the cable with a jeweler's slitting saw and with a pair of dividers measure the distance from the edge of the dielectric to the edge of the wire, refer the dividers to a scale graduated in one sixty-fourths of an inch, rotate the section of cable 180° and measure again from the edge of the dielectric to the edge of the wire. After measuring the diameter of the wire itself the percentage of eccentricity could be calculated by a formula.

There were countless flaws to this system. It is extremely difficult to slice through a coaxial cable, however carefully it might be done, and not move the wire from the center where it was placed during the extrusion process. Obviously the resulting observation could not be depended upon to be an accurate representation of the true structure of the cable being tested. In addition, this method was very slow and slowness in any phase of getting materiél to the Armed Forces was not to be condoned.

Also, at the time of inspection, it was not known which one of the services would be using the cable under inspection. In order to make certain that the co-ax carried the approval of the inspector representing the ultimate user, all inspectors made their tests on the same co-ax. Due to human error and the possibility of physical distortion during the slicing process it often happened that one lot of co-ax might be tested and approved by one, two, or even more inspectors and then be rejected by one or more others. This, insofar as the life and use of the cable was concerned, was fatal. There was no alternative except to scrap it.

A tremendous amount of co-axial cable fell by the wayside in this manner and was thus lost. This was not only terribly expensive but it also meant that the services were not getting all the co-ax they needed.

CO-AXIAL CABLE (Continued)

The Fluoroscopic Co-axial Eccentricity Jig was conceived and developed by Amphenol engineers[1] as an answer to this inspection problem. It remains in constant use at Amphenol and duplicate equipment is now used by the Army and the Air Force.

Basically, it consists of a V block with one section movable which holds the section of cable to be tested and acts as a straight edge, a micrometer head mounted on the V block and a fluoroscopic screen assembly so placed that a fluoroscopic shadow of the cable and micrometer spindle falls upon the screen and is visible to the operator. The V blocks are removable and built in several sizes to accommodate cables of varying diameters.

Typical Test

To more clearly illustrate the use of this equipment, a typical test will be described. It might be well to mention at this point, however, that this inspection is concerned only with the position of the wire conductor within the solid dielectric core of the cable.

For this test we shall use an example of single conductor co-axial cable designated as RG-8/U. This cable has a core diameter of 0.285 in.

The first step of the test is to place the cable in the V block which, as mentioned previously, causes the cable to lie in a perfectly straight line. The cable is rotated slowly until the shadow of its wire, as shown on the fluoroscopic screen, is farthest from the operator.

The next step is to bring the micrometer spindle forward until just a faint line of light is discernible between the end of the spindle and the wire. Fig. 2 is an actual x-ray photo showing how this step would appear to the operator. It will be noted that the heavy black line running horizontally across the picture is slightly more to the top of the surrounding white space. This is the shadow of the wire itself in a position farthest from the operator. The micrometer spindle can be seen as the rectangular black area almost but not quite touching the black wire shadow near the center of the large white rectangle.

When the micrometer head has been adjusted to show a faint line a reading is taken. In this particular case the micrometer reads 0.127 in. This figure can be considered purely arbitrary inasmuch at it means nothing when considered by itself but is important only through its relationship to the next figure to be read. This figure is obtained by rotating the cable in the V block exactly 180°, backing the micrometer head off slightly and again moving it forward until a faint white line shows between the wire shadow and head shadow. The reading on the micrometer head is now 0.136 in. Fig. 3 illustrates these steps.

By subtracting the first reading, 0.127, from the second 0.136, we obtain a difference of .009 in.

The final step of this test is to refer to a previously prepared chart (Fig. 4). This chart is divided into vertical columns each representing a different cable core diameter. The horizontal columns on the chart indicate the difference in thousandths of an inch between micrometer head readings. So, in our test, we move down the left hand vertical column of the chart until we reach the figure 0.009. This corresponds to the 0.009 in. difference between micrometer readings. Then keeping on this line we move across the column until we reach the vertical column under the heading figure of 0.285. We note that the figure reads 3.17.

This, then, means that the cable under inspection has an eccentricity percentage of 3.17. It should be mentioned here that these figures are merely for purposes of illustration.

The maximum eccentricity allowed by Specification JAN-C-17A is 10% for cable the size of RG-8/U. As the cable sizes increase the allowable percentage of eccentricity decreases for obvious reasons. For example, the percentage of eccentricity allowed in RG-18/U is just half that of RG-8/U : 5.0%.

This inspection, as can be readily seen, takes but a few minutes to perform and the possibility of error is practically eliminated. Little training is required to operate the Fluoroscopic Coaxial Eccentricity Jig with a fine degree of accuracy.

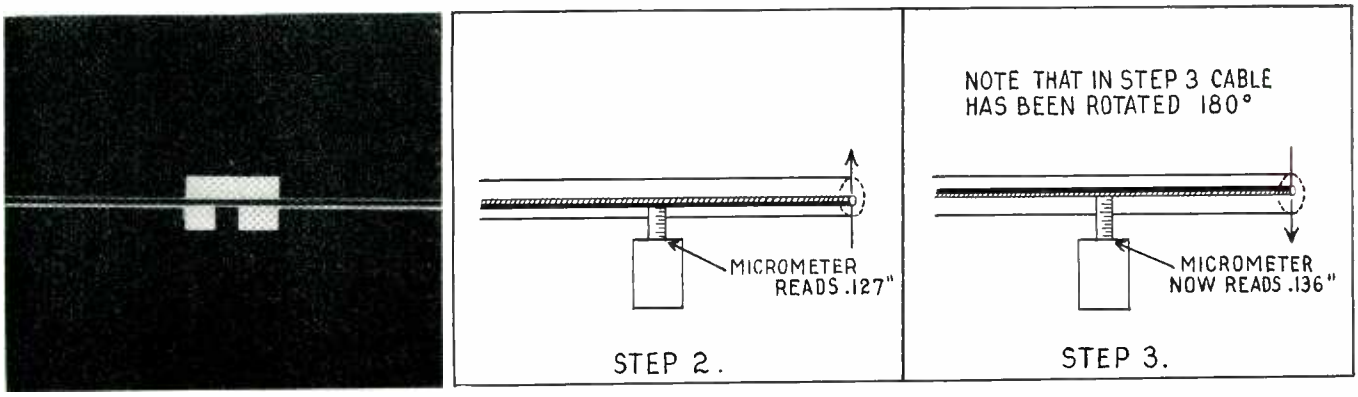
Twinax Cable Measurements

The eccentricity test on twin conductor cable such as Amphenol Twinax is essentially the same. When used for this purpose, this device really comes into its own.

Let's see how easy it is to explore the secrets of this type of cable. First, we know that the two or more conductors that run down the dielectric must be spaced a definite distance from one another, they must be centered in that dielectric both vertically and horizontally, they must be properly located in the dielectric and, finally, they must maintain their relationship to one another. To secure this data, therefore, our procedure is broken into three separate steps, as follows:

Step 1: To measure spacing between conductors we measure fluoroscopically from the edge of one conductor to the corresponding edge of the other conductor. (Dimension A in Fig. 5, Step 1.) This tells us whether the spacing between conductors is proper.

Fig 2: (Left) X-ray photo showing how step 1 in inspection process appears to operator. Micrometer head is rectangular black area almost touching the black wire shadow near center of the large white rectangle. Fig. 3: (Right) Measuring coaxial eccentricity



Step 2: We rotate the cable so one of the conductors is closest to the operator or micrometer spindle so that it just barely touches the shadow of the wire, leaving the characteristic white line previously mentioned. We then read the micrometer; let's say it reads 0.192 in. Then by rotating the cable 180° from the reference point, we bring the opposite wire to the head and get another reading, let's say it's 0.195 in. Subtracting, we get 0.003 in. or the information that our conductors are 0.0015 in. removed from true center. This procedure we have called locating the "horizontal" center, Fig. 5, Step 2.

Step 3: Locating the "vertical" center. We rotate the cable on the fluoroscopic screen so that one conductor is directly over the other, thereby seeing only one conductor, see Fig. 5, Step 3. Then we bring the micrometer head up again and get a reading, let's say it's 0.275 in. Now by rotating the cable 180°, we can effectually measure the other side of the cable. Let's say the reading is 0.280 in. This would indicate a 0.005 in. difference in micrometer reading, or tell us that the vertical centering was 0.0025 in. removed from true center. To our knowledge, there's no other way of measuring these extremely important facts on complicated multi-wire cables.

X-ray photos and the fluoroscopic screen plays an important role in another interesting co-ax and twin-ax inspection. This test is to determine if the conductor, or conductors as the case may be, have remained in the center of the core or whether they have "pulled through" or moved away from center when the cable is subjected to stress and high temperature.

To perform this test, the two ends of a section of cable are stripped back so that the bare conductor is exposed. A weight is attached to each end of the conductor and the cable is then hung over an "arbor" in an oven heated to a temperature of 98°C. The cable remains in the oven at this heat for a period of seven and one-half hours. It is then taken out, cooled, and placed under the fluoroscopic screen where any movement that may have taken place within the cable is readily apparent. For permanent records of such tests, x-ray photos may be taken. Such a photo is shown in Fig. 6. There are but two variables in this test, as regards the different sizes of cables. One is the size of the arbor upon which the cable is placed in the oven. The arbor must have a diameter ten times greater than that of the cable being tested. The other variable is the size of the weights attached to the cable conductors. These vary also in accordance with the cable under test. In the case of RG-7/U this weight amounts to two pounds on each end.

Coaxial cable is somewhat like a suit of clothes—the fabrication being as important as the quality of ma-

(*Continued on page* 72)

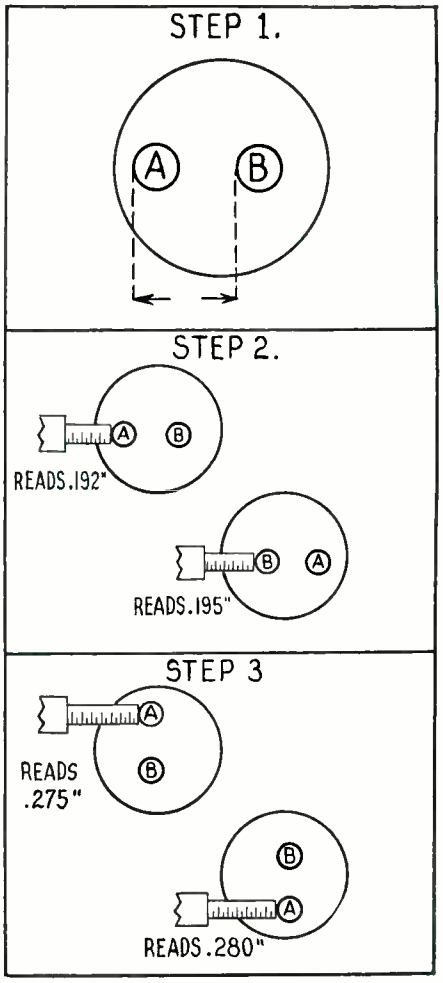
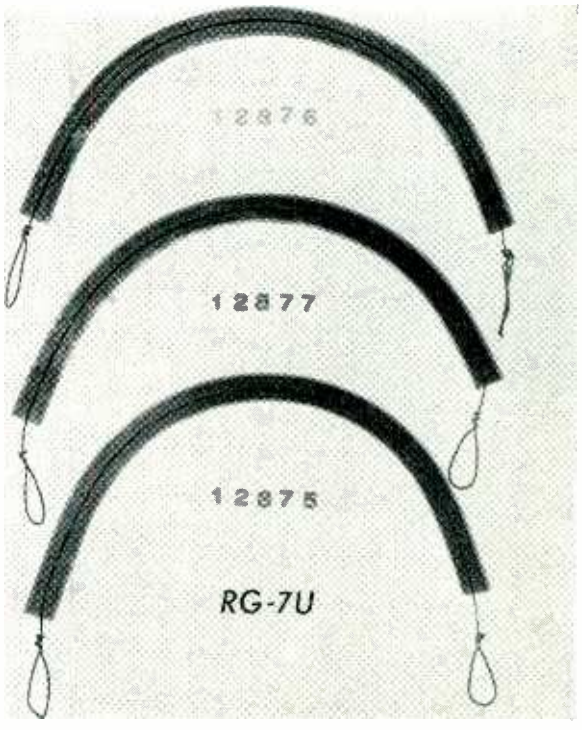


Fig. 5: Eccentricity test on Twinax Device will find extended use for measurements on other types of multiwire cable

Fig. 4: (Left) Typical chart used in determining the percentage of cable eccentricity
Fig. 6: (Right) Flow test on coax to determine if inner conductor has moved in relation to outside shield when subjected to specified tension and temperature over time

	COAXIAL CABLE SIZE										
Diff. in .000"	.116	.146	.185	.196	.250	.285	.330	.370	.460	.680	.910
.001	.95	.685	.54	.15	.4	.35	.32	.27	.18		
.002	1.72	1.37	1.08	1.04	.8	.7	.6	.42	.35	.294	.22
.003	2.6	2.2	1.62	1.53	1.2	1.05	.91	.81	.65		
.004	3.46	2.74	2.16	2.04	1.6	1.4	1.2	1.08	.87	.59	.44
.005	4.3	3.42	2.7	2.05	2.	1.75	1.5	1.35	1.09		
.006	5.2	4.1	3.24	2.55	2.4	2.10	1.82	1.62	1.30	.85	.66
.007	6.05	4.8	3.78	3.06	2.8	2.45	2.12	1.89	1.52		
.008	6.9	5.5	4.30	3.57	3.2	2.81	2.42	2.16	1.74	1.18	.88
.009	7.75	6.15	4.85	4.1	3.6	3.17	2.73	2.43	1.96		
.0010	8.6	6.85	5.40	4.6	4.	3.5	3.03	2.7	2.18	1.47	1.10
.0011	9.5	7.6	5.59	5.1	4.4	3.85	3.33	2.98	2.4		
.0012	10.4	8.2	6.50	5.6	4.8	4.2	3.6	3.24	2.6	1.76	1.32
.0013	11.2	8.9	7.	6.1	5.2	4.45	3.94	3.52	2.83		
.0014	12.1	9.6	7.56	6.6	5.6	4.9	4.25	3.78	3.04	2.06	1.5
.0015	13.	10.3	8.1	7.1	6.	5.25	4.55	4.05	3.26		
.0016	13.8	11.	8.7	7.7	6.4	5.6	4.85	4.33	3.48	2.45	1.7
.0017		11.7	9.2	8.2	6.8	5.95	5.15	4.59	3.7		
.0018		12.3	9.75	8.7	7.2	6.3	5.45	4.88	3.92	2.65	1.98
.0019		13.	10.3	9.2	7.6	6.65	5.75	5.1	4.14		
.0020		13.7	10.8	9.7	7.8	7.	6.05	5.4	4.35	2.94	2.2
.0021			11.4	10.4	8.4	7.35	6.35	5.68	4.57		
.0022			11.9	10.7	8.8	7.7	6.65	5.95	4.79	3.23	2.42
.0023			12.4	11.4	9.2	8.05	6.95	6.23	5.		
.0024			12.9	11.7	9.6	8.4	7.3	6.5	5.22	3.53	2.64
.0025				12.3	10.	8.75	7.6	6.75	5.44		
.0026				12.8	10.4	9.1	7.9	7.	5.66	3.83	2.86
.0027					10.8	9.5	8.2	7.3	5.88		



Approaches to CBS Color

Many problems must be solved in implementing field sequential color TV. Disc synchronizing and scanning methods are discussed

By JOHN H. BATTISON

A TREMENDOUS amount of speculation has taken place among engineers as to the best way of designing receivers to operate with the new sequential color standards. In an effort to present as much information on the subject as is available circuits for the vertical and horizontal drives and motor synchronizing system are given in the accompanying diagrams. TELE-TECH has already published details of the Chapin Roberts converter (TELE-TECH page 68, April, 1950) as applied to a Bendix receiver. While individual manufacturers will have circuit differences the application of the frequency selective changeover relay will be similar in most instances.

Motor Circuits

Judging by the number of comments we have received concerning this phase of the color system, the motor and color-disc speed and synchronizing control circuits are of great interest to many engineers.

Motors made by Eastern Air Devices of Brooklyn, N. Y. and Cyclohm, Racine, Wisconsin, have been used to drive the disc and appear to be generally suited to the type of control used. In the circuit shown, an alternator wheel on the color disc driveshaft generates a 144 cycle frequency which is compared in a clamp circuit with the incoming signal from the vertical drive section of the receiver.

The motor which drives the disc is a capacitor inductor 1/20 HP motor with a saturable reactor in series with it. By means of a drive belt and reduction pulleys the disc is driven at approximately the desired speed. Across the motor side of the saturable reactor is connected a push-button switch which short-circuits the winding when it is closed. This of course increases the speed of the motor slightly and allows the disc to change speed by about 1 RPM. In this manner correct colorphasing is obtained by pressing the button until the correct colors are seen.

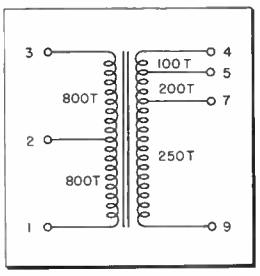
When it is released the clamping circuit takes over and maintains a constant motor speed by means of the combination of reactor current and the alternator control.

The alternator armature consists of six pieces of transformer iron, each $1\frac{15}{16}$ by $\frac{3}{4}$ by 0.020 inches. They are mounted on the periphery of the disc in the blank areas. The disc itself is made of $\frac{1}{16}$ inch boilable Lucite on which are mounted six color filters. The red filter is an Eastman Kodak 26, the green is a Monsanto, 4/3 density, #61, and the blue is an Eastman Kodak, density $\frac{1}{2}$, #47. However, it is understood that the trichromatic coefficients for the filter specifications (published by TELE-TECH on page 21 of the November 1950 issue) may shortly be changed by the FCC to reflect the actual filters used in the camera since these latter are specifications over which the FCC has jurisdiction as part of the broadcast installation.

In the camera, a small disc is used driven by the vertical drive pulses which are converted into sine waves and amplified; since the disc is so small a constant speed is assured.

