Including ELECTRONIC INDUSTRIES for Defense

See page 1

TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

IN TWO PARTS • PART ONE

San Francisco, where the 1951 Western IRE Convention will be held August 22-24

Remote Control for FM Broadcasting • Shock Testing of Airborne Electronic Equipment • 30-in. Cathode Ray Tube • UHF-TV Coverage Map

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August • 1951 CALDWELL-CLEMENTS, INC.

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TEMPERATURE COMPENSATING

DISCAPS

DESIGNED TO REPLACE CERAMIC AND MICA CONDENSERS AT LOWER COST!

Ten years of research and over two years of volume production have provided the "know-how" behind RMC's leadership in the production of these new low cost disc type temperature compensating and general purpose DISCAPS.

AN RMC DEVELOPMENT

RMC is the only ceramic condenser manufacturer with actual production experience in the manufacture of disc type temperature compensating ceramic condensers. This is your guarantee of dependable performance.

USED BY LEADING TV MAKERS

RMC Type C temperature compensating DISCAPS conform to the electrical specifications of the RTMA standard for Class 1 ceramic capacitors. They are specified by the leading TV and electronic manufacturers because of their high quality, low inherent inductance, small size and low cost.

Available in a wide range of capacities and temperature coefficients between P-100 and N-2200, DISCAPS may prove to be the answer to many of your problems.

"RMC DISCAPS" *The Right Way to Say Ceramic Condensers*

SEND FOR SAMPLES AND TECHNICAL DATA

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RMC

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Formerly ELECTRONIC INDUSTRIES

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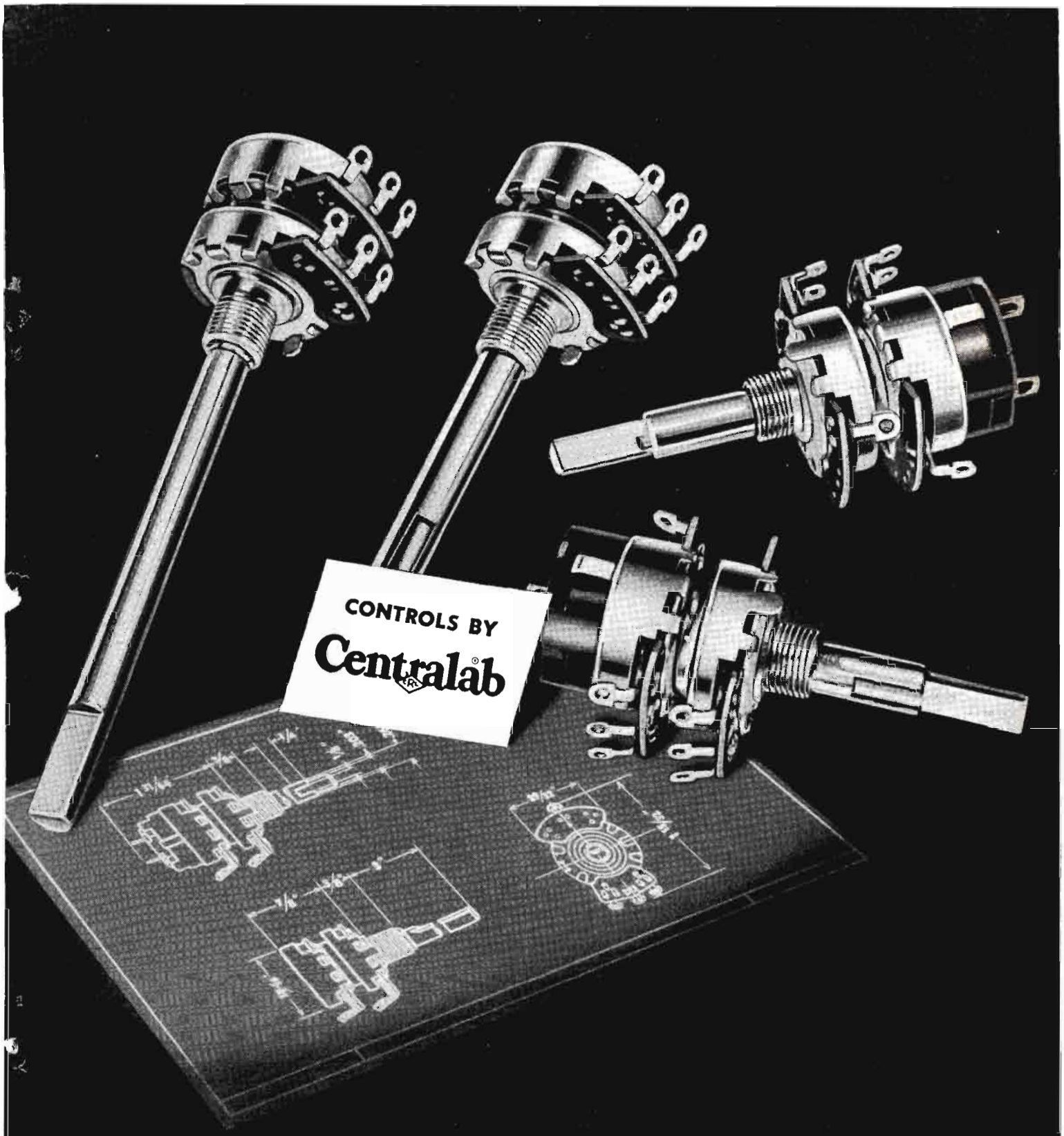

Nowhere can you obtain a broader variety of finer quality controls than those made by Centralab—the Company which introduced carbon controls to the electronic industry more than 25 years ago!

For more information see next two pages →

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CENTRALAB OFFERS A VARIETY OF STANDARD AND CUSTOM

Centralab's New Model 2 Radiohm

14 Good Reasons Why
CRL'S Model 2 Radiohm is the Control for You!

1. **Switch** — with positive detent in both on and off positions. **Terminals**—with surfaces elevated to eliminate danger of shorting to cover legs . . . ⅛" hole diameter for simplified wiring . . . hot tin dipped for easy soldering . . . mechanical lock to prevent loosening in soldering operations.
2. Cadmium plated steel **cover** completely shields resistor.
3. **Insulator's** high dielectric strength permits breakdown test at 1000 volts R. M. S. Dust and dirt can't get in.
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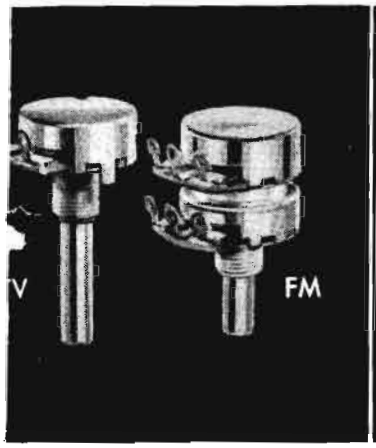
5. High grade laminated phenolic **shoe** maintains high insulation resistance under humidity conditions.
6. Contact Spring gives you double wiping contacts on both resistor and center terminal ring . . . is accurately formed to maintain uniform pressures and minimize noise.
7. Electro tin-plated **terminals** provide soldering ease. Tightly crimped terminals give you direct contact to resistor . . . assure constant contact under humidity and soldering conditions.
8. **Resistor** is made of special resistance material bonded to high quality phenolic for smooth operation, low noise level, outstanding humidity characteristics.
9. Cadmium-tipped **center terminal** provides easy soldering . . . good shelf life without oxidation. Adequately lubricated for good rotation life, center terminal is finished to give you smooth take-off . . . minimum noise.
10. Laminated phenolic **base** maintains high insulation resistance under humidity conditions.
11. Cadmium-plated steel **ground plate** assures positive grounded cover.
12. Cadmium-plated steel **bushing** is accurately finished and fit to shaft for smooth rotation.
13. **Retaining ring.**
14. **Shaft.** Unlimited variations available to meet your specifications.

**Switch Type, Tapped. Exploded View: Switch Type, Untapped.*

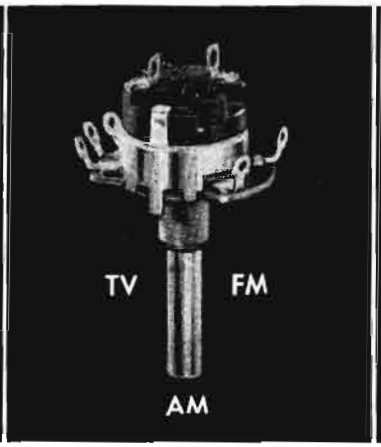
YOUR AM—FM—TV APPLICATIONS

SPECIFICATIONS TO MEET COMMERCIAL AND GOVERNMENT REQUIREMENTS

Famous new Centralab Model 2 Radiohms now available in plain or switch types—standard or custom designs—with plain or dual concentric shafts. 15/16" control diameter meets today's demand for smaller size.

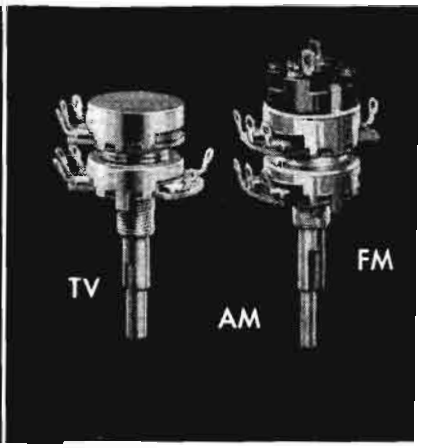


New Centralab Model 2 Radiohm Control — Left, single unit plain type, untapped; right, twin unit plain type, untapped. Both with single shafts.



New Centralab Model 2 Radiohm Control—control shown is a single unit switch type, tapped. Control has single shaft.

New Centralab Model 2 Radiohm Control — this control is a twin unit switch type, untapped. It has a single shaft.



New Centralab Model 2 Radiohm Control — Left, twin unit plain type, front section tapped; right, twin unit switch type, rear section tapped. Both units have concentric shafts.

OF SPECIAL INTEREST.....

The World's Smallest Volume Control — Centralab's Model 1

Smaller than a dime! Less than ¼" thick.
Available in plain or switch type.
Ideal for miniature electronic gear.

FOR COMPLETE SPECIFICATIONS AND SAMPLES

If you want further information — taper curves, physical dimensions, engineering specifications on Centralab's Model 2 Radiohms or Model 1's, mail in coupon below. *Manufacturer's samples on request.*

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CRL

Division of GLOBE-UNION INC. • Milwaukee

Centralab Div. Globe-Union Inc.
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Please send me Control bulletin No. 42-85 on Centralab Model 2 Radiohms. ☐ Also include Control bulletin No. 42-85 on Centralab's Model 1 miniature control.

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TELE-TIPS

TO SEE CBS COLOR—Many TV old-timers will recall that the pre-war TV sets, because of their wide range of controls, could bring in CBS color broadcasts as four "quarter-screen," black-white pictures. Many of the earlier post-war sets of one principal maker can still accomplish this, by recourse to the back-chassis adjustments. So if you want to see, in black-white, what's going on during CBS color programs, try twiddling the front and back controls of your receiver. You'll get at least some amazing futuristic design motifs. And you may be able to stretch your adjustments to bring in some cute program miniatures!

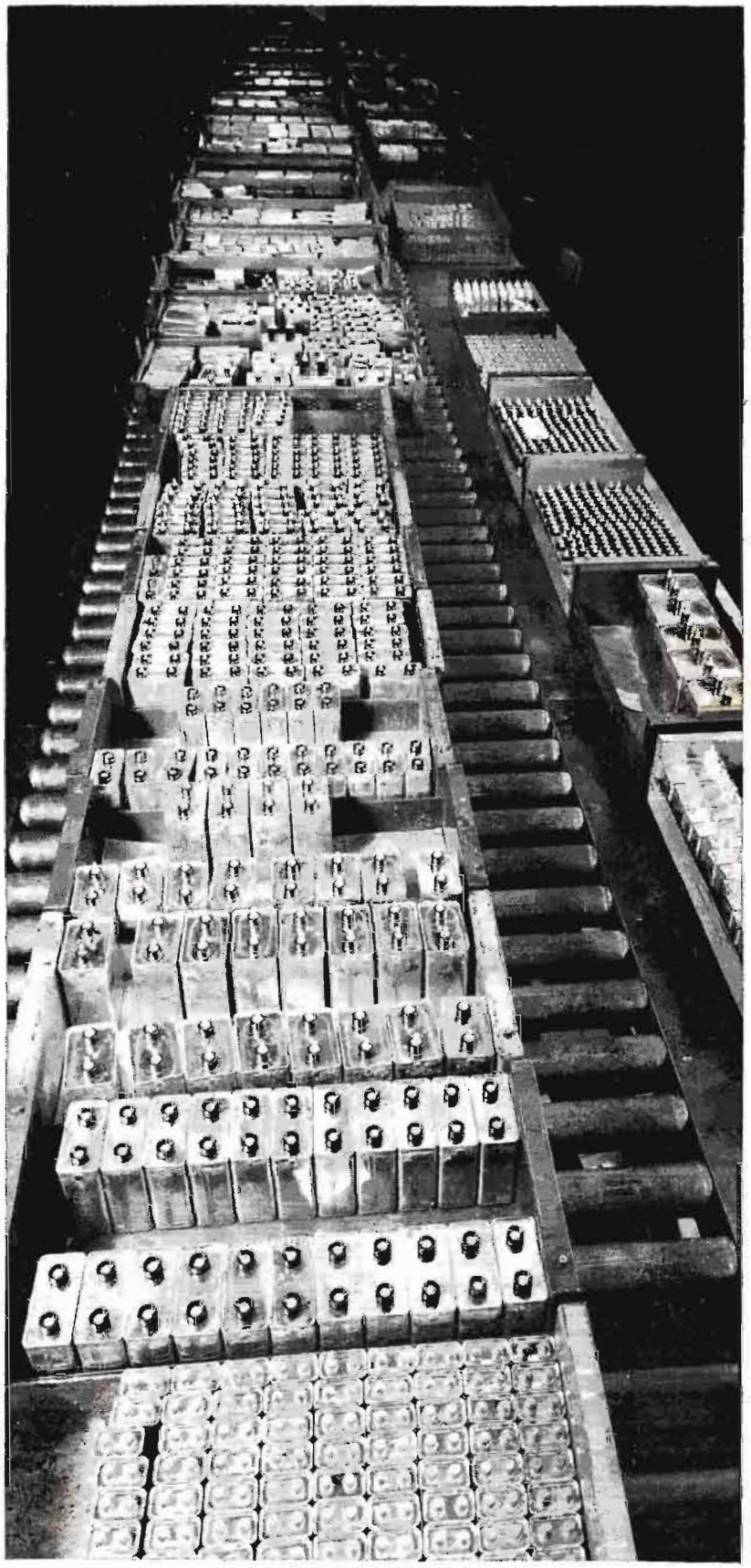
ADAPTOR BURNS—In a number of TV sets now on the market, use of an adaptor to bring in color broadcasts in black-white, produces a smaller picture in the center of the screen. Continued operation of such a smaller image is expected to result in a discoloration pattern on the phosphor which will be noticeable and objectionable when a full-size picture is being viewed. Beware!

L.A. No. 2 TV CITY—according to latest NBC surveys! Los Angeles now has 933,000 TV sets in use, having overtaken Chicago with 930,000 sets. Others in the "first ten," are: Philadelphia, 858,000; Boston, 741,000; Detroit, 491,000; Cleveland, 477,000; Baltimore, 301,000; St. Louis, 293,000 and tied for tenth place Minneapolis-St. Paul, Pittsburgh and Washington, D. C. each with a total of 265,000.

INFLUENCE OF TELEVISION is becoming more marked in all fields. Already hard pressed by television competition, and complaining that it is the cause of lowered attendances, movie theatres are now taking a leaf from television's book and advertising their houses as having screens of "so-many-thousand square inches area". The sales pull of a 30,000 square inch movie screen against a home television screen of "only", say, 256 square inches may be the psychological factor needed to restore sagging movie audience figures!

(*Continued on page* 16)

General Electric can build and test JAN-C-25 CAPACITORS in mass production quantities



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General Electric Company,
Schenectady 5, New York

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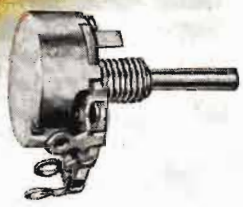
Never Before!

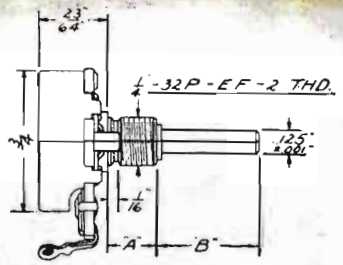
DELIVERS TOP PERFORMANCE IN AN UNPRECEDENTED TEMPERATURE RANGE FROM THE BITTEREST COLD IN ARCTIC REGIONS OR EXTREME ALTITUDES TO FIERY HOT TROPICAL BATTLEFIELDS . . . AND IN AN UNPARALLELED HUMIDITY RANGE FROM COMPLETE ARIDITY TO THE SATURATION POINT.

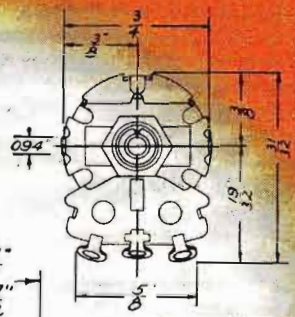
Highly recommended for use in jet and other planes, guided missiles, tanks, ships and submarines, portable or mobile equipment and all other military communications.

Manufactured from specially developed materials, this absolutely unique variable resistor is available in *miniaturized* size (Type 65) or in conventional size (Type 95) in resistance ranges from 250 ohms to 10 megohms.

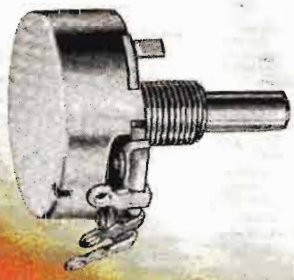
TYPE 65
MINIATURIZED

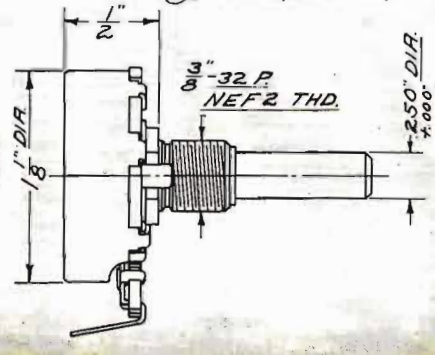


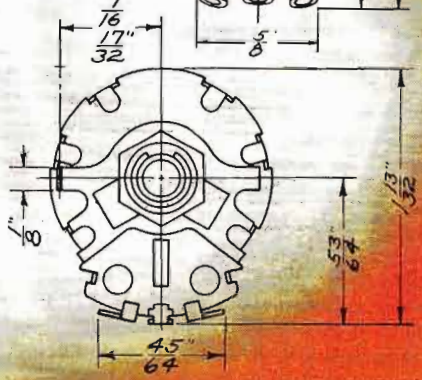




TYPE 95







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Specialists in

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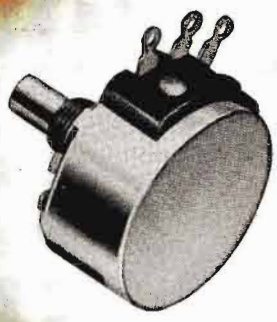
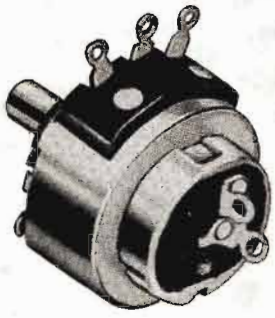
VARIABLE RESISTORS (COMPOSITION and WIRE WOUND)

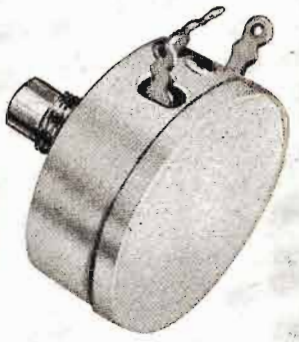
MEETS ALL JAN-R-19 SPECIFICATIONS



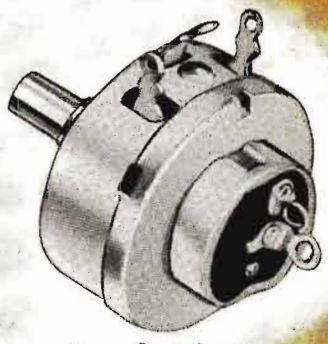
JAN Type RA 20A
2 Watt (CTS Type 252)



JAN Type RA 20B
2 Watt (CTS Type GC-252)

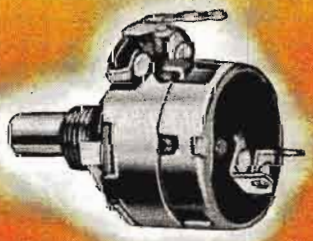


JAN Type RA 25A or 30A
3 or 4 Watt (CTS Type 25)

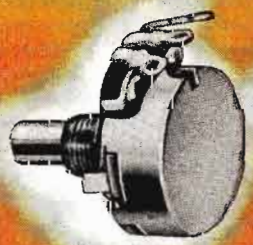


JAN Type RA 25B or 30B
3 or 4 Watt (CTS Type GC 25)

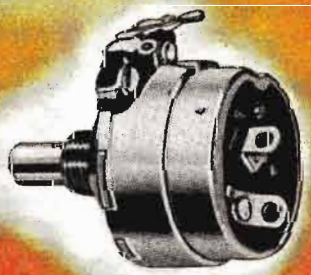
JAN-R-94, Type RV-3A
CTS Type 35, 1⅛" Diameter, Composition



JAN-R-94, Type RV-2B
CTS Type GC 45 with Switch

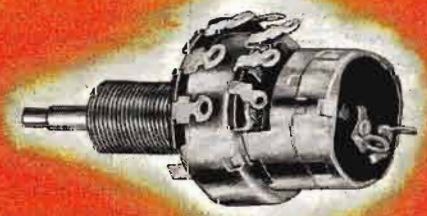


JAN-R-94, Type RV-2A
CTS Type 45, 1 5/16" Diameter Composition



JAN-R-94, Type RV-3B
CTS Type GC 35 with Switch

Type 85 NEW High Voltage Electro-Static Focusing



Type G-C-35-45 Concentric Shaft Tandem

Type JJ-033 Microphone Jack

Type JJ-034 Phone Jack

ILLUSTRATIONS ARE ACTUAL SIZE

Precision Mass Production of Variable Resistors

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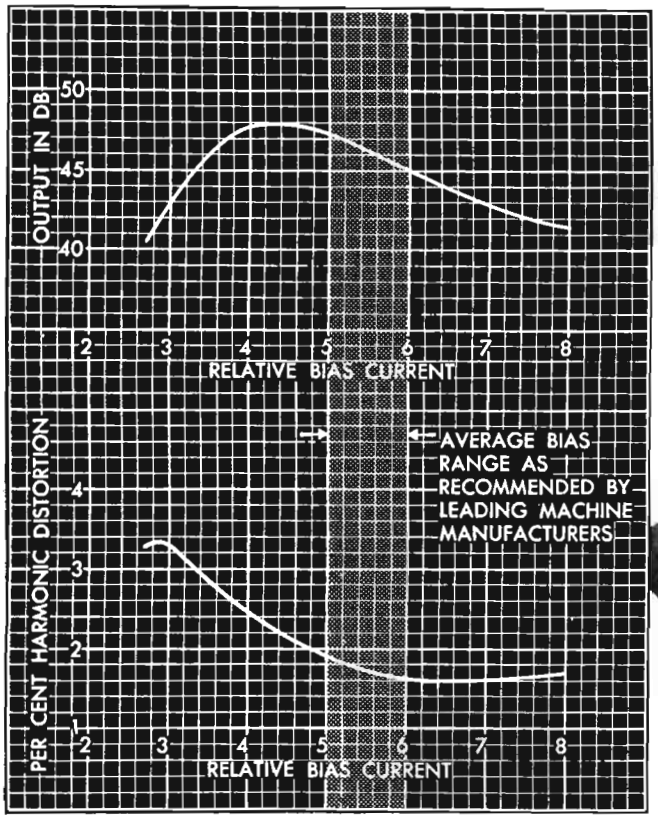
BURTON-BROWNE ADVERTISING

For MAXIMUM OUTPUT with MINIMUM DISTORTION



you can't beat audiotape

TRADE MARK

As all professional recordists know, the proper operation of any tape recorder involves a compromise between *decibels* and *distortion*. And Audiotape has been especially formulated with this important relationship in mind—to give you higher output (and thus better signal to noise ratio) and lower distortion in the normal bias range of all machines.

Test it. Compare it with any other tape. Plot your own output vs distortion curves, similar to the ones shown above. You'll find that in the useful, low-distortion bias range, Audiotape combines maximum output with maximum fidelity and freedom from distortion.