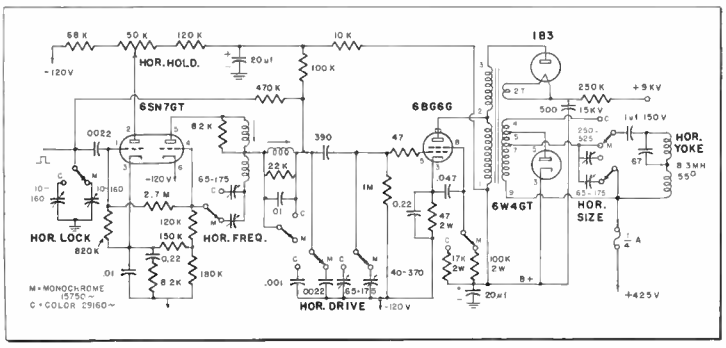
Over one hundred various motor control circuits have been tried, but the one presently described seems to be the best found to date. Thyratrons have been used, but they provide poor waveform and tend to produce motor jitters and vibration. However, in common with the other facets of color TV, once a service starts it is certain that better ways

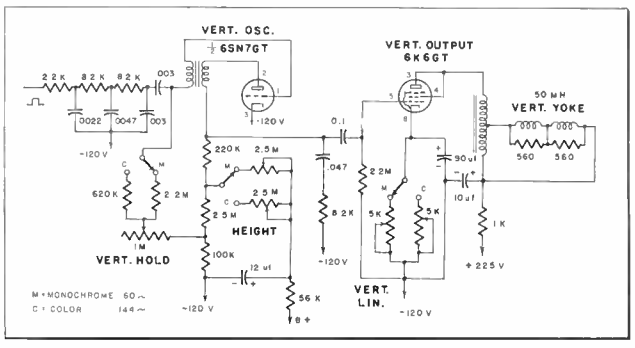
HORIZONTAL OUTPUT TRANSFORMER SPECIFICATIONS



COIL	WIRE	CAM	GEAR #1	GEAR #2	
Sec. 4 to 9	# 28 SSE	0.875	30	89	Coils wound in the order given.
Pri. 1 to 2	10-44 Lite or #36 SNE	0.500	50	67	Core: Square type ferrite with 15 mil gap in each leg.
H.V. 2 to 3	"	0.156	72	29	Yoke should also employ ferrite.

Fig. 1 (left): Dual frequency synchroguide scanning circuit for 9T246. Switches are in monochrome positions, yoke is standard
Fig. 2 (right): Vertical scanning circuit changes for dual frequency operation. This circuit does not present too many problems





of producing the same results will be found by the hundreds of engineers working on the problems.

The manufacturer's problem is confused. Shall he make convertors, adapter-convertors, or separate units which plug into existing sets and produce an entirely new picture. The Tele-Tone Corporation of New York City has approached the problem in a novel manner by designing a complete unit which contains duplicate high and low voltage supplies, sync separator and vertical and horizontal sweep circuits, addition to a duplicate tube, and a color disc and motor. The sync separator in the existing receiver is removed and an adaptor containing a cathode follower is inserted; the tube is then replaced in a socket on the top of the adaptor. Thus no modifications to the original receiver are required and operation is simple. If, later, the color system is changed, or the color portion is no longer used it can be made into a slave unit for black and white reception.

In general it appears that only RCA receivers were modified by CBS during their research, at least the information in the records of the hearing concerns RCA receiver types, and circuit modifications for various RCA models are illustrated in the accompanying diagrams. As a matter of fact CBS has made no general recommendations, but in the record said "this is how we do it." Each receiver model is presumably a different problem.

Another approach is that of the Commander Television Corporation which is building TV receivers with the adapter built as an integral part in line with the bracket receiver specifications. At the present time circuit details have not been divulged; presumably many of the points mentioned in connection with circuit below have been covered.

An adapter made by the Astatic Co. was demonstrated in November. It was plugged into the sync separator socket of an RCA 721 receiver, and it is understood that no other changes were made. A convertor motor and disc placed before the tube produced perfect color pictures. A driving connection was made from the adapter to the convertor.

Design Problems

As will be deduced from examination of the RCA receiver circuits shown in the illustrations adaptation of an existing receiver to color is somewhat complicated. A number of factors have to be considered, among them, circuits, components, and hum.

Considering circuits first it is seen that as many as twelve circuits may have to be switched to effect the change from monochrome to color reception. Figure 5 shows one form of switching which was used to obtain two sizes of picture. Conceivably, a series of wafer switches spaced at intervals in the chassis could accomplish the changes required, or, in conjunction with the Chapin Roberts automatic changeover could be actuated by a number of relays placed at the closest positions to the "hot" points. In any case low capacity switches and wiring in addition to good insulation will be required for many circuits. Further problems of a non-technical nature may be posed in obtaining underwriters' laboratory approval of switched high voltage circuits.

Components—Among the components requiring modification are the horizontal output transformer and possibly the yoke. Modern transformers and yokes employ ferrite as the core material, this is essential to achieve any degree of satisfactory operation without modification of these components. Even with this type of core construction special types of output transformer and yoke are advisable. The GE transformer with variable taps for use with many different sized tubes would probably offer a solution here. Appreciating this factor CBS has issued data on transformer and yoke design which is given in the accompanying table.

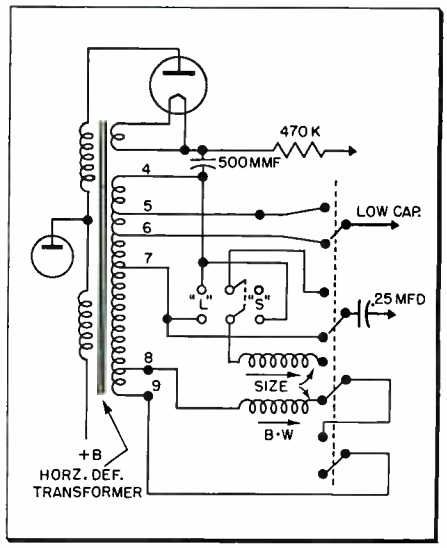


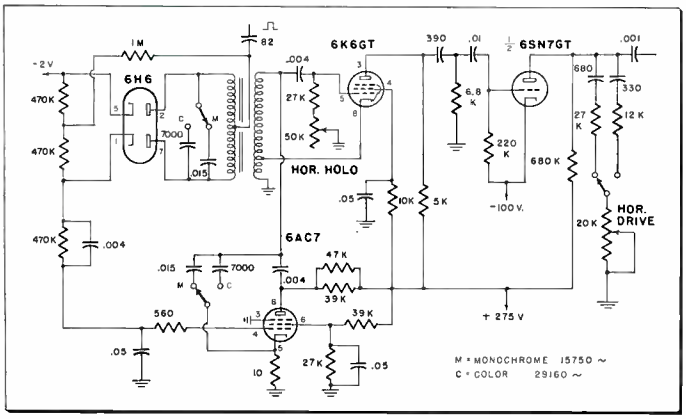
Fig. 5: Switching arrangement for two-size black-and-white and color pictures

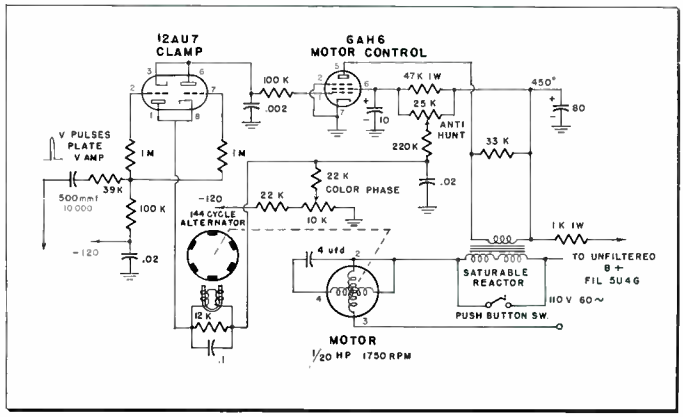
Hum—This is a consideration which may have escaped the attention of some engineers due to preoccupation with other circuit details.

By virtue of the 48 field repetition rate and the 60 cps power supply frequency there is great risk of producing a 12 cycle beat which will cause flicker in the picture. A method of eliminating this type of hum from stray fields was used by Philco in the receiver which they demonstrated before the FCC; however it would hardly be applicable to production line construction.

The Philco method was to connect two filament transformers to the line, with open secondaries, and move them around the chassis until the fields cancelled the undesired hum fields existing on the chassis.

Fig. 3 (left): Synchrolock scanning circuit for dual frequencies as applied to 630 TS chassis. Fig. 4 (right): Motor control circuit similar to that used in Teletone circuit and described in the CBS technical data filed with FCC during the color hearings





Testing Dielectric Properties

Five KW variable frequency transmitter provides power to identify many causes of insulation failure. Five major conclusions list several forms of breakdown associated with vibration and physical and chemical change

By R. K. WITT and J. J. CHAPMAN

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DUE to an ever increasing interest in the behavior of dielectric materials at higher frequencies, and provoked by practical demands, the Navy Department, Bureau of Ships, supported a program for the evaluation of breakdown strength from 60 cps to 18 MC. Thermoplastic, molded thermosetting, laminated thermosetting, and ceramic materials were studied.

In rough summary, the general trend of results is indicated as in Fig. 1. A similarity in the variation of dielectric constant and that of breakdown (volts per mil) with frequency is indicated. The results are not conclusive as yet, because some ranges of frequency are yet to be explored. It is suggested that this presentation be regarded as a progress report.

The step-like changes in dielectric constant have been the subject of many investigations and the phenomena involved are generally understood. In Figs. 2 to 5 inclusive a pictorial review of polarizations causing a step-like behavior of dielectric constant with increasing frequency is presented in proper order. In a complex dielectric possessing all such polarizations, the interdependent displacement mechanisms comprise a vibratory system capable of many modes.

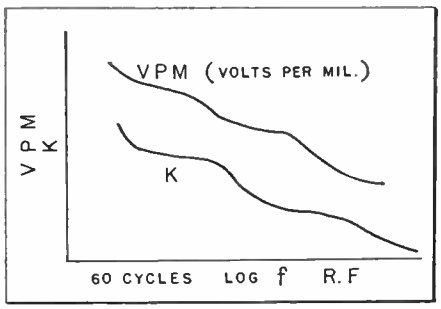


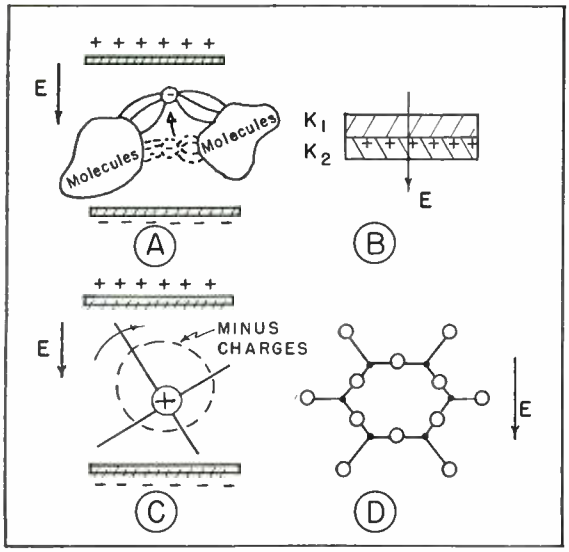
Fig. 1: Trend of results indicates similarity in variation of dielectric constant and voltage breakdown with frequency

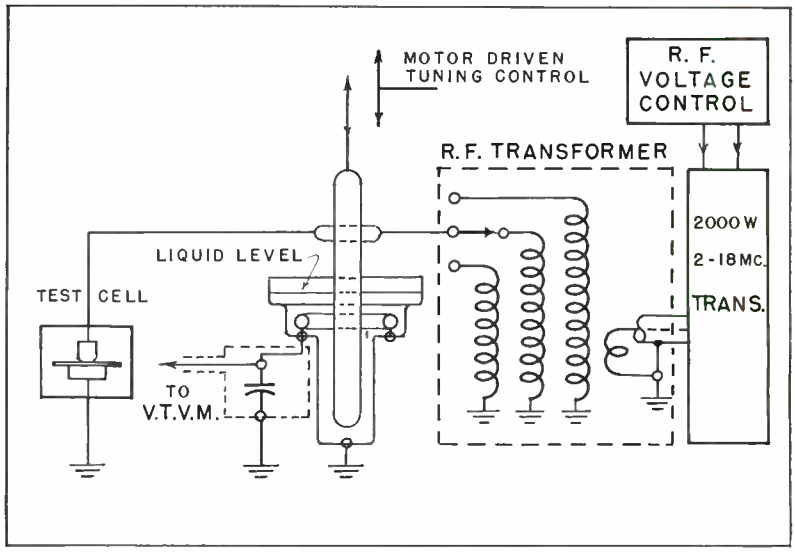
Although the restoring forces in some cases find their origin in the randomness of thermal agitation and simple description is admittedly incomplete, the essential considerations for vibratory or periodic motion are fulfilled.

In this present work these same polarization mechanisms invoked in explaining the variation of dielectric constant with frequency are suggested as playing a major role in forming the step-like breakdown (VPM) curve.

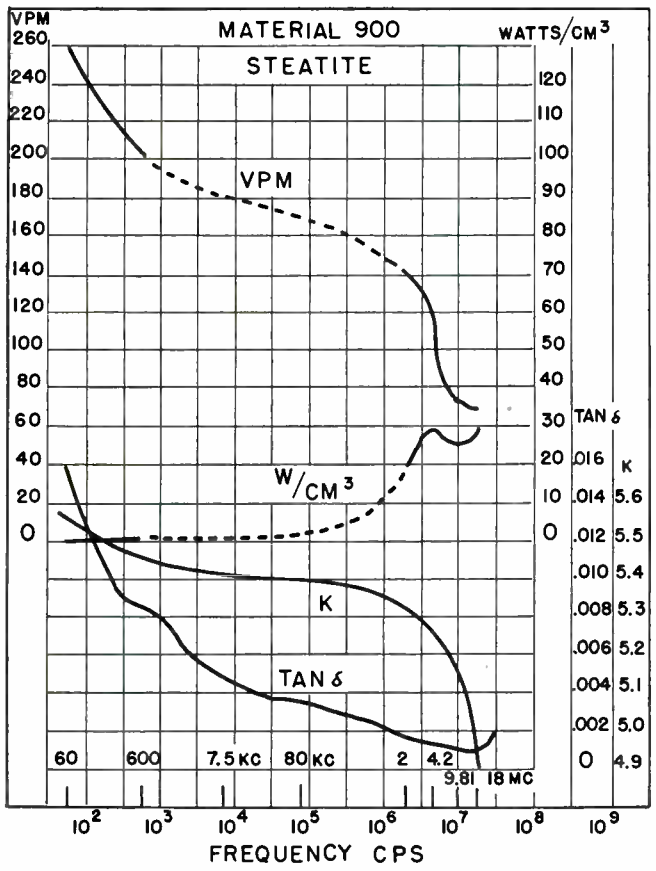
In Fig. 6, a transmitter (represented by a block on the right) capable of supplying 5 to 3 KW of power for short periods of time at 2 to 18 MC is shown coupled to an r-f transformer. The latter has a selection of secondary windings each insulated for 30 KV and each suitable for a small range of frequency. The secondary selected for a particular test must be tuned, using a liquid variable capacitor. A voltage divider ring is also contained within the capacitor, so that the developed voltages may be read upon a Vacuum Tube Voltmeter. The test cell is shown to the left, with a ¾ in. diameter electrode rounded by ⅛ in. radius and a 2 in. diameter electrode rounded by ¼ in. radius. The test immersion medium was continuously dried and filtered; dibutyl sebacate and mineral oil both have useful

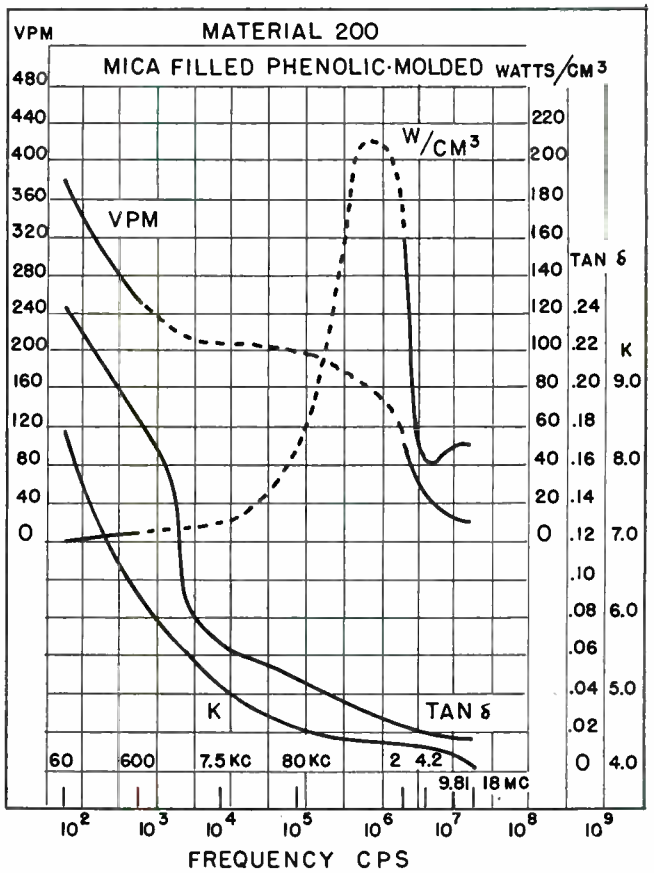
Figs. 2 to 5: (Left) Pictorial review of polarizations causing a step-like behavior of the dielectric constant with increasing frequency presented in proper order. Diagram at A shows bound charge, B—interfacial charge, C—permanent dipole and D—Structural modes. Fig. 6: (Right) Transmitter (block diagram at right) capable of 3 to 5 KW power at 2 to 18 MC for short time periods shown coupled to r-f transformer



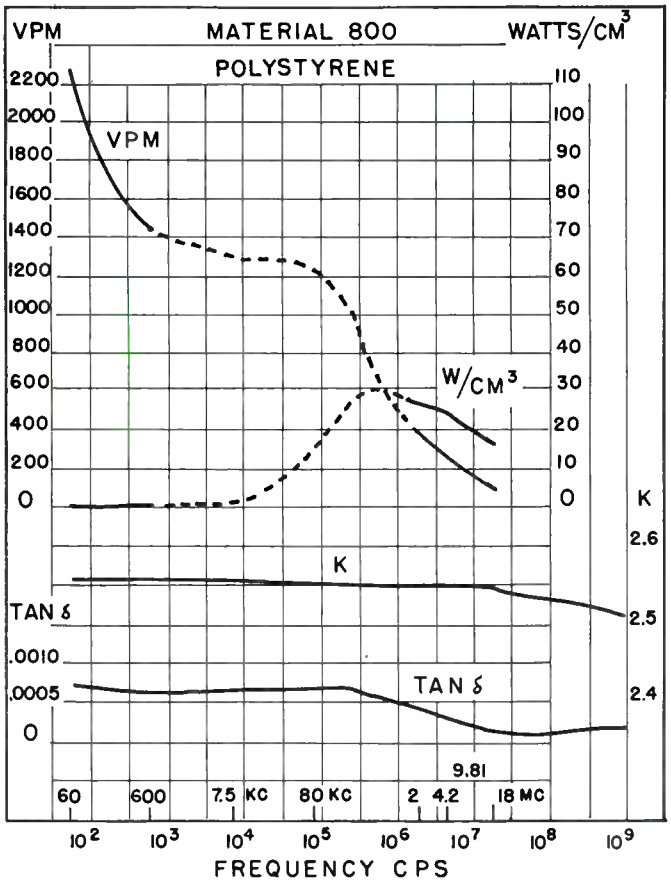


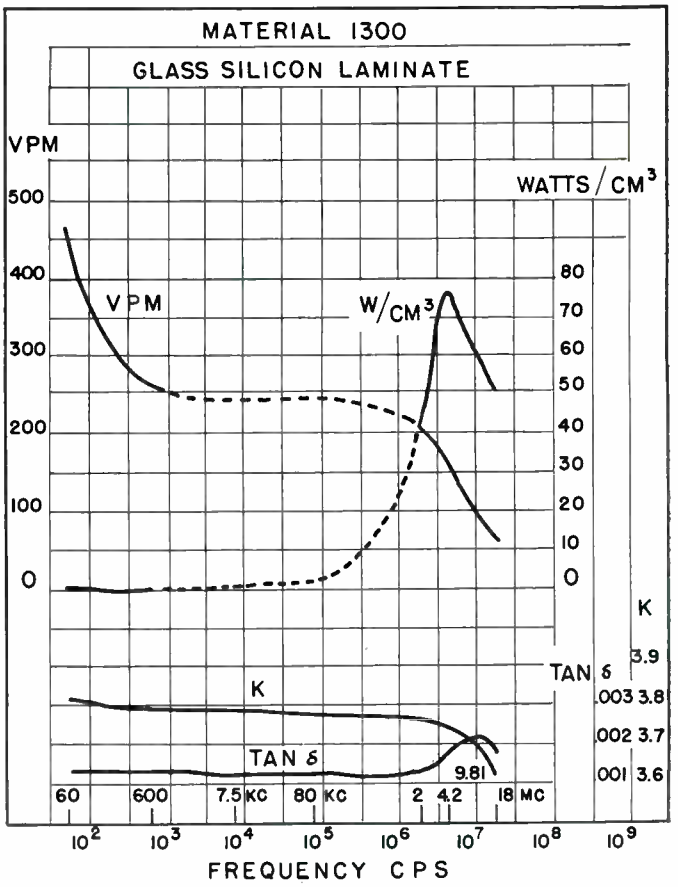
at High Frequencies





Figs. 7 to 10: Breakdown curves for various insulating materials. Note similarity between the dielectric constant and VPM curves





TESTING DIELECTRIC PROPERTIES (Continued)

ranges of application. The former liquid is to be preferred, but care must be exercised because of its softening action upon certain materials. In order to prevent corona and edge burning, a fillet of polyethylene must be applied to the electrode. A very successful technique employing polyethylene was developed. The voltage was applied gradually, using an automatic device, so as to require approximately 40 seconds for breakdown.

Twenty-five materials were tested, the nominal thickness being 1/8 in. This latter dimension was reduced in the case of a few materials requiring more than 30 KV for breakdown at 2 to 18 MC. Typical results are shown graphically in Figs. 7 to 12 inclusive. The dotted portion of the VPM curve is speculative due to the lack of breakdown equipment in the 10^4 to 10^5 cps region. The values of dielectric constant K and dissipation factor (tan δ) were obtained by use of the 716 GR bridge, Q-meter, and Twin T bridge. The watts per cubic centimeter at breakdown curve (W/cm^3) is of doubtful value, since it is a computed curve.

$$\text{Watts/cm}^3 = \left[\frac{\text{VPM}}{2.54}\right]^2 \cdot g$$

where $g = \omega/(0.9 \times 4\pi) \times$ Loss Factor $\times 10^{-6}$ micromhos per cm^3

The uncertainty lies in the fact that the loss factor was measured with low voltage bridges and not at a stress commensurate with breakdown.

However, the value of K determined with the generally available low voltage bridges appears to have prophetic value.

In Fig. 7, the breakdown of a ceramic material, steatite, is shown. The dielectric constant curve and the VPM curve appear to be similar.

In Fig. 8, the breakdown curve of a Mica-filled, phenolic-molded material is shown. Similarity between K and VPM variation with frequency is again suggested. As before the step in the VPM curve enters earlier in frequency spectrum than that of the K curve. The step in the former curve is usually more emphatic than in the latter curve.

In Fig. 9, the breakdown curve for polystyrene is shown. In this case the step in the breakdown curve enters decades earlier in the frequency spectrum than that of the K curve. It is also more pronounced in magnitude at both ends.

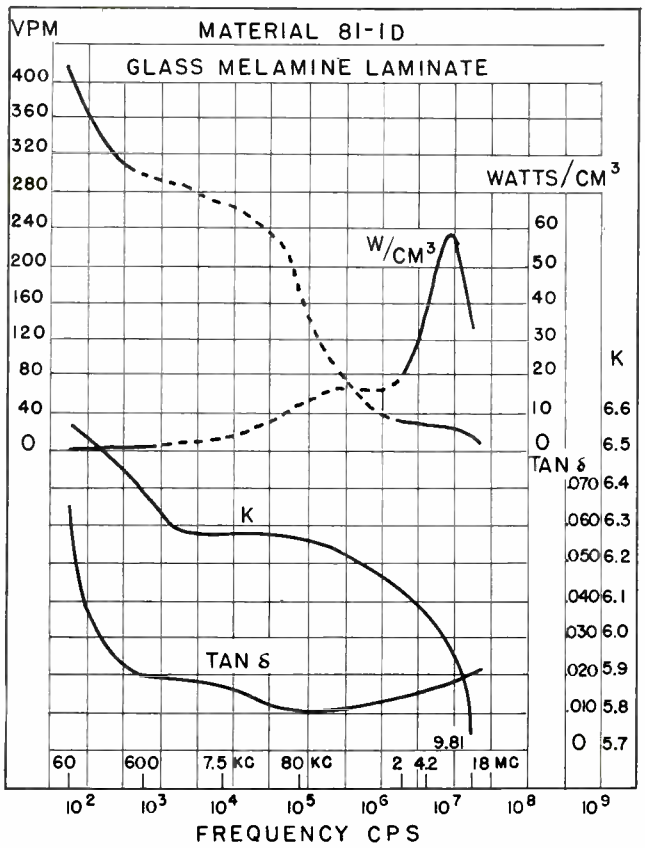
Fig. 10 shows the breakdown curve for a glass-silicone laminate. Again the VPM and the K curves are similar, but the former shows more emphatic steps and with appearance earlier in the frequency spectrum. It is noteworthy, but not conclusive, that as the estimated thermal dissipation decreases, the VPM still continues to decrease.

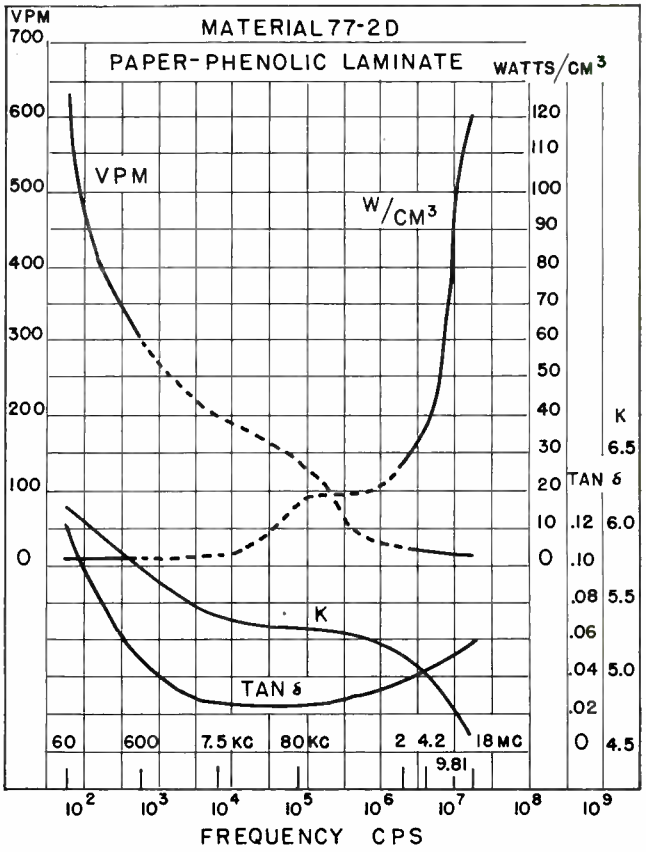
In Figs. 11 and 12 respectively, results upon a glass melamine and a paper phenolic laminate are shown. The laminated materials constitute 40% of the test program. Unfortunately, the unexplored region 10^4 to 10^5 cps represent a most important part of the suggested step-like curve in the case of these materials. This would be the region of interfacial polarization. It is planned for future experiments to explore the 10^4 to 10^5 cps region for all of the tested materials.

In Fig. 13, the work of V. M. Montsinger published in 1935, Electrical Engineering, is a matter of related interest. The upper curve is the original presentation of data and shows a step-wise decrease of crest voltage with time of application. At very long periods of time, it was generally supposed that corona and heating could play a role. However, neither of these phenomena afford completely satisfactory explanation for short time measurements of experiences.

(*Continued on page* 72)

Figs. 11 to 12: Results obtained on a glass melamine and paper-phenolic laminate. 40% of the material is laminate.





CUES for BROADCASTERS

Practical ways of improving station operation and efficiency

Edited by John H. Battison

Atomic Age for TV

A NEW use for radio active gas has been found by the American Broadcasting Co. It is mixed with the nitrogen normally employed to keep transmission lines dry and leaks are detected by means of a Geiger counter which is lowered over the lines in routine checks. Since there are about two miles of transmission line involved this is obviously much quicker than the usual method of rubbing the joints with soapy water and looking for bubbles. This detector system will be used on the new Empire State Building antenna installation and the other four ABC TV stations.

Cable Disconnect for RCA 88-A Mike

GUY C. RAUER, Chief Engineer, WCSS, Amsterdam, N. Y.

FACED with repeated cable breakdown on our RCA 88-A mikes, we decided that disconnects at the mike would be more practical than the integral cable, as supplied. A search through the Cannon catalog yielded a connector ideal for the purpose, #XL-3-50.

Remove rear case from mike, disconnect cable and remove from case. Saw off threaded boss at cable entrance and drill out hole so that rear skirt of connector shell will fit very snugly into mike case. Bevel inside edge of hole.

So that the rear of the connector

Type 88A mike with quick cable disconnect

body will not project into the mike case, a washer 3/32" thick is needed between mike case and connector shell. We made ours by drilling out an aluminum washer of the proper diameter. The junk box supplied a piece of steel rod 5/8" in diameter and 1¼" long which exactly seated against the shoulder inside the connector shell. Through this we drilled a 5/16" hole. Also needed is a 5/16" X 2½" flat head screw, nut and washer.

Assemble as shown and tighten nut slowly. The taper on the screw head will expand the inner portion of the connector shell against the bevel. Use caution in tightening as too much force will collapse the shell. Remove screw, nut, etc. Flexible connections about 3" long will allow room for soldering to connector. Use cable connector # XL-3-11.

$$$ FOR YOUR IDEAS

Readers are invited to contribute their own suggestions which should be short and include photographs or rough sketches. Typewritten, double-spaced text is preferred. Our usual rates will be paid for material used.

A Useful Mixing Circuit

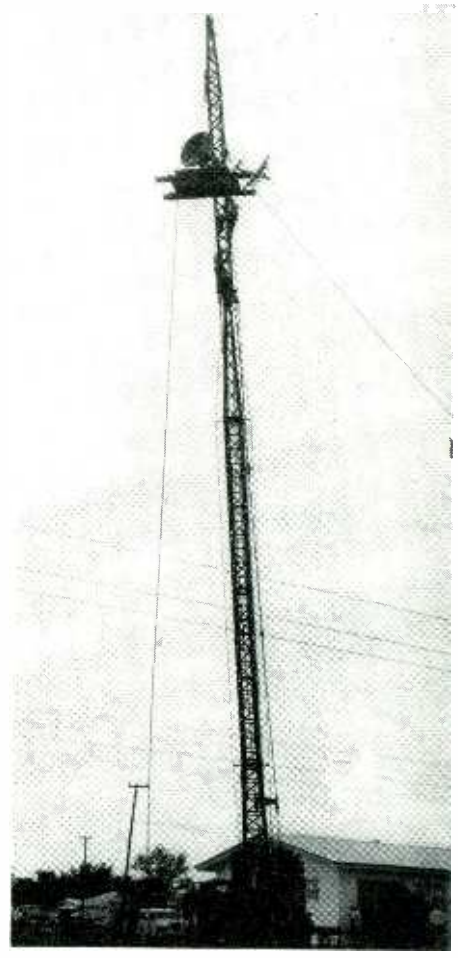
R. S. HOUSTON, 18 Oak Lane, Havertown, Pa.

WHILE the circuit described here is not unknown to the broadcast engineer, this particular use may be. The two incoming lines are put into a multiple jack, with the two outgoing circuits connected in parallel. On the face of it, this appears to be a perfect match, since 250 ohms looks into 250 ohms. But looking from one of the generators, there is a five hundred ohms source looking into 188 ohms, which is the result of the two terminations plus the other generator all in parallel.

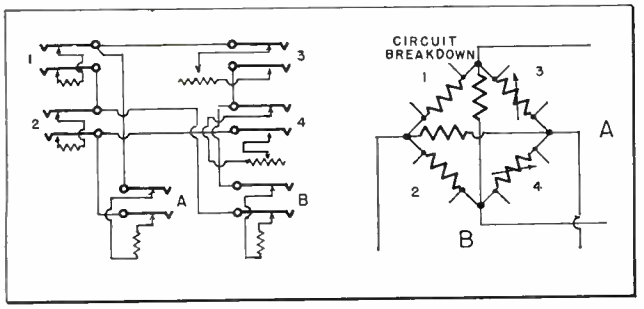
By taking six jacks and connecting them in the bridge circuit as shown, with terminating resistors on the normalizing contacts, it is possible to set up a mixing circuit that will match up to four lines, either for sending, or receiving, or both simultaneously. Since the impedance as measured across any two of the input connections will be equal to the impedance of the bridge, (as determined by the resistors) the various inputs and outputs can be patched in any combination. However, it is the usual custom to put inputs in the jacks marked 1-4, with the outputs in the jacks marked "A, B".

One use is feeding cue back to a remote operator while the program

REMOTE PROBLEM SOLVED



WTVJ, Miami, Fla., recently proved that a little ingenuity makes any "remote" possible. The remote site was such that the microwave transmitter placed on top of the building did not have the line-of-sight clearance necessary for the TV signal to be relayed to the WTVJ control tower atop the Everglades Hotel. No other building in the area was tall enough to accommodate the microwave antenna. A 100-ft. crane hoist solved the problem. At 82 feet above the ground, the antenna platform was anchored by guy wires and the WTVJ technical crew aligned the "dish" with the downtown antenna



Four line mixer for feeding cues over broadcast lines

is coming in over the same line. This is useful in "ghosting" of broadcasts to enable the operator to give cues etc., since he can hear what was being fed from the studio. In this case, the incoming line is patched to a numbered jack, with output A going to the remote input fader, and output B going to the cue circuit. The isolation under these conditions is from forty to sixty db, depending on the balance of the lines.

To improve this balancing, two of the inputs could be provided with variable 600 ohm resistances (in the case of a 500 ohm circuit), so that varying line impedances could be accommodated and compensated for. By careful adjustment of these two, it is possible to get a high degree of isolation. It is not necessary to use repeat coils in coming from this network; although on long lines, such as a phone circuit, it would be advisable, as would equalization. If equalization is attempted after the network, it is likely to result in impaired response from the other circuits, since there is no interaction between the circuits, thus the capacity of the unequalized line would not reduce the high frequency response of the others.

Line Monitoring Amplifier

R. FINKBEINER, Engineer, WHRV, Ann Arbor, Mich.

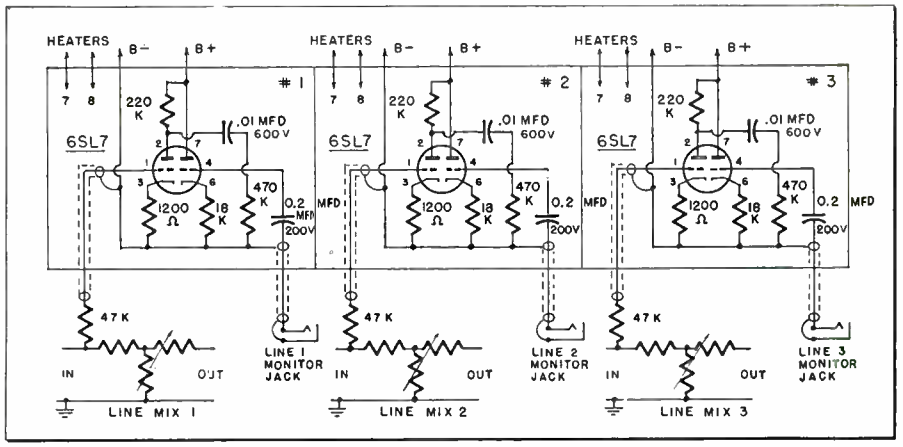
THIS line monitoring amplifier is intended to be used when situations arise that make it impossible to use the line cueing facilities normally found in the station console. This occurs in combination stations and in stations where the announcer operates the console and must be able to monitor network or remote program lines while on the air. Since the usual line cue circuit is a speaker monitor, and this cannot be used next to an open microphone, a headphone monitor is necessary.

The amplifier in use at WHRV is really three identical amplifiers, one for each of the line mix controls on the console. During a network co-op program the announcer can hear the network announcer while he is filling locally. Or, when a remote is about to be broadcast the announcer can hear the signal appearing at the line mix control while reading the introduction, thereby avoiding possible embarrassing situations should the control be opened too soon. Also, chances for operational error are reduced because all switches and patches preceding the line mix control must be properly set before a signal will be heard in the phones. Two way communication to remote locations, over the program line, is also simplified. If the second channel of the console was formerly used for line cueing purposes it can now be left free.

A single 6SL7 is used for each amplifier. One unit is connected as a simple resistance coupled amplifier and feeds the second unit, a cathode follower, which is coupled to the headphones. The cathode follower provides a better impedance match to magnetic phones than possible with a straight triode. Note that no connection is made to the chassis, but that all ground returns are made to the B– lead. Shielded lapel microphone cable is used for the input and output connections. To save space the 0.2 mfd. condensers should be of the 200 volt variety.

The three amplifiers are constructed on a 8x 2½ x 1½ chassis with shield partitions between amplifiers as a precaution against crosstalk.