That's just one of many reasons why more and more professional recordists are specifying Audiotape for their most exacting magnetic recording requirements. Remember—Audiotape is made *by* audio engineers, *for* audio engineers. *It speaks for itself.*

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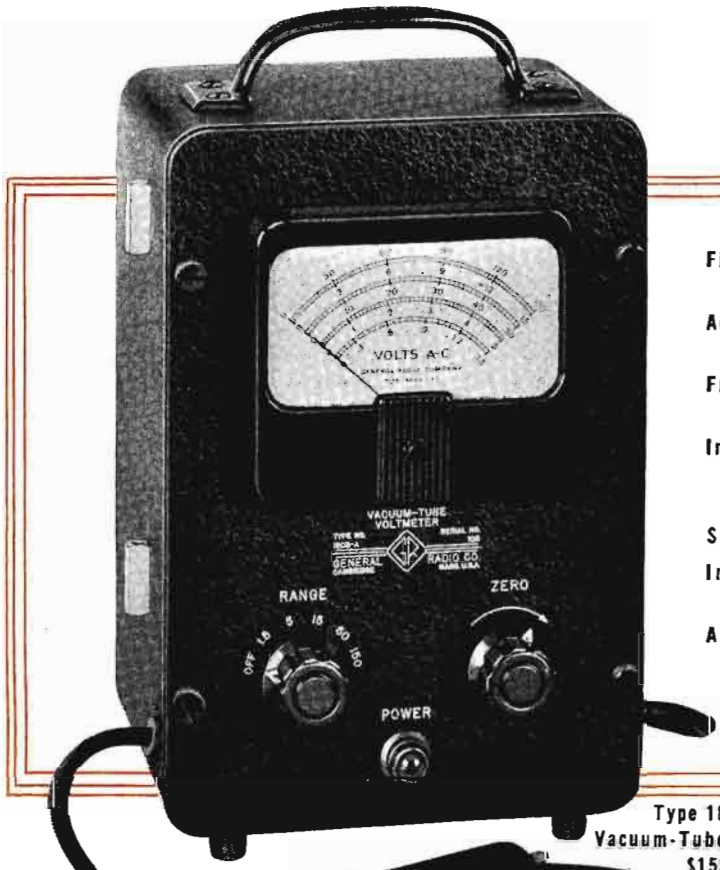
YOU GET an Esterline-Angus output curve in every five-reel package of plastic-base Audiotape. This curve, made from one of the reels in that package, actually measures the output characteristics of all five reels, since they are all slit from the same roll after coating. Now you can *see*, as well as *hear*, the exceptionally high output uniformity that you get only in Audiotape. What's more, every 1250-ft. and 2500-ft. reel is guaranteed FREE FROM SPLICES!

a Moderately Priced

A-C Vacuum-Tube Voltmeter



Five Ranges *Four Scales cover the ranges from 0.1 to 150 volts a-c (full scale 1.5, 5, 15, 50, and 150 volts).*

Accurate ± *3% of full scale on all ranges; r-m-s values of sine-wave voltage.*

Frequency Range *Without correction, up to 120Mc with maximum error of 10%. Correction curve supplied.*

Input Impedance *Equivalent input capacitance of probe is 11 μμf; with plug connectors 12 μμf; equivalent parallel input resistance 7.7 megohms at low frequencies.*

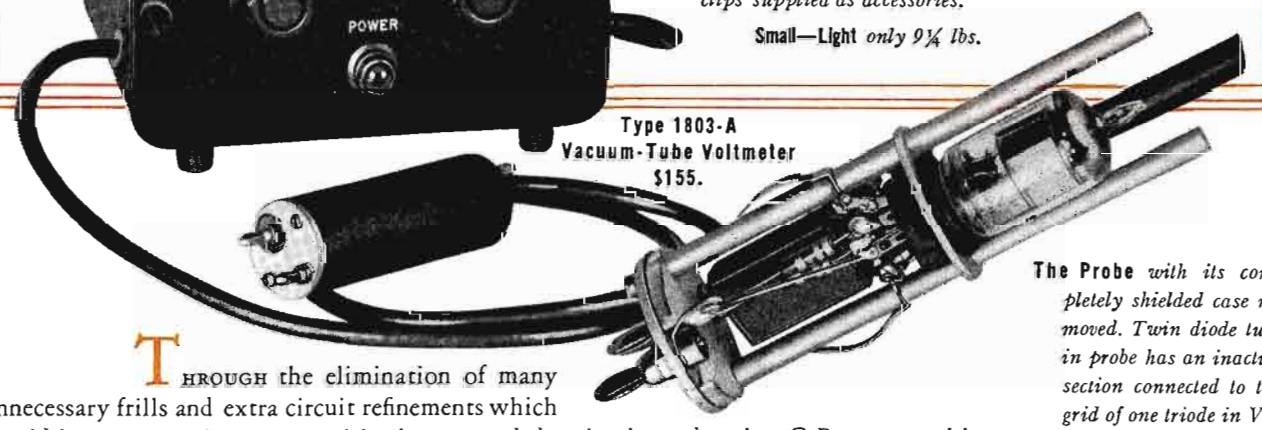
Single Zero Adjustment *for all ranges.*

Internal Calibration Control *Single adjustable resistor corrects calibration if amplifier tube is changed.*

Auxiliary Connectors *a G-R double plug, pair of 30" test leads, pair of test prods and two alligator clips supplied as accessories.*

Small—Light *only 9¼ lbs.*

Type 1803-A
Vacuum-Tube Voltmeter
$155.



The Probe *with its completely shielded case removed. Twin diode tube in probe has an inactive section connected to the grid of one triode in V-2 amplifier while active section is connected to the grid of the other triode, both sections of the amplifier being used in a balanced circuit. The balanced amplifier insures very little zero shift when line voltage varies.*

THROUGH the elimination of many unnecessary frills and extra circuit refinements which would be necessary in a meter with ohmeter and d-c circuits and scales, G-R presents this a-c vacuum-tube voltmeter with a straightforward circuit and with accuracies sufficient for most laboratory requirements at a very moderate price.

Substantially duplicating the performance of the very popular pre-war Type 726-A instrument, this new Type 1803-A Vacuum-Tube Voltmeter sells for less than its predecessor and is improved over the older model in that it is smaller, lighter, has a probe that is also smaller and completely shielded, has a single zero adjustment for all ranges and a power supply not limited to operation at a single frequency.

The probe plugs into clips on the side of the cabinet, in which position the auxiliary test leads and terminals supplied with the instrument can be conveniently attached to the input connections.

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Today, as never before, RCA is engaged in far-reaching electronic developments that have created a need for career men of talent. This means you have the chance of a lifetime to make a permanent connection with RCA in a position offering you the opportunity of a successful career in the field of your choice. Here is what RCA offers.

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RADAR—
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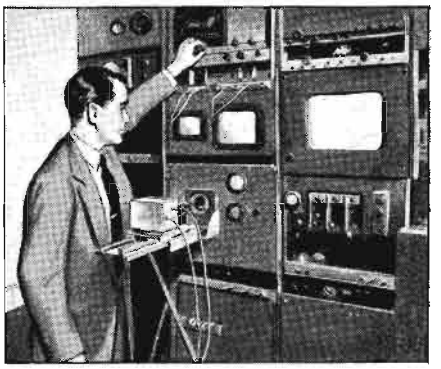
ELECTRONIC EQUIPMENT FIELD SERVICE

Professional Status. RCA engineers enjoy the highest professional recognition among their colleagues. You work in close collaboration with scientists and engineers who are distinguished in the industry. You receive recognition for your accomplishments.



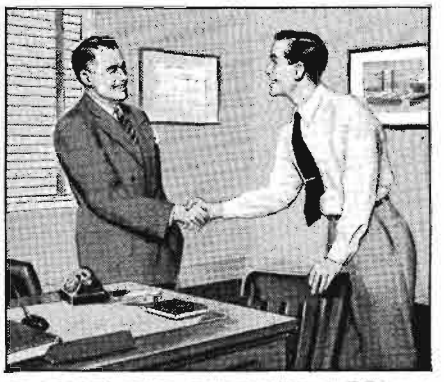
Laboratory Facilities. At RCA, unexcelled laboratory resources and advanced technical apparatus are available. You have unlimited opportunities for the complete expression of your talents in the fields of electronics.

If you qualify for any of the positions listed above, write us for a personal interview—include a complete resumé of your education and experience. Write to:

**Mr. Robert E. McQuiston, Specialized Employment Division,
Dept. T-87, Radio Corporation of America,
30 Rockefeller Plaza, New York 20, N. Y.**

Good Living Conditions. You have a choice of residential locations offering suburban-convenience or quiet, countryside living. Good shopping facilities, schools, churches, medical services and modern hospitals are close by. Excellent opportunities for graduate study.

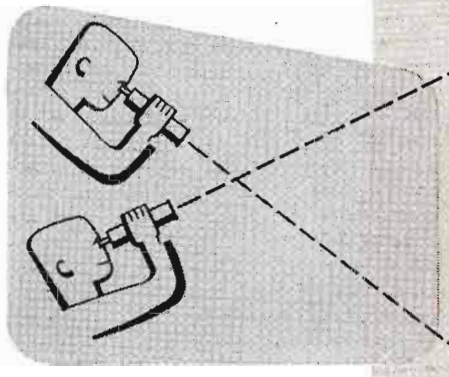
Position Security. These are not temporary positions. Activities are focused not only on the long-range national defense program, but also on a diversified line of products for commercial use. You and your family are protected by Company-paid hospital, surgical, accident, sickness, and life insurance. A modern retirement program helps provide for your future.



Rapid Advancement. Opportunities at RCA are exceptional, for you to move ahead in the career of your choice. You can advance to high-level and supervisory positions which are filled from RCA's engineering staff. Salaries, determined on the experience and ability of individual applicants, are reviewed at regular intervals for increases on a merit basis.

RCA RADIO CORPORATION of AMERICA

LOOKING HIGH



AND LOW

For high dielectric strength
For high volume and surface resistivity
For high dielectric constant

For low loss factor
For low power factor
For low cost

look to Corning for **ALL** your electronic glass requirements

Literally hundreds of glasses with widely varying electrical characteristics are available at Corning —glasses that meet almost every electrical requirement. In V.H.F. and U.H.F. applications, where miniaturization and low loss pose difficult problems, one of Corning's glasses often proves the answer. And glasses can be obtained with high physical and thermal shock resistance, and excellent sealing properties, when these characteristics are needed.

While Corning manufactures much standard electronic glassware, such as electronic tube blanks, television tube blanks, sealing beads, and glass tubing, our engineers are ready to work with you on special requirements. In the hands of Corning technicians, glass can be made in a surprising variety of complicated shapes, often to extremely close tolerances. Their technical know-how, years of practical experience, and complete research and engineering facilities are available to help solve your problems. Let us know what you have in mind!

PYREX T.M. REG. U.S. PAT. OFF.

CORNING GLASS WORKS, CORNING, N. Y.

Corning means research in Glass

ELECTRONIC SALES DEPARTMENT — ELECTRICAL PRODUCTS DIVISION

1851 · 100 YEARS OF MAKING GLASS BETTER AND MORE USEFUL · 1951

GENERAL ELECTRIC

RADIO DIAL LAMPS

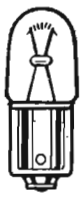
Designed and engineered for the job

BECAUSE of the vibration conditions under which General Electric radio dial lights must operate, General Electric devotes special care to their design and manufacture. Filaments are designed to vibrate without damage and are secured by a shake-proof joint.

General Electric research is constantly at work to assure the quality and serviceability of G-E radio dial lamps. Shock tests, vibration tests and base torsion tests are used in the laboratory to make certain customers will get good service from General Electric lamps.

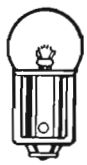
Features like these make it worthwhile for you to sell and install G-E lamps:

1. *Dependable, trouble-free performance.*
2. *High level of maintained light output.*
3. *Low current consumption.*
4. *Long life.*
5. *Preferred by both dealers and customers.*

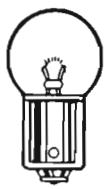


T-3¼ Miniature Bayonet

T-3¼ Miniature Screw

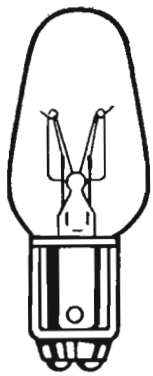


G-3½ Miniature Bayonet

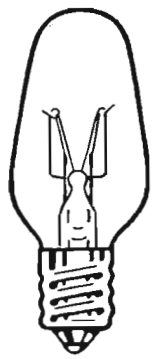


G-4½ Miniature Bayonet

MINIATURE LAMP TYPES



C-7 Double-Contact Bayonet



C-7 Candelabra Screw

LARGE LAMP TYPES

SPECIFICATIONS

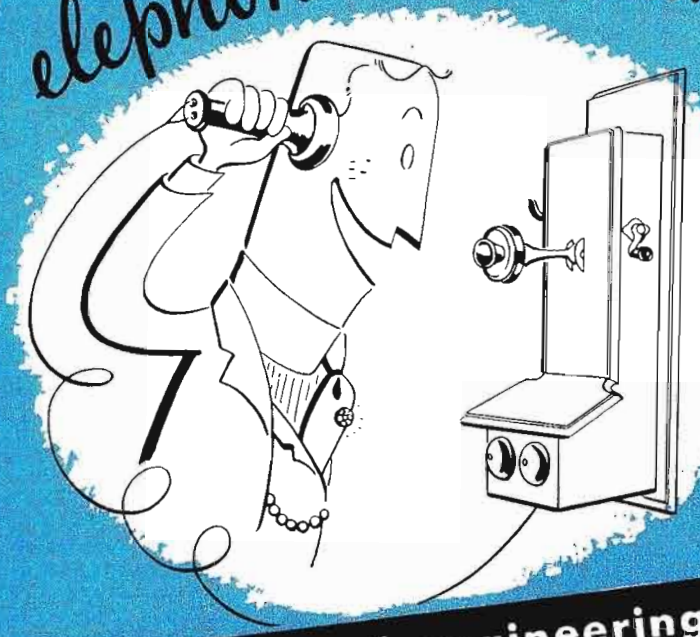
Lamp Number	40	41	42	43	44	45	46	47	48	49	51	55	1490	10C7	10C7DC
Volts	6-8	2.5	3.2	2.5	6-8	3.2	6-8	6-8	2	2	6-8	6-8	3.2	115-25	115-25
Amps	0.15	0.50	0.35	0.50	0.25	0.35	0.25	0.15	0.06	0.06	Max.0.25	Max.0.45	0.16	10 watts	10 watts
Bulb	T-3¼	T-3¼	T-3¼	T-3¼	T-3¼	T-3¼	T-3¼	T-3¼	T-3¼	T-3¼	G-3½	G-4½	T-3¼	C-7	C-7
Base	Min. Screw	Min. Screw	Min. Screw	Min. Bay.	Min. Bay.	Min. Bay.	Min. Screw	Min. Bay.	Min. Screw	Min. Bay.	Min. Bay.	Min. Bay.	Min. Bay.	Cand. Screw	D.C. Bay.

General Electric makes a complete line of neon glow lamps—including NE-51, NE-2, NE-45, NE-48, NE-16, NE-17—for radio and other electronic applications.

You can put your confidence in—

GENERAL ELECTRIC

Telephones have changed....



...and in this era of engineering progress MODERN ELECTRONICS LOOK TO HI-Q*

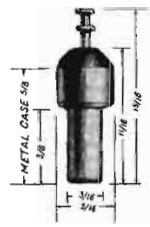
Capacitors • Trimmers • Choke Coils • Wire Wound Resistors

Yes, telephones have changed, and countless developments have played a part in electronic progress since the day of those old stem winders on the wall. Compactness, engineering precision and never-failing dependability are now demanded where the only question once was, will it work at all? In meeting these modern demands of modern electronics for modern ceramic components, **HI-Q** has led the way.

The **HI-Q** trademark is unquestioned assurance of capacitors, trimmers, choke coils and wire wound resistors that are uniformly dependable in every respect and rigidly meet specifications and tolerances. As the leading specialists in the ceramic field, **HI-Q** has come to be regarded by producers of radio, television, communications and other electronic equipment, as their best source of technical assistance in developing new components to meet the special needs of any circuit. **HI-Q** engineers are at your service any time you see fit to call them.

JOBBERS—ADDRESS: 740 Belleville Ave., New Bedford, Mass.

METAL CLAD STANDOFF



(Illustration Actual Size)

Ceramic tube of this quick mounting capacitor is enclosed in Cadmium plated metal case with special end seal for protection against humidity and temperature changes. Capacity 1500 mmf ± 500 mmf.

BETTER 4 WAYS

- **PRECISION**
- **UNIFORMITY**
- **DEPENDABILITY**
- **MINIATURIZATION**

HI-Q*

**Trade Mark Registered, U. S. Patent Office*

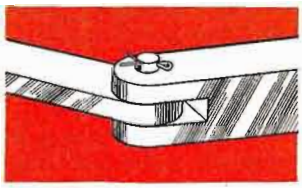
Electrical Reactance Corp.
OLEAN, N. Y.

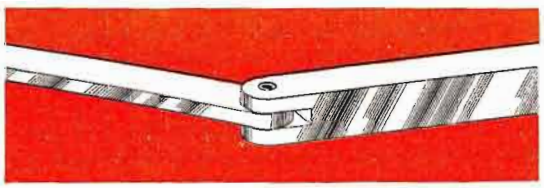
SALES OFFICES: New York, Philadelphia, Detroit, Chicago, Los Angeles

PLANTS: Olean, N. Y., Franklinville, N. Y. Jessup, Pa., Myrtle Beach, S. C.

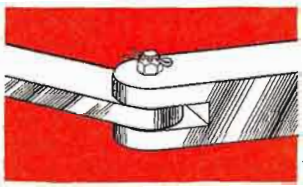
Rollpin replaces hinge pin for faster assembly of hinges. Inexpensively and simply driven in place, it cuts assembly costs. Constant spring tension holds Rollpin firm against vibration on heavy-duty automobile door hinges —on lightweight sheet metal hinges for meter or instrument panel covers.

How to replace hinge pins and cotter pins with ROLLPIN self-locking fasteners





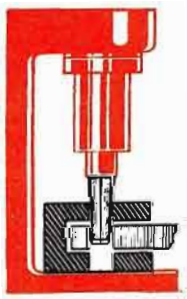
IF YOU DO THIS ▲ *OR THIS* ▼ . . .



TRY THE ROLLPIN WAY INSTEAD . . . Rollpins offer many advantages as pivot and clevis pins for linkages or yoke assemblies. Heat-treated to provide excellent fatigue resistance and wear characteristics, Rollpins fit flush, grip firmly in the outer or inner members, depending on your design requirements, and are simply, inexpensively pressed in place. They are faster to install than cotter pins or safety wire . . . straight edges protect workers' fingers and clothing. Rollpins are readily removed with a punch . . . can be used again and again . . . assure simplified maintenance.

USE ROLLPINS **(1) To replace set screws and rivets. (2) To pin or key gears . . . pulleys . . . levers . . . knobs. (3) As locating dowels, stop pins or shafts for small gear trains.**

Once you test their effectiveness you'll want the secure, vibration-proof fastening of Rollpins in your products. Write now for a sample package and full details. Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J.



HERE'S HOW ROLLPINS PROVIDE A VIBRATION-PROOF FIT

Rollpins are easily pressed into production drilled holes—chamfered ends facilitate automatic or manual insertion.

Rollpins compress as they are driven—are self-retaining in production drilled holes—fit flush. Secondary hole-reaming or riveting operations are eliminated.

Constant spring tension against walls of hole locks Rollpins permanently in place until deliberately removed with a pin punch. Rollpins don't damage the hole and can be used again and again.

ROLLPIN ™ TRADEMARK

A PRODUCT OF

ELASTIC STOP NUT CORPORATION OF AMERICA

ESNA

GET YOUR FREE TRIAL ASSORTMENT OF ROLLPINS

Mail this coupon now

Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, N. J.

Please send me full application data and test samples of the Rollpin.

Name_____ Title_____

Firm_____

Address_____

City_____ Zone___ State_____

TELE-TIPS

(*Continued from page* 6)

LIGHTNING AT 1466 FT.—Dr. K. B. McEachron, GE's famous lightning-protection expert, has shown that at least 80% of the strokes to the Empire State Building are initiated by the building, rather than by the cloud. Apparently the stress at the top of the building, due to its great height and its configuration, is such that a step "leader" usually begins at the building and progresses toward the cloud. The velocities are of the same order of magnitude as found for downward step leaders. Usually, no return stroke was found from the cloud, but instead a continuing current flowed, in one case as long as 0.625 sec. Following the initial step leader, successive discharges may occur and these, where leaders have been photographed, were downward followed by the return discharge from the building.

COLOR TV may be here officially so far as the FCC is concerned but from the standpoint of the manufacturers, distributors and dealers it still has a pretty long and rough road to hoe. Dealers and distributors find it difficult to place orders in the absence of adequate demonstration equipment to sell from, fixed delivery schedules, firm prices, etc. Manufacturers are unhappy because they cannot get their distributors and dealers to tell them how many sets to build. And even if they did know, availability of some materials is so uncertain that no delivery schedules could be set.

WIDE-BAND-ANODE-VOLTAGE-TUNING for magnetrons is a newly demonstrated method of use in which variations in anode voltage can be made to control the frequency of the transmitter. This application was recently publicized by H. Peters, Jr., of the General Electric Research Laboratory, and is expected to have important uses in the FM broadcasting field.

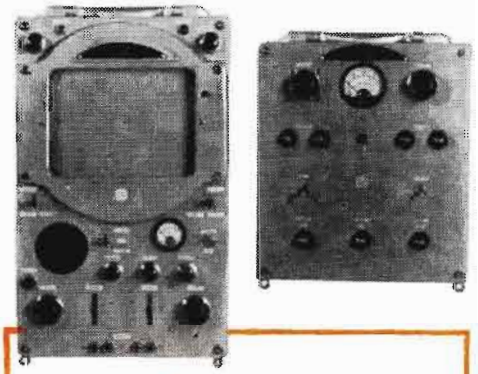
"TROUBLE with the world is that the stupid are cocksure, and the intelligent full of doubt," says Salesman Sam. . . . "Before you flare up at anyone's faults, take time to count ten—ten of your own; for the fellow who never makes a mistake takes his orders from one who does. . . . Humility leads to strength and not to weakness; it is the highest form of self-respect to admit mistakes and to make amends for them. . . . The Ladder of Life is full of splinters."

NOW...

GPL

Makes TV's Outstanding Camera Chain

Even Better!



GPL's 1951 Image Orthicon Chain is delivering even more features – better performance – than the previous model which itself set new industry standards! Compare it for ease of operation, uniform high quality, flexibility in studio or field.

Set this camera up to meet varying requirements . . . control it remotely if desired . . . select any of four lenses at the press of a button . . . adjust focus from right *or* left side of camera, with the same 300° arc of focus adjustment for all lenses . . . choose color filters, masks, at the flick of a thumb . . . control the motor-driven iris from camera or camera control unit. Normal optical focus range automatically adjusts for constant 9" diagonal at close-up, for all lenses except telephoto. Overtravel switch provides *extended* focus range, obtaining full optical focus on all lenses.

In every way, GPL's is a "human-engineered" camera chain, built to do a tough job more easily, built to do *your* specific job *best!* Arrange to see this great new model at the earliest opportunity.

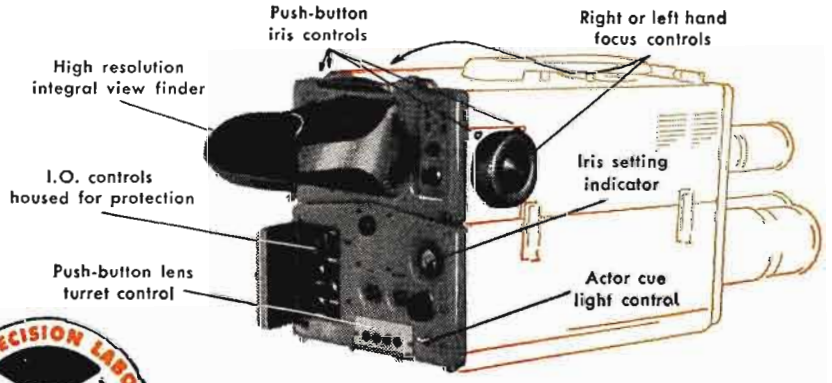
Compare

THESE FEATURES WITH ANYTHING ON THE MARKET TODAY

- Three Compact Units
- Push-button Lens Change
- Right or Left Hand Focus Knobs
- Right or Left Hand Lens Iris Control Buttons
- Turret, Focus and Iris Controls from remote location if desired
- High Resolution Integral View Finder
- Enclosed I.O. Controls
- Iris Setting Indicator
- Pre-loaded Color Filter Wheel
- Swing-up Chassis
- Focus Range Selector Switch
- Equal Flexibility in Studio or Field

WRITE, WIRE OR PHONE FOR DETAILS

FINGER-TIP OPERATION
from CAMERA or REMOTE LOCATION



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

GENERAL PRECISION LABORATORY INCORPORATED

Pleasantville New York

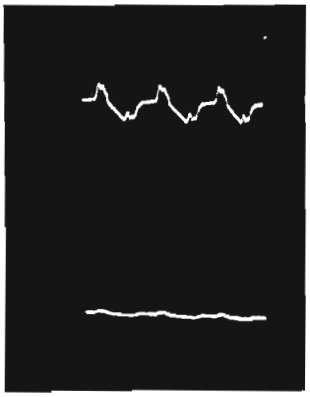
Where "Photographic Memory" Counts!