Monitor for multiple line operation by engineer announcers



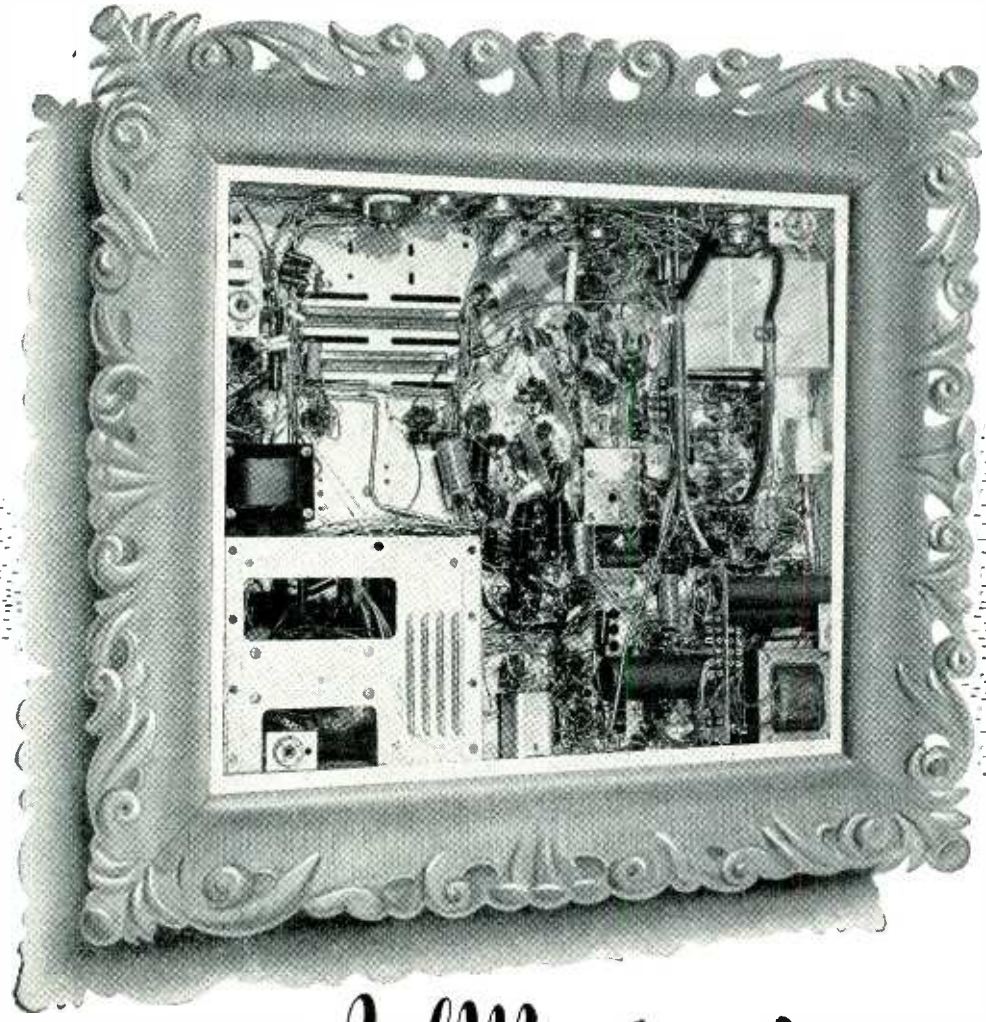
Flash—A New 3-Color Picture Tube

Dr. Jenny Bramley, a mathematician, of Monmouth Junior College, Long Branch, N. J., has divulged details of a three-color picture tube which operates on the secondary emission principle.

Two guns are used, one for red and the other for blue and green. On the inside screen face is a semi transparent conducting film. On this are deposited sets of fluorescing green and blue strips. Over these is a secondary emitting layer.

The thickness of these strips is such that maximum light output for green is produced by 16 KV, and for blue by 2 KV bombarding electron voltages. About 1 MM from these strips is stretched a sheet of aluminum foil with a red fluorescing coating on the screen side, this is also coated with a secondary emitter such that a 2KV bombarding voltage produces maximum red light output. The foil is connected to the anode HV supply.

The tube operates on the principle of the potential difference between the electron beam and the aluminum foil. By rapidly switching the potentials on these elements field sequential color pictures can be produced. The tube thus offers an alternative to the mechanical disc for CBS color TV.



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High Definition Monochrome TV

Interleaved video transmission provides key to extended frequency response and provision of greater detail in black and white television

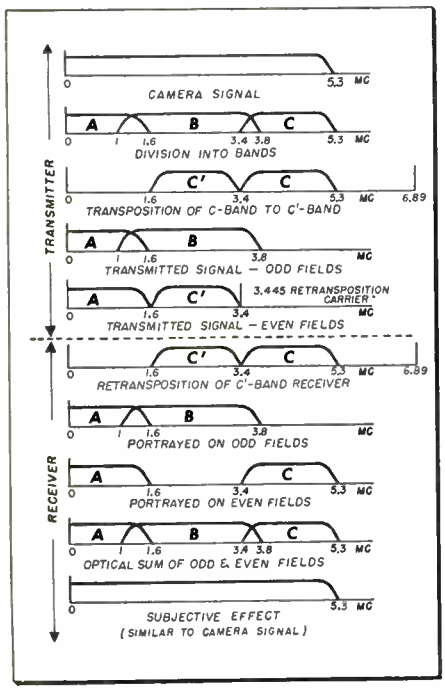
By FRANKLIN LOOMIS

R. B. DOME of the General Electric Co., known for his Inter-Carrier method of TV reception and GE's Color Television System, has proposed to the FCC a system which, while using present 6-MC channels, improves the horizontal detail in monochrome pictures by 50%. According to a GE report, the improvement lies in a combination of several effects: the eye is not as susceptible to flicker in small areas of the picture as it is in large areas; the low frequency portion of the picture's video band is transmitted at the standard rate, while the higher frequencies, after being separated by filters, are transmitted during odd picture fields; super-fine detail, finer than that now transmitted, is transposed in frequency and fitted in the band normally used by fine details and transmitted during even fields.

Advantages—(1) It is compatible. (2) Precision equipment is at the transmitter. Over four additional tubes are required at the receiver. (3) The received picture has 50% more detail and "texture" similar to present pictures.

On the other side of the ledger Mr. Dome mentions: (1) Relay circuits must have a bandwidth of 4 MC. If, they cut off at 2.7 MC, special equipment can overcome some of the resulting disadvantage. (2) Strong cw interference at the retransposition frequency can reduce definition. (3) If a "sampling" method were used instead of the Dome Frequency - Interleaving method, a 100% increase in detail, theoretically would be possible; however, a more complicated receiver would be needed and a dot texture would be visible.

Fig. 1: GE high definition B-W TV waveforms



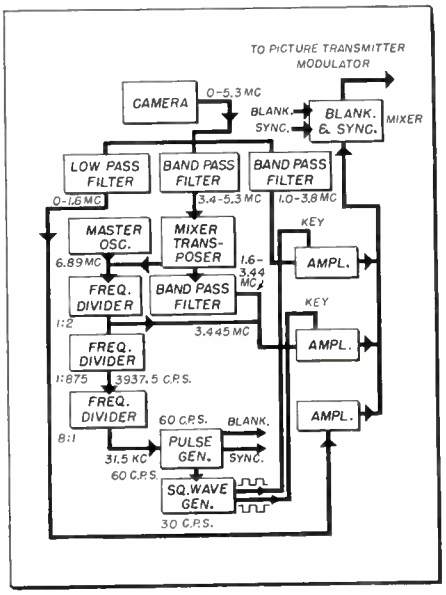


Fig. 2: Diagram of high definition transmitter

Transmitter — Assume a camera passing frequencies up to 5.3 MC. Its output is impressed on three wave filters; 0-1.6, 1.0-3.8 and 3.44-5.3 MC. See Fig. 1. Keyed amplifiers, a mixer-transposer in which modulation of a master frequency, 6.890625 MC., occurs, the addition of a 3.4453125 MC frequency, wave filters, etc., are employed to produce the desired composite video frequency which is fed to the modulator of a standard TV transmitter.

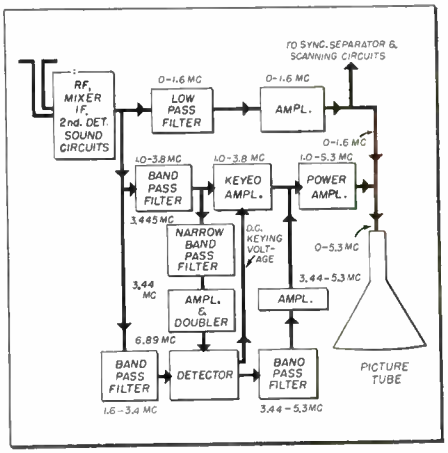


Fig. 3: Special receiver for new GE system

Receiver—This is conventional except for the v-f amplifier, where three filters are fed from the second detector. The 0-1.6 MC filter operates for both odd and even fields and supplies standard video. The 1.0-3.8 MC filter is connected to a keyed amplifier, and a power amplifier, these signals are also impressed on the picture tube. A side circuit from this filter is tuned to the retransposing frequency, 3.445 MC, which is amplified and doubled to 6.89 [illegible] and used for demodulation. The [illegible] component of the detected wave [illegible] the amplifier, cutting it off when the 3.445 MC frequency is present.

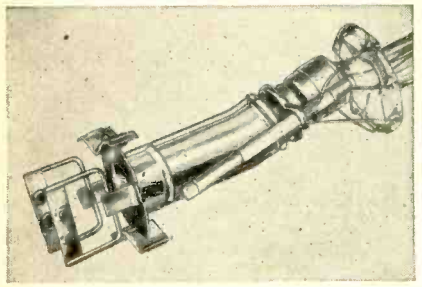
The third filter, 1.6-3.4 MC, feeds into the 6.89 MC Demodulator, which contains difference frequencies in the band 3.44-5.3 MC. After passing through another filter, which removes unwanted frequencies, the [illegible] are amplified and passed to the kinescope.

Compatibility—Standard receivers will provide pictures having resolution when receiving high-definition transmissions. Quality will be affected by: (a) a weak, fine-grained pattern from the retransposing wave; (b) the non-utilized, super-high signals, which theoretically should cancel, do not quite do this (because persistence of vision is not infinite) and result in slight, spurious signals. (c) About 50% reduction in brightness of high frequency detail because this occurs in alter-

(*Continued on page 71*)

Bent Gun

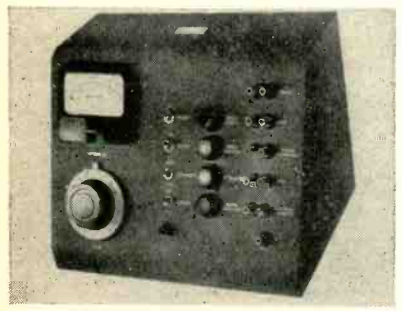
Uniform focus over the entire usable screen area is now attained by means of the new Du Mont bent gun. A higher de-



gree of pre-focusing in the new model passes a smaller diameter beam bundle through the deflection field. This reduces spot distortion and results in uniform focus over the entire usable screen area for pleasingly sharp pictures. A new grid-cathode assembly makes it possible to obtain this greater pre-focusing without increasing the overall length of the tube. An improved bulb spacer simplifies electron gun centering and insures proper anode contact. Stray emission at higher voltages is minimized by rounding the corners of pertinent electron-gun components.—**Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.**—TELE-TECH

Dynamic Analyzer

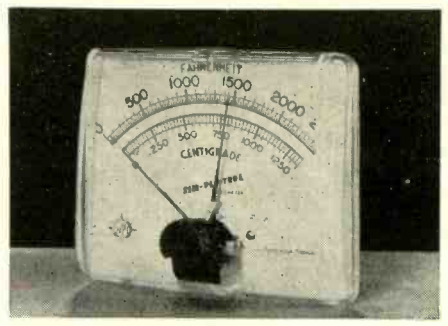
Model 100-A is an instrument which facilitates the measurement of frequency and transient response of low frequency



systems by electrical methods. It provides periodic perturbation signals to be injected into the error or input channels of the device under test together with sweep and comparison voltages with which to view the output member excursion on the CR oscilloscope. These waveshapes are generated by electromechanical elements geared together and driven by precision speed control. Range of modulating frequencies is from 0.1 to 50 cps for transfer function tests. Phase measurements can be made with accuracies of ±2°. For the transient tests, the damped natural frequency and the height of the first overshoot can be measured. —**Industrial Control Co., 1462 Undercliff Ave., New York 52, N. Y.**—TELE-TECH

Contact Meter Relay

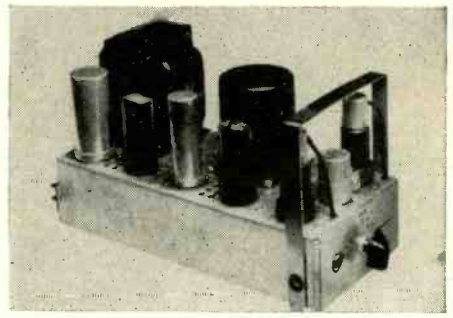
The new, larger size Simplytrol 451-C contact meter relay provides a scale length of 4 in. Manufactured as microammeters, milliammeters and ammeters as well as voltmeters and millivoltmeters (ac and dc), these units have contact settings which are adjustable to any point on the scale arc. Single and double contact arrangements are available to provide high limit, low limit or both high and low limit. Micro contacts used in these meters are energized contacts. One platinum contact is carried on the pivoted movement. It is connected to



an extra winding on the moving element. The mating contact is spring mounted on the adjustable red pointer. Magnetic action in the coil securely locks the contacts together.—**Assembly Products, Inc., Chagrin Falls, Ohio**—TELE-TECH

Line Amplifier

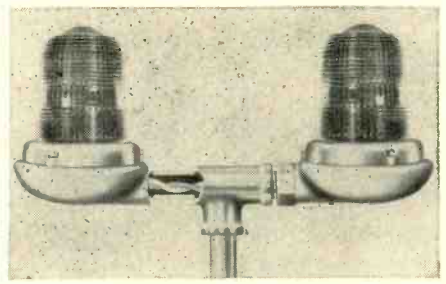
Model MI-12160 line amplifier can be used as a master mixer for up to four preamplifiers, a booster amplifier for sup-



plying zero level to a telephone line, a line amplifier capable of operating from a telephone line, or a bridging amplifier for bridging a low impedance line. It provides excellent frequency response from 30 cps to 15 KC with low distortion. Inverse feedback and voltage-regulated power supply are featured. Power output is rated up to 2 watts. An interstage gain control with positions 0 to 10 is mounted on the front apron of the chassis for easy operation. The self-contained power supply consists of a power transformer, high vacuum fullwave rectifier tube, and low hum output filter.—**Radio Corporation of America, RCA Victor Div., Camden, N. J.**—TELE-TECH

Tower Light

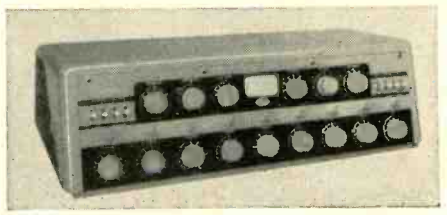
A lightweight, heavy duty tower light has been developed for use on upright conduits or masts which differs from



conventional obstruction lights in that the side of the light base incorporates standard ¾ in. internal pipe conduit threads. No elbow connections or other attachments are required to mount the "Telico" light to a ¾ in. diameter mast. It weighs less than 4 lbs. and is waterproof and corrosion resisting. Weep holes for condensation drainage in the bottom of the light housing are optional. —**Dave Rumph Co., P. O. Box 3178, Fort Worth, Texas.**—TELE-TECH

Audio Console

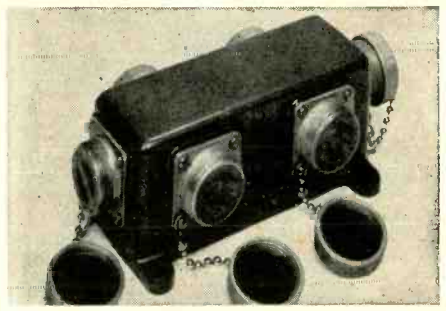
The RC-12 audio console has been designed with the requirements of television in mind. Among the many other



desirable features it includes: provision for operating the console as a single channel unit with monitor and a second VU meter; seven preamps—2 stage, 36 db gain—1 remote fader and 1 network high level fader; control panel and large size VU meter, both illuminated for TV control room use; brilliance of illumination adjustable; provision for tape recorder; three (provision for five maximum) studio speaker relays (fast operating) on terminals to allow connection of any desired relay to any studio mike key; all tubes miniature type, extremely quiet; high level cue channel feed to remotes; distortion less than 1%, 50 to 15,000 cycles; threshold noise level —125 dbm below 1 milliwatt; wide range plus or minus 1 db, 50 to 15,000 cycles; ground buses for all external wiring.—**Raytheon Manufacturing Co., Waltham 54, Mass.**—TELE-TECH

Outlet Box

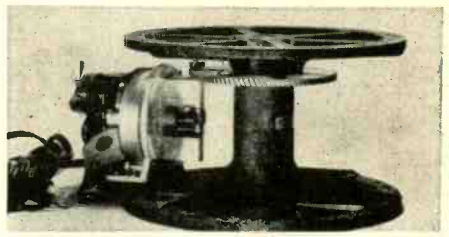
Designed for AM-FM radio and television remotes, the 6005 waterproof outlet box provides reliable and safe con-



nections that will not open when used with type 106 and 115 accessory connectors. Wiring from the inlet to all outlet receptacles is symmetrical. Each outlet will conservatively carry 1500 watts and the inlet receptacle is rated at 6,000 watts, all at 115 v. The circuit is undergrounded to permit use on ac or dc and mounting on a grounded or ungrounded metal surface. Each receptacle is equipped with a waterproof screw-on cap and is attached to the body by a short chain.—**Equipment and Service Co., 6815 Oriole Drive, Dallas 9, Texas**—TELE TECH.

Turntables

Models 500 and 600 turntables are designed for turning loads up to 125-150 lbs, on discs from 3 to 4 ft. in diameter.

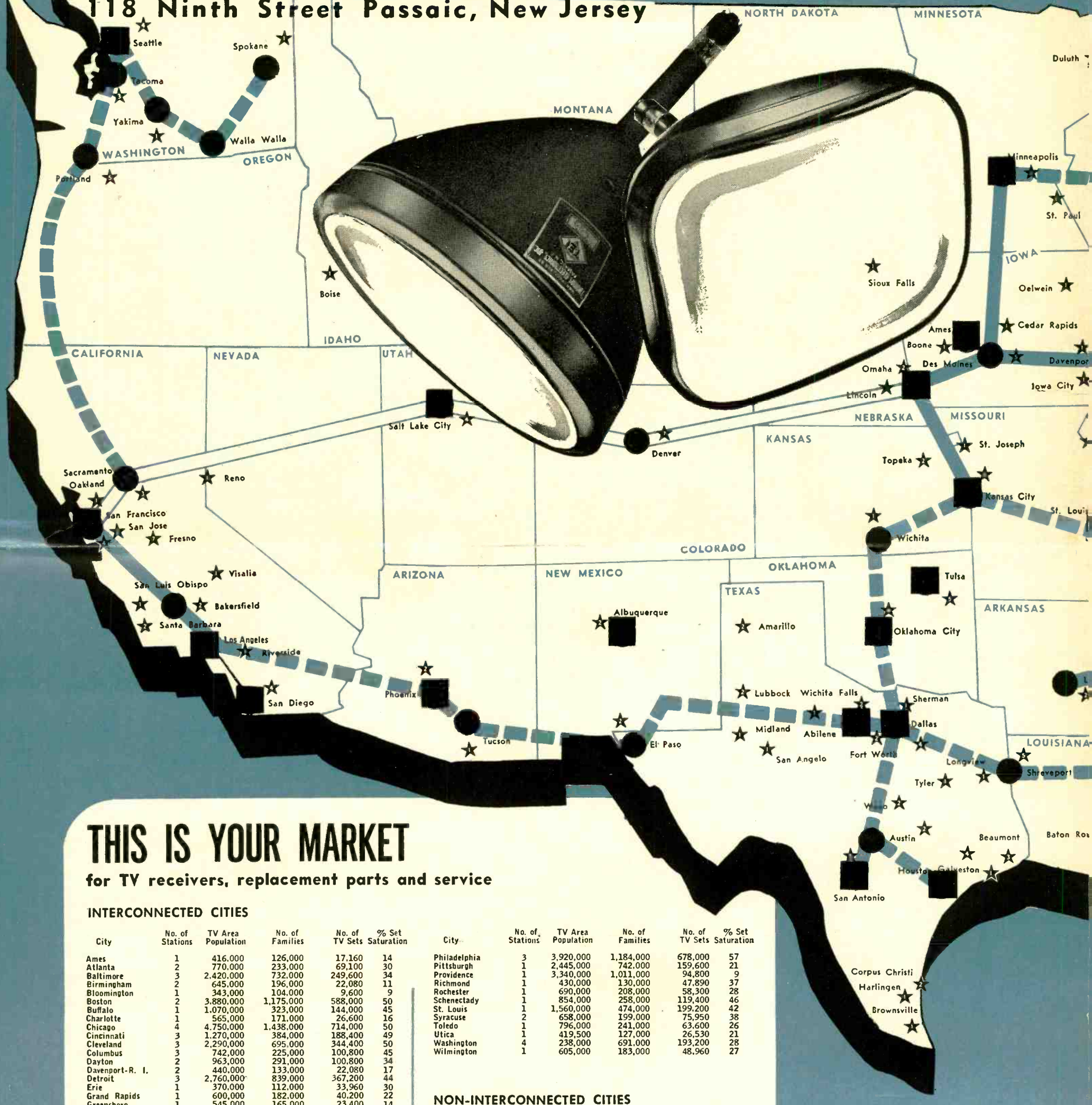


These mechanisms are 5 and 6 in. high, respectively. Speeds are 3 rpms and 2 rpm and the diameters of the full round top casting are 8 and 11 in. Shipping weights are 13 and 29 pounds. Merklekorff ac induction motors are employed with friction-driven top casting.—**Gale Dorothea Mechanisms, 37-61 85th St., Jackson Heights, L. I., N. Y.**—TELE-TECH

THOMAS ELECTRONICS INCORPORATED

1951 TEL

118 Ninth Street Passaic, New Jersey



THIS IS YOUR MARKET

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INTERCONNECTED CITIES

City	No. of Stations	TV Area Population	No. of Families	No. of TV Sets	% Set Saturation
Ames	1	416,000	126,000	17,160	14
Atlanta	2	770,000	233,000	69,100	30
Baltimore	3	2,420,000	732,000	249,600	34
Birmingham	2	645,000	196,000	22,080	11
Bloomington	1	343,000	104,000	9,600	9
Boston	2	3,880,000	1,175,000	588,000	50
Buffalo	1	1,070,000	323,000	144,000	45
Charlotte	1	565,000	171,000	26,600	16
Chicago	4	4,750,000	1,438,000	714,000	50
Cincinnati	3	1,270,000	384,000	188,400	49
Cleveland	3	2,290,000	695,000	344,400	50
Columbus	3	742,000	225,000	100,800	45
Dayton	2	963,000	291,000	100,800	34
Davenport-R. I.	2	440,000	133,000	22,080	17
Detroit	3	2,760,000	839,000	367,200	44
Erie	1	370,000	112,000	33,960	30
Grand Rapids	1	600,000	182,000	40,200	22
Greensboro	1	545,000	165,000	23,400	14
Huntington	1	435,000	132,000	24,150	18
Indianapolis	1	930,000	281,000	75,900	27
Jacksonville	1	310,000	94,000	18,000	17
Johnstown	1	825,000	250,000	40,680	16
Kalamazoo	1	473,000	143,000	17,160	12
Kansas City	1	910,000	275,000	55,600	20
Lancaster	1	280,000	85,000	70,650	83
Lansing	1	550,000	168,000	22,800	14
Louisville	2	621,000	188,000	55,800	30
Memphis	1	586,000	177,000	59,150	33
Milwaukee	1	1,078,000	327,000	175,200	54
Minn.-St. Paul	2	1,100,000	333,000	145,200	44
Nashville	1	508,000	154,000	2,400	2
New Haven	1	1,840,000	557,000	114,600	21
New York	7	11,850,000	3,597,000	1,867,000	52
Norfolk	1	646,000	196,000	33,480	17
Omaha	2	436,000	132,000	35,760	27
Philadelphia	3	3,920,000	1,184,000	678,000	57
Pittsburgh	1	2,445,000	742,000	159,600	21
Providence	1	3,340,000	1,011,000	94,800	9
Richmond	1	430,000	130,000	47,890	37
Rochester	1	690,000	208,000	58,300	28
Schenectady	1	854,000	258,000	119,400	46
St. Louis	1	1,560,000	474,000	199,200	42
Syracuse	2	658,000	199,000	75,950	38
Toledo	1	796,000	241,000	63,600	26
Utica	1	419,500	127,000	26,530	21
Washington	4	238,000	691,000	193,200	28
Wilmington	1	605,000	183,000	48,960	27

NON-INTERCONNECTED CITIES

City	No. of Stations	TV Area Population	No. of Families	No. of TV Sets	% Set Saturation
Albuquerque	1	72,600	22,000	5,520	25
Binghamton	1	435,000	131,000	22,800	17
Dallas	2	950,000	277,000	47,530	17
Ft. Worth	1	879,000	269,000	37,690	14
Houston	1	716,000	217,000	44,640	21
Los Angeles	7	4,540,000	1,372,000	765,500	56
Miami	1	386,000	117,000	40,680	35
New Orleans	1	744,000	225,000	41,160	23
Oklahoma City	1	456,000	138,000	50,780	15
Phoenix	1	162,000	49,000	20,930	43
Salt Lake City	2	307,000	93,000	30,360	33
San Antonio	2	430,000	130,000	30,240	23
San Diego	1	375,000	113,000	66,000	59
San Francisco	3	2,720,000	825,000	102,300	12
Seattle	1	1,030,000	307,000	45,350	15
Tulsa	1	414,000	125,000	41,170	33

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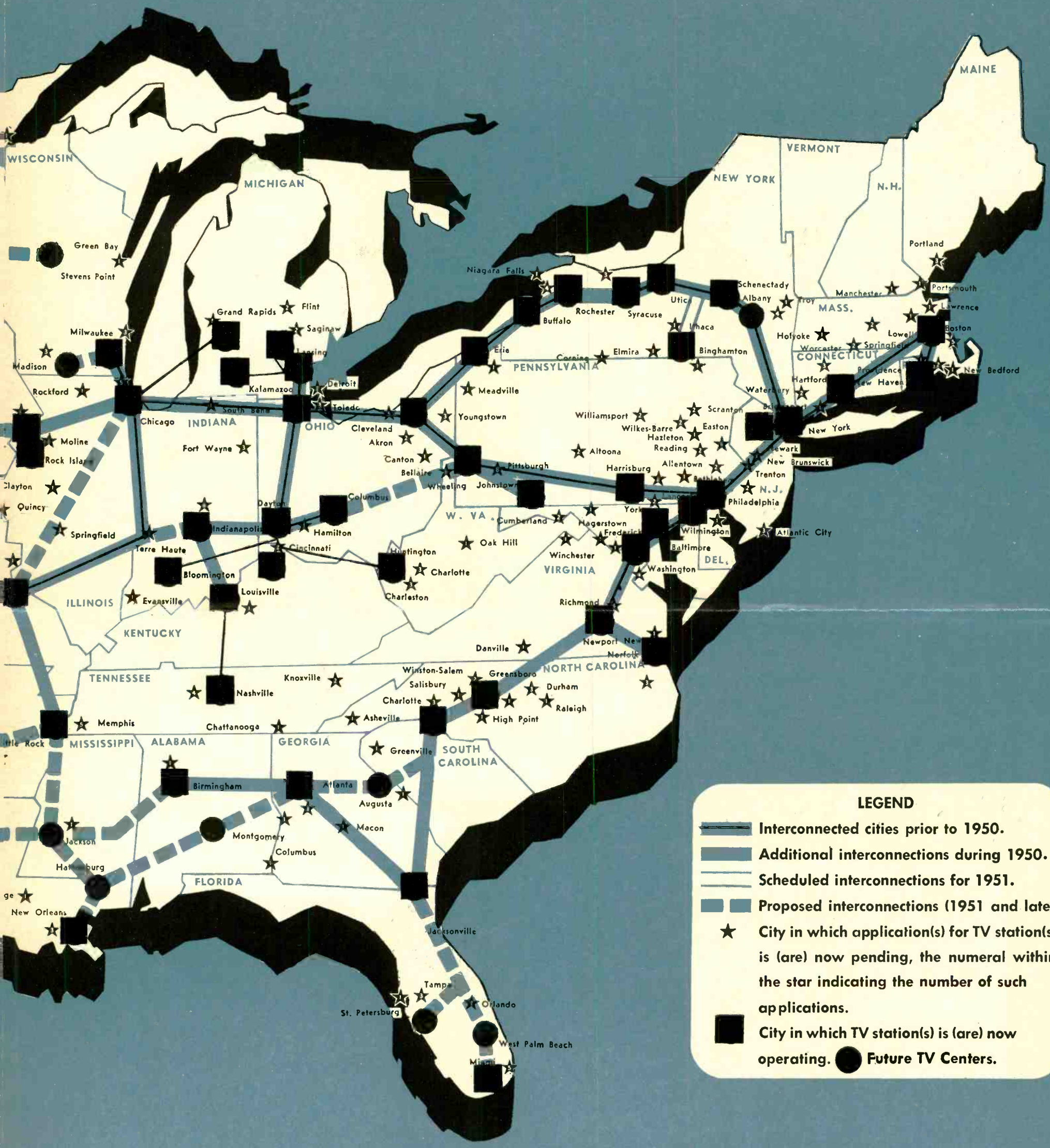
EVISION MAP & MARKET DATA



LEGEND

- Interconnected cities prior to 1950.
- Additional interconnections during 1950.
- Scheduled interconnections for 1951.
- Proposed interconnections (1951 and later).
- ★ City in which application(s) for TV station(s) is (are) now pending, the numeral within the star indicating the number of such applications.
- ■ City in which TV station(s) is (are) now operating. ● Future TV Centers.

As market conditions dictate, it is our pleasure to compile and bring to you sound, factual material such as this in the interest of the stable development of the television industry, and the promotion of better business within that industry. We trust that you will find this information useful, and will be pleased to receive your comment.

Thomas Electronics, Inc.

NEW EQUIPMENT for DESIGNERS and ENGINEERS

Compiled by the Editors of TELE-TECH, Caldwell-Clements, Inc., 480 Lexington Ave., New York 17, N. Y.

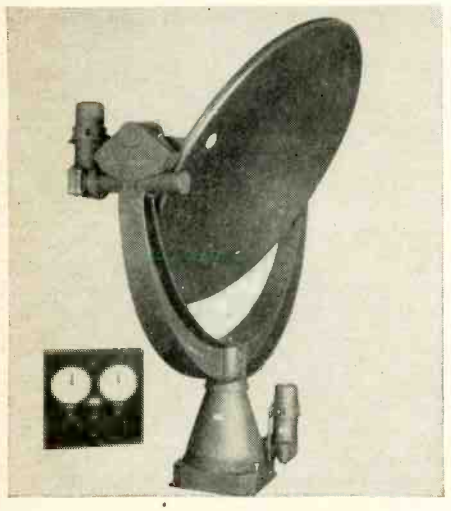
Oscilloscope

Model T-1601-A oscilloscope is a general-purpose, high-quality oscilloscope which includes the necessary engineering

features of phasable 60-cycle sweep, internal voltage calibrator, as well as wide band amplifiers and driven sweep circuit. The instrument has 17 tubes, including a 5-in. CRT and a sensitivity of 10 mv. Band width is 12MC and sweep magnification is five times screen size. Input requirements are: 105 to 125 v. rms, 50/60 cps; 174 watts.—**Television Equipment Corp., 238 William St., New York 7, N. Y.**—TELE-TECH

Remote Control for Microwave Parabolas

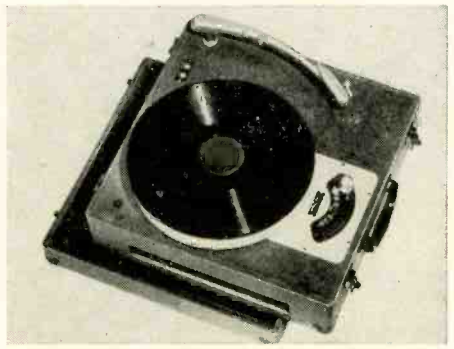
A new system for remote control of microwave parabolic antennas in the field at distances up to 1500 ft. is now avail-



able. Control of the saucer-shaped reflectors from greater distances can be achieved with the use of additional control equipment. The new system consists essentially of a rotatable field mount and a remote control unit equipped with switches and indicating devices. Design of the field mount provides for azimuth and tilt positioning of the parabola. The field mount operates in the open without any protection and will withstand a wind velocity of 120 mph. The parabola is driven with 1/6 hp motors providing a torque of 10,500 in.-pounds at 1 rpm. which is the speed of the azimuth and tilt drives.—**Radio Corporation of America, RCA Victor Div., Camden, N. J.**—TELE-TECH

Variable Speed Turntable

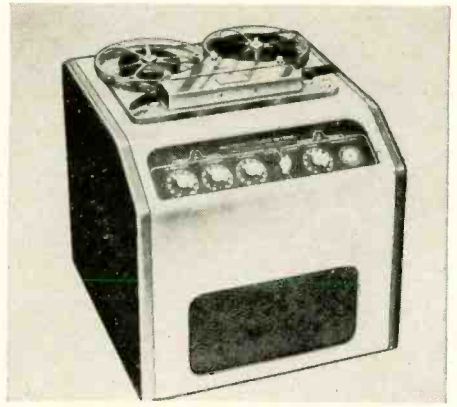
A continuously variable speed professional turntable has been developed that plays any rpm from 25 to 160 without



wow. The 12 in. cast aluminum turntable is fitted with hardened and ground shafts. Noise level is 30 db below average recording level and flutter is ± .25%. The motor is a constant speed, four-pole unit. The turntable is available as a chassis or mounted in a portable case with 16-in. pickup.—**Rek-O-Kut Co., 38-01 Queens Blvd., Long Island City, N. Y.**—TELE-TECH

Tape Recorder

The Magnemaster Consollette may be operated at tape speeds of 50 CPS to 15 KC; or at 7½ in./sec. with a frequency



response of 50 cps to 10 KC ± 2 db. After the reel has run through, the instrument instantaneously and automatically changes direction of tape travel, and plays an equal length of time in the other direction. As a result continuous playing time of 30 min. at 15 in./sec.; and 60 min. at 7½ in./sec. are possible using standard 7 in. diameter 1200-ft. reels of tape. Separate sets of heads for record-erase, and monitor permit simultaneous monitoring of the recorded signal to be made off the tape for quality control. The unusual head construction guarantees positive lifetime alignment. A dynamic range of better than 50 db is attained without isolating the power stage.—**Amplifier Corporation of America, 398-26 Broadway, New York 13, N. Y.**—TELE-TECH

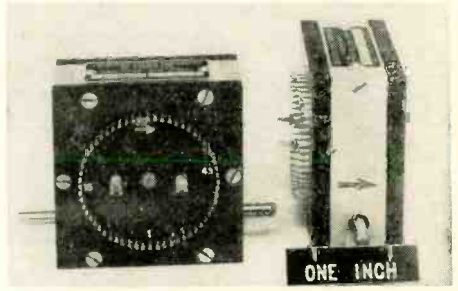
Transmitting Tube

A transmitting tube (GL-5680) designed for use as a power amplifier is forced-air cooled and may be operated at maximum

ratings at frequencies as high as 5 MC. In pulse r-f power amplifier service, it is capable of delivering a peak power output of 90,000 watts at 15,000 v. under typical operating conditions. It can also be used as an r-f power amplifier and oscillator or as an a-f power amplifier and modulator for commercial transmitters. In such service the plate dissipation is 2500 watts at 6000 v.—**General Electric Co., Syracuse, N. Y.**—TELE-TECH

Sampling Switch

Model 260S-L high speed multichannel sampling switch is provided with a 60:1 internal gear reduction and two separate



poles each of which contains 60 contacts. This design enables the two synchronized wipers to sample their respective contacts at a rate of one contact per revolution of the input shaft, thus permitting the user to correlate data from different channels with respect to angular position from a fixed reference for the drive shaft. The shorting type wipers allow greater versatility in wiring arrangements with the possibility of having as many as 60 independent channels per pole for "make-before-break" switching and 30 per pole for "break-before-make" switching when alternate contacts are left unwired.—**The Applied Science Corporation of Princeton, P. O. Box 44, Princeton, N. J.**—TELE-TECH

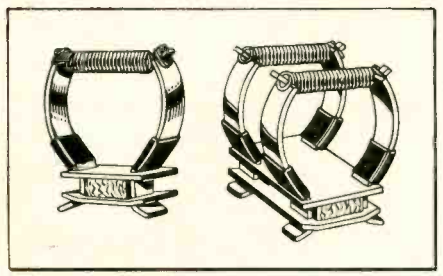
Resistors

Type T high voltage resistors have been designed especially for television applications. They will withstand high dc, pulse

and transient voltages encountered in TV power supplies. They have a high stability carbon resistance coating applied on a rugged steatite form. The coating is applied as a helix on the surface of the form to provide a long resistance path in a small space. Because of the long path length the voltage per unit length is relatively low, insuring long life with good stability. Spacing between turns is ample thus eliminating possibility of arcing or high voltage stress.—**Resistance Products Co., 714 Race St., Harrisburg, Pa.**—TELE-TECH