When you're comparing waveshapes it takes the "photographic memory" of a camera to give you the whole story in accurate, permanent form.

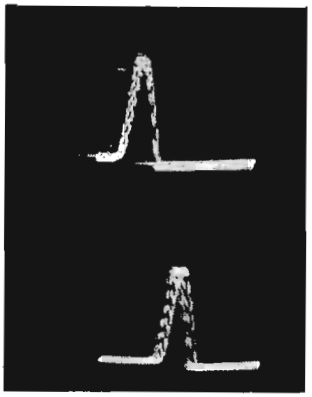
Until recently, photographic oscilloscope recording called for considerable trouble in setting up equipment and a long time period for developing the results. But today, with the Fairchild-Polaroid Oscilloscope Camera, it's an easy job to record as many traces as are needed.

Take a look at the prints below. They provided the engineer with valuable but inexpensive records for immediate evaluation. All were removed from the camera *one minute* after the final exposure was made.

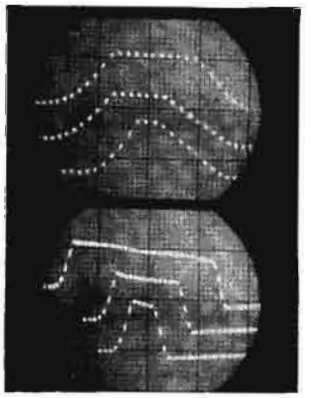
The stories of 3 "One Minute" Oscillograms



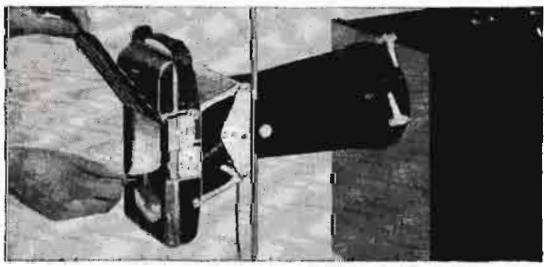
1. BEFORE AND AFTER. A visual comparison of "before and after" conditions is an easy job for the "one step" camera. Here, the upper trace shows the output of a full wave rectified power supply with insufficient filtering. The lower trace shows the effectiveness of the addition of a filtering condenser. The camera is easily adjusted to two positions (upper and lower) for two exposures; traces are exactly one half scope size.



2. SUPERIMPOSING FOR COMPARISON. The problem—determine the maximum time-interval variation between successive camera shutter openings and flash circuit closings. Instead of carefully measuring successive scope traces, the engineer superimposed several exposures for easy comparison. The length of the trace before the shutter opened is a measure of the time between the electrical contact closing and camera shutter opening.



3. MULTIPLE EXPOSURE PRE-SOLARIZATION. Here, by making 3 successive exposures on each half of the print, the engineer was able to record performance of a camera shutter at its 1/100, 1/200, 1/400 second (upper) and 1/25, 1/50, and 1/100 second settings (lower). "Pre-solarizing," the process of pre-exposing the print with the trace off the screen, made it possible to record the high writing speeds involved.



A minute after you've pulled the tab a finished print is ready for evaluation.

for still or *continuous-motion* oscilloscope recording on 35-mm film or paper

—THE FAIRCHILD OSCILLO-RECORD CAMERA

The Fairchild Oscillo-Record Camera is the first unit specifically designed for the purpose of recording cathode-ray tube images. Features: records still or continuous motion on standard 35-mm film or paper, film footage indicator, electronic speed control—1 to 3600 in./min., film capacity—100, 400 or 1000 feet.

SPECIFICATIONS

Lens and Shutter—Choice of 75mm f2.8 Wollensak Oscillo-Anastigmat with #2 Alphox shutter having speeds of 1/25 sec. to 1/100 sec., "time" and "bulb"; or, 75mm f1.9 Wollensak Oscillo-Anostigmat with #3 Alphax shutter having speeds of 1 sec. to 1/100 sec., "time" and "bulb".

Picture Size—3¼ x 4¼ in. (2 or more images per print; 16 exposures per roll of film.)

Image Size—One-half reduction of scope image.

Writing Speed—With f2.8 lens, up to 1 in/μsec at only 3000V accelerating potential; higher speeds at higher voltages. With f1.9 lens these values are approximately doubled.

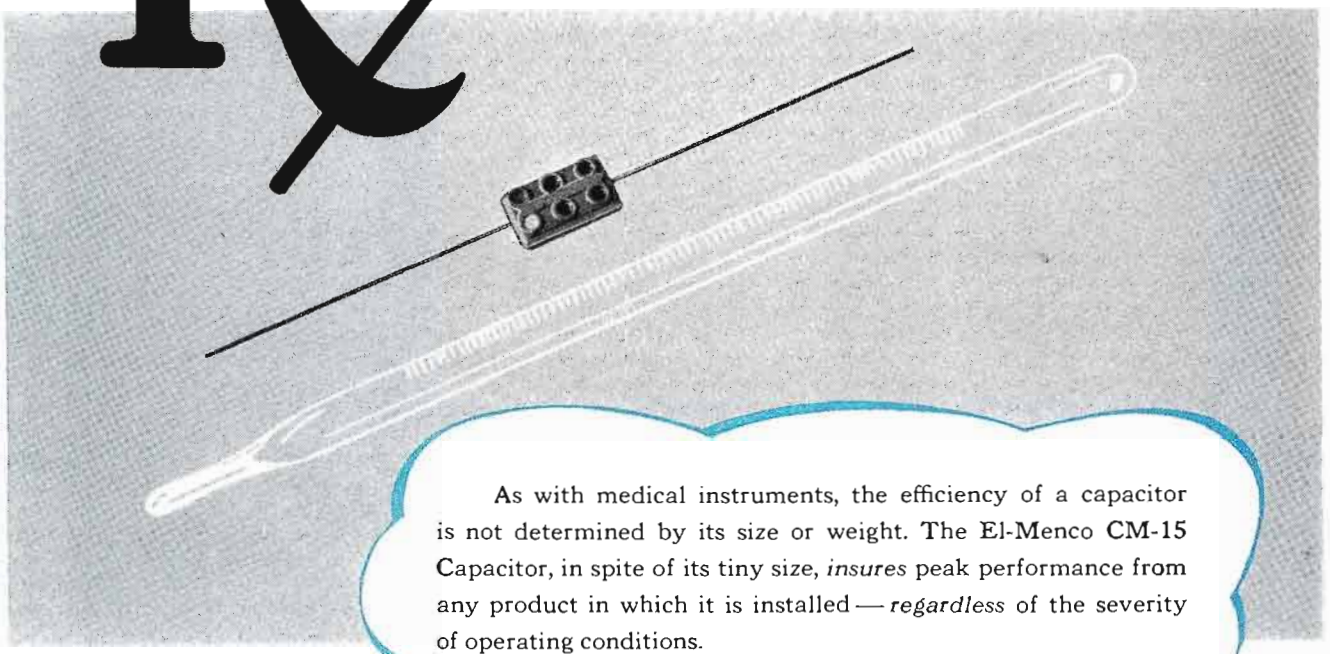
Dimensions—Camera, 10½ x 5¼ x 6¼ in.; hood, 11 in. length, 7½ in. dia; adapter, 2 in. width, 6⅝ in. max. dia.

Weight—Complete, 7¾ lb.

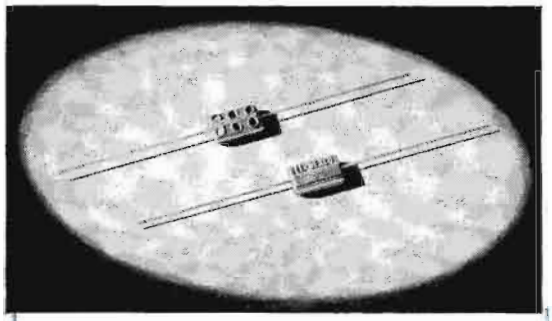
Fairchild-Polaroid Oscilloscope Camera Kits include camera, carrying case and film. Write today for complete data on the Fairchild-Polaroid and Foirchild Oscillo-Record Cameras. *Fairchild Camera and Instrument Corp., 88-06 Van Wyck Blvd., Jamaica 1, N. Y. Dept. 120-1581.*

FAIRCHILD
OSCILLOSCOPE RECORDING CAMERAS

Rx FOR PERFORMANCE



As with medical instruments, the efficiency of a capacitor is not determined by its size or weight. The El-Menco CM-15 Capacitor, in spite of its tiny size, *insures* peak performance from any product in which it is installed — *regardless* of the severity of operating conditions.



CM-15 MINIATURE CAPACITOR

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.

EL-MENCO CM-15 CAPACITOR

Pretested at *double* its working voltage, this tiny capacitor must prove its ruggedness *before* leaving the factory. It is tested for dielectric strength, insulating resistance and capacity value.

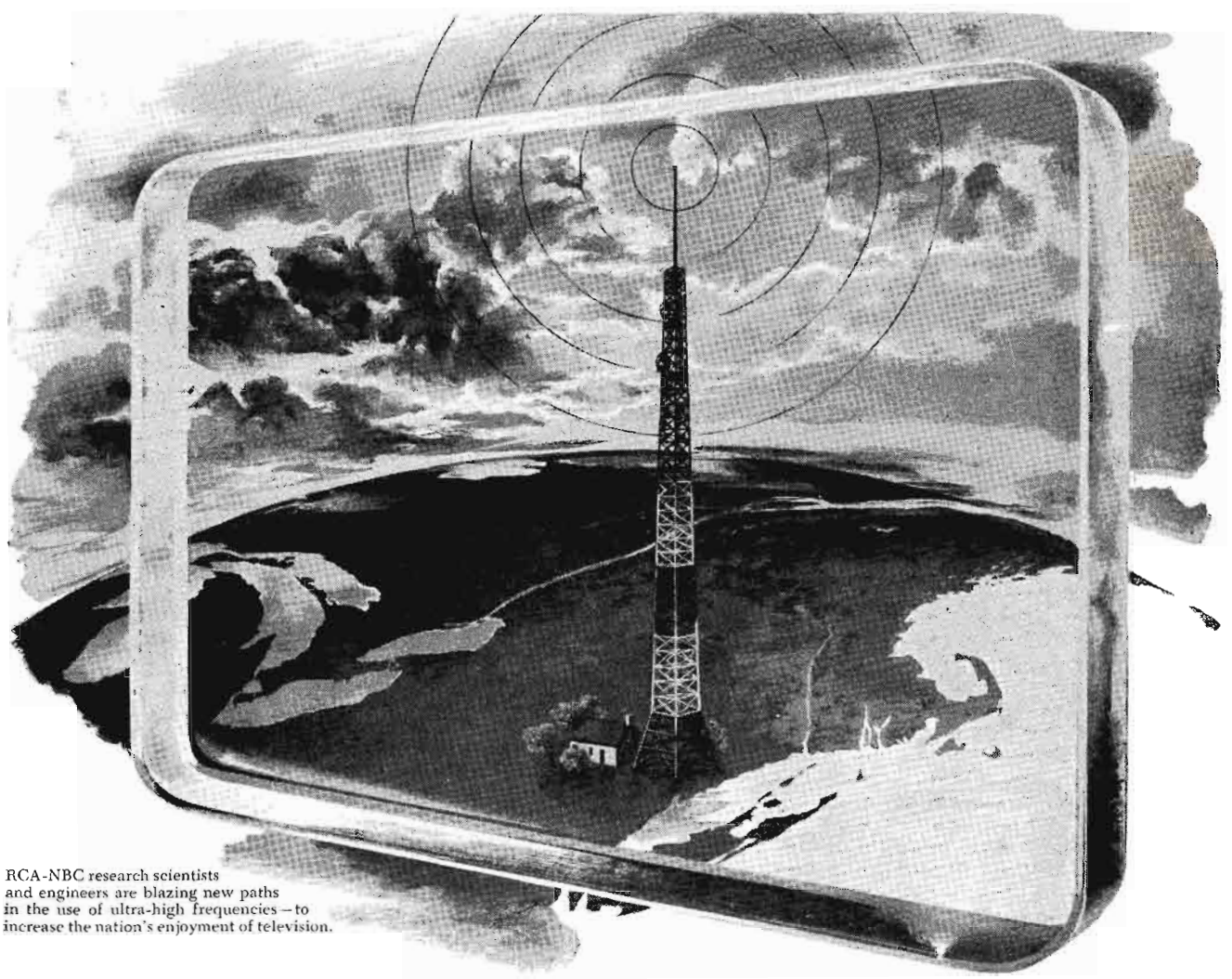
WHEN YOU WANT PEAK PERFORMANCE IN YOUR PRODUCT YOUR *BEST* ASSURANCE IS EL-MENCO CAPACITORS.

THE ELECTRO MOTIVE MFG. CO., Inc.
Willimantic, Connecticut

MANUFACTURERS ARE INVITED TO SEND FOR SAMPLES

MOLDED MICA El-Menco MICA TRIMMER CAPACITORS

FOREIGN RADIO AND ELECTRONIC MANUFACTURERS COMMUNICATE DIRECT WITH OUR EXPORT DEPT. AT WILLIMANTIC, CONN. FOR INFORMATION.
ARCO ELECTRONICS, INC. 103 Lafayette St., New York, N. Y.—Sole Agent for Jobbers and Distributors in U.S. and Canada



RCA-NBC research scientists and engineers are blazing new paths in the use of ultra-high frequencies—to increase the nation's enjoyment of television.

World's first custom-built **UHF** station —points the way to more **TV** for more people

Although television now reaches 45 million people in more than 12 million homes, thousands of communities are still too far from existing stations to be reached by *any* programs. Moreover, under present conditions, many cities with limited program service want, but can't have, additional TV stations.

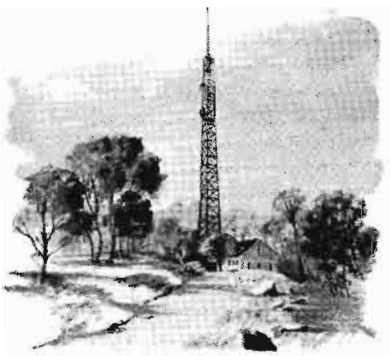
In preparation for the establishment of a country-wide television service, RCA has pioneered for many years in ultra-high-frequency (UHF) research.

Today—an experimental station built by RCA at Bridgeport, Conn., is supplying the practical experience and engineering facts needed to design the best UHF equipment—including transmitters, receivers, and converters. NBC programs on the air during the full broadcast day are used by RCA—and other manufacturers, too—for large-scale field tests.

From results of this pioneering, RCA engineers have determined that practical UHF equipment can be built to serve the public, and that present RCA Victor television sets can be readily adapted to give equally fine performance on both UHF and VHF.

* * *

See the latest in radio, television, and electronics at RCA Exhibition Hall, 36 W. 49th St., N. Y. Admission is free. Radio Corp. of America, RCA Building, Radio City, N. Y. 20, N. Y.

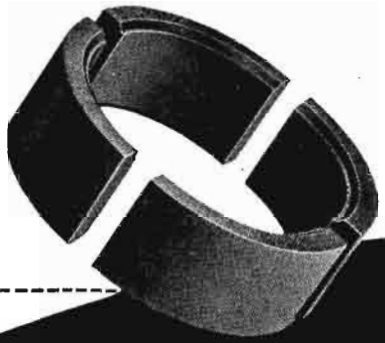


Built by RCA at Bridgeport, Conn.,—first UHF transmitter to operate on a regular schedule.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

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

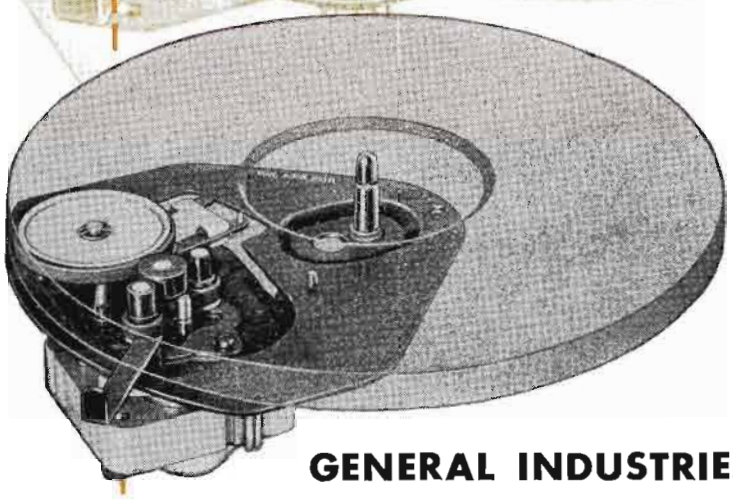
STACKPOLE CARBON COMPANY, St. Marys, Pa.

HPB-617

TOPS

IN DEPENDABILITY
IN QUIETNESS
IN FIDELITY
IN LONG LIFE

. . . in the 3-speed field



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Write *today* for complete information about this and General Industries' *complete* line of three-speed, dual-speed and single speed phonomotors, and the popular new GI Tape-Disc Recorder Assembly. Quantity price quotations furnished promptly upon request.

The GENERAL INDUSTRIES Co.

DEPARTMENT L • ELYRIA, OHIO

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1. In Minneapolis, the police radio network is linked to hospital ambulances by two-way mobile rigs equipped with Sylvania receiving and transmitting tubes. Immediately the Minneapolis Police headquarters hears of an accident, a General Hospital ambulance is alerted by 2-way radio and routed to the scene.

2. Police cars nearby are also instructed to go to the location and lend whatever police help is needed.

Minneapolis calls on Sylvania tubes

3. This quick, efficient coordination between the Minneapolis Hospital and the Police Department has been an important factor in enabling this city to win the *National Safety Council award as the nation's "Safest City" . . . for 2 successive years.*

In Minneapolis, when seconds count, police and hospital authorities know they can count on the sure performance of Sylvania high-quality tubes.

In scores of other critical assignments, including railroads, airlines, steamships, and taxi cabs, you'll find Sylvania tubes get first call.

Now available in types and sizes for every need . . . from subminiature, low-drain battery types to television receiving and picture tubes. For full information and ratings about the types you need, drop a line to: Sylvania Electric Products Inc., Dept. R-1408, Emporium, Pa. *Sylvania Representatives are also located in all foreign countries.*

SYLVANIA ELECTRIC PRODUCTS INC. 1901-1951 FIVE DECADES 50th ANNIVERSARY OF PROGRESS

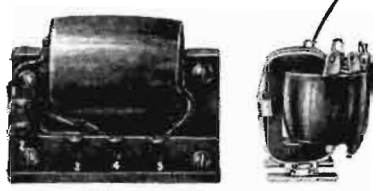
SYLVANIA

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

Ceroc 200

CERAMIC-COATED MAGNET WIRE

...FOR HIGHER RATINGS IN SMALLER WINDINGS



Same v-a rating! At the left is a filament transformer for a radio transmitter wound with double vinyl-acetyl insulated wire and impregnated with synthetic varnish. It is rated at 1,000 hours life under 85°C. ambient temperature operation. At the right is the same transformer, redesigned, and wound with CEROC 200 and impregnated with silicone resin. It has a rated life of 10,000 hours at 160°C. ambient temperature operation!

Shrink the size of small transformers, chokes, relay coils, and other wire-wound electrical components by winding them with Sprague's CEROC 200 Magnet Wire.

This wire has an exclusive ceramic-silicone insulation which permits continuous operation at 200°C. Size for size, it safely carries far larger currents than ordinary magnet wires using conventional insulating materials. Consequently, CEROC 200 can save both copper and magnetic materials for you.

Write for Engineering Bulletins 401 and 403B

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Ceroc T Wherever higher temperatures and severe mechanical stresses are present, investigate CEROC T, the most heat-resistant of all magnet wires! For specifications on this 250°C. ceramic-Teflon insulated wire, write for Engineering Bulletin 402F.

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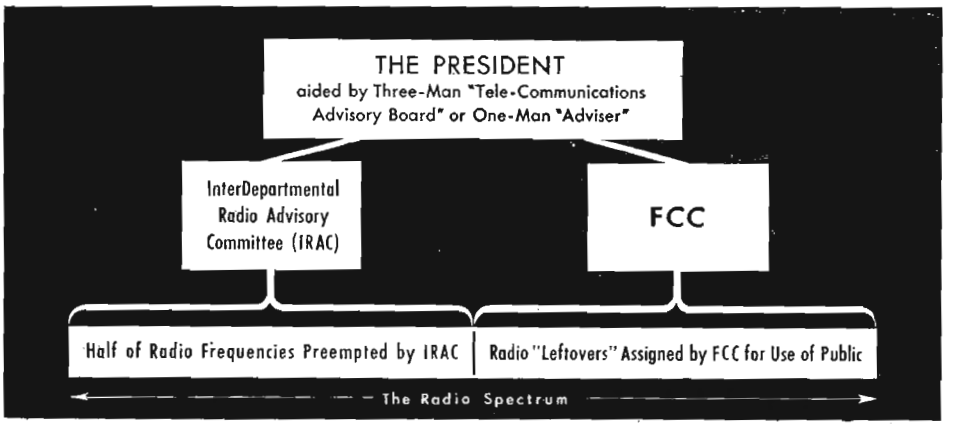
TELE-TECH
TELEVISION • TELECOMMUNICATIONS • RADIO
O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

More Frequencies for FCC and the Public



All the troubles of the human race, it is said, can be traced back to two and only two basic causes: (1) The inclination of the ecliptic, and (2) The separation of the sexes!

And practically all the troubles of radio and television can be traced back to one principal cause, *shortage of frequencies*, running back even behind the FCC. This fundamental evil lies in the casual practice by which a little group of Washington bureaucrats known as IRAC has, to date, preempted half of our precious radio frequencies for government departmental use.

For the FCC is not the all-powerful potentate of our channels which most radio men assume the Commission to be. When it comes to controlling frequencies, indeed the FCC itself sits at "second table" and obediently "takes the leavings!" For *first* choice of all channels is exercised by IRAC (the Interdepartmental Radio Advisory Committee). Such channels as it rejects are then passed along to the FCC, for assignment to the radio-TV industry and the public.

This vast and uncontested privilege granted IRAC grew up gradually from past and indifferent delegation of the President's personal radio powers, under the radio law, to the various Washington departments.

The President's Policy Board Report

Now, as a result of the 248-page report filed by the President's temporary Communication Policy Board, it is recommended that these primary radio powers of the President be put back into the hands of the White House. And that a Presidential three-member Telecommunications Advisory Board (or even one-man Presidential Adviser) be set up to formulate a national policy on frequency assignments and the operation of communications systems by government agencies.

Chairman Stewart's committee has told the President that by better management of spectrum allocations much more can be done with radio services.

"The means on which we have relied in the past for management of the spectrum are no longer adequate to resolve in the best national interest the problems produced by this increasing pressure," said the report. "The current difficulty growing out of the search for suitable space for television broadcasting in itself emphasizes this inadequacy."

Restore Channels to Public Use

Shortage of radio frequencies is at the bottom of most of radio's troubles, as demand grows for wider services for the public.

Responsible assignment of limited government frequencies will prevent present wastes of valuable spectrum space, and could restore to public use badly needed frequencies with a public gain of as much as 50 to 60 percent over present available channels.

With a strong White House hand supplanting IRAC or holding it in check and making Washington Bureaus justify their radio demands (as private licensees have to justify theirs) great new expansion can come to radio and TV.

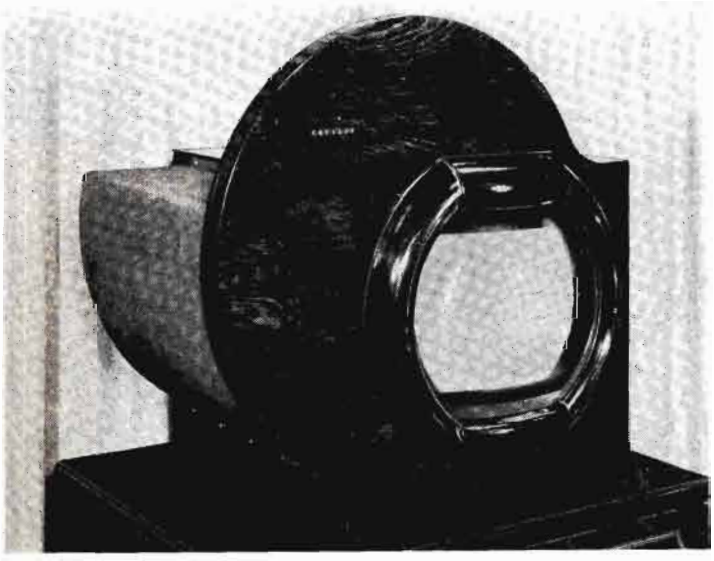
The RADARSCOPE Revealing at a Glance

THE PENTAGON

$152,406,500 will go for radio-electronic installations, out of the $6½ billions military public-works construction funds just requested by Secretary Marshall. The U.S. Army Signal Corps installations would take $71,543,500. Included also is $79,315,000 earmarked for two Air Force bases which include communications and electronic centers—Keesler, Miss., where the electronic staff school is located, $43,879,000; and Wright-Patterson, Ohio, which is the site of communications and electronic materiel and research activities, $35,436,000. Naval funds would include $943,500 for Naval Communications stations in Annapolis, and $605,000 for a communications center in Washington.