TV Centering Controls

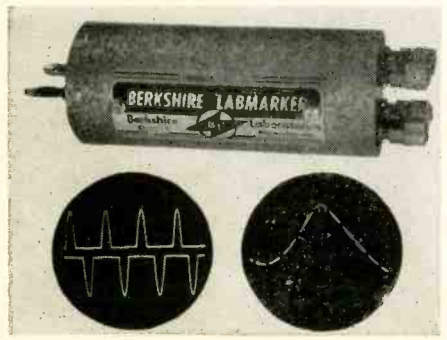
New "Beamajuster" television centering controls are now available in single or double magnet designs. The spring



mechanism facilitates mounting the ion trap on the tube neck and the relatively wide magnet supporting legs assure permanence of adjustment.—**Perfection Electric Co., 828 South State St., Chicago 5, Ill.**—TELE-TECH

Wave Shaper

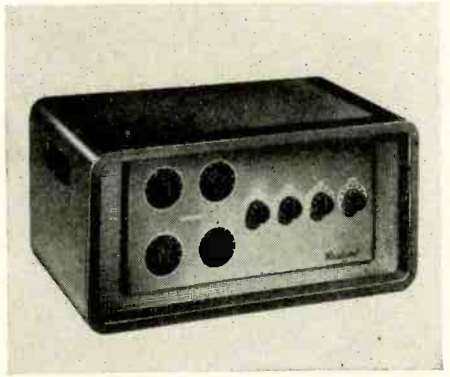
A wave-shaping device for the production of timing marks in cathode ray oscillography has been developed. It converts a sinusoidal input of up to 30 v. rms into a series of sharp undirectional pulses. The new model 1-U Labmarker permits



the use of either positive or negative pulses, or both at once. Approximate characteristics are: pulse duration, one-third of a second; pulse amplitude, one-half of the rms input voltage; frequency range, 25 cps to 1 MC. The oscillograms show the output wave forms of the model 1-U and a record timed with the instrument.—**Berkshire Laboratories, P. O. Box 707, Concord, Mass.**—TELE-TECH

Amplifier

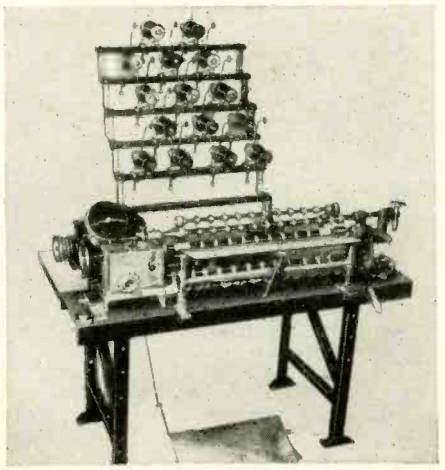
Rated output of the model 1960 amplifier is 60 watts at 5% or less total harmonic distortion (measured at 100, 400



and 5,000 cps). Peak power is 85 watts. It has four microphone inputs and each is convertible for use with a low-impedance mike by means of a plug-in transformer. True electronic mixing and fading is provided on all six inputs. Frequency response is ± 1 db, 40 cps to 15 KC. Output impedances are: 4, 8, 80 (70 v.), 250 and 500 ohms.—**Rauland-Borg Corp., 3523 Addison St., Chicago 18, Ill.**—TELE-TECH

Transformer Winder

Model 37S transformer winder will multiple-wind power and audio coils up to 9-in. O.D. instead of the 6-in. O.D. wound



by the old model 37. Mandrels up to 30 in. long may be used for maximum economy and 30 or more coils may be wound simultaneously. All turns are accurately registered by a 6-in. full-vision clock face dial counter. Set-ups can be changed in five minutes.—**George Stevens Mfg. Co., Inc., Chicago 30, Ill.**—TELE-TECH

Optical Barrel

The new Schmidt optical barrel will project TV, radar, or oscilloscope images on screens as large as 6 by 8 ft. Images

can be varied in size by means of a control on the barrel. A different lens is available which will project smaller images with the utmost clarity. The unit has a diameter of 13 in. and is 17 in. high.—**Spellman Television Corp., 3029 Webster Ave., Bronx 67, N. Y.**—TELE-TECH

Low Frequency Q Indicator

Designed specifically to measure the Q factor of coils, model 1030 can also be used to measure inductance, distributed

capacity, impedance, and dielectric loss. The study of the magnetic properties of iron, including the stability of iron cores in function of applied voltage, and iron losses as a function of the frequency, are additional uses of the instrument. Another feature of the model 1030 is its ability to measure Q through the whole audio and supersonic range. Q range is from 0.5 to 5.0. Frequency range is from 20 cps to KC.—**Freed Transformer Co., Inc., 1718-36 Weirfield St., Brooklyn 27, N. Y.**—TELE-TECH

Mixed Highs Improve Color Definition

A paper entitled "An Analysis of Color Television" was presented before the Institute of Radio Engineers Fall Meeting at Syracuse, N. Y., by A. V. Loughren, vice president of Hazeltine Electronics, Long Island, N. Y. He stated the human eye is incapable of perceiving color in fine detail. The principle of mixed highs uses this fact to make possible very much better color television pictures in a given channel bandwidth.

It was shown that a color television picture having 12 MC bandwidth has the full resolution of a normal black and white picture. It was also shown that by the use of "mixed highs" with cross-over frequencies ranging between .5 and 2 MC, the total bandwidth required for the transmission of a picture of full sharpness may be reduced from 12 to 8 MC with no impairment of the color, and further reduced from 8 to 5 MC with only very small impairment. Table II shows the numerical relations between cross-over frequency, bandwidth, and picture elements for the various cases illustrated.

The use of a television channel simultaneously by two related signals was described. He showed one method of utilizing this possibility for the addition of color information to a black and white picture resulting in a color picture as sharp and brilliant as those of the best current black and white television. The effective sharpness of the picture—and thus its capacity for transmitting detail—is proportional to the quantity, elements per picture contributing to detail in column 6 in Table I.

TABLE I

COMPARISON OF COLOR TELEVISION SYSTEMS

Channel Width Mc	Effective Video Band, Mc	Elements per Second	Pictures per Second	Elements per Picture: Total	Elements per Picture: Contributing to Fine Detail	Elements per Picture: Used for Color	Relative Fine Detail
Standard Monochrome—							
6.0	4.0	8,000,000	30	267,000	267,000	—	1.0
Simultaneous Color—							
15-18	12.0	24,000,000	30	800,000	267,000	533,000	1.0
Simultaneous Color—							
6.0	4.0	8,000,000	30	267,000	89,000	178,000	0.33
Field-Sequential Color—							
6.0	4.0	8,000,000	24	330,000	110,000	220,000	0.41
Field-Sequential Color with Dot Interlace—							
6.0	0.4*	8,000,000	24	330,000	110,000	220,000	
	2-4	4,000,000	24	165,000	55,000	110,000	
				495,000	165,000	330,000	0.62
Band Shared Color with Mixed Highs—							
6.0	0-4*	8,000,000	30	267,000	267,000	—	
	2-4	4,000,000	30	133,000	—	133,000	
				400,000	267,000	133,000	1.0

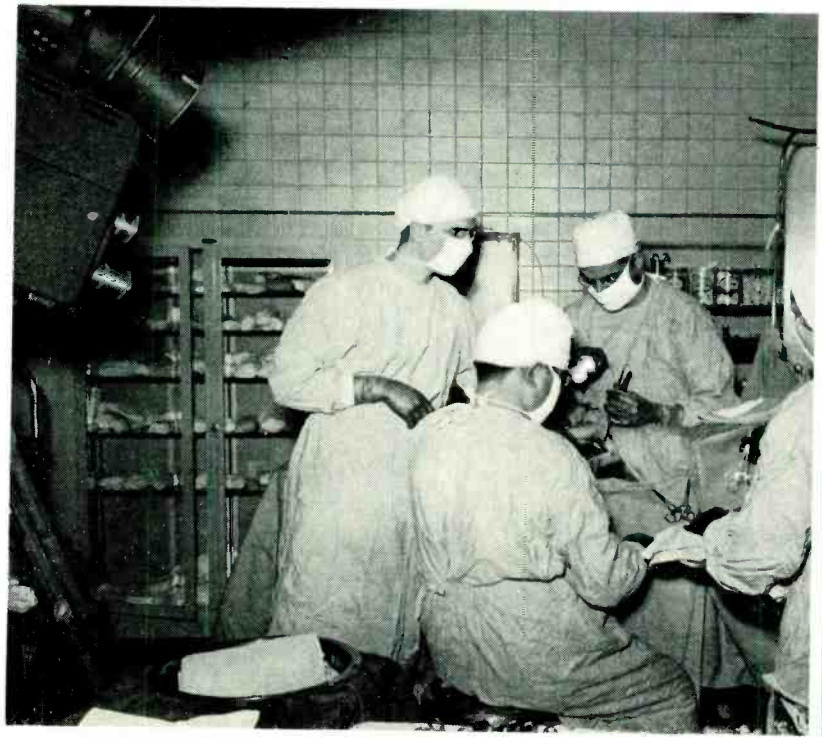
*0-4 band transmitted normally
2-4 band transmitted as interleaved low-visibility components

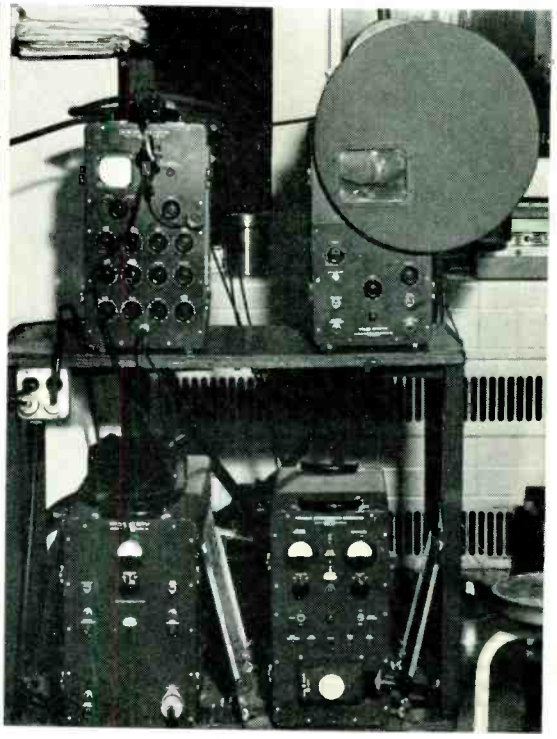
TABLE II

ECONOMY OF BANDWIDTH OBTAINED BY USE OF MIXED HIGHS

Crossover Frequency Where Mixed Highs Start, Mc.	Effective Video Band, Mc	Elements per Second	Elements per Picture: Total	Elements per Picture: Contributing to Fine Detail	Elements per Picture: Used for Color
0.0 (Standard Monochrome)	4.0	8,000,000	267,000	267,000	—
0.1 (Simultaneous Color)	4.2	8,400,000	280,000	267,000	13,000
0.5	5	10,000,000	333,000	267,000	67,000
1.0	6	12,000,000	400,000	267,000	133,000
2.0	8	16,000,000	533,000	267,000	267,000
4.0	12.0	24,000,000	800,000	267,000	533,000

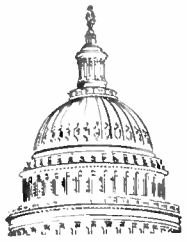
SURGICAL APPLICATIONS OF DU MONT COLOR TELEVISION DEMONSTRATED





Medical application of the Du Mont Industrial Color Television sistem was demonstrated recently at St. Clare's Hospital, New York. The system uses a standard television camera with the normal four lens turret and produces pictures with a 525 line definition. By the use of 180 color fields per second and a standard monochrome horizontal scan speed, first class definition is obtained. Since the system is a closed circuit, band width restrictions do not apply and an 18 MC band is used. One illustration shows the camera control equipment set up in the hospital. It will be noted that this is almost identical with the standard field equipment except for the addition of the color disc over the camera monitor. Other photo shows an operation in progress. Extra light on the front of camera provides deep illumination in body cavities since normal operating room lighting is used. Industrial color television over closed circuits is becoming more popular, not only for teaching, but for spot selling and the remote viewing of operations in atomics and industry

WASHINGTON
News Letter



Latest Radio and Communications News Developments Summarized by TELE-TECH's Washington Bureau

20 TO 30% CUT IN OUTPUT of television and broadcast receivers, because of the military defense procurement requirements with the impact of siphoning off from civilian manufacturing uses copper, aluminum, nickel, cobalt and other scarce metals and materials, has become effective this month under the metals limitation orders of the National Production Authority. Defense procurement orders were expedited into effectiveness with the radio-electronic manufacturers, in a greatly stepped-up tempo during the past month of November so that the managements of this vital industry for the national defense preparedness would not have severe dislocations of employee forces and manufacturing operations.

COLOR-TV IMPACT ON WAR EFFORT—The "cause celebre" of the history of the Federal Communications Commission—the "green light" to the Columbia Broadcasting System's color television—centered on the outcome of the decision by the Federal three-judge court in Chicago, and the newspaper searchlight of publicity was beamed on the court action and the interchange of statements by the FCC and industry leaders. But given almost no publicity were the cold facts that the imperative requirements of the Armed Services were making critical metals and materials in serious short supply and scarce, and furthermore to develop and produce the adapters and converters sought by the FCC meant a problem because of the very "short" supply of radio engineering and technical talent available to manufacturers. These facts were stressed in the conference between the chief executives of 28 leading radio-electronic-television manufacturing companies and Maj. Gen. William H. Harrison, NPA Administrator. But, in addition, it is known that the leading officers of the Armed Services concerned with electronic-radio procurement regard the FCC demands upon the industry for color-television developments directly contrary to the tenor of the national emergency.

BROAD-BAND FCC HEARING HIGHLIGHT—In their quest to preserve an unbroken span of 470-890 megacycles for UHF television, the proposal of the Bell Telephone Laboratories to establish a broad band multi-channel transmission system for mobile radio communications in the 30 megacycles of the 470-500 MC portion of the spectrum was slated to encounter stiff opposition from leading groups in the television industry either during late November or early December. Cross-examination of the Bell Laboratories' proponents of the broad band system will be conducted by the Television Broadcasters Association, Allen B. DuMont Laboratories and the Philco Corp. Meanwhile, during the long and sometimes rather torturous hearings in November the television industry spokesmen, especially those presenting the views of television stations, gave the Commission "food for thought" that the move of video "upstairs" still had a lot of problems and "bugs" before public UHF television service could be established.

DETAILED MILITARY PROGRAM—At long last, the Armed Services are scheduled to present their total requirements program for radio-electronic equipment procurement to the manufacturing industry when the Electronics Equipment Industry Advisory Committee to the Munitions Board holds its meeting during December, the first session since last September. This has been a factor which has been a difficult obstacle for the manufacturing industry's top managements in planning their production capacity and schedules of output for civilian television, radiobroadcasting and radiocommunications equipment and components since the total military needs have been up to the present not well delineated in detail. The radio-electronics industry's components and parts manufacturing companies in preparation for the Armed Services' program and for the topside Industry Advisory Committee have cut through very well in meetings of subcommittees of different types of components the planning of production of the components and of expansion of needed plant facilities to fulfill the defense procurement orders.

MOBILE RADIO SERVICES' STATUS—Mobile radio communications services of various categories appear likely to be continued in rather normal fashion even under the controlled limitations of supplies of strategic metals and materials, according to informal advices to TELE-TECH from different government sources like the National Production Authority, the Armed Services and the FCC. Several of the major mobile radio services—petroleum industry, railroads and taxicabs—have already presented their programs to aid in the national defense preparedness economy and in civil defense activities to the National Security Resources Board, the National Production Authority, the military services and the President's Communications Policy Board. They—and other vital mobile radio services—are seeking special consideration in priorities for metals and materials for equipment.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington, Editor

Eye witness reports from a fiery furnace!

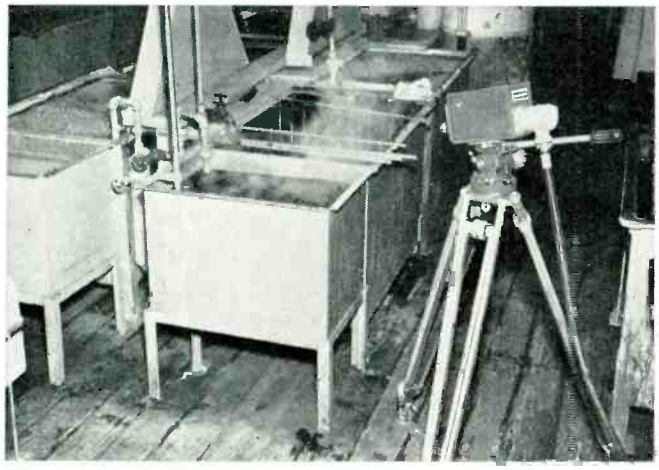
A new television development which adds to industry's efficiency

No. 11 in a series outlining high points in television history

Photograph and painting from the RCA collection

Compact industrial television system—*developed at RCA Laboratories—lets us see the unseeable in safety!*

● Something's wrong in a big blast furnace, and it is too hot for engineers to approach in safety. But now, with the Vidicon camera of an RCA Industrial Television System focused on the flames, the furnace can be studied closely and carefully on a television receiver.



Here's RCA's Vidicon system at work *beside a steaming vat. Note how the compact television camera is getting a safe "close-up" of the action.*

One of the great advantages of this system—other than its contributions to industrial safety—is its ability to save both time and money. No longer need engineers "shut-down" machines or processes to observe them. Normal operations can continue without waste, while the Vidicon System gathers information.

Key to the success of Vidicon is a tiny television camera—small enough to hold in one hand—and inexpensive. The camera's "eye" is the sensitive Vidicon tube developed by scientists at RCA Laboratories. The only other equipment needed is the Vidicon camera's suitcase-size portable control cabinet, which operates on ordinary household current, and *any* television receiver—on which to view the pictures.

Adaptable to many uses, RCA's Vidicon camera could be lowered under water to watch divers at work—or stand watch on atomic piles, secure from radiation. And this RCA Industrial Television System can also be arranged for *3-dimensional pictures* . . . real as life!

Radio Corporation of America
WORLD LEADER IN RADIO—FIRST IN TELEVISION

NEWS . . .

IRE Elects Coggeshall President

Election of Ivan S. Coggeshall, general traffic manager of Western Union Telegraph Company's overseas communications, as president of the Institute of Radio Engineers for 1951 is announced by the society's Board of Directors in New York. Mr. Coggeshall is noted for his activity in the adoption of electronic methods and devices in the telegraph and submarine cable field. He will succeed Raymond F. Guy, manager of radio and allocation engineering of the National Broadcasting Company.

Jorgen C. F. Rybner of Copenhagen, professor of telecommunications at the Royal Technical University of Denmark and noted author of Danish and English textbooks on network theory, was elected vice-president. He will succeed Sir Robert Watson-Watt of London, a pioneer and outstanding authority on military radar.

Directors elected by the Institute for 1951 are: William H. Doherty, director of electronic and television research for Bell Laboratories, Murray Hill, N. J.; George R. Town, associate director of the engineering experiment station at Iowa State College, Ames, Iowa; Harry F. Dart, office manager of the electronics department of Westinghouse Electric Corporation, Bloomfield, N. J.; Paul L. Hoover, head of the department of electrical engineering, Case Institute of Technology, Cleveland, Ohio; William M. Rust, Jr., head of geophysics research for Humble Oil and Refining Company, Houston, Texas; and Allan B. Oxley, chief engineer of RCA Victor Company, Montreal, Quebec.

In addition, the following directors will continue to serve on the Board during 1951: S. L. Bailey, R. F. Guy, W. L. Everitt, D. G. Fink, W. R. Hewlett, J. W. McRae, H. J. Reich, F. Hamburger, Jr., J. D. Reid, and A. V. Eastman.

Peter Mole Elected President of SMPTE

Peter Mole, president of the Mole-Richardson Co., Hollywood, was elected president of the Society of Motion Picture and Television Engineers for 1951 at the Society's 68th semi-annual convention at Lake Placid, N. Y.

Election of Herbert Barnett, General Precision Laboratories, Pleasantville, N. Y., as executive vice-president, and John G. Frayne, of the Westrex Corp., Hollywood, as editorial vice-president, was also announced.

Officers re-elected were William C. Kunzmann, as Convention vice-president, and Robert M. Corbin, as Secretary. Other officers of the SMPTE include Fred T. Bowditch, engineering vice-president, Ralph B. Austrian, financial vice-president, and Frank Cahill, treasurer.

Cornish to Larger Offices

Cornish Wire Company, Inc. moved its general executive offices October 30th, to greatly enlarged space at 50 Church St., New York 7, N. Y.

J. D. COLVIN NEW AES PRESIDENT

John D. Colvin, Chief Engineer of Commercial Radio Sound Inc., makes his inaugural address as the newly-elected president of the Audio Engineering Society at the annual Audio banquet. The meeting, a highlight of the Audio Fair, was attended by 225 members and guests. Others in the photo are (l to r) Bob Smith, Western vice president of AES; C. J. Lebel, Audio Consultant; Ted Lindenberg, Fairchild Recording Equipment Corp.; Howard Chinn, CBS and recipient of the John H. Potts annual memorial award for outstanding achievement in audio.

Engineers in the new General Electric Laboratory at Lynn, Mass., are shown putting developmental instruments through electrical tests at a harmonic generator, variable frequency, and dc power control board. GE's new lab is staffed by engineering specialists in magnetism, electricity, sound, light and color.

Sound Test Chamber Developed at M.I.T.

A half-million pound test chamber with equipment which can make as much noise as a battalion of artillery and draw a "contour map" of its sound has been built at the Massachusetts Institute of Technology.

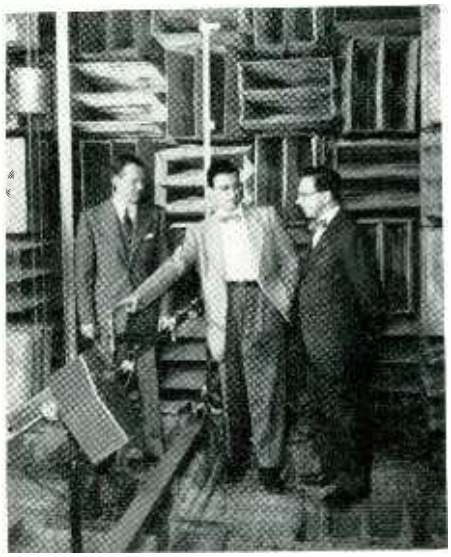
The scheme for sound measurement used in the new equipment has essentially three parts. A uniform steady sound is pushed toward one side of a wall to be tested. On the other side is a microphone which picks up the sound which gets through the test sample. As the microphone moves, the sound it finds is amplified and recorded on a super-precise electronic mapping device.

The source of sound is an array of 256 small loudspeakers mounted close together in a panel of 16 rows of 16 speakers each. Electronic oscillators drive the speakers, and they can be "phased" so that they all push in unison, forward and backward simultaneously, or so that some are a bit ahead or behind others. Together, the 256 speakers have more than 12 times the power of the public address system at Yankee Stadium, New York.

This array of loudspeakers is brought up close to the panel whose sound-carrying is to be checked—and covered from behind so that the rest of M.I.T. is relatively sheltered from their insistent whine. In front, they create a barrage of sound against the wall section under test.

Inside the test chamber a tiny microphone moves systematically across the face of the wall panel. Its output is fed to a mapping device which automatically puts the information on a map-like plot of the test panel.

The result is a "contour map" which



Interior of the new test chamber at M.I.T. Dr. J. J. Baruch, designer of the electronic components points to the traveling microphone while Dr. R. H. Belt (left) and Dr. I. L. Beranek (right), director and technical director of the laboratory respectively, view the equipment.

shows what parts of the panel muffle sounds best, what parts do so less effectively. With this result on one panel M.I.T. engineers may be able to design another panel incorporating only the best features of the previous one.

Raytheon Opens New Pilot Plant

Production began last month in Raytheon's new pilot plant in Quincy, Mass. The new plant is engaged in the manufacture of electronic tubes of the subminiature and miniature construction for military requirements exclusively, but may be expected, some time in the future to augment the company's receiving and special purpose tube capacity.

This initial operation will be limited to approximately 19,000 sq. ft. of manufacturing space located in a new two-story building and will serve the dual purpose of effectively sampling the local labor market as well as producing military product which are in urgent demand.

Sonotone to Make Miniature TV Tubes

Sonotone Corporation, Elmsford, N. Y., leading manufacturer of hearing aids, has started production of miniature electron vacuum tubes for radio and television sets.

The tubes are being manufactured in Sonotone's new Receiving Tube Plant, a single-story building with 20,000 sq. ft. of floor space and working positions for 425 persons. Approximately 200 men and women are to staff its nine departments in initial production.

AD HOC Report—Part II

The report in general deals with methods of calculating interference caused by a number of interfering signals as an aid to determining the service area to be obtained from a given television station. These figures are based on three factors: the acceptability ratio between desired and undesired signals; the time availability of the desired signal; and the probability factor of receiver location.

The publication of the report was accompanied by various reactions from its compilers. Seven of the committee endorsed it without reservation. Seven others endorsed it with reservations, and three members refused.

The general reservations were that the methods given for calculating interference are too vague, based on too many assumptions and while, perhaps, statistically correct and of little or no practical value since they are too complex for most engineers to use.

The complete dissenters insist that the methods given are still the subject of arguments among the staffs of the very organizations which bore them as well as being far too vague and confusing, based as they are on meagre details.

There is no doubt that a great deal of work has been put into preparing this report and that it is of high theoretical quality but it seems to be unfortunately true that the tool which was supposed to be forged to help determine the problems of the freeze has turned out to be more or less useless. It is certainly not an easily used report and as one engineer put it "the results to be obtained do not warrant the efforts involved using it." Thus the FCC still requires a *usable* method of evaluating television interference. Incidentally, it is interesting to note that most of the engineers who disagreed with the report were consultants who naturally are interested in the practical application of such data to their own professions. Those who concurred were for the main part members of the FCC or similar government bodies which have little incentive to produce information of practical application.

WSM-TV Operating Own Microwave TV Link

Nashville, Tennessee's first television station, WSM-TV has recently initiated operation of the world's longest privately-owned inter-city television microwave link. The microwave link, together with the station's 5 KW transmitter and auxiliary facilities, was supplied by Federal Telecommunication Laboratories, Inc. of Nutley, N. J., associate of International Telephone & Telegraph Corp. The link, comprising two terminal stations and five unattended repeater sites, connects the television network program facilities at Louisville, Kentucky with WSM-TV at

Nashville, a distance of 163 miles.

To provide sound for the programs, FTL has employed an ingenious method known as "sound diplexing" as an accessory for the television microwave link, enabling the sound and the picture to be picked up and transmitted simultaneously over the same link. A portable television microwave link and sound diplexer have also been supplied for on-the-spot news coverage. The television link equipment, which is turned on and off by time clocks, includes an automatic alarm, by means of which an instantaneous check of the entire system may be obtained.

Corning All-Glass CR Tube Reduces Glare

The Corning Glass Works of Corning, N.Y. has announced a new type of picture tube face plate which is designed to eliminate spectral reflections from lights in the room. Most picture tubes have spherical cross section faces which tend to reflect light in all directions. The new tube has a cylindrical contour. By tilting the tube very slightly any room light reflections are directed downward and thus miss the eyes of the observer. The degree of tilt required for a conventional tube would be excessive to produce the same results.

Demonstrations showed that the new cylindrical face is superior to etching the glass plate since it eliminates a manufacturing operation as well as lessening the liability of the face to marring by scratches and dirt. There is of course no loss of resolution or fuzziness with the cylindrical contour.

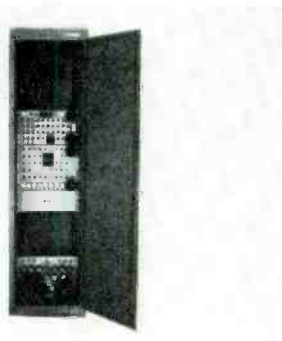
Bernard F. Osbahr, who acts as executive editor of TELE-TECH, is the smiling subject of this snapshot by Sid Chertok, well-known technical expert for Sprague Electric Co., and former executive secretary of the wartime Components Standardization Committee. Chertok set up this persuasive corner at the Syracuse IRE-RTMA meet the first of last month

TEC makes Color-TV Adapter Available

Television Equipment Corp., 238 William St., New York 7, N. Y., recently held a demonstration of the company's newly-developed color television adapter. Retail price of the unit has been fixed at $12.95. Delivery is immediate. It may be used in any size receiver and, in effect, allows the viewer to receive color telecasts in black and white without interfering with normal black and white reception. Only the converter, which is the color wheel and synchronous motor, need be added to receive full color television.

Signal Generator for CBS Color

Model 2201 television synchronizing signal generator, intended for use with CBS color standards, is now in production. General design of the new equipment, incorporating binary dividers to obtain the necessary frequency division, follows the existing model 2200. However, the numerous design modifications required to meet CBS color standards will make field or factory conversion impractical. All output circuits of the new 2201 are intended for use with 75-ohm lines. Output signal voltages are within RMA specifications for similar circuits.—**Tel-Instrument Co., Inc., East Rutherford, N. J.**—TELE-TECH



Coming Events

January 10-12 — High Frequency Measurements, Conference, Sponsered by the IRE, AIEE, and National Bureau of Standards, Hotel Statler, Washington, D. C.

January 18-20 — Society of Plastics Engineers, 7th Annual National Technical Conference, Hotel Statler, New York City.

January 22-26 — AIEE, 1951 Winter General Meeting, Hotel Statler, New York City.

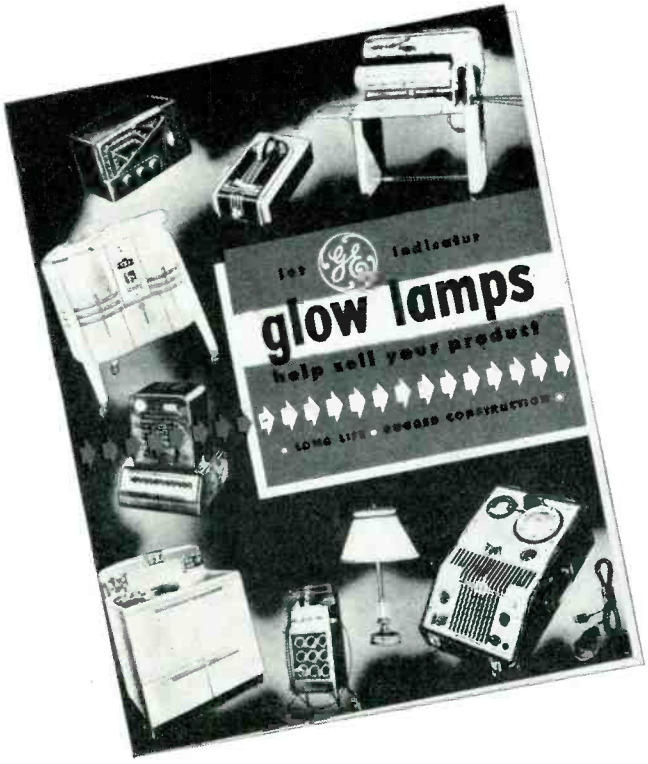
March 5-9 — American Society for Testing Materials, Spring Meeting and Committee Week, Cincinnati, Ohio.

March 19-22 — IRE Annual Convention, Hotel Waldorf-Astoria and Grand Central Palace, New York City.

June 18-20 — American Society for Testing Materials, Annual Meeting, Atlantic City, N. J.

FREE BOOKLET

shows how 15 products are improved with G-E Glow Lamps!



SEE specific suggestions for improving the usefulness and sales appeal of home appliances, wiring devices, industrial equipment with G-E Neon Indicator Glow Lamps. Glow Lamps give off practically no heat, require a minimum of current, withstand severe vibration and shock, generally last for the life of the product.

WRITE NOW *for this free, informative booklet to Lamp Department, Div. 166-TT12, General Electric Company, Nela Park, Cleveland 12, Ohio.*

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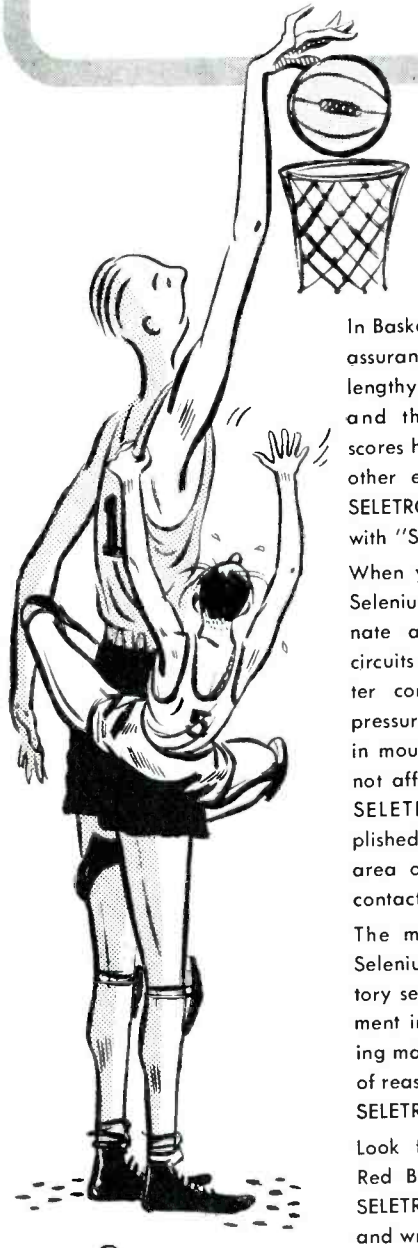
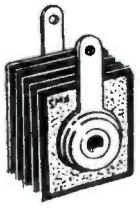


In Basketball there's no better assurance of victory than a lengthy lad jumping center . . . and there is nothing that scores higher in radio, TV and other electronic circuits than SELETRON miniature rectifiers with "Safe Center" plates.

When you specify SELETRON Selenium Rectifiers you eliminate arc-over danger, short circuits and heating at the center contact point. Assembly pressure, or pressure applied in mounting the rectifier cannot affect its performance—a SELETRON feature accomplished by deactivating the area of the plate under the contact washer.

The millions of SELETRON Selenium Rectifiers in satisfactory service as original equipment in the products of leading manufacturers are millions of reasons why you can specify SELETRON and be *safe!*

Look for Howard W. Sam's Red Book Supplement listing SELETRON replacements . . . and write for Bulletin No. MR-4.



Seletron

SELETRON DIVISION

RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics

Sales Department: 251 West 19th St., New York 11, N. Y.

Factory: 84 North 9th St., Brooklyn 11, N. Y.

Monochrome TV

(*Continued from page* 52)

nate fields. By using pre emphasis this can be made negligible. High-definition receivers will produce pictures from present transmitters.

Tests—Certain elements, have been tested. Division of the received band into three parts has been carried out and experiments in keying even and odd fields made. Flicker was not observed in large areas and in small areas only when excessive amplification was employed. From the tests it was found feasible and practical to subdivide the v-f band and transmit portions of the high end alternately. Retransposition was not tested, but this is a matter of circuit design.

Fee Television

The Zenith Co., Chicago, Ill. have applied to the FCC for an extension of time to start Phonevision tests, until December 1. Lack of suitable pictures is given as the reason. This is the third time an extension has had to be requested due to disinclination on the part of the movie industry to supply films for the tests. Subscribervision, the scrambled TV system developed by Skiatron Inc. of New York, is still testing with WOR-TV on closed circuits.

Co-Axial Cable

(*Continued from page* 43)

terial going into it. In order to insure that a piece of coax will perform its function properly, it must necessarily go through a series of electrical tests as well as mechanical or physical inspections. These include the meaurement of attenuation—for the most part at 400 MC, an impedance test, capacity test, velocity of propagation test, corona test, high-voltage test, continuity of center conductor test and many others. These electrical tests are more or less standard in the industry and are, in general, familiar to the reader. The inspections as described in this article are made on a sample of cable taken from each 2500 ft. reel. A complete set of tests, both electrical and physical, are made on an average of every 5000 ft. of cable and to date over 29,000 complete sets of tests have been conducted at this one plant. Each test represents the probability of cable being approved that might previously have been rejected because of inferior inspection methods. It is quickly apparent that vast amounts of finished cable, raw materials and man-hours of labor have been saved through the application of American "know-how" and the desire of American manufacturers to bring to the market better and less expensive products.

1. The eccentricity jig was developed by Ringland Krueger who applied X-rays for observing co-ax eccentricity. The jig, micrometer head and fluorescent screen were added in perfecting the device.

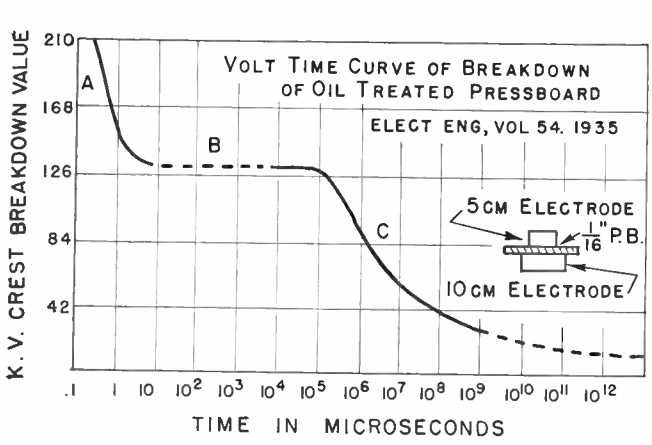
Dielectric Properties

(*Continued from page* 48)

The lower plot in Fig. 13 represents the same data but integrated impulse, Force x Time, that is, the product of VPM and Time (an area) is singled out as a measure of dielectric strength. The times of critical change are marked upon the curve. The data in this form suggests that pulse strength decreases as phenomena become more rapid. In at least a qualitative way this data is also satisfied by a vibratory mechanism.