REARMAMENT

CONVERSION EXCELLENT — Military requirements for the fourth quarter of 1951 are large but the radio-TV manufacturing industry has been foresighted in anticipating the goals of the Armed Services with orderly conversion of television-broadcasting receiver and tube plants during the July-vacation regular plant shut downs. DPA authorities expressed the view that the conversions had been accomplished in an excellent fashion. The conversions of civilian to military production were accomplished by the larger manufacturing companies such as General Electric, RCA, Federal Telephone and Radio, Capehart-Farnsworth, Western Electric, Philco and Westinghouse during the regular summer vacation closedowns for inventory and retooling surveys.



Crosley's color-TV "slave" unit plugs into standard sets of the same line and produces a picture in color on present FCC color standards. The 10-inch screen is magnified to 12½ inches. For this experimental unit, the color-wheel alone costs the manufacturers $150. Crosley engineers, however, publicly state that not the present FCC standards, but a compatible all-electronic system is "the color system of the future!"

MECHANIZATION

SEVERAL MAJOR MANUFACTURERS are now in the process of extending plant mechanization (with support of military equipment procurement agencies in the interest of obtaining more rapid production) so as to permit construction of complete subassemblies and in some cases complete end equipments. This is an extremely significant trend because it foretells of a complete change in assembly methods as we know them today, with attendant changes in the labor and financial structures of the industry. Smaller component manufacturers might do well to review their current productive techniques with a view towards keeping pace with mechanization developments. As automatic fabrication of complete subassemblies and end items progresses, new and improved component design will be needed to yield components that can be produced more efficiently and that will lend themselves to mechanized final assembly operations.

TV FILMS

CONTINUED INCREASE in film usage over the air is finally sparking a demand among telecasters for improved film transmission equipment. No longer are producers satisfied by receipt of just any sort of TV film print. Already, vacuum-tube-operated sensitometric equipment is being designed and built. However, the real bottleneck is still the iconoscope tube with its edge flare and secondary emission. The new image-orthicon TV film camera, recently demonstrated should eliminate most of the troubles. Once the TV "freeze" ends, there will be a tremendous spurt in attention given to such methods.

PROPAGATION

TROPOSPHERICS—Interstation TV interference has raised its ugly head, this summer, to an extent not before observed. Horizontal bars and shimmers appear across the picture, run up, stand still or scamper down. At the same time, the TV sound is spoiled by growls and roars as the interfering signal tries to take control of the FM output. These effects have appeared in outlying sections, 10 to 20 miles or more from stations, and usually occur around twilight. Miami, Norfolk and Oklahoma City, for example, have been observed mutilating WNBT's Empire State signal. This interference is coincident, of course, with the many long-distance TV records reported this summer. Havana, Cuba, has been seen in the Middle Atlantic and Middle West areas, and a number of mid-

continent U. S. stations have been picked up in Havana. Fortunately, the interference has been a short-period phenomenon, lasting only an hour or so, and the trouble may be expected to disappear at the end of hot summer weather.

AUDIO

PRE-RECORDED MAGNETIC TAPES will soon become available through many local outlets. This should go along well with the products of several manufacturers who in recent months have announced availability of magnetic-tape units for playback purposes only. Initially, the new magnetic-tape library will be composed of 14 programs. Each program is a professional-quality recording made on Minnesota Mining type 111A plastic tape, lasts for approximately ½ hour, and consists of 9 to 11 selections. Sales appeal is assured because the recorded programs are not available on discs. This arrangement should be an excellent proving ground for gauging public acceptance of tape vs. disc qualities.

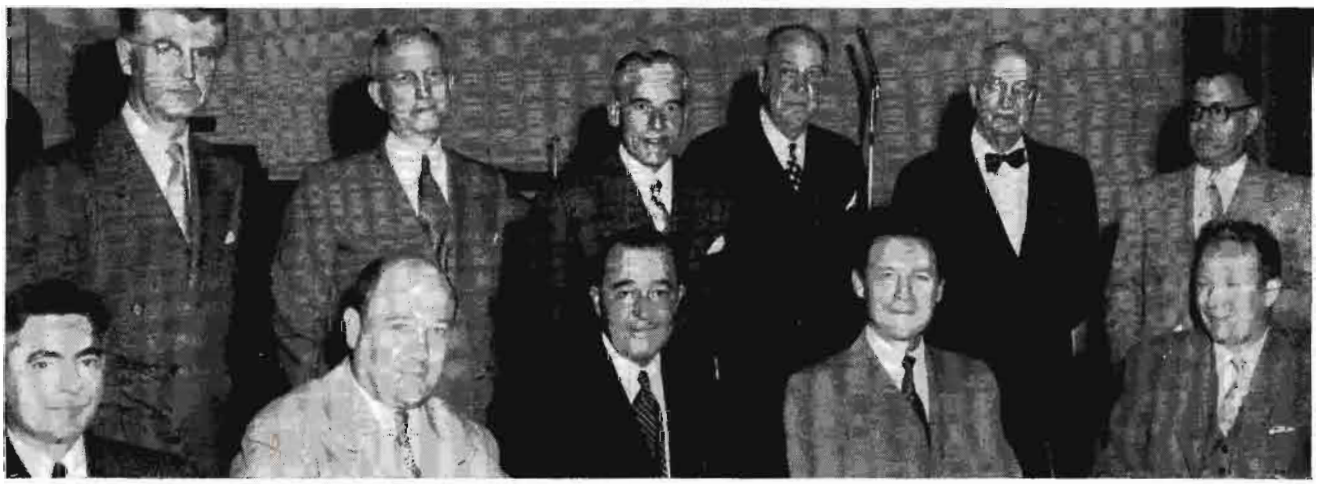
TELEVISION

COMMUNITY TV—Freeze or no freeze, additional cities are now getting TV without grace of FCC, through expansion of the multiplex-antenna idea. This "community antenna system" is already working in Astoria, Ore., Bellingham, Wash., Grass Valley, Calif., Dansville, N. Y., and Lansford, Coaldale, Mahanoy City, and Honesdale in Pennsylvania; installations are under way in 50 other non-TV cities. Harrisburg, Pa., is next, having just completed its twin pick-up towers on a 1300-ft. ridge overlooking the city. The 100-ft. towers will pick up Channels 2 (CBS) from Baltimore, 75 miles, 4 from Lancaster, 35 miles, and 6 from Philadelphia, 90 miles. Harrisburg citizens have organized a corporation, "Perfect TV, Inc." to which the individual subscriber will pay a "connection charge" of about $135, and then about $3.75 a month. In Lansford (pop. 7,500), with 350 television sets connected to the system, the local corporation already reports "a reasonable profit."

MANPOWER

ENGINEERS WANTED—A mid-1951 survey of the needs of 378 companies and government agencies shows that about 80,000 engineers are needed now, exclusive of the needs of the military. When the current graduating class of 38,000 is absorbed there is still an unfilled demand for 42,000 engineering graduates. However, a recent study of the 1951 class of engineering graduates showed that the military, through R.O.T.C. and reserve programs, and through the Selective Service System, will siphon off about 19,000 engineering graduates. The actual unfilled demand will then be for more than 60,000 engineers. Thus, the urgent need for engineers cannot be met through the current sources of supply. The 1952 graduating class will be only about 26,000; 1953 about 17,000; 1954 about 12,000. Of course these figures cover all engineering, but radio-electronic men make up a large and important section.

1951 LEADERS OF THE RADIO-TV MANUFACTURING GROUP



Officers and directors of the Radio-Television Manufacturers Association. Standing, left to right, are: James D. Secrest, general manager and secretary; Max F. Balcom, past president; A. D. Plamondon, Jr., vice president; W. J. Barkley, vice president; John W. Van Allen, general counsel; and Dr. W. R. G. Baker, director of the RTMA Engineering Department. Seated, left to right are: Arie Liberman, vice president; John W. Craig, vice president and chairman of the Set Division; Leslie F. Muter, treasurer; Glen McDaniel, RTMA president; and Robert C. Sprague, past president and chairman of the Board.

TV Receiver Manufacturers Ready

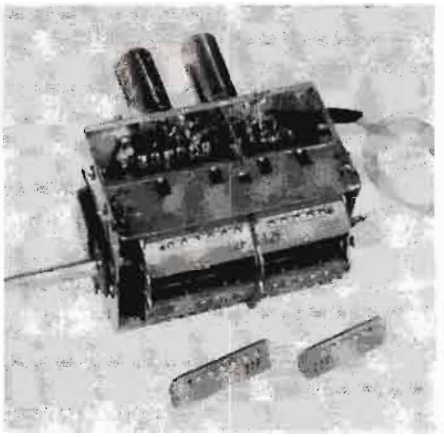
Set makers show FCC and industry engineers various ceive programs from future UHF stations. (See also

WHILE at Washington the engineers of the FCC and the broadcast stations work to set up a UHF TV allocation (see large chart accompanying this issue of TELE-TECH), the manufacturers of TV sets also have been busy designing conversion devices which will permit present VHF standard TV sets to receive stations in the UHF band.

And although a year or two may elapse before UHF-TV becomes a matter of actual general operation in the United States, the manufacturers well recognize that TV sets going on the market this Fall will be expected to serve their owners for a number of years and so must be simply convertible to receive UHF signals when these do come on the air in 1952, '53 or '54!

Bridgeport Tests

Progress in UHF conversion of standard TV receivers of many makes was high-lighted several weeks ago when the RTMA invited the FCC members and engineers to a demonstration of UHF adapters, held at Bridgeport, Conn., where NBC has an experimental UHF transmitting station in regular operation.



CAPEHART-FARNSWORTH—Using a regular Capehart CX-33 receiver chassis, four miles from the Bridgeport transmitter ultra-high-frequency conversion was accomplished by inserting UHF channel strips in Standard Coil tuner already a part of instrument. Complete Capehart line uses same chassis.

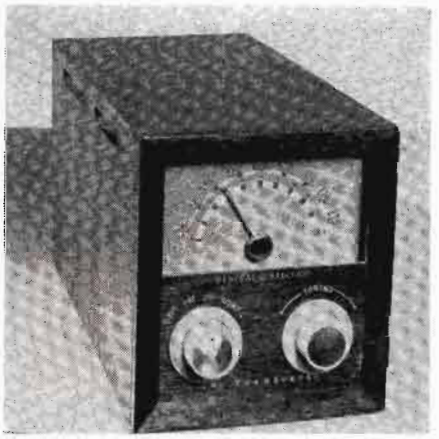
The TV receiver makers had set up their conversion devices in the bedrooms of Bridgeport hotels, about 4 miles from the transmitter, and the Washington officials trooped from room to room, watching the clear, bright UHF pictures received on 529-535 megacycles at 4 miles distance, and comparing these with the same program—snowy and diathermy-ridden—received on VHF channel 4 from New York, 56 miles away.

In this respect, the Bridgeport demonstrations proved almost too convincingly that UHF gives superior results without reception difficulties. For as the manufacturers' experimental engineers vied with each other to bring in perfect UHF reception in the lofty hotel rooms, the non-technical observers did not always stop to think what corresponding quality of UHF reception would be possible in the homes of an average city or town with hills and building obstructions.

Downlead Problems

Difficulties of carrying UHF signals many feet from antenna to chassis were also apparent. One maker had installed a roof-top antenna 25 ft. away but experienced such losses in the down-lead, that a built-in antenna in his converter box gave practically the same effective signal! The tiny UHF antennas of pencil length, however, showed the simplicity of the UHF pick-up problem for direct-view locations. Some UHF antennas were simply stuck up on the wall with adhesive.

CROSLEY—"Ultra tuner" measures 7 x 7 x 9½ in.; attached by screwdriver to receiver. Works with any continuous-tuning TV receiver. One model Ultratuner with self-contained UHF antenna. Installation requires no work on receiver. Covers 122 to 132 megacycle frequency range. Retail price, about $40.



GENERAL ELECTRIC — This Translator (Model UHF-101) has been tested for 18 months in the Bridgeport area and is now in limited production. Below the megacycle numerals there is a logging scale for added convenience in tuning. A travelling dial light spot-illuminates each numeral.

HALLICRAFTERS' new ultra-high-frequency converter operates over a 450- to 900-megacycle range. The output frequency feeds into either Channel 3 or 4 of any present-day television receiver. The Hallicrafters Company also has UHF coil strips available for its turret-type "Dynamic Tuners."

with UHF Conversion Devices

means for adapting present standard VHF sets to re-
UHF Station Allocation Chart, Part II of this issue)

STROMBERG-CARLSON'S converter, styled in green leatherette and measuring only 8 x 4 x 6 in., uses a 6F4 as a local oscillator, a 6BQ7 as a cascode r-f preamplifier, and a 1N72 germanium crystal mixer. Unit has a 12MC bandwidth and balanced output feeds VHF-TV channels 5 or 6.

To the lay Commissioners, the novel converter container shown by Stromberg-Carlson in the form of a handsome tooled-leather cigar box, attracted special attention, and pointed a possible trend of decorative camouflaging which purchasers may demand, if UHF converters are to be kept on top of their present TV receivers in their living rooms.

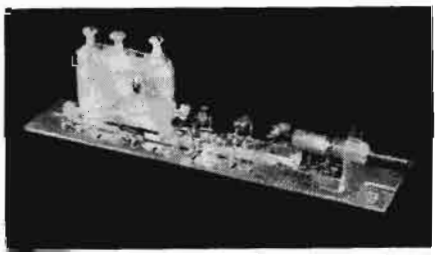
Pictured herewith are a number of UHF converters or translators which have been developed by TV manufacturers for their own receivers or for general use with all or most receivers. Included also are several designs which were not demonstrated at the RTMA-FCC Bridgeport session.

Other Exhibits

In the case of certain converting devices exhibited at Bridgeport, photographs were not released but information as follows was made public at the individual session:

PHILCO—While this company has been experimenting with several types of UHF conversions, it demonstrated at Bridgeport only an external converter with continuous tuning which may be attached to any Philco TV set. This covers the full range of proposed UHF channels and is easily attached. Philco also has its tiny "match-box" single-channel converters which may be made available later, for use under appropriate conditions.

RCA VICTOR—Designed to bring in all UHF channels and suitable for attachment to any television receiver, the RCA converter was shown to give pictures that compare favorably in every respect with VHF reception. On the face of the attractively designed converter are two knobs and an easily read dial. Installation of the converter is sufficiently simple to be performed from an instruction sheet by the average set owner. Retail price, about $50.

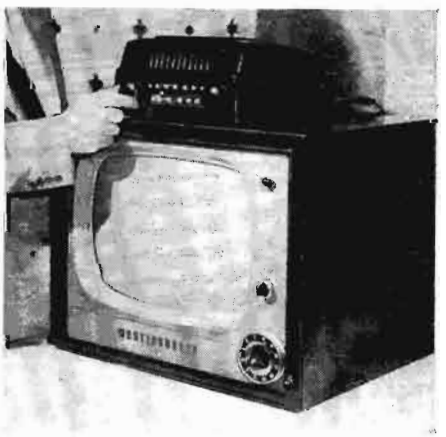


ZENITH—During the FCC Bridgeport demonstrations, Zenith engineers showed how a UHF strip (like that pictured) could be slipped into the Zenith tuner in a very few minutes, enabling the standard receiver to operate on UHF without any change in the set itself

MALLORY—Means for converting standard television receivers were demonstrated at the Stratfield Hotel, Bridgeport, and inspected by the FCC party, but photographs and technical details requested by TELE-TECH were not available at press-time.

STANDARD COIL — Simple transfer of strips in tuner, readies any set so equipped, for reception of uhf signals within a few minutes. The two-section strips in effect turn TV set into a double conversion circuit. CK 710 diode is used as converter. Fingers shown belong to Edwin Thias, engineering VP.

TARZIAN—Full-band UT-1 tuning unit for ultra-high-frequency telecasts is adaptable to any set now in use; does not interfere with VHF channels. Self-contained power supply. No electrical changes are necessary in present television sets. Unit may be placed on top of the set or installed inside.



WESTINGHOUSE—With this new UHF converter, the set is capable of receiving all uhf channels, in addition to standard telecasts in the very-high-frequency range. The converter, housed in a mahogany finished wood cabinet, can be easily connected to all Westinghouse television receivers now in use.

Remote Control System for

First completely unattended radio broadcast station operation permitted by full circuit details and information presented in exclusive article. Equipment is

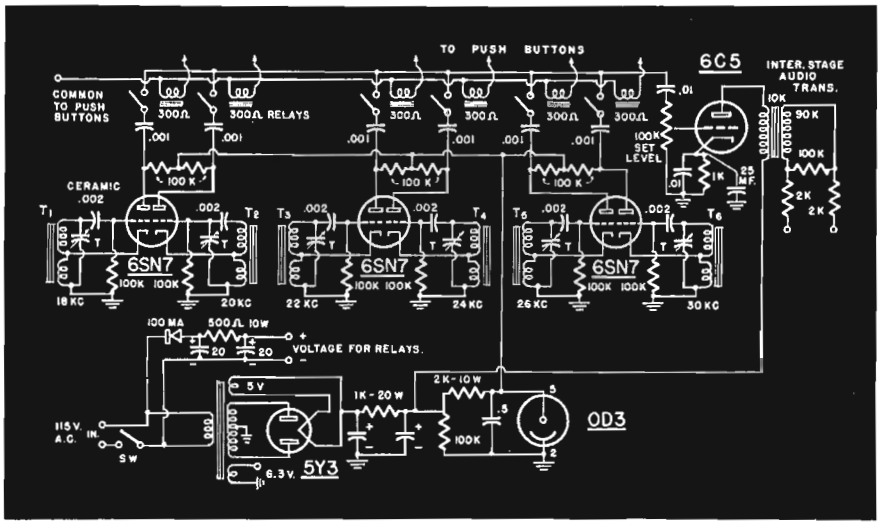


Fig. 1: Sub-carrier converter signal generator for telemetering information selection

***PHILIP WHITNEY**, Chief Engineer, WINC, WRFL, Winchester, Va.*

AN effective remote system has made it possible for FM broadcast station WRFL to control its transmitter from equipment in the Winchester, Va., studios, more than 20 miles away. No operators have been in regular attendance at the mountaintop site since experimental authority was granted by the FCC in April, 1951. The complete system, with certain necessary protective devices, is described below.

The equipment was built in a little less than a year, using inexpensive receiver components. Most of this time was spent in research and experimentation. Several types of control systems were tried and discarded. The one ultimately adopted was found to be the most nearly foolproof, and practical. The FM engineering section of the FCC was most helpful in suggesting methods which would assure full compliance with the Commission's exacting engineering standards for this class of service.

The present equipment is divided into the following main integrated units: six control oscillators, push-button operated, at the studios; a band pass amplifier at the STL receiver; six selective tuned relay circuits and functions at the transmitter; an electrically-reset circuit breaker in the transmitter primary; an automatic overload relay and circuit breaker recycler; link failure protective relay to cut carrier in event of STL failure; telemetering generator and control; telemetering receiver and selective meter amplifier at studios; signal strength meter and carrier failure indicator at studios; antenna and booster for modulation and frequency meter at studios; aural "off the air" monitor at studios.

The WINC (AM) transmitter is located in the same building as the WRFL studios. The licensed operators employed at WINC also control and operate WRFL. This affords a considerable economic advantage of particular importance to FM operation. The problem of finding operators for an isolated mountain peak job is solved. The operating schedule of the station has been expanded and continuity of service of the station has been improved. Automatic recyclers work faster than manual operation and poor roads, snow and automobile breakdowns no longer cause late sign-ons.

FM Transmitter Control

The FM transmitter control is effected, and meters are ready, by transmitting the outputs of six control oscillators ranging in frequency from 18 to 30 KC through the regular program link at about 5% modulation. These control frequencies are never heard on the air. At the link receiver in the FM transmitter building on the mountain, a bandpass amplifier brings the level of these control frequencies up to the necessary level, cutting off the program audio frequencies.

The control frequencies are fed through a coaxial line from the cathode of an audio tube in the link receiver to the input circuit of the selective bandpass amplifier, and also through a coaxial line from this to the selective relay chassis. Six plate relays are operated, which in turn operate two impulse type relays to turn on and off low and high voltages in the transmitter and two telephone type six volt relays which control an antenna rotating motor of the type commonly used for TV installations which increases or decreases the final tank to output coupling and thus controls the transmitter power.

The Federal transmitter at WRFL is broadly tuned so that it is never necessary to retune the plate tank circuit with coupling changes. It is therefore unnecessary to provide a "tuning" motor in addition to the "coupling" control. This may be necessary with other types of transmitters, and would require another circuit.

The fifth plate relay operates a continuously rotating step-switch, which selects sampling voltages from the various meters, as well as from the standard calibrating voltage pro-

FM Broadcast Stations

PART ONE OF TWO PARTS

FCC is described and simple and fool-proof

vided by two "hotshot" type batteries in series. Another set of contacts on this step-switch also turns the telemetering subcarrier on and off. The sixth plate relay operates another impulse type relay. This is a spare function which at the present time is being used to cut in or out an FM tuner at the mountain which is used to pick up a distant FM station for relaying purposes. This station cannot be received at the studios in town.

An impulse type relay is one which needs no holding current to maintain an "on" or "off" condition. It operates much like a pull chain socket. One impulse puts it on, a similar one puts it off. By using this type control, fewer circuits are needed, and it is not necessary to leave the control subcarrier on as long as the relay remains on. A tenth-second pulse is usually sufficient to operate this type of relay. The pulses used are 6 V. ac, but it was found that using dc instead caused them to snap in much more quickly and positively.

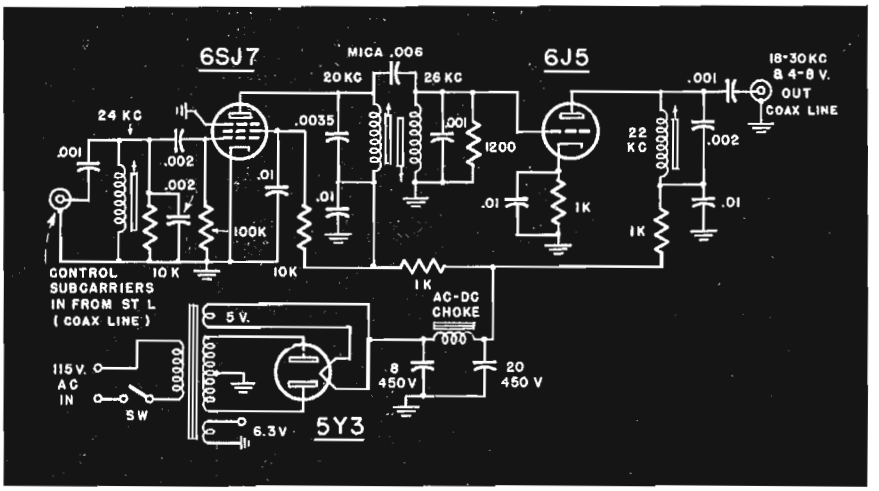


Fig. 2: Band Pass amplifier at STL receiver location (remote WRFL transmitter)

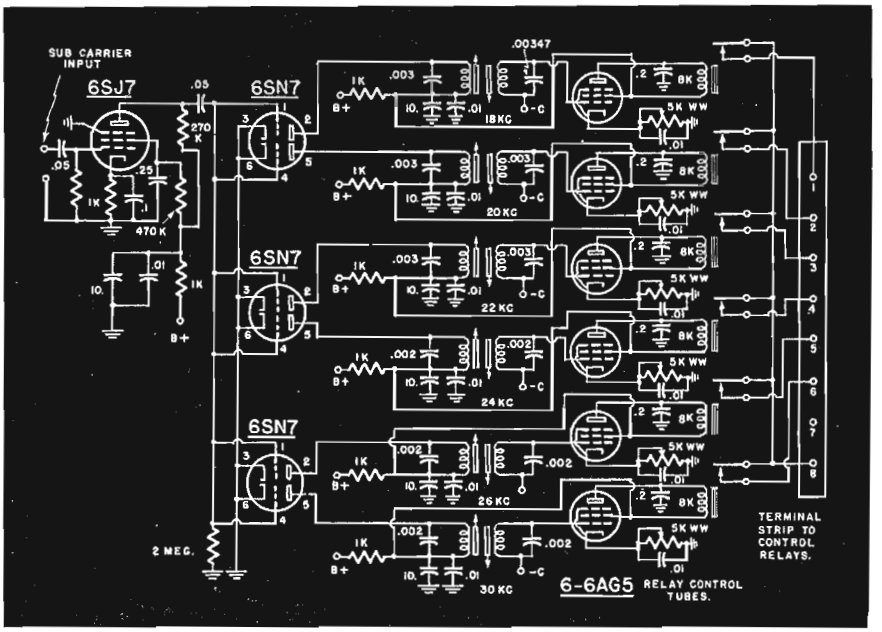


Fig. 3: Remote control chassis at WRFL. This contains all the selection relays.

Control Oscillators

The control oscillator circuits were made as simple as possible, using readily available and inexpensive parts. These oscillators must be very stable, have low distortion, and be easily keyed. A regulated power supply and good tuning condensers were found to be necessary. Low distortion is important for the stability of the system and to assure inaudibility of the control signals. The oscillators use the standard electron-coupled circuit. A Hewlett-Packard audio oscillator was used while developing the system, and worked very nicely. However, this does not lend itself to push-button control, since the oscillator dial setting must be changed for each function. The unit shown in the diagram uses mica five-plate trimmers as oscillator frequency controls. The oscillators are adjusted to 18, 20, 22, 24, 26 and 30 KC, by using a 'scope and standard audio oscillator as a comparison wavemeter. The 30 KC function is isolated from the other frequencies by an additional 2 KC as a safety factor, since this function is used frequently for meter readings. The oscillators run continuously. Their outputs are keyed by 300 ohm relays. By running continuously, false operation is avoided by eliminating the possibility of frequency creep when starting them up. All outputs are fed to the relays, then to the grid of a single bridging tube. The 5% subcarrier modulation of the link transmitter is adjusted by first measuring the audio voltage applied to the input of the link for 100% modulation. The gain control of the bridging tube is then adjusted to about one-twentieth of this value. Percentage modulation above 5% could cause intermodulation distortion, therefore these control voltages and the telemetering subcarrier on the FM transmitter at the mountain never exceed 5% modulation. A 15 KC filter in the STL receiver prevents the control signals from modulating the transmitter. The only subcarrier that actually modulates the FM transmitter is the telemetering 30 KC signal which is applied momentarily during meter reading periods.

The control carriers are picked off an audio tube cathode in the STL. The band pass amplifier, through which these signals must pass as the

next step after the link receiver, amplifies frequencies used for the control only, and discards all other frequencies. Slug-tuned audio frequency coils, in aluminum cans about the size of the average i-f can, are used as the selective transformers in these circuits. They are from surplus Hammarlund "Fleet Control" units, and are modified by removing the condensers inside the cans and substituting the condensers shown in the diagram. These coils were designed to operate at about 6000 cps, but will operate in the 18 to 30 KC range. Ten of these coils are used in the complete system. This bandpass amplifier not only brings up the level of the control signals, which is necessary to operate the selective relays, but also prevents unwanted audio frequencies appearing at a higher level than the control frequencies. The amplifier is built on the familiar "stagger tuned" principle used in many TV circuits. It could be made flatter if desired by using more tubes and circuits.

Selective Relays

The output of the band pass amplifier is fed through a coaxial line to the chassis which contains the amplifiers, separators, relay control tubes, selective filters, and the final controlled relays. The first tube on this chassis is a 6SJ7 audio amplifier, with circuit components chosen to favor the control frequencies. The plate of this tube feeds the parallel grids of three type 6SN7 separator tubes. Each of these plates is loaded with a primary of the audio filter coils.

The secondary of these coils is loosely coupled to the primary circuit, making a very sharp response curve. Capacitive coupling was not added, because this broadens the response curve. The primaries and secondaries of these filters are tuned to the frequency for the specific function in a manner to be described later. The grids of the relay control tubes (6AG5's) are biased past cutoff by the application of the six volt fixed bias from the "hotshot" bias battery, and through self bias from the 5000 ohm variable wirewound cathode resistors. The bias resistors are finally adjusted, so that the plate relay in each circuit pulls in firmly when the control signal is applied at the normal level to each grid. The fixed bias must be supplied by a low impedance source, rather than from a rectifier-filter arrangement, as this allows too wide a bias fluctuation from inoperative to operative condition. The plate relays are sensitive 8000 ohm Clare type.

As each relay control tube conducts because of excitation of its grid by the respective control signal, its plate relay closes. This in turn operates the impulse relays, the telephone type relays to control transmitter power, and the rotary type telemetering switch. The latter switch is a six volt solenoid operated device used in automatic car radios as a station selector. This rotary relay has two sets of contacts. One set is used to select the sample voltages for telemetering. The other set operates a keying relay which applies the output of the telemetering amplifier to the program circuit feeding the WRFL transmitter. This current, which modulates the transmitter at about 5% is applied only while taking meter readings. The antenna rotator motor was attached to the shaft of the coupling mechanism through a right angle bevel gear from a dial drive assembly. The motor is permanently mounted on the front panel of the transmitter above the control shaft.

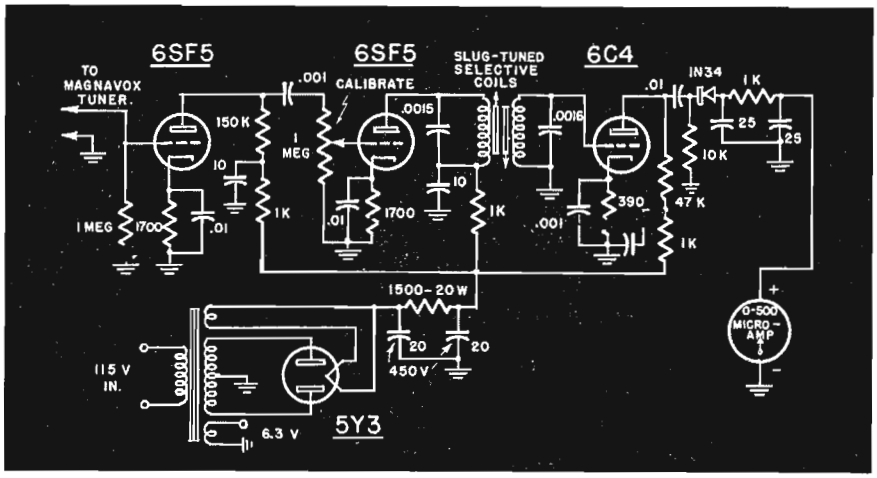
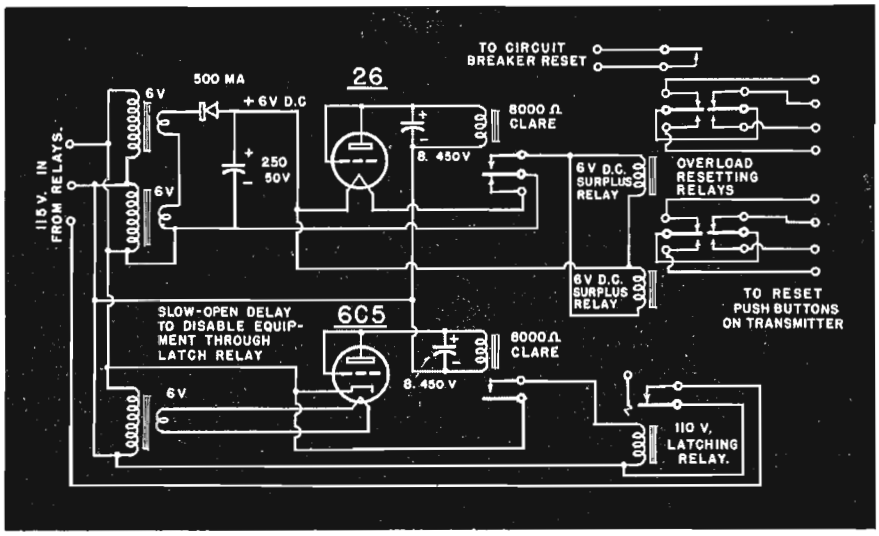


Fig. 4: Selective amplifier at studio for reproducing remote transmitter information

Fig. 5: Recycling chassis. The type 26 tube will heat about 4 times before disabling



Power Supply

The power supply is built up on a 10 x 17 x 2 in. steel or aluminum chassis, as are all units in the system, and is of straightforward design, using voltage regulator tubes for stability. The Supply provides approximately 300 volts for the plates, heater currents, and six volts at better than five amperes for the low voltage relays. All chassis are mounted with the open bottoms facing the front of the rack. The panels thereby shield the subchassis wiring from the high r-f fields present at the transmitter. The chassis bottoms are easily accessible by removing these panels.

All the selective relay circuits are

tuned by using a calibrated audio oscillator and a vacuum tube voltmeter. The audio oscillator is coupled to the grid of the 6SJ7 tube at low level. The voltmeter, using the 30 volt scale, is placed across each of the cathode resistors of the 6AG5 relay control tubes. The resistors should all be set at maximum resistance during this operation. The audio oscillator is then set at each control frequency and the slugs in the tuned circuits are adjusted for maximum readings which is about 27 volts in this application.

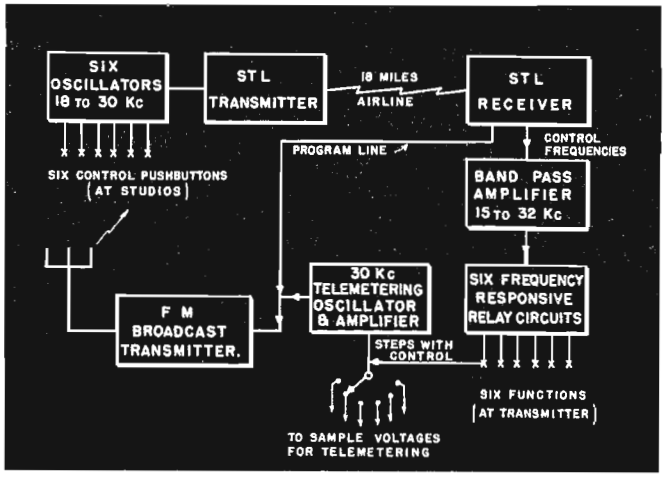


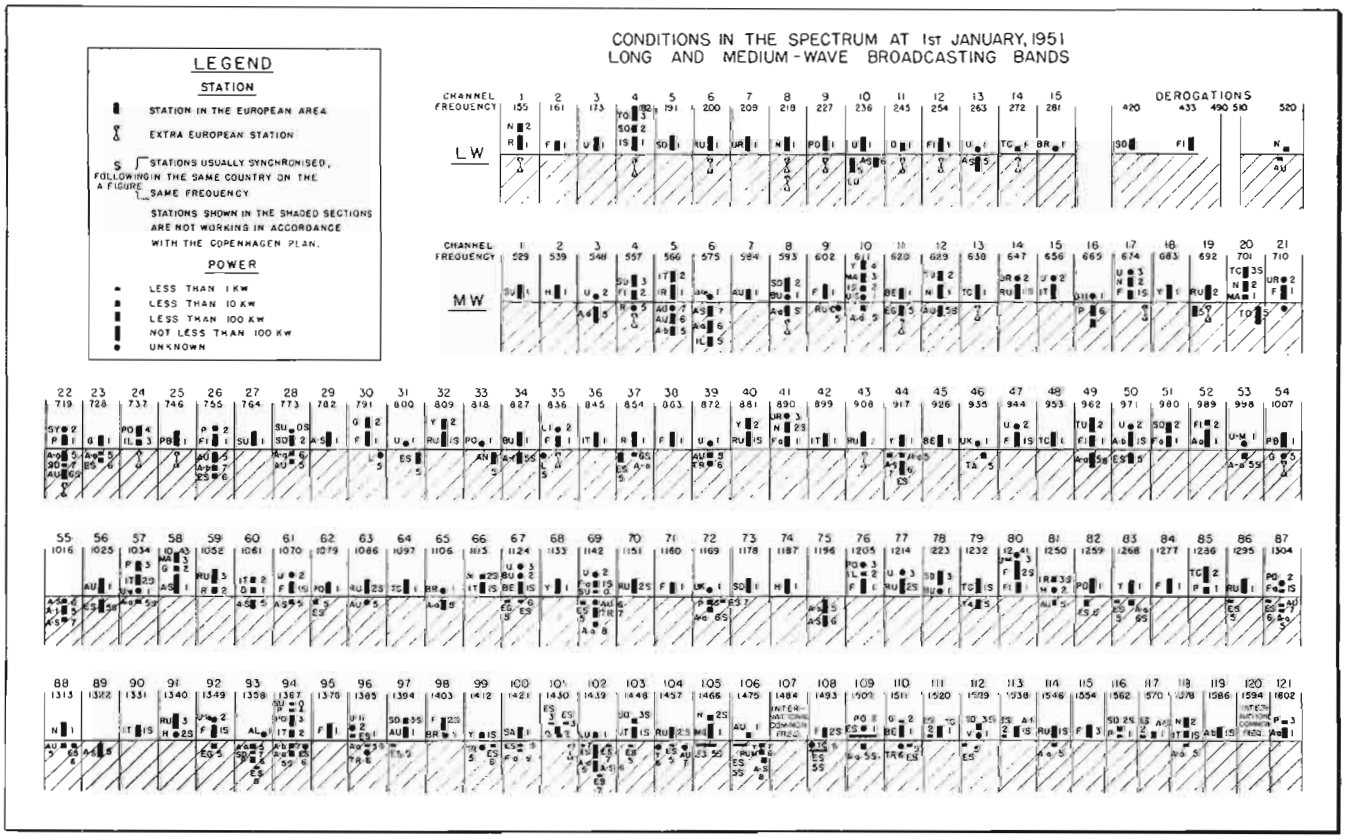
Fig. 6: Block diagram of WRFL remote control installation. Figure shows the six functions monitored by the telemeter

Automatic Protective Circuits

The WFRL transmitter is situated on a mountain peak and power is obtained from a long, lightly-loaded line up the mountain. Charges from electrical storms have caused more momentary failures than all other causes combined. These line surges kick out the main transmitter circuit breaker or the plate overload relays in the high power amplifiers in the transmitter. With an operator at the transmitter the circuit breaker and overload relays were reset manually.

(*Continued on page* 75)

THE COPENHAGEN PLAN FOR EUROPEAN BROADCASTING

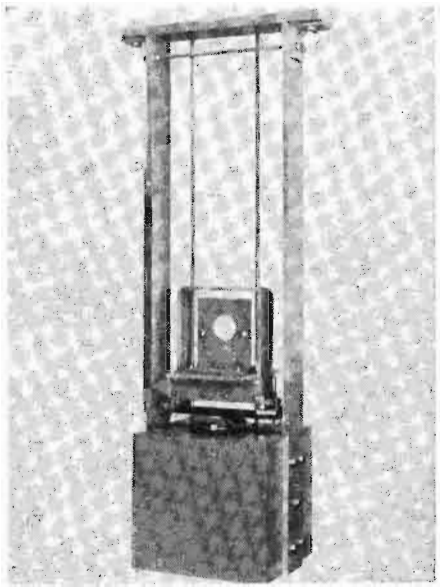


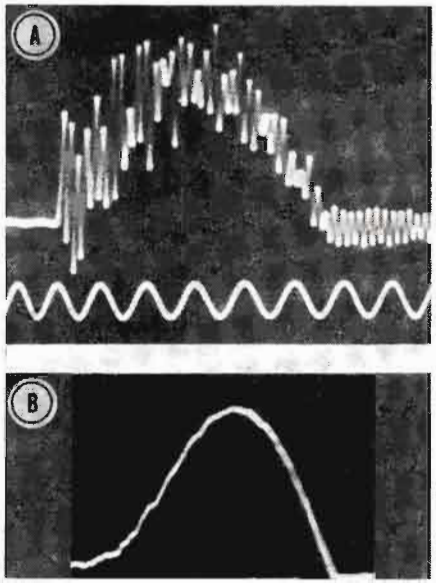
Above is a spectrum analysis of the distribution of broadcasting stations in Europe. Note that the frequency range is from 155 to 1602 KC, including 420 to 520 KC band. Figures beside entries indicate: 1-4 stations conforming with the plan: 5-9 non-conforming stations. Swiss stations sharing frequencies are shown by a zero. Table is based on E.B.U. Bulletin

A-a	Germany-American zone	ES	Spain	L-t	Tripoli	RU	Great Britain and Northern Ireland	TQ	Turkey
A-b	Germany-British zone	F	France	LI	Lebanon	RU-c	Cyprus	TR	Trieste
A-f	Germany-French zone	F-a	Algeria	LU	Luxembourg	RU-g	Gibraltar	TU	Tunisia
A-s	Germany-USSR zone	FI	Finland	MA	Morocco	RU-m	Malta	U	U.S.S.R.
AL	Albania	G	Greece	MO	Monaco	SA	Saar	U-c	Finno-Carelia
AN	Andorra	H	Hungary	N	Norway	SD	Sweden	U-e	Estonia
AU	Austria	IL	Israel	P	Portugal	SM	San Marino	U-le	Latvia
BE	Belgium	IR	Ireland	P-a	Azores	SU	Switzerland	U-li	Lithuania
BR	Bielorussia	IS	Iceland	P-m	Madeira	SY	Syria	U-m	Moldavia
BU	Bugaria	IT	Italy	PB	Netherlands	TA	Tangier	UR	Ukraine
D	Denmark	L	Libya	PO	Poland	TC	Czechoslovakia	V	Vatican City
D-f	Faroe Islands	L-c	Cyrenaica	R	Roumania			Y	Yugoslavia
EG	Egypt								

Shock Testing of Airborne

Characteristic features of shock as experienced of measuring shock severity discussed and typical





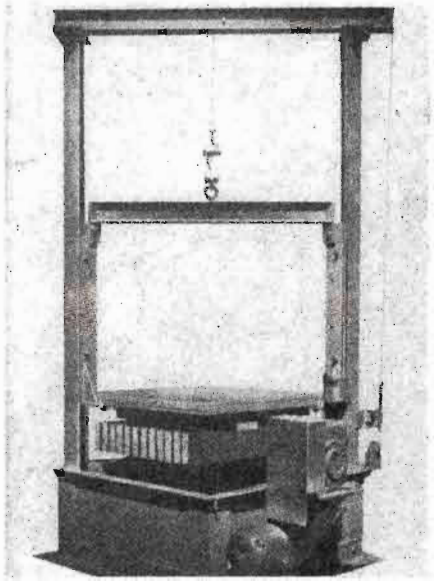


Fig. 11: (Left) American Standards Association drop-type shock testing machine used for small instrument measurements
Fig. 12: (Center) Typical acceleration-time diagrams measured on elevator of shock testing machine in Fig. 11. High frequency vibration shown at A was eliminated by placing a drop of oil between the spring and anvil giving the oscillogram at B
Fig. 13: (Right) Type VD Medium Impact Shock Machine is similar to that in Fig. 11 and is used for testing airborne equipment

By ***CHARLES E. CREDE,*** *Chief Engineer, The Barry Corporation, 700 Pleasant St., Watertown 72, Mass.*

THE American Standards Association drop type shock testing machine, shown in Fig. 11, is used extensively for testing small instruments. The equipment undergoing test is attached to a small elevator. The elevator carries, on its bottom face, a spring in the form of a simple beam. Upon free fall of the elevator, an anvil rigidly fixed to the massive base of the machine strikes the center of the beam spring. The elevator rebounds upwardly, and is caught by the operator. The acceleration-time diagram which defines the motion of the elevator during engagement of the spring with the anvil is substantially semi-sinusoidal, as shown in Fig. 12. The high frequency vibration embodied in the oscillogram shown at Fig. 12 (A) represents vibration of the elevator table in its fundamental mode. It was found that this vibration could be excluded, as shown in Fig. 12 (B), by placing a drop of oil between the spring and the anvil.

A somewhat similar machine used for testing airborne electronic equipment is the Type 150 VD Medium Impact Shock Machine, based on a design by Mr. K. W. Johnson of the U. S. Air Force. This machine is shown in Fig. 13. The elevator of this machine is much larger than that of the ASA machine shown in Fig. 11, and its downward velocity is arrested by loose sand contained in a sandbox forming the bottom part of the machine. The suddenness with which the motion of the elevator is arrested may be varied by changing the arrangement of wooden cleats attached to the under side of the elevator. The impact with the sand is substantially inelastic, and the elevator does not experience the upward rebound which characterizes operation of the ASA machine. The acceleration-time diagram measured on the elevator of the Type 150 VD Medium Impact Shock Machine is illustrated in Fig. 14. This diagram is essentially a half-sinusoid, with superposed high frequency vibration representing vibration of the elevator table, and with some distortion which tends to extend the latter part of the record as the elevator gradually settles in the sand.

The results obtained from shock testing, using machines of the types illustrated in Figs. 11 and 13, are investigated by considering the support for the beam-load system of Fig. 4 to be attached to the elevator of the shock testing machine. Assuming a half-sinusoidal acceleration-time diagram for the elevator as its downward motion is arrested, the response of the beam-load system can be predicted analytically. The maximum acceleration of the load (d^2y/dt^2 in Fig. 4) with reference to the maximum acceleration of the elevator d^2x/dt^2 is shown in Fig. 15[1]. When the natural frequency of the beam-load system is great relative to the predominant frequency of the impulse which arrests the motion of

Electronic Equipment

PART TWO
OF TWO PARTS

in various military applications illustrated. Means testing machines are described and illustrated

the elevator, the abscissa ratio is large; i.e., the results are defined by the right side of Fig. 15. The ratio plotted on the ordinate is then approximately unity. The maximum acceleration that is experienced by the load supported by a relatively stiff beam is thus approximately equal to the maximum acceleration experienced by the elevator table. This applies to all beams that are relatively stiff, and is substantially independent of the natural frequency of the beam, except for the qualification that the frequency ratio on the abscissa must be appreciably greater than unity.

Low Frequency Ratio

When the stiffness of the beam is low, the natural frequency of the beam-load system is small and the frequency ratio which forms the abscissa of Fig. 15 has a low value. Applicable conditions are then indicated by the left side of Fig. 15. It is then evident that the maximum acceleration of the load carried by the beam is not directly proportional to the maximum acceleration of the elevator, but is a function also of the frequency ratio which is plotted as the abscissa in Fig. 15. The nature of this function is pointed out below.

The maximum acceleration d^2y/dt^2 of the load carried by the beam in Figure 4, with reference to the *velocity change* of the elevator and the natural frequency of the beam-load system, is illustrated in Fig. 16[2]. The velocity change of the elevator is related to the height of free fall. The Type 150 VD Medium Impact Shock Machine shown in Fig. 13 exhibits substantially inelastic impact, and the velocity change is numerically equal to the velocity of the elevator immediately before it engages the sand. The ASA Shock Machine shown in Fig. 11 exhibits substantially elastic impact, and the velocity change is approximately twice the downward velocity of the elevator at time of impact. The frequency ratio plotted as the abscissa of Fig. 16 is in the same terms as in Fig. 15. For small values of this ratio, the curve is a straight horizontal line. The maximum acceleration that is experienced by the load on the beam is thus directly proportional to the velocity change of the elevator and inversely proportional to the natural frequency of the beam-load system. It is independent of both the acceleration of the elevator and the frequency of the impulse which arrests the motion of the elevator.[3]

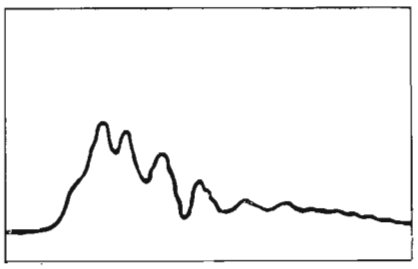
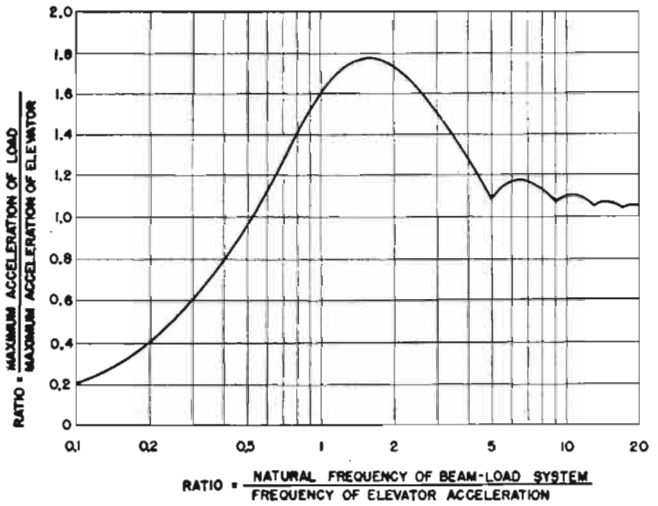


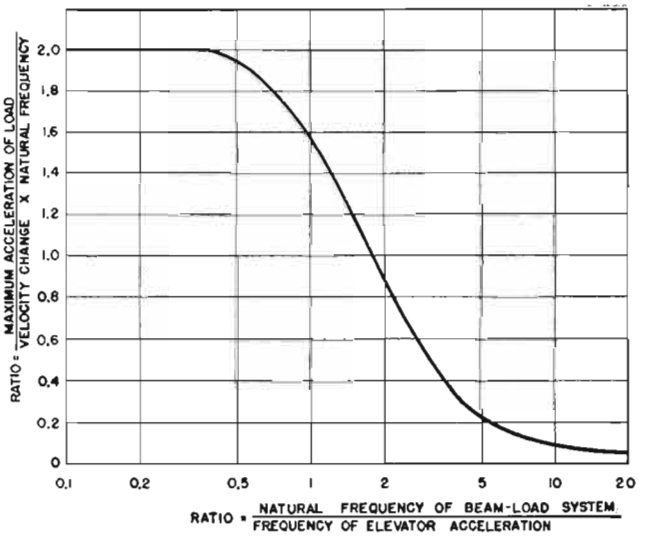
Fig. 14: Acceleration-time diagram from shock testing machine shown in Fig. 13

The principles illustrated by Figs. 15 and 16 may be applied to the design of equipment which is required to withstand shock tests. Each principal structural assembly of the equipment is first simulated by a beam-load system, as illustrated in Fig. 4. Its natural frequency is then estimated, and the maximum acceleration d^2y/dt^2 of the load is determined from Fig. 15 or Fig. 16, whichever is applicable. The maximum force on the beam is the product of the mass (or weight) of the load and its maximum acceleration[4].

(*Continued on page* 68)

Figs. 15 (left) & 16: Curves defining response of beam-load system (Fig. 4) when support is attached to elevator of shock machines (Figs. 11 & 13). Results are a function of ratio of natural frequency of beam load system to predominant frequency embodied in acceleration-time diagram for elevator as its downward motion is arrested. Max. acceleration of load with reference to max. acceleration of elevator is at left, and max. acceleration of load with reference to velocity change of elevator and natural frequency of load system is at right





IRE-WCEMA at San Francisco

West Coast Engineers and Manufacturers Convene August 22-24

THE 1951 Western IRE Convention and the 7th Annual Pacific Electronic Exhibit will open its doors in the San Francisco civic auditorium on August 22, 1951, for a three-day run with the theme—"Behind the Scenes in Electronics."

Attending the San Francisco sessions will be radio and television engineers, members of the Institute of Radio Engineers' 7th Region, comprising Sections in the seven Western states. The International Scientific Radio Union will also be represented at several of the meetings.

The West Coast Electronic Manufacturers Association has also taken active leadership in plans for the convention and Pacific Electronic Exhibit. The manufacturers and wholesalers of the area will take part in the Business Conference scheduled for the period of the big Coast get-together. Some twenty-two "representatives" also will have 33 booths in the exhibit hall, showing products or lines of 174 radio-electronic concerns who are not direct exhibitors.

Expect 10,000

The 1950 attendance figure of 7,500 is expected to be surpassed with a final total close to 10,000 registrants. The exhibit was originally established by WCEMA which has sponsored it for six years. This year, for the first time, the western regional (9th) of the IRE will share in the responsibilities of the exhibit.

IRE annually holds its western convention at the same time and place and this meeting will include the usual run of technical papers and field and inspection trips. The annual banquet has not been scheduled in order to prevent any conflict with exhibit hours, which will be from 1 to 9:45 P.M.

Comprehensive exhibits will be displayed by eastern and western factories; manufacturers' representatives will show wares of their client factories and universities and government agencies will provide educational displays. On August 22 and 23 there will be afternoon speaking programs with government pro-

TV-FM-UHF POINTS OF INTEREST IN SAN FRANCISCO—1. IRE Convention Hall; Civic Auditorium. 2. KDFC. 3. KPIX (TV). 4. KRE-FM. 5. Los Angeles-San Francisco microwave relay terminal. 6. KLX-FM, KPFA-FM. 7. KSBR. 8. KCBS-FM. 9. FCC Primary frequency monitoring station. 10. KSFO-FM. 11. KGSF, KALW. 12. KRON-TV, KRON-FM. 13. KNBC-FM. 14. KGO-TV, KGO-FM.

Exhibitors at San Francisco Civic Auditorium

Advance Electric & Relay Co., Burbank, Calif.
Aerovox Corporation, New Bedford, Mass.
Aircraft-Marine Products, Inc., Harrisburg, Pa.
Airtron, Inc., Linden, N. J.
Altec Lansing Corporation, Beverly Hills, Calif.
American Microphone Co., Pasadena, Calif.
American Phenolic Corporation, Chicago, Ill.
W. R. Ames Company, San Francisco, Calif.
Andrew Corporation, Chicago 19, Illinois.
The Arnold Engineering Company, Marengo, Ill.
Audio Devices, Inc., New York, N. Y.
Automatic Electric Sales Corporation, Chicago, Ill.
Herb Becker, Los Angeles, Calif.
Berkeley Scientific Corporation, Richmond, Calif.
E. L. Berman Company, San Francisco, Calif.
Bird Electronic Corporation, Cleveland, Ohio
Brown Electro-Measurement Corp., Portland, Ore.
The Brush Development Company, Cleveland, Ohio
Burlington Instrument Company, Burlington, Iowa
Bussman Mfg. Co., St. Louis, Mo.
Cannon Electric Company, Los Angeles, Calif.
Centralab, Div. of Globe-Union, Inc., Milwaukee, Wisc.
Chicago Transformer Division, Essex Wire Corporation, Chicago, Ill.
Cinema Engineering Company, Burbank, Calif.
Clear Beam Television Antennas, Los Angeles, Calif.
Cleveland Electronics, Inc., Cleveland 3, Ohio.
Coastwise Electronics Co., Inc., Beverly Hills, Calif.
Corning Glass Works, Corning, N. Y.
Distillation Products Industries, Div. of Eastman Kodak Company, Rochester, N. Y.
Drake Electric Works, Inc., Chicago, Ill.
Allen B. DuMont Laboratories, Inc., Cathode-Ray Tube Division, Electronic Component Division, Clifton, N. J.
Electronic Component Division.
Thomas A. Edison, Inc., Instrument Division, West Orange, N. J.
Eitel-McCullough, Inc., San Bruno, Calif.
Electro Engineering Works, Oakland, Calif.
Electro-Voice, Inc., Buchanan, Michigan.
Electronic Associates, Inc., Long Branch, New Jersey.
Electronic Instrument Co., Brooklyn, New York.
Erie Resistor Corporation, Erie, Pa.
Fairchild Camera & Instrument Corp., Jamaica 1, New York.
General Electric Company, Syracuse, N. Y.
General Radio Company, Cambridge, Mass.
Gertsch Products, Inc., Los Angeles, Calif.
Girard-Hopkins, Oakland, Calif.
Goodyear Aircraft Corporation, Akron 15, Ohio.
Guardian Electric Mfg. Co., Chicago, Illinois.

(*Continued on page 79*)

Technical Papers Program

WEDNESDAY, AUGUST 22

Broadcast and Television

"Utilization of Microwave Radio Relay in Bell System Radio and Television Services—a Progress Report" by Francis M. Ryan—American Telephone & Telegraph Co.
"Klystron Transmitting Tube Suitable for UHF Television" by Wayne Abraham—Varian Associates.
"A New High Power Transmitter and High Gain Antenna for UHF Television" by Frank P. Barnes—General Electric Co.
"Established Subjective Tolerances for Color Television Pictures" by W. E. Evans and Clinton M. Kelley—Stanford Research Institute.

Propagation and Optics

"A Correlation Computer and Applications to Radio Propagation" by F. E. Brooks, Jr., and H. W. Smith—Electrical Engineering Research Laboratory, University of Texas.
"Quasi-static Solution for Diffraction of a Plane Electromagnetic Wave by a Spheroid" by C. T. Tai—Stanford Research Institute.
"Strip Transmission Line Study" by N. A. Begovich—Hughes Aircraft Co.
"The Zero Phase-Front in Microwave Optics" by J. E. Eaton—Naval Research Laboratory.

Noise and Communication Theory

"The Generation and Measurement of Low Frequency Random Noise" by R. R. Bennett and A. S. Fulton—Hughes Aircraft Co.
"Probability Distributions of the Zero-Crossing Periods of Filtered Random Noise" by Dr. C. R. Gates—Jet Propulsion Laboratory, California Institute of Technology.
"Applications of Communication Theory to Radio Navigation Systems" by M. Leifer—Sylvania Electric Products, Inc.
"An Octave Band Noise Analyzer" by Dr. Arnold Peterson—General Radio Company.

THURSDAY, AUGUST 23

Measurements

"A Direct Reading VHF Frequency Meter" by Leonard Cutler—Gertsch Products, Inc.
A new approach to the problem of frequency meter design. "A Precision Frequency Measuring Equipment" by D. A. Pitman—Marconi Instruments, Ltd.
"Digital Frequency Measurement up to 10 Mc." by A. Bagley—Hewlett-Packard Company.
"Precision Time Delay Generation" by J. S. Johnson—Rutherford Electronics Company.

Vacuum Tube Applications

"The Coaxial Tetrode as a Wideband Power Amplifier at VHF and UHF" by D. H. Preist—Eitel-McCullough, Inc.
"Subminiature Tubes Developed for 26.5-volt Operation" by William R. Wheeler—Sylvania Electric Products, Inc.
"Reduction of Non-Linear Distortion in Broad-Band Amplifiers" by W. E. Ayer—Stanford University.
"A Single-Ended Push-Pull Audio Amplifier" by Dr. Arnold Peterson and Dr. D. B. Sinclair—General Radio Company.

Linear Array Antennas

"Optimum Patterns for Arrays of Non-Isotropic Sources" by George Sinclair—University of Toronto, and Frank V. Cairns—National Research Council.
"Slot Radiators and Arrays at X-Band" by Robert J. Stegen—Hughes Aircraft Company.
"Factors Affecting the Performance of Linear Arrays" by L. L. Bailin and M. J. Ehrlich—Hughes Aircraft Company.
"Thickness Effects in Slots Located in Various Positions in Rectangular Waveguide" by L. Felsen, H. Kurss, N. Marcuvitz, and A. A. Oliner—Polytechnic Institute of Brooklyn. (Paper to be presented by A. A. Oliner).

Circuits

"Frequency Analysis of Control Systems Employing Digital Computers" by J. M. Ham, J. M. Salzer and W. K. Linvill—

(*Continued on page 70*)

(*Continued from opposite page*)

curement authorities addressing the trade.

Two forums have been arranged for executives, production, and operating personnel of manufacturers and wholesalers. These are open to all visitors to both exhibit and convention.

The electronic industry on the west coast centers largely in California, though in the field of supersonic and military airplane production 65% of the nation's activity in this field is located all the way from San Diego to Seattle.

The WCEMA is the region's primary trade group. Established in 1943, it was felt that combined effort was the best avenue of approach in securing prime and sub-contracts from the government.

Approximately seventy member factories now belong to WCEMA. This represents about 13,500 employees and floor area of well over two million square feet.

Organization of WCEMA

The statewide WCEMA group is headed by Paul F. Byrne, president; Fred W. Falck, vice-president; A. C. Davis, secretary; and Norman H. Moore, treasurer.

The San Francisco council has Mr. Byrne as chairman; Noel E. Porter, vice-chairman and Mr. Moore, secretary-teasurer. The Los Angeles Council officers are: Mr. Falck, chairman; Leon B. Ungar, vice-chairman; and Mr. Davis, secretary-treasurer. The Directory committee consists of Don C. Larson, chairman, Al Ogilvie, Noel Porter and C. A. Swanson.

There are 14 WCEMA directors: H. P. Balderson, immediate past president; Paul F. Byrne, state president; William Gates; Norman H. Moore; Noel E. Porter; Russell Varian; John M. Kaar; L. W. Howard; Orrin H. Brown; Fred W. Falck; A. C. Davis; E. P. Gertsch; Leon B. Ungar; and Robert Bell.

CUES for BROADCASTERS

Practical ways of improving station operation and efficiency

Edited by John H. Battison

Cleansing Sapphire Needles

WAYNE T. BOOTH, Chief Engineer, KLO, Ogden, Utah

WE have found the following very effective in restoring sapphire point recording needles when they have accidentally cut into the aluminum base of a transcription blank. When aluminum gets on the tip of the sapphire point, we do not send them away to be resharpened, but carefully dip the sapphire tip into some *muriatic acid.* The acid works on the aluminum, within a few minutes the aluminum is dissolved and the point is as good as new. By examining the tip under a microscope (most transcription equipment has one) it is possible to tell when the aluminum is completely dissolved. We have tried this acid bath on needles which hiss and are noisy due to foreign matter on the tip and found that it generally restores them to good quiet cutting needles.

KLO has been using this method for over a year without any bad results to needles or fingers, and finds that the muriatic acid does not affect the saphire. If in cutting into the aluminum base, the sapphire tip is chipped, this method will be of no use and the needle will have to be resharpened. By examining the tip under a microscope after the aluminum has been dissolved, it can soon be determined if the tip is chipped.

Be careful when handling the needles and acid. The shaft of a sapphire needle is also made of aluminum and acid will cut as as well as the tip deposit. Generally the time involved in cutting the aluminum from the tip is rather short and if the shaft gets into the acid for this short period it will only tarnish. Every precaution should be taken to keep the shaft out of the acid however. The usual caution should also be used in handling the acid in order to keep the hands and face from being burned. *Do not try this method on steel needles.*

Portable Storage Cabinet for Magnecorder

K. WINSTON BUGG, Chief Engineer, WABE, Atlanta, Ga.

SHELVES are provided for the three recorder units, and a large storage drawer beneath contains phones, extension cords, and other accessories. For ventilation and passage of connecting cables, there is a two inch space above each unit, concealed by an apron on the front of the shelf. The shelves do not extend to the rear of the cabinet. The cabinet is wide enough to allow for plug connections at the ends of the Magnecorder units, hinged doors at each side of the front allowing access to these connectors.

Portable storage cabinet for Magnecorder

Material is three-quarter inch, five ply, plywood, stained to match the station furniture. Two-inch swivel castors and heavy sash lift type handles make the cabinet easy to move about.

On the right side of the cabinet near the bottom are mounted three microphone input jacks of the type standard for WABE. Permanently mounted shielded cables and plugs connect these to the amplifier unit. At the top of the right side are two pairs of standard patch panel jacks, connected by shielded cable and plugs to the bridging input and 600 ohm output terminals of the amplifier.

The recorder may be patched as desired into either control room, where it becomes an integral part of the station equipment, and is used as a rack-mounted recorder. It may be moved to any studio for direct recording of simple programs, when all control room channels are in use. Attached to the sound cart, it is a valuable accessory for the sound effects man, who can record for instant cueing successive sounds which occur too close together for disc work.

$$$ 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.

Foolproof Disc Recorder Monitoring

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

SINCE it is so easy to observe the groove during disc recording monitoring of that groove seems to have been neglected, or left to chance. While many present-day tape recorders provide actual tape monitoring, there apparently has been no effective way of doing this for discs. Some stations have actually played back the disc as it was cut. However, that has the fault of a time delay. This is of no value in checking intermittents. While it is true that such a fault would ruin a program, at least instant detection and correction might save it from being a total loss.

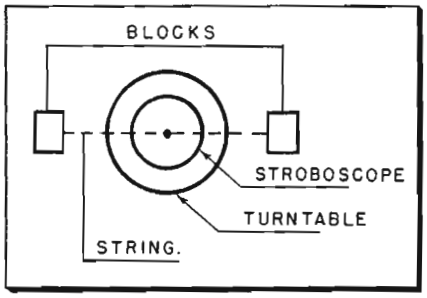
A resistor about equal in value to the impedance of the head is connected in series with the cutter lead. The monitor is then connected across this resistor. About one volt will be derived this way, sufficient to drive any bridging amplifier. By having the monitor in series, it is possible to detect any open circuit in either the cutter head, or the lead connecting it to the amplifier. The lead wire is often a neglected spot, and often is not suspected as a source of trouble. Placing the resistor in the circuit has an additional advantage. Since the output transformer must be adjusted for the impedance of the cutter and the resistor in series, the load becomes more constant. When the impedance of the cutter varies with frequency its change is a smaller proportion of the total impedance in the circuit, and thus a smaller actual change is reflected back to the transformer. By using a system such as this, the monitor becomes truly a check on what

is going on. Also, since any distortion in the cutter is reflected back into the line by the generated back emf, faults such as a frozen cutter, groove chatter of certain types, and even cutter overswing and worn dampers can be discovered this way.

Sighting Strobe Discs

DAVID JORDAN, Chief Engineer, WPLI, Jackson, Tenn.

IN checking the speed of turntables with a stroboscope disc it is often difficult to tell if the table in question is varying in speed or if one's eyes are following the disc around. A simple method of determining which of the two is happening is to place a small block on either side of the table, attach a string to these blocks and use the string as a sight.



Plan of stroboscope sighting device

Guarding Against Hum Caused by Ground

LEE MALONE, Chief Engineer, WMFT, Florence, Alabama

TO guard against grounds developing in remote lines on the air we have installed a 500/500 ohm line transformer in the jack panel. When a ground appears on a live pickup line, or one being used on the air, this transformer is inserted between the concole input, which is balanced, and the line output. The line is no longer balanced but it *is* free of hum caused by the ground on the incoming loop. In all cases encountered so far this has worked perfectly with no cross talk or line noises appearing. Of course, the center tap output of the remote amplifier must be broken, and by placing a toggle switch on the back of the remote amplifier the output of the remote amplifier can be switched from balanced to unbalanced output at will. By this procedure, many times instead of losing a program at the most a 5 or 10 second delay has occurred, during which time the control engineer makes the correct patches at the jack panel.

Emergency Transmitter Consolette

RICHARD H. ECKELS, Chief Engineer, WKAN, Kankakee, Ill.

FOLLOWING a plan to provide additional facilities to conduct a normal schedule of broadcasting, should the need arise during an emergency, WKAN has installed a transmitter consolette with the necessary associated equipment to carry regular broadcasts from the transmitter.

Since the transmitter is located out of town, equipment not generally used on a daily basis is incorporated. One channel remote amplifier, two Presto portable 6N disc recorders with 85A type amplifiers, a few lever action keys and jacks from an unused telephone jack panel were used. The only additional cost was two Pickering cartridges, a Pickering 163A equalizer, and a limited amount of material to support the portable recorders, (now used as playback turntables). The playback units were made in cabinet form so they could be used for storage. Regular levelling bolts were used to level the turntables.

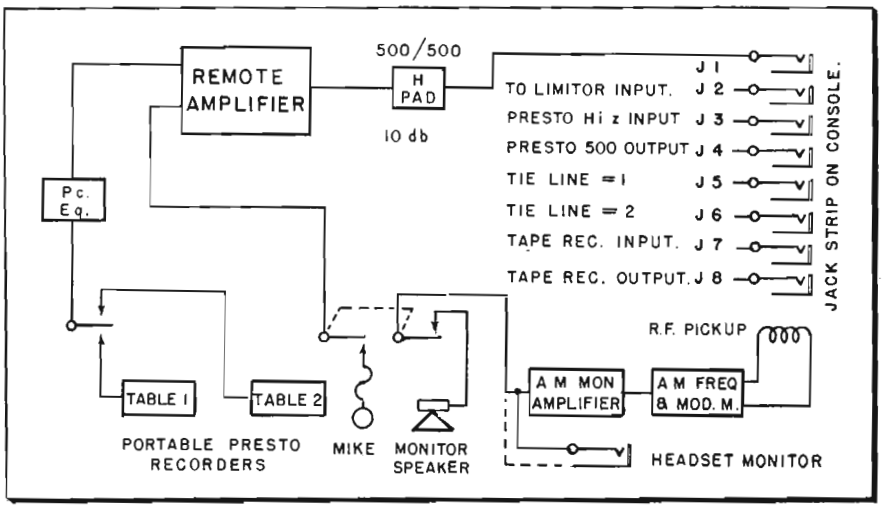
The Pickering 120-E cartridges were mounted into the playback arms of the recorder units and balanced accordingly. Outputs of the cartridges are selected respectively by the use of a DPDT switch which is in turn connected to a single input on the remote amplifier. This was done for several reasons. (1) To reduce the cost of a second equalizer, (2) To have a spare input channel since only two of the three need be used, (3) To simplify operation for the combination announcer-engineer who operates the consolette.

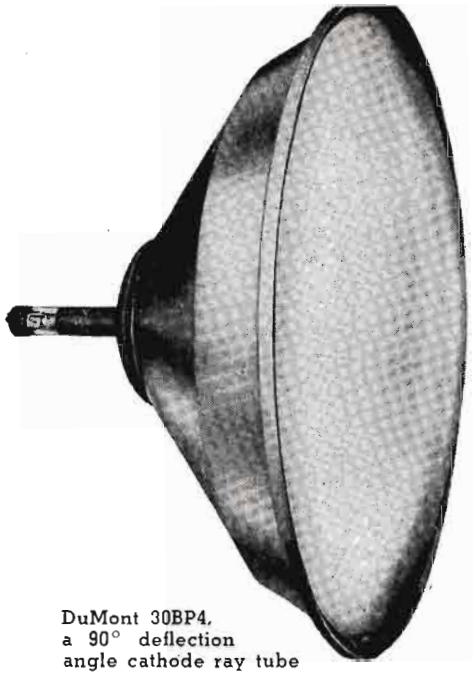
A microphone problem at the transmitter was quickly solved. A Western Electric 633-A salt shaker mike was selected and placed in a box made of ⅜ inch plywood lined with sound absorbing material. The rectangular unit is 14 inches long, 10 inches wide, and 6 inches high. One end of this box was left open for the announcer. Since the room housing the transmitter was not designed for use as a studio, the many flat sound reflecting surfaces made it necessary to use this as a microphone baffle. It was necessary to reduce the area directly behind the mike to prevent a barrel effect. In this manner, extraneous noises were eliminated.

Special consideration was given to grounding and shielding all connecting cables from the consolette to the AM rack where the patch and jack panel terminate, to prevent any RF carrier rectification due to proximity of the final RF amplifier, and to keep noise and distortion to a minimum. The distortion is less than 1.5% from 50 to 10,000 cps.

It is possible to broadcast news, transcribed music, tape recording or playback from either the transmitter building or main studio as connected by the patch cords in the jack panel. Also, disc recording may be accomplished by feeding material from transmitter or studio since one of the portable recorders was left intact for instantaneous recordings. The output of the amplifier connects to a 5—/500 10 DB pad, in order to increase the gain of the amplifier to override any noise which might originate in the associated equipment. The pad connects directly to the limitor input (with patch cord) when broadcasting from the transmitter. Levels are so adjusted to provide equal settings for the limitor regardless of the origin of the program.

Emergency or defense transmitter control console for isolated station operation





DuMont 30BP4, a 90° deflection angle cathode ray tube

The Design of 90°

A discussion of the problems opment of a production type,

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750 Bloomfield Ave., Clifton, N. J.

THE increased popularity of large screen picture tubes has made the physical limitation of tubes of lower deflection angle apparent; the length of the picture tube is usually the controlling factor in determining the length of the television receiver cabinet. Since the neck length is fixed by the amount of space required for deflection, focus, and ion trap components, a reduction in tube length for a given screen diameter requires that a larger deflection angle be used.

A larger deflection angle necessitates an increase in deflection power, and may result in increased spot distortion. In an attempt to determine the seriousness of the above limitations, 90° deflection angle tube designs were made. The results obtained were sufficiently encouraging to plan on the use of this deflection angle for a production type tube.

To minimize the increase in deflection power required, the design of the neck contour was made as closely as possible to the ideal. First, a neck diameter large enough to accommodate the electron gun structure and a neck wall thickness of sufficient strength must be used. Having thus fixed the outside diameter of the cathode ray tube neck, the most efficient deflection yoke and wall contour design is one in which the yoke fits as closely as possible to the neck wall and in which the wall contour follows the deflected beam path as closely as possible. The general shape of the wall section and beam path is shown in Fig. 1a. The effect of an increase in wall thickness or of incorrect wall contour in the critical region on the location of the center of deflection is shown in Fig. 1b and 1c. The critical region is the region near the front of the deflection yoke winding.

Note that an increase, $\triangle$ T, in wall thickness in the critical region causes a deflection center shift of 1.4 times $\triangle$ T. Because of the manner in which center of deflection varies with yoke length, the yoke must be shortened by over twice this amount to about 3½ times $\triangle$ T, in order to scan the tube having the thicker wall section. Fig. 1c shows that, when the wall contour does not follow the deflected beam path, the yoke must again be shortened to maintain full deflection. Both pictures emphasize the point that the deflection yoke should be located as closely as possible to the deflected beam.

The key to the design of the wall contour in the critical region lies in the knowledge of the electron beam path in this region. To determine the beam path a special 19-in. tube was made. A picture of this tube is shown in Fig. 2. A ruled mica sheet, coated with a conductive fluorescent material was placed inside the tube on a plane through the tube axis. The beam skimmed along the surface of this sheet showing the beam path.

Plotting the Path

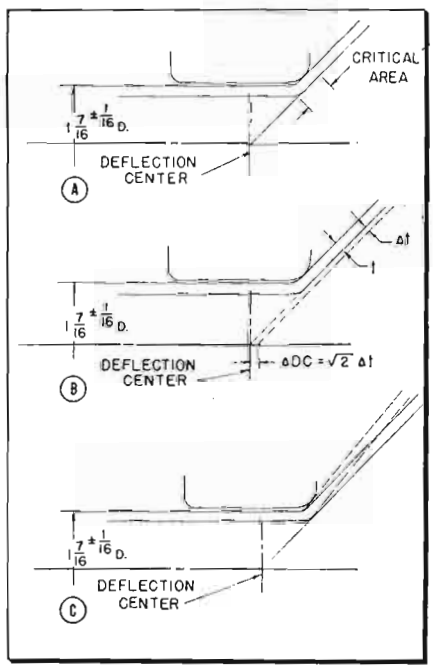
Plotting the path on cross-section paper showed that practically no deflection occurred beyond the straight portion of the deflection yoke winding. As the beam enters the critical region, then, it is moving in a straight line at an angle of 45° to the tube axis, and the wall section should be a portion of a right-circular cone having an included angle as close to 90° as is practical. Because of the precision to which wall thickness and contour can be held, an all-molded part is used, even though the wall thickness of this type part is slightly greater than that obtained by other processes.

The tube deflection angle is the greatest single factor affecting tube length and is also of prime importance to the yoke manufacturer. The deflection angle of a given tube design cannot become too small or tube overall length will be exceeded, and cannot become too large or design yokes will not scan the tube. A plus and minus tolerance about the design deflection angle is therefore needed. A tolerance of ± 2% of the design angle was chosen as limiting variations to a reasonable value.

Tube Dimensions

The tube dimensions and tolerances controlling the tube deflection angle are those of the screen diameter, the length of the metal portion of the tube wall and the length of the glass portion of the tube wall, after the glass to metal seal has been made. Tolerances on these dimen-

Fig. 1: Diagrams showing effect of incorrect design on location of center of deflection



Deflection Picture Tubes

and solutions involved in the devel-
30-inch television cathode ray tube

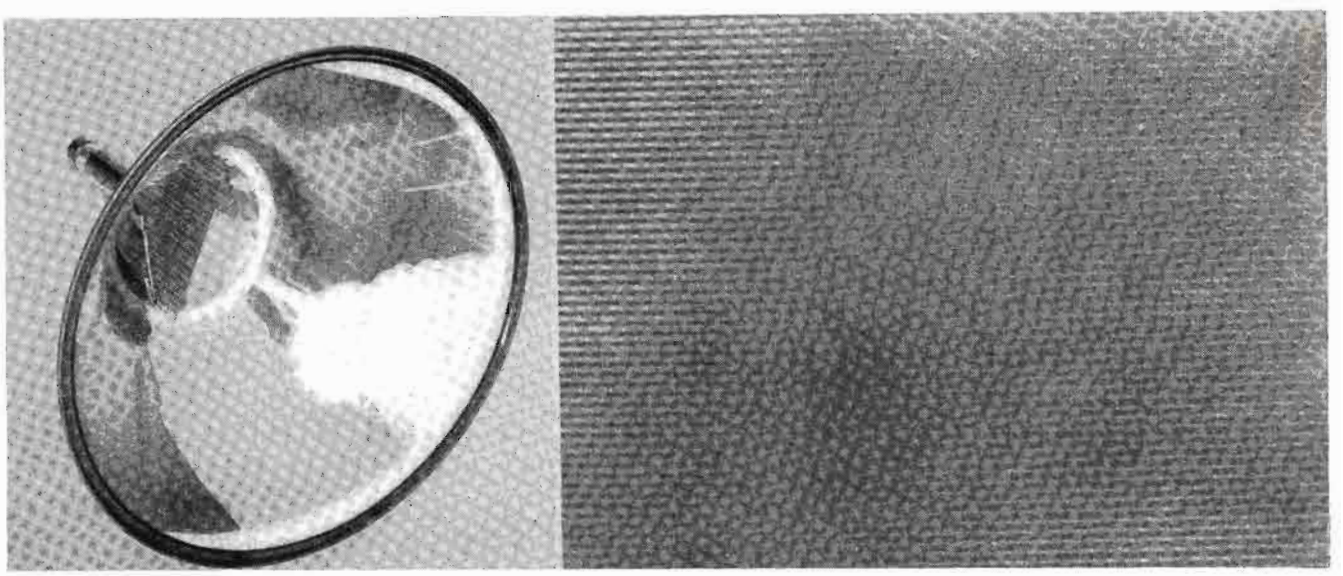


Fig. 2: (Left) Experimental tube for determining electron beam path. Fig. 3: (Right) Types of merged patterns obtainable

sions have been chosen so that with the screen diameter at its maximum and the tube wall length at its minimum, the deflection angle will not exceed 91.8°. Conversely, a minimum deflection angle of 88.2°, together with tolerances on maximum screen diameter, neck length, and faceplate rise, effectively limits overall tube length.

Electron Gun Design

When considering the electron gun design, three important facts must be noted. First, since a non-uniform deflection field is required to maintain a straight-sided pattern on any tube having a faceplate radius of curvature greater than the distance from the deflection center of the beam to the faceplate, the spot undergoes certain aberrations due to deflection. The greater the angle, the greater are the attendant aberrations. By reducing the beam diameter in the yoke, however, different parts of the beam cross-section are in more nearly the same deflection field and a reduction of deflection distortion results.

Second, the action of the magnetic focus coil of the cathode ray tube is analogous to that of an optical lens in that the magnification of the system is directly proportional to the image distance. The image distance is the distance from the center of the focus coil air gap to the cathode ray tube screen. For a given screen diameter, this distance is shortened by a factor of approximately 1.4 by increasing the deflection angle from 66° to 90°, resulting in a lower magnification and smaller spot size for the 90° design.

Increasing the deflection angle of a 66° tube to 90°, then, would change the center resolution by a factor of 1.4 from, say 550 lines to 770 lines. Such a value of center resolution means a very fine line width, so fine that there is a considerable amount of dark space between the lines of the raster. To minimize this effect, the picture must be viewed from a greater distance, so great that the added center detail, due to higher resolution, is lost.

Third, electron optical laws show that the diameter of the beam in the region of the deflection yoke is directly proportional to the tube resolution. Therefore, a tube with high center resolution (fine center line width) has a beam of large diameter in the yoke region, which beam is grossly distorted when deflected. The result is a picture having excessively fine lines in the center portion and almost no detail at the edges. For these reasons, it is advisable that center resolution not be too high.

Tube Resolution

Before tube resolution can be controlled and before subjective evaluation of the effect of changing tube resolution can be made, an effective means of objectively measuring resolution must be used. This was done by using a "merging raster" method. This method was described in detail at the fall meeting of the IRE. Every other field of a television raster was blanked, leaving an extremely stable 262½ line raster. After careful adjustment of ion trap, focus coil, and deflection yoke components, the vertical height of the pattern was reduced until the lines merged, yielding a uniformly bright pattern. Incompletely merged, merged and overmerged patterns are shown in Fig. 3. (In this picture, the lines have been defocussed to produce the desired effect.) At the left, the lines have not yet merged; the center shows the merged lines; at the right the lines have overmerged. (The thin white lines are the result of overlapping of adjacent lines.)

The height of the merged raster is

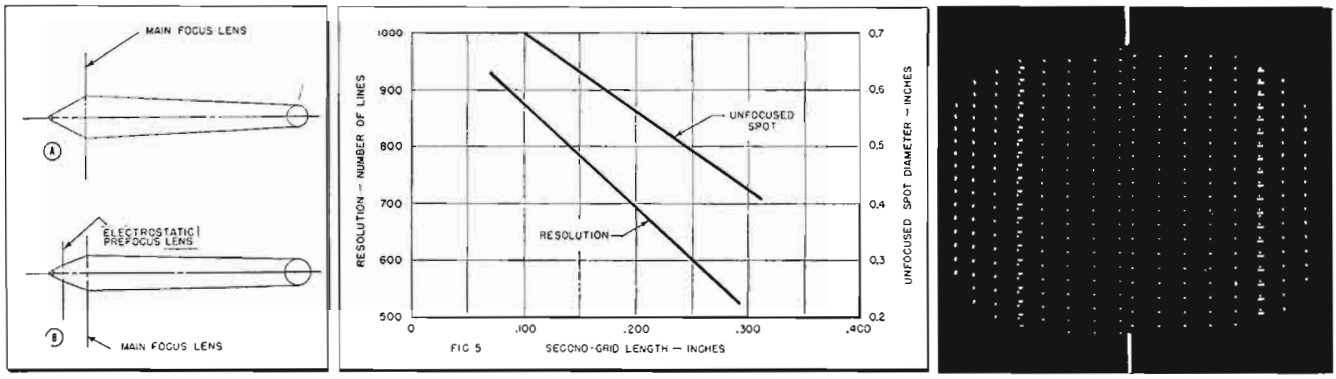


FIG 5

Fig. 4: (Left) Action of prefocus lens in reducing beam diameter and increasing focused spot diameter. Fig. 5: (Center) Experimental data verifying action shown in Fig. 4. Fig. 6: (Right) Dot pattern used to measure deflection defocussing

measured; the tube resolution is given by the ratio of normal picture height to merged raster height times the number of lines in the pattern (262½). Subjective evaluation of tubes having different values of center resolution, as measured by this method, showed that center resolution between 500 and 600 lines gave best overall picture quality. This figure is necessarily a compromise between a higher resolution, causing the defects we have already noted, and a lower resolution, with attendant loss in picture detail.

Adjusting Magnetic Lens

Adjustment of tube resolution is made by adjusting the position of the object of the magnetic lens. This can be done by moving the entire electron gun closer to the focus coil. Since the image distance is now reduced by a factor of approximately 1.4, the object distance could be shortened by the same factor, to maintain the same overall magnification and center resolution.

This method has two disadvantages, however. First, focus current varies as the square root of the change of the object distance. Focus current, therefore, increases by nearly 20%. Heat dissipation, especially important when considering that much of the heat dissipated contributes to increasing the temperature of the deflection yoke, increases by 40%. Second, moving the gun forward brings the anode aperture close to the focus coil. Any attempt to center the pattern by means of focus coil tilt, then, will decenter the beam in the aperture, a highly undesirable condition.

The object of the magnetic lens can be moved optically rather than physically, however. Since the object of the magnetic lens is a virtual image erected by the second grid-anode lens, adjustment of tube resolution can be effected by changing the characteristics of this lens. This method, in addition to reducing center resolution will, since it partially focusses the beam, actually cause a reduction instead of an increase of focus current. The action of this lens is shown in Fig. 4. Fig. 4a shows a single lens structure with no prefocussing; Fig. 4b shows the effect of prefocussing in reducing beam size and increasing final spot size.

With all other distances remaining fixed, as the distance from the electron-beam crossover to the second-grid-anode lens is increased, the beam size is further reduced and final spot size further increased. In the actual tube, an increase in the length of the second grid part corresponds to an increase in the distance from the object to the prefocus lens.

Experimental curves showing the variation of beam size and resolution with second grid length are shown in Fig. 5. Note that a relatively slight change in second grid length produces a great change in tube resolution and beam size.

Pulsed Raster Used

In order to compare deflection defocussing of the 90° type to that of a 66° type, a pulsed raster was used, allowing the examination of spot size and shape at different portions of the screen. The type of dot pattern obtained is shown in Fig. 6. This picture is a double exposure. To the left of center is shown a tube with high center resolution and a great amount of spot distortion at the edges of the pattern. To the right of center is shown a tube with low center resolution and reduced spot distortion at the edges.

Using a 15,750 cycle horizontal scan rate would require an impractically short pulse time, in order to pulse the spot on and off quickly enough to "freeze" the spot. Horizontal scan frequency was therefore dropped to 1,500 cps. Synchronized pulses having a 30,000 cps repetition rate and 0.25 microsecond duration were applied to the first grid, resulting in the 25 line, 20 dot-per-line pattern shown.

Deflection Distortion

The ratio of the longest dimension of the distorted spot at the edge of the pattern to the diameter of the center spot was taken as a measure of deflection distortion. Measurements show that, for the same value of center resolution, this ratio is slightly smaller for the 90° tube than it is for the 66° tube. The picture quality of the 90° tube, therefore, is better than that of the lower deflection angle tube.

The DuMont 30BP4, a 90° picture tube designed according to the principles outlined is shown at the beginning of this article. This tube has a nominal screen diameter of 30 in., a minimum usable screen area of 550 square in. and an overall length of only 23-9/16 in. Comparing it with the type 19AP4 tube, we find that the nominal screen diameter has been increased 1½ times, screen area has been increased by over 2½ times, and overall length has been increased by less than 10%.

The design work described in this report was carried out under the direction of and cooperatively with Mr. K. A. Hoagland, A. B. DuMont Laboratories, Inc.

Video Levels in TV Broadcasting

Reviewing improvements in operating techniques and standardization activities that have led to the development of new CRO measuring scales

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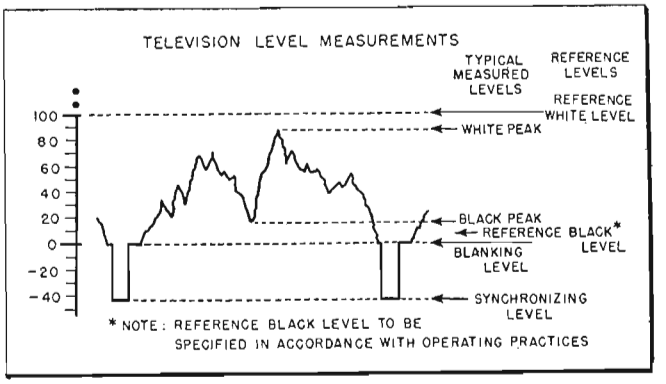


Fig. 1: Significant levels and details of standard scale

THE subject of video levels in television broadcasting, from standpoints of both standardization and measurement, has been going through a slow process of evolution ever since the early experimental broadcasts in the 1930's. At first, as should be expected, the significance of all the factors was not fully appreciated, and, as a result, accepted values and methods have been changed from time to time in an effort to keep pace with the advances in techniques and equipment. There is no assurance that this evolution has now reached its final stage, but substantial changes which have developed recently are a sufficient reason for restating the situation as it appears to be at present.

In 1936, the first major installation of television broadcasting equipment in New York was made in the studios of NBC in Radio City. One feature of this installation which bears on the subject of levels was a mile and a quarter of coaxial transmission line connecting the studios to the transmitter in the Empire State Building. With the lines and equalizers used at that time, it was thought necessary to feed the input of the line at a level of about 5 to 10 volts, peak-to-peak, in order to secure an acceptable signal-to-noise ratio at the transmitter input. This situation set the pattern for line amplifiers at the studio output until the approach of the development of commercial equipment during the last year of World War II. Video levels within the studio plant during that period were generally set at about 1 volt, peak-to-peak.

RTMA Standards

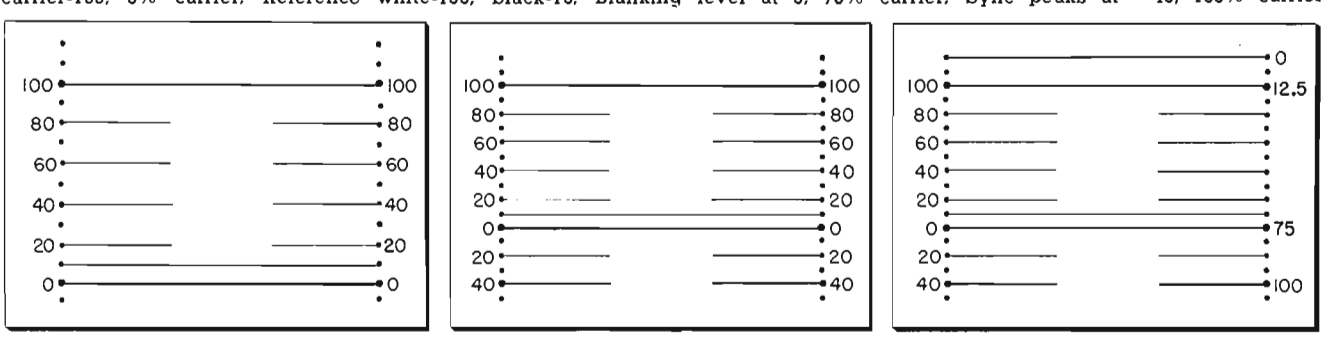
In connection with post-war developments, there was activity in technical committees of the Radio Manufacturers' Association (now the RTMA) to evolve suitable standards for commercial television equipment. Among the standards adopted by these committees in 1946, was one which specified that studio output amplifiers should be capable of producing a level of 2 volts, peak-to-peak, of composite picture signal, including about 0.05 volt of sync. At that time, there were some wire line interconnections in use in New York provided by the Telephone Company and consisting of ordinary telephone cable pairs with equalizers spaced at frequent intervals. The 2-volt level was considered high enough to avoid objectionable noise, and low enough to avoid noticeable cross talk in the telephone cables. Furthermore, it appeared to be possible to develop this voltage efficiently with acceptably low distortion, on a 75 ohm transmission line load by using a single 6AG7 tube in the output stage of a studio amplifier. It was also felt that the use of a 2-volt level would permit simple and economical designs of picture monitors with a minimum amount of video signal amplification. In RCA pickup equipment, the 2-volt level was adopted as standard on nearly all 75 ohm interconnecting circuits carrying composite signals, and a 1.5-volt level on 75 ohm circuits carrying non-composite signals (no sync present).

The cathode ray oscilloscope has been used universally, during all these various stages of evolution,

Fig. 2: (Left) Operating scale No. 1 for use at camera controls. Reference white-100, black-10; blanking level-0

Fig. 3: (Center) Scale No. 2 for use with composite signals. Reference white-100, black-10; blanking level-0; Sync peaks at —40

Fig. 4: (Right) Operating scale No. 3 for use at a transmitter location where depth of modulation is to be measured. Zero carrier-100, 0% carrier; Reference white-100, black-10; Blanking level at 0, 75% carrier; Sync peaks at —40, 100% carrier



primarily as a level indicator, but in addition as an indicator of quality of the picture signal. One typical example of its use as a quality indicator is found in the adjustment of shading signal controls where the CRO gives a more critical indication of uniform background than does the eye by direct observation of the monitor kinescope.

Recent Trends

The rapid and continuing growth of network facilities, together with the almost unbelievable expansion of studio facilities in some of the larger stations with all their highly complex interconnections, has made evident some weaknesses in the adopted video level standard as related to the design of equipment which is in widespread use at present. It has become apparent that the earlier concept of acceptable amplitude distortion limits in line amplifier stages has to be modified when applied to a large system where the number of equipment units is greatly increased as compared to that involved in a small operation. For example, a signal originating in an outlying studio of a large station may be passed through as many as ten line amplifier stages before arriving at the transmitter. If the signal is fed through a cross-country cable network, it may pass through several hundred repeater amplifiers before reaching its destination. It is obvious that the distortion in any one amplifier must be held to an extremely low value if the cumulative distortion in such a system is to be tolerably small.

Amplitude distortion of a television picture signal results in unnatural tones of gray in the reproduced scene. The most common type of distortion changes tonal gradation in the light grays and near-whites. Faces may look too white and washed-out, and lack any appearance of depth. In order to illustrate the significance of a small amount of distortion in a single amplifier unit which is part of a large system of many similar units, let us assume that the permissible limit of compression of the whites accumulated in the entire system is 25%. This particular value has no special significance, but it is an amount of compression which is observable, and may be assumed for purposes of discussion. In the case of a system having 100 amplifiers in cascade, the compression per unit would have to be less than 0.3 of 1% to stay within the assumed limit.

Avoiding Distortion

Fortunately, the network equipment is designed to avoid distortion to an acceptable degree. On the other hand, many studio amplifiers do not have adequate linearity to provide satisfactory operation in cascade in large numbers with a level of 2 volts. Rather than recommend modification or replacement of the large number of such amplifiers now in use, with attendant high cost and inconvenience, it seemed preferable to recommend a reduction in the standard signal level which would make possible a noticeable decrease in distortion without an appreciable increase in noise.

This problem came to a head early in 1950 in New York which had by that time become the principal source of network programs on television. Another problem had also been adding to the confusion, namely, that in spite of the RTMA standard 2 volt level for video amplifiers, there was no adherence to any operating standard in this matter. The levels put out by the New York stations were nearly all different, determined largely by requirements of common carrier equipment used for interconnections and for networking. These varying requirements resulted from the fact that common carrier terminal equipment had grown up with the demand; it represented in some cases, different stages of development, and did not adhere to one standard in the matter of levels.

The situation was given special attention by an informal committee composed of representatives of the six television stations in New York City and of the Telephone Company and of some interested manufacturers of television equipment. This group held several meetings between May and September and proposed a standard operating level of 1.4 volts, peak-to-peak, of composite signal as outlined in Fig. 1. The new level has subsequently been adopted by the New York stations as well as by some others. It has been agreed that this level will be satisfactory in the common carrier operations though there will be a transition period required for modernizing some of the existing equipment during which it may be necessary to continue the use of other levels.

IRE Standard Scale

The choice of the new level of 1.4 volts was guided, of course, by the need for reduced distortion, but in addition, it was influenced by the recently adopted IRE Standard[1] which included, among other things, a standard scale for measuring video levels. This scale is shown in Fig. 1 which is a reproduction of the diagram in the IRE Standard. The special committee of New York broadcasters and television manufacturers decided to recommend correlating the new video level in volts with the arbitrary units in the IRE scale. The desired relationship is given by the expression: Video Signal in Volts = *Number of IRE Scale Units*/100.

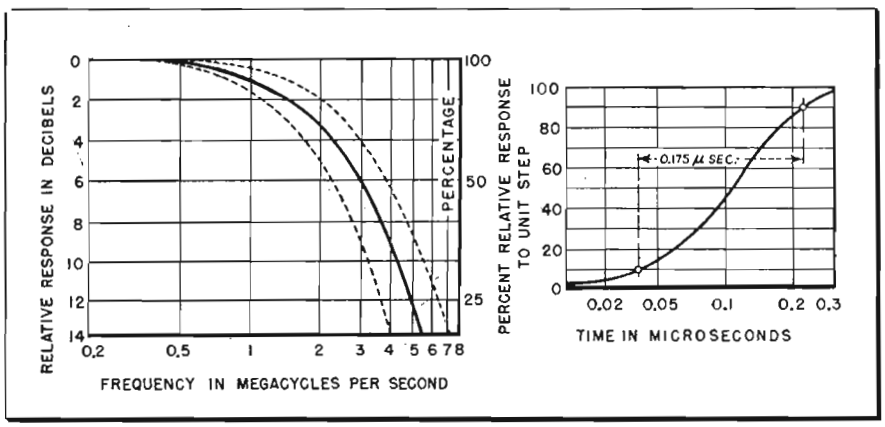
The three scales shown in Figs. 2, 3, and 4 were recommended by the Special Committee for practical use on the faces of 5 inch CRO tubes as follows:

Scale 1 (Fig. 2).

To be used with either studio or film camera controls where non-composite (no sync) signals are used. Blanking level is at 0; reference black is indicated at 10; and reference white is at 100. Total deflection is 2 inches between 0 and 100.

Scale 2 (Fig. 3)

Fig. 5: Frequency and time response for standard oscilloscope



To be used at studio or master control outputs, or for preview monitors, or for any monitor where composite signals are present. Sync peaks are at —40; blanking at 0; reference black is indicated at 10; and reference white is at 100. Total deflection is 2 inches between —40 and 100.

Scale 3 (Fig. 4)

To be used at the transmitter location where composite signals are present and where it is desired to measure depth of modulation. Scale numbers on the left hand side are the same as for Scale 2. On the right hand side, the numbers are per cent of modulation. Total deflection is 2 inches between —40 and 100, or between 100 and 12.5 on the per cent scale.

The value of 2 inches for vertical deflection on the CRO using the new scales was adopted after tests which indicated that this deflection was reasonably linear in present equipment. Units which were not linear at 2 inches of deflection were found to contain subnormal amplifier tubes.

A fortuitous relationship between the IRE standard and the proposed operating level is evident in Fig. 4. Here the numbers on the right hand side of the scale indicate per cent of modulation of the r-f carrier and show how it relates to the IRE scale. By setting zero carrier opposite 120 on the IRE scale, and maximum carrier opposite —40, blanking level (or zero) corresponds with 75% of maximum carrier, and reference white (or 100) corresponds to 12.5% which is the minimum allowable carrier level. Thus the FCC specifications on carrier levels are embodied in this same scale.

Use of New Scales

Experience over several months of operation in a number of television stations has shown that the new voltage level and the new scales are a substantial aid in attaining improved performance. As a result of this experience, a recommendation has been sent to RTMA that its standard be revised to specify a video level range of 1.4 volts, peak-to-peak, for studio equipment. The recommendation is now being considered in the technical committees of the RTMA.

It is highly recommended that all television stations adopt this level in operating practice as soon as practicable. It will not only improve performance, but it will do a great deal to facilitate the interconnection of stations and the exchange of programs through the networks.

For those users of Master Monitors, or other equipment employing 5-inch CRO tubes, scales, similar to those shown in Figs. 2, 3, and 4, printed in black on thin clear plastic, may be obtained by writing to the Engineering Products Dept., Building 15-7, RCA Victor Div. Camden 2, New Jersey. These scales may be applied to the faces of CRO tubes with pieces of transparent adhesive tape. This type of scale is not as durable nor as easily visible as is considered desirable, but it is being made available as a temporary measure until the design of a more satisfactory type can be completed.

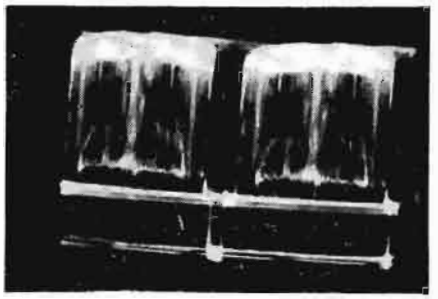


Fig. 6: A normal monoscope signal on a wideband CRO (RCA Type 715-B)

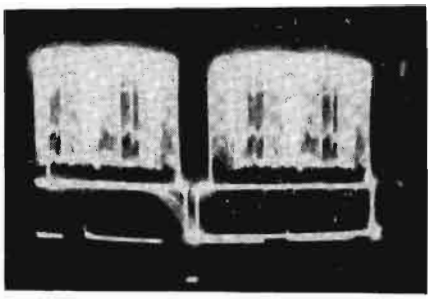


Fig. 7: Normal monoscope signal on CRO in modified TM-5 Master Monitor

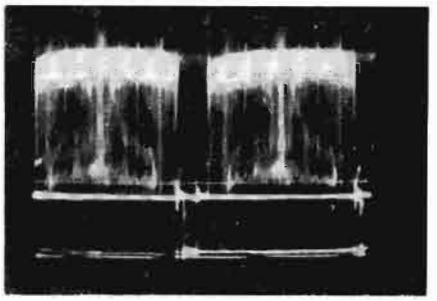


Fig. 8: Monoscope signal with severe overshoot distortion shown on wideband CRO. Note black overshoots in sync region

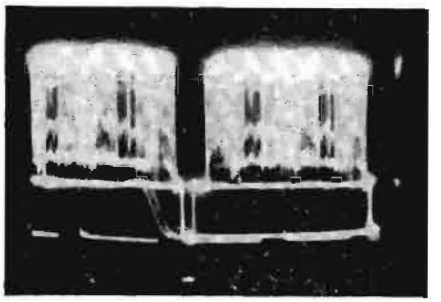


Fig. 9: Same signal as shown in Fig. 8, but appearing on the TM-5 Master Monitor with IRE roll-off in CRO amplifier

The term setup, though not officially recognized, has been, for a long time, applied to the difference in level between blanking level and reference black. In a perfect television system, it might be possible to hold setup to zero with satisfactory results. By doing so, it would be possible to obtain the most efficient utilization of video, r-f, and i-f amplifier characteristics. However, perfect signals would be required, without amplitude distortion (overshoots in the black direction), and very careful adjustment of the background controls in receivers would be required to avoid retrace lines or clipping of blacks in the kinescope.

By raising setup to some reasonable value, it is possible to realize much more practical operating conditions. Small black overshoots can be present without extending into sync territory, and in the receiver it is possible to adjust the background control so that retrace lines are surely blanked out without clipping black peaks in the picture signal.

Amplitude of Setup

In the picture line amplifier standard output adopted by RTMA (Revised Oct. 9, 1946), the recommended amplitude of setup is 5% of the difference between blanking level and reference white level. This corresponds to 5 units on the IRE scale. Experience in most stations has shown the desirability of increasing this amplitude to about 10%. The increase reduces the utilization of amplifier characteristics, but it improves overall performance by allowing more tolerance for overshoots in the blanks, and by permitting final clipping at blanking level in stabilizing amplifiers in order to eliminate overshoots in the sync region. This clipping usually reduces setup somewhat below 10%, a process which would not be permissible if the initial value of setup were only 5%. For these reasons, the scales adopted for operating use include a line at 10 to indicate the maximum amount of setup. This 10% line, as well as the zero line, is made continuous across the scale to emphasize its importance.

(*Continued on page* 60)

For MANUFACTURERS

New Methods, New Materials and New Machines

Edited By Bernard F. Osbahr

Whiskering Zinc

Bell Telephone Laboratories, Inc., 463 West Street, New York 4, N. Y., reports that some time ago a puzzling phenomenon was encountered on some precision electrical filters of the hermetically sealed type. A few months after construction, some of these filters showed abnormally high transmission losses to low level currents. A conducting path within the filter from one of the three air condensers to ground would result in the high pass-band loss indicated. Attempts to locate such a condition

(Above) Three long whiskers, one bridges gap between condenser and ground, magnified 15X (Below) Same view after applying 135 V d-c across the whiskers

proved fruitless at first, since most frequently the trouble cleared while the cover was being removed from the filter. One day a chance gleam of light revealed a very fine "whisker" reaching from the mounting bracket to the supporting stud of an air condenser. A paper knife was inserted between the condenser and bracket, breaking the whisker and immediately clearing the trouble, and thus the cause was found.

A more careful microscopic examination of the metallic surfaces of this and other filters revealed the presence of a whiskery growth attached to the zinc plated surfaces. The whiskers were of approximately uniform diameter for their entire length and were good electrical conductors. Photomicrographs on slides taken at 500X and projected to give an image 6000X showed that they were of a uniform diameter of only about one micron—less than 0.00005 in. Some were at least ⅜ in. long. Although they are normally invisible, they have a very shiny surface, and it was the reflection from this surface that first revealed them.

Zinc has been and is being used widely as a protective coating for steel and because of its electrochemical protection has proved quite satisfactory. The growth of whiskers from zinc plating seems to be an unusual occurrence which takes place only under special conditions.

They appear to be pure metal, and they have been grown from zinc, cadmium, and tin plated surfaces. Of the more common types of metals used as a protective coating for steel, copper appears to be free of whiskers. Hence, copper is being used as a protective coating on steel in those applications where it is expected that the presence of whiskers would cause trouble. Such problems must be considered by the design engineer in the future.

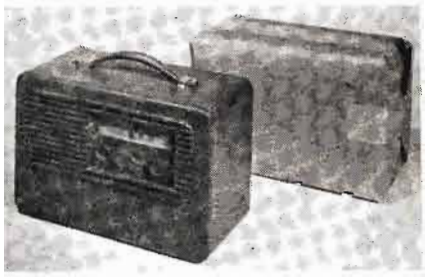
$$$ FOR YOUR IDEAS

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.

Improved Master Carton Packing

"Shellcrease" is the name of a new packing material having the flexibility of wrapping paper and the cushioning qualities of corrugated cardboard, thus enabling wrapped radios or similar electronic equipment to be placed snugly together in a master shipping carton. Not having to take up the space ordinarily filled with stuffing permits using a much smaller master carton. This represents savings in the purchase of both stuffing materials and oversized cartons.

Another advantage is that it is not necessary to place each radio in an individual carton with special inserts to protect knobs, etc. Shellcrease "molds" to the shape of the radio or to any similarly shaped product. Its flexibility is due to the minute scoring marks in the corrugation, which permit folding or rolling in any direction without sacrificing the protective characteristics of corrugated board. Manufacturer is Shelton Manufacturing Company, Inc., 42-24 Orchard St., Long Island City, N. Y.

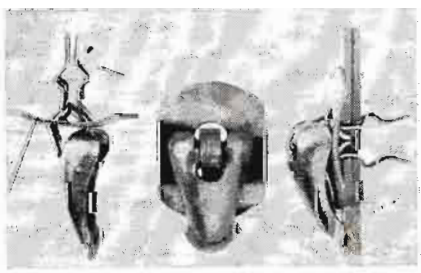


Radio receiver can be easily wrapped in corrugated material (right) for packing in master shipping carton

New Snap Fastener

A new small, inexpensive metal fastening device has recently been put on the market by The American Shower Door Company of 1028 La Brea, Los Angeles, Calif. Known as the "Thumbweld," the new device is designed primarily to be used as a permanent fastener where rapid assemble or disassemble is important,

Top and side views of new fastener

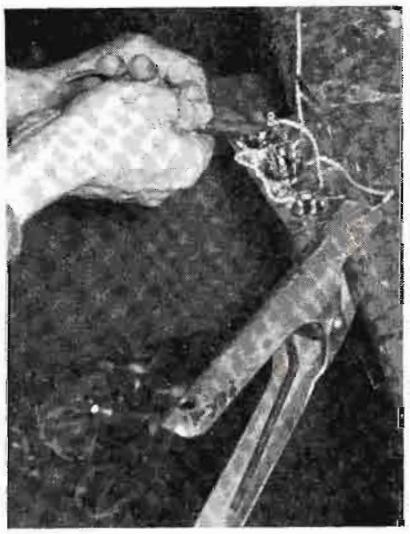


or to replace screws or bolts securing parts that are occasionally removed for service or inspection as, access plates, radio parts, metal housings, panels, cable brackets, intruments, etc.

The "Thumweld" fastener applies from one side and requires only the drilling of a 3/16-in. hole. Thumb pressure alone is sufficient to lock it in place. Once locked the fastener grips as securely as a metal screw or bolt and will not jar loose. To release, a quick pry with a screw diver or thumb nail is sufficient. "Thumbweld" fasteners are available for hole sizes ranging from 1/8 to 1/2 in. and for metal thickness up to 1/2 in.

Spring Clamps Save Jig Costs

Confronted with the problem of having to design new jigs for small chassis and subassemblies going through production, engineers at Dean Electronics Inc., 35—Fifth Avenue, Brooklyn, N. Y., reduced their headaches by purchasing several large flat-mouthed clamps (No. 3 or larger). These were used to hold the chassis on top and along the edge of the work bench for connections and soldering operations.



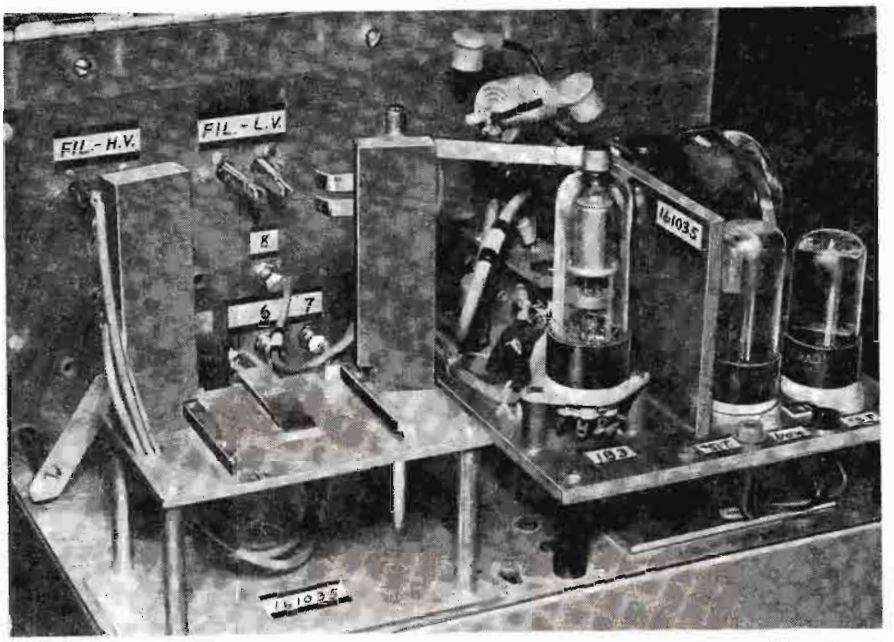
Amplifier chassis clamped on work bench

Identification Tapes

A new pressure-sensitive tape which, when written upon, becomes a water-proof, oil-proof, smudge-proof, and acid resistant label is now being produced by the Labelon Tape Co., 100 Anderson Ave., Rochester, N. Y. It is made of two layers of acetate with a white waxy substance sandwiched in between. Pressure on the top clear layer indents the thin white layer and exposes the colored bottom layer to view. Marking may be accomplished by the pressure of any blunt instrument. Typewriter may also be used.

Available in black, blue, red or green; in 5/8, 3/4, 1, and 1 1/2 in. widths and in 400 or 800 in. standard industrial rolls.

The tape requires no moistening and will adhere to wood, glass, plastics, metals, ceramics and to almost any other clean surface. It can also be transferred from one surface to another repeatedly without leaving a sticky residue or destroying the adhesive qualities of the tape.



Flyback transformer test equipment on TV production lines of the Stromberg-Carlson Co., Rochester 3, N. Y., uses pressure sensitive tape to identify elements

Microfilming Vital Data

Radio-TV manufacturers might also consider microfilming their vital engineering design and other important company or corporate data. Ford Motor Co., recently announced plans for 4,250,000 microfilm shots to provide top security in the event of a bombing attack. All important drawings of dies, guages, jigs, and fixtures will be filmed. Included also are all old and current drawings of cars, trucks and engines from the model T to late 1951 models. Negative microfilm copies are being held in fireproof vaults in Dearborn, Mich., while positive copies are in distantly located underground bomb-proof vaults.

Response Analyzer

Shown below is a photograph of a coaxial loudspeaker receiving a response and sensitivity test on a production line by means of visual spectrum analysis. This test position, installed in the University Loudspeakers, Inc., plant at 80 South Kensico Ave., in White Plains, N. Y., uses an automatic sweep audio oscillator to send a 50 to 15,000 cps signal to the speaker through an amplifier.

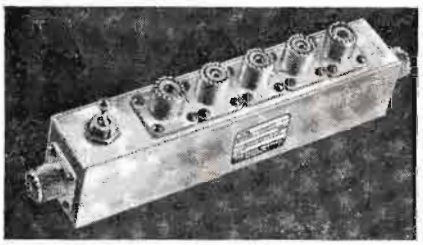
The acoustic output is picked up by a microphone within the cabinet on which the speaker rests, and fed to an oscilloscope equipped with a long-persistence cathode ray tube. Because the sweep rate is several times per second, the response curve is held stationary across the face of the cathode ray tube. Built-in cross-over network and high-frequency attenuator are simultaneously tested. This type of final test position enables manufacturer to make a 100% check on all finished or outgoing units.

Testing loudspeaker response and sensitivity by visual spectrum analysis

New Equipment and Components

Video Distribution Network

A new video distribution network (Type V-101) provides a ready means of dividing the output of a single source



into from one to five bridging amplifiers for video program distribution. In operation, the network is inserted in the line between the source and the load. Connectors are provided at each end for readily inserting the network into the program line. Connectors are also provided on the side of the network for the connection of from one to five video amplifiers or program distribution. An internal variable capacitor is provided on each output channel for the adjustment of any appreciable change of capacity introduced by the addition of channels. A switch is provided for terminating the source with an internal adjustable 73 ohm resistive load. This termination can be readily set for zero reflection by means of a screw driver adjustment.—**The Daven Company, 191 Central Ave., Newark 4, N. J.**—TELE-TECH

Tape Drive

The TL-10 tape drive consists of a triangular shaped cast chassis which mounts on two small posts fastened to the disc turntable panel. One point of

the triangle carries the tape capstan and this rests directly on the center pin of the turntable to which the TL-10 is attached. A belt drive from the under side of the capstan rotates the take-up reel through a slip clutch. The reproducer head and guide pulleys are located on the upper side of the chassis and the equalizer network is placed below. Two capstans are provided: for 15 and 7½ in. per sec. speeds. Rewinding is achieved by transferring the empty reel to the take-up spindle and releasing the drag on the supply spindle. This allows the tape to transfer at a relatively fast speed. The output of the head and equalizer is sufficiently high to be fed directly into a high quality preamplifier such as found in standard broadcast speech input equipment.—**Presto Recording Corp., P.O. Box 500, Hackensack, N. J.**—TELE-TECH

Crystal

Valpey type DFS is an entirely new crystal unit for standard frequency applications. It incorporates two separate quartz crystals entirely independent of one another but so designed that frequency stability and zero frequency adjustment are equal on 100 and 1000 KC. Both crystals are highly active and capable of producing high oscillator output together with instant starting when used in conventional circuits. Compactness, desirable in most applications, has not been sacrificed in accomplishing these improvements. Separate oscillators may be used, thus furnishing 100 and 1000 KC signals simultaneously. Switching may be used in the oscillator, making available 100 or 1000 KC outputs as desired.—**Valpey Crystal Corp., Holliston, Mass.**—TELE-TECH

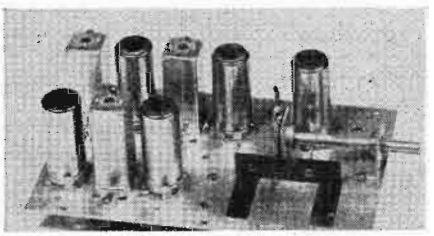
Automatic Counter

The type M1731 Eventometer is designed to provide a flexible instrument for the measurement of events occurring in a desired interval of time. This instrument uses counting techniques throughout and is entirely electronic in its operation. The time base chain operates on the binary principle, with feedback, to provide for division by 100,000 from an internal 100 kc oscillator or from an external frequency source. By this division, when using the internal oscillator, a "scan" time of one second is provided resulting in an answer expressed in cycles per second. Through provisions included in the instrument, other frequencies, less than 200 KC, may

be used to control the time base so that the scan time may be changed as desired over a range from one-half second to an indefinitely long period.—**The Walkirt Co., 5808 Marilyn Avenue, Culver City, Calif.**—TELE-TECH

FM Tuner Chassis

The Collins RD-1C FM tuner chassis is said to be a new approach to high fidelity radio reception, without the expenditure for more elaborate, expensive units. The tuner comes supplied mounted on an aluminum plate measuring 7¼ x 4½ in. It may be readily fitted into a chassis of the user's choice by cutting a hole 7 x 3⅞ in. By proper placement and mounting it may be directly coupled to a tuning dial assembly, such as manufactured by National or Millen. It is suggested however that the dial assembly and tuner be located independently



of each other and driven by two pulleys of equal diameter by dial cord. This allows a much more flexible and logical placement of parts. No separate i-f amplifier is needed. The tuner is complete: converter, oscillator, i-f amplifier and detector are supplied on one chassis plate.—**Collins Audio Products Co., Inc., P. O. Box 368, Westfield, N. J.**—TELE-TECH

TV Positioning Control

A more constant, usable, unilateral field is said to be maintained over the entire adjustment range of a new TV

picture positioning control designed for use with electrostatic tubes. No alnico is used. The magnetic material which is used is non-essential from a procurement standpoint.—**Heppner Manufacturing Co., Round Lake, Ill.**—TELE-TECH

Oscilloscope

A new five-inch oscilloscope has been designed especially for use in microwave installations. The type ST-2C, has a high sensitivity and wide frequency response. Vertical sensitivity ac input is 0.075 volts RMS per in. All frequently-used controls are located on the front panel and are grouped conveniently according to their function. The cathode ray tube is cradled in rubber and is provided with a ¼-in. thick green-colored safety window. The vertical input attenuator is designed to permit quick selection of three levels of input from the input binding posts or three levels of input from the RC probe. This compensated attenuator will faithfully attenuate voltages by as much as 1,000 to 1 without frequency discrimination.

Adequate drive from the horizontal amplifier is available to expand the trace to several times the diameter of the cathode ray tube. This permits a good display of short-duration pulses

and allows closer observation of portions of a wave pattern. Since the output stages of both the horizontal and vertical amplifiers are direct coupled, the positioning controls are positive in their action, and the trace responds immediately to any change in the positioning control settings. The amplifier circuits are designed for quick recovery from overload. Wide frequency response is obtained without recourse to peaked amplifier coupling circuits, resulting in excellent transient response. Straight resistance coupling is used and there is no positive slope to the frequency response curve. The response falls off gradually and the slope can be used to view signals containing frequency components up to 7 MC.—**General Electric Co., Syracuse, N. Y.**—TELE-TECH

for Designers and Manufacturers

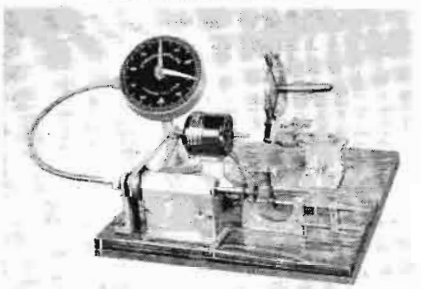
Power Supply

Model 1250 regulated high voltage power supply features excellent regulation, low ripple content, and low output

impedance. It is continuously variable from 200-1000 volts and delivers from 0-500 milliamperes. In the range 200-1000 volts the output voltage variation is less than ½% for line fluctuations from 105-125 v. and less than ½% for load variation from 0-500 ma. Ripple is less than 20 millivolts. Input and output fuses on the front panel, a time delay relay, and an overload relay are included. The high voltage dc terminals are clearly marked on the front panel. Negative side of the high voltage is grounded to the chassis. The terminals are also brought out at the back of the chassis.—**Kepco Laboratories, Inc., 149-14 41st Avenue, Flushing, N. Y.**—TELE TECH

Miniature Coil Winder

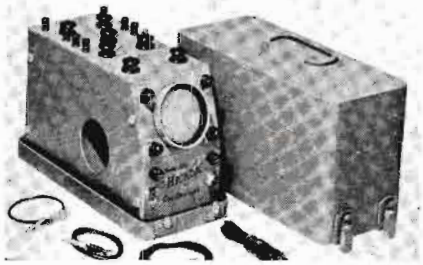
A new miniature coil winder (model 39) for winding tiny, fine wire, random wound bobbin coils up to ¾ in. width and up to 1½ in. diameter for the minia-



ture field has been developed. Transmission of motor vibration to winding head is reduced to an absolute minimum by a specially designed flat fabric belt. Weighing only 26 lbs. and measuring (including counter) 24 x 12 x 8 in., the new machine is easily portable. One model T-2 tension with supporting bracket is furnished for wire gauges 20 to 42 spools up to 4½ in. diameter. For wire gauges 42 to 46, model T-6 tension is available. Winding speeds up to 5000 rpm are achieved by ⅓₅ hp variable speed, series wound, ac-dc motor and foot-operated speed control of 115 v. operation. For 230 v. operation, a step down transformer is available. Smooth operation during rapid winding is assured by high speed, ball bearing head stock.—**Geo. Stevens Mfg. Co., Inc., Chicago 30, Ill.**—TELE-TECH

Portable Oscilloscope

Model 380 "Miniscope" has a 3-in. scope and a frequency coverage to 2.5 MC. It also features sensitivity of 0.1 RMS v. per in.; direct connection to CR tube elements; provision for Z-axis modulation; and telescopic light shield. It is shock mounted and housed in a strong moisture-proof aluminum case. Though designed to exacting military specifications, the model 380's versatility makes it an ideal, low-cost 'scope for industrial and laboratory engineering use. Built in a handy, portable size,



6 x 9 x 13¼ in., it weighs only 14 lbs., leads included.—**The Hickock Electrical Instrument Co., 10606 Dupont Ave., Cleveland 8, Ohio**—TELE-TECH

Dynamic Headphones

Flat frequency response from 100 to 7000 cps is assured in a new high fidelity Dynamic series and up to 4500 cps in

the Standard series. Permoflux dynamic headphones are said to be capable of taking even minute electrical impulses and converting them into sound over a wide frequency range at uniform response and high intensities. Sound reproduction is free from irritating blasts and rattles.—**Permoflux Corp., 4900 W. Grand Avenue, Chicago 39, Ill.**—TELE TECH

Germanium Crystal Diode

The high quality, high back resistance germanium crystal diode, GCD-1, standardized for, and heretofore exclusively used in Berkshire Labmarkers is now being made available to other laboratories and users. These diodes feature rugged construction, long life, low shunt capacitance and high humidity

resistance. They pass JAN-1A Crystal specifications for cycle immersion in hot and cold water and for temperature cycling. — **Berkshire Laboratories, 518 Lexington Rd., Concord, Mass.**—TELE-TECH

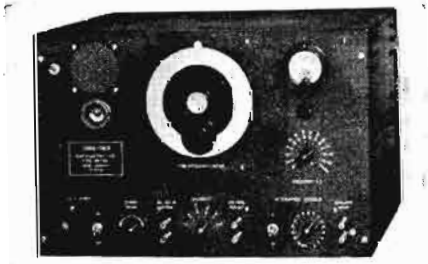
Square Wave Generator

The EMR 43A square wave generator is a versatile laboratory instrument for use in testing audio, video and radio frequency amplifiers and networks. It includes a wide-range variable-frequency multivibrator which drives a two-stage clipper circuit to produce negative-going square waves. No external driving voltage is required, although a synchronizing input circuit and buffer amplifier are provided to allow the generator to be operated synchronously with other equipment. A separate output sync signal is also available for triggering purposes. This sync circuit includes a differentiating element, to give peak signals, and a shielded cable which reduces the chance of coupling with the main signal output when the latter is used at low levels. The shape of a high frequency square wave can easily be impaired by the use of long or improperly arranged leads between the generator and the equipment to which it furnishes a signal. This danger

is greatly reduced in the model 43A by the provision of a flexible, terminated, 300-ohm transmission line which is driven by the output tube, through a step attenuator. At the far end of the line is a continuously variable attenuator mounted in a shield can and having a range of approximately 24 db. An additional ground wire is included in the sheath containing