Our failures were due to the application of a sinusoidal stress of increasing magnitude applied over a period of 40 seconds while those of Montsinger were due to a single unidirectional (d.c.) application of stress increasing with time.

It may seem strange to regard something of longer than one second as an impulse, but the significance of the word is relative. Some polarizations or space charges re-



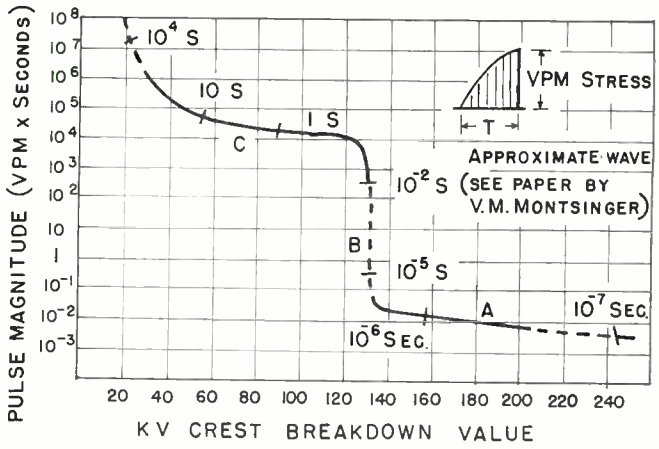


Fig. 13: Earlier breakdown curves shown from work by V. M. Montsinger are analyzed in the light of current research developments

quire hours in forming and disperse slowly upon removal of the electric field. At the best, such a system represents a least stiff model and is only of a pseudo vibratory character. However, a one second pulse applied to such a system is a truly rapid phenomenon.

Conclusions

(1) Levels of breakdown strength may be associated with change in mode of vibration.

(2) Small changes in dielectric constant are important in the study of breakdown.

(3) The ultimate character of failure may be of many forms, melting, chemical change, gas evolution, etc. . . . all generally accelerated by the generation of heat.

(4) In the regions of transition from one mode of vibration to another, lack of conformal motion results in the chaotic motion of the charge system and real power is dissipated. Uncertainty in the position and momentum of charge leads to an "in phase" component of current. Motion in conformity with the applied field would dissipate no real power, it would be strictly reactive.

(5) When the applied field is of a rapidly varying nature, conformal motion cannot encompass the slower parts of the system. Under such conditions, greater proportion of stress results in the active polarization mechanisms.

John W. Dzimianski, graduate electrical engineering student and C. Frank Miller, assistant professor of electrical engineering, The Johns Hopkins University, contributed to the execution and planning of the experimental program to a most important extent. Also, it is necessary to thank the Navy Department, Bureau of Ships for support and encouragement.

Video Distribution

(*Continued from page* 30)

which showed some promise; however, special core samples of improved materials could not be obtained before it became necessary to "freeze" the design of the particular amplifier system.

As an alternative arrangement the output stage was re-connected as a cathode-follower eliminating the requirement for dc isolation. This required the addition of another stage to take care of polarity reversal. The final arrangement is shown in Figure 5. This circuit provides a frequency response that is flat within one db from 20 cps to over 6 MC. If desired, a low-frequency phase shift compensation circuit can be placed in one of the interstage coupling networks. However, in the interest of simplification and economy it was dispensed with as there is no visible integration of the vertical blanking signal.

The amplifier is intended to be fed from the standard 1.5 volt peak-to-peak composite picture signal and normally is operated as a unity gain device. However, the design is such that the overall gain may be adjusted to any value from .5 to 2 times the input voltage. The design shown provides 30 db isolation between outgoing channels. The degree of isolation is such that a several hundred foot length of unterminated coaxial cable may be hung on one output without producing any noticeable reflections in the other channels. Any one of the outgoing channels may be either opened or shorted with perceptible but not objectionable (about two percent) changes in level on the other circuits. It is felt at WMAL-TV that this amount of isolation is satisfactory in equipment application.

Figure 6 shows the last experimental unit built in accordance with the circuit just described. This has been thoroughly tested and found to be satisfactory in all regards. Now in production are twenty units of this electrical design which incorporate certain refinements in layout and construction. These amplifiers will be employed in a new studio layout to distribute program and monitoring signals from the output of our three iconoscope film cameras and four to six image orthicon studio cameras. All camera controls for both studios will be in one centrally located camera control room and isolated picture lines will be run to each of the two main studio control rooms as well as auxiliary lines to an emergency switching position.

Each control room contains only the producer, the audio engineer and the technical director. The producer has full monitoring facilities enabling him to see simultaneously all film and studio camera signals in addition to network and incoming remote lines. The signal from any camera may be switched on or off in either control room without affecting service to the other switching positions. Thus in effect both studio control rooms are master controls and switching between them is accomplished for picture and sound simultaneously on an interlocked basis.

In conclusion, recognition should be given to Mr. E. S. Hall, of the WMAL-TV Engineering Department, who constructed the experimental units and assisted the author in carrying out this development.

Printed Circuits

(*Continued from page* 32)

the printing of coils as even minute inexactness in definition or passage of metallic particles into the interspaces, or any other effect on the unprinted plastic will completely upset the Q value. A good electrical plastic should have an insulating resistance of 500,000 megohms over the whole surface. Unless the process of printing can be relied on not to impair that property it will be impossible to print coils to a standard Q value from one drawing. It must be clearly understood that all advantages of printed circuitry are lost the minute "touching up" by hand is necessary. A good method should be entirely automatic and once the press is set, and the print located, each print obtained must be complete on its own merits to a standard, exactly like the requirements of any other printing technique for books or colour prints.

Part Two will appear in the January issue.

TV Circuit For Louisville

A second coaxial circuit from Indianapolis to Louisville, which will make full-time network service available to the two television stations now operating in the latter city, has been placed in service by the Long Lines Department of the American Telephone and Telegraph Company. A network program originating in New York would travel by either coaxial cable or radio relay facilities to Toledo, O., then south by coaxial cable to Dayton, O. From this city it takes to the microwaves for five instantaneous hops to Indianapolis, then underground again via coaxial on the final leg into Louisville.

New UHF Magnetron

(*Continued from page* 40)

find wide use in commercial communication equipment. While mass production of the new tube will be timed to fit into the FCC's release of the new UHF channels, limited quantities are presently available for experimental work.

The Z-2061 is capable of operating continuously as a local oscillator from 30 to 900 MC with an output of approximately 250 milliwatts. An external permanent magnet is employed and the frequency of oscillation is controlled primarily by an external tuned circuit which may be of either the lumped-constant or distributed-constant type. Costs to manufacturer users have been estimated as from 65 to 70 cents per tube and an addition 25 to 35 cents for the magnets. Magnets may take the form of bar or round types or may appear as a combination tube shield and magnet holder. Other pertinent technical characteristics for this tube are:

Cathode	Coated Unipotential
Heater Voltage (A-C or D-C)	6.3 Volts
Heater Current	0.3 Ampere
Envelope	T-5½, Glass
Base	E7-1, Miniature Button 7-Pin
Outline Drawing	5-2
Maximum Diameter	¾"
Maximum Overall Length	2⅛"
Maximum Seated Height	1⅞"
Mounting Position	Any
Direct Interelectrode Capacitances:*	
Plate 1 Input (P1 to H + K)	1.0 μμf
Plate 2 Input (P2 to H + K)	0.8 μμf
Plate-to-Plate	1.7 μμf

MAXIMUM RATINGS (Design Center)

Plate Voltage	200 volts
Total Plate Dissipation	3 watts
Total Cathode Current	30 Ma.
Heater-Cathode Voltage	90 volts

CHARACTERISTICS

Average Diode Current:**
Measured with +50 Volts D-C Applied 55 Ma.

Notes:

The recommended magnetic flux density is 600 gausses.

The magnetic flux should align with the axis of the cathode.

It is recommended that pins 2 and 6 be grounded.

* Without external shield.

** With both plates tied and with no external magnet.

RTMA Eng. Dept. Move

The New York headquarters of the Radio-Television Manufacturers Association's Engineering Dept. and Data Bureau has been moved from 90 West St. to 489 Fifth Ave., just off 42nd St.

The RTMA office is located in suite 710-711 and the new telephone numbers are Murray Hill 2-8190-8191-8192. Larger space afforded by the new location will take care of the continuing expansion of the services now rendered by the RTMA Engineering Dept. Facilities include a conference room which will accommodate most of the committee metings of the Enginering Dept. Ralph R. Batcher, former consulting editor of TELE-TECH, heads the office as RTMA chief engineer.

PERSONNEL

John F. Byrne has been appointed to the post of associate director of research in the Division of Communications & Electronics, Motorola, Inc., Chicago, Ill. He was formerly vice president and chief engineer of Airborne Instruments Laboratory, Mineola, N. Y.

L. J. Totten, H. J. Hagerty and Thomas M. Garretson have been added to the sales engineering department of Federal Telephone and Radio's Selenium-Intelin Div.

David S. Rau has been named assistant vice president and chief engineer of RCA Communications, Inc.

J. S. Jacoby, Jr., recently joined the Capehart-Farnsworth Corp., Fort Wayne, Ind., as assistant chief engineer to **Anthony Wright,** Capehart's vice president in charge of engineering for the consumer products division.

Lynn C. Holmes, who has been associate director of research at Stromberg-Carlson Co., Rochester, N. Y., since April of 1950, has been named director of research for the company, succeeding **Benjamin Olney,** retired.

Dr. Vincent Salmon, Stanford Research Institute, has been elected chairman of the San Francisco Section, Audio Engineering Society.

Annual Index - 1950

The Annual Index has been arranged by subjects for easy reference to related topics. The first figure indicates the month in which the article appeared; the second figure indicates the page.

DETECTION AND RECTIFIERS, DISCRIMINATORS

FREQUENCY ALLOCATIONS

FM

GENERAL

GOVERNMENT COMMUNICATION

INSTRUMENTS & MEASUREMENTS, TEST METHOD

ANNUAL INDEX *(Continued)*

MATERIALS, PROPERTIES OF

OSCILLATORS

RECEIVERS

RECORDING & TRANSCRIBING

STATISTICS

TELEVISION

TRANSMITTERS

TUBES

WAVE PROPAGATION

BULLETINS

Industrial Color TV

Allen B. Du Mont Laboratories, Inc., Clifton, N. J., has released a new booklet on the TA-164-A closed-circuit industrial color television equipment. Available on request. Use company or professional letterhead.

Iron Core Powder

The Metal Powder Association has just released a standard entitled "Preferred Iron Core Dimensional Specifications." The new standard, designated M.P.A. Standard 11-50T, defines the terms commonly associated with electronic cores made from iron powder.

Resistors

Cinema Engineering Co., Burbank, Calif., has issued a catalog (14-R) entitled "Non-Inductance Wire Wound Precision Resistors." The manufacturer claims accuracies of 1% to 1/20 of 1%.

Tube Engineering Manual

A new engineering manual and catalog which gives important electronic tube data has just been published by Electrons, Inc., Newark, N. J., manufacturers of electronic tubes for industry.

The manual completely covers the subject of gaseous discharge rectifier and control-rectifier tubes. Amply illustrated with diagrams, the writing includes information on the ratings, applications, and life expectancy.

Two-Way Radio

A new booklet, covering broadly the use of two-way radio in the petroleum industry, is now available from the General Electric Commercial Equipment Division at Electronics Park, Syracuse, N. Y.

Connectors

A new Bulletin coded DPM-2 has just been issued by Cannon Electric, Los Angeles 31, Calif., on the two miniature rack and panel connectors, Types DPM-14 and DPM-A20 for radio, aircraft and special instrument applications.

TV Picture Tubes

A new 12-page booklet, in which characteristics of 194 CR tubes for television receiver, oscilloscope and radar applications are tabulated, has been published by Sylvania Electric Products, Inc., Emporium, Pa. The tubes described include 103 designed for magnetic deflection and 91 electrostatic types with screen sizes ranging from two to 22 in.

Sarkes Tarzian Opens Batavia Tube Plant

A new plant with a potential production of 50,000 television picture tubes per month has been opened in Batavia, Ill. by Sarkes Tarzian, Inc. Various sizes of glass and metal-glass tubes are being produced. The Batavia operation, which covers 53,000 sq. ft. of floor space, is the second plant in the Sarkes Tarzian Tube Div., supplementing production facilities at Hawthorne, N. J.

E. R. Ewald is manager of the new plant; H. H. Schmalz is in charge of manufacturing operations; F. J. Finn is director of purchases; and P. H. Davis, Jr. supervises product quality and customer contacts. Approximately 200 people are involved in tube production at Batavia.

TELE-TECH

Advertisers December, 1950

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

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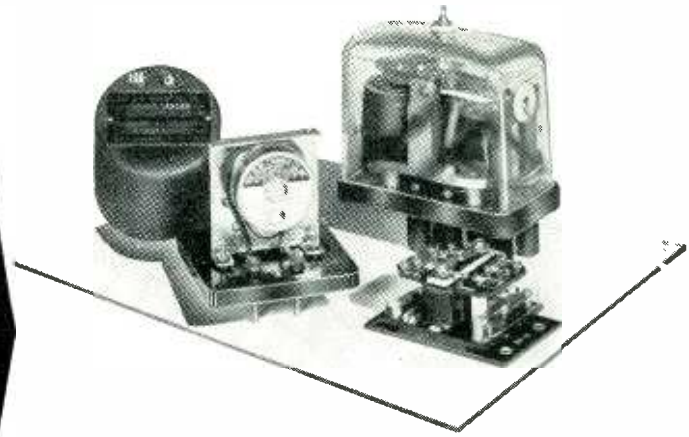

This list represents only a few types of Special Relays. We also have huge stocks of Standard D.C. Telephone Relays, Midget Relays, Contactors, Keying Relays, Rotary and Slow Acting Types as well as many others. Write or wire us about your requirements.

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R-503	12/32 VDC.	100	3A, 2C	G.E. Ant. Keying 500W 2C6530-653AR1	$ 2.25
R-749	600 VDC.	...	Max. 28 Amps.	Allen Bradley 810 Dashpot	5.95
R-804	550 VAC.	...	1B/38 Amps.	Culter Hammer C-261173A34 Contactor	3.50
R-250	115 VAC.	...	Adj. Cir. Breaker .04-.16A	Westinghouse MN Overload	12.95
R-579	220 VAC.	...	1B	Adlake 60 Sec. Thermo Delay	6.95
R-294	27.5 VDC.	200	1B	Edison 50 Sec. Thermo Delay	4.25
R-686	115 VAC.	...	2C	Leach 1157T-5/20 Sec. ADJ. Delay	4.95
R-246	115 VAC.	...	1B	Cramer 2 Min. Adj. Time Delay	8.95
R-246A	115 VAC.	...	1A	Cramer 2 Min. Aoj. Time Delay	8.95
R-611	24 VAC.	...	1A 30 Amps.	Durakool BF-63	4.25
R-283	12 VDC.	125	AC 10 Amps.	Onan Rev. Current 3H4512/R24	1.00
R-614	18 24 VDC.	60	1A 15 Amps.	Rev. Current Cutout 3H2339A/E1	3.50
R-262	... ...	200	1C	W. U. Tel. Co. 41C Single Current	3.75
R-245	12 VDC.	25	4 In. Micalex Lever	.....	.95
R-527	6/12 VDC.	50 50	In Series	2Z7668 For Scr-274N	.95
R-544	12 24 VDC.	60 60	1C	G.E. Push Button Remote Relay #CR2791-R-106C8	1.65
R-255	....	...	1A	G.E. Pressure Switch #2927B100-C2	.95
R-669	75 VAC.	400 CYC.	1B, 1A	Clare 400	.95
R-660	6 VDC.	...	⅜" Stroke	Cannon Plunger Relay #13672	.95
R-651	24 VDC.	100	Solenoid Valve	....	2.50
R-295	12 VDC.	275	Annuncitar Drop	... ...	2.15
R-230	5 8 VDC.	2	2A. 1C	Guardian Ratchet Relay	2.15
R-813	12 VDC.	12	Wafer	Ratchet Relay From Scr-522	4.25
R-275	12 VDC.	750	1A, 1B, 1C	Guardian BK-10	2.75
R-716	24 VDC.	70	2A 5 Amps.	BK-13	1.45
R-620	6 12 VDC.	35	2C. 1A	Guardian BK-16	1.05
R-629	9 14 VDC.	40	1C 10 Amps.	Guardian BK-17A	1.25
R-778	8 VDC.	4500	1C 5 Amps.	Kurman BK-24	2.10
R-720	24 VDC.	50	2C, Ceramic	45A High Power	1.35
R-500	12 VDC.	10 10	2C 6 Amps.	Str. Dunn. Latch & Reset	2.85
R-816	12 VDC.	10, 15	2C 6 Amps.	Guardian Latch & Reset	2.85
R-811	48 VDC.	8000	1C	Sigma 4R	1.65
R-524	24 VAC/DC.	...	.....	Edwards Alarm Bell	.95
R-838	90, 120 VDC.	925	2A	Allen Bradley-Bulletin #702 Motor Control	4.50
R-839	100/125 VDC.	1200	3A	Allen Bradley-Bulletin #200E Motor Control	4.50
R-840	115 VDC.	1200	2A	Allen Bradley-Bulletin #209 Size 1 Motor Control W/Type "N" Thermals	5.50
R-841	115 VDC.	1200	4A	Allen Bradley-Bulletin #709 Size 2 Motor Control W/Type "N" Thermals	25.00
R-842	115 VDC.	925	3A	Allen Bradley Bulletin #709 Motor Control W/Type "N" Thermals	5.50
R-843	115 VDC.	1200	3A	Allen Bradley-Bulletin #200 Motor Control	4.50
R-844	115 VDC.	1200	3A, 1B	Allen Bradley-Bulletin #202 Motor Control	4.50
R-845	220 VAC.	Intermit.	3A	Allen Bradley-Bulletin #704 Motor Control	4.50
R-831	7.5/29 VDC.	6.5	1A/250A, 1000A Surge	Leach B-8	3.50
R-837	110 VAC.	...	2A/30 Amps.	Leach 6104	2.75
R-835	24 VDC.	2800	1A Dble. Brk./10 Amps.	Wheelock Signal. B1/39	1.95
R-836	220 VAC.	...	2A Dble. Brk./10 Amps.	Wheelock Signal, A7/37	3.45
R-566	115 VAC.	(Coil only, Not a complete relay)		Leach #6104	.75
R-710	.....	150-Ohms. Coil Only		Guardian #38187	.50

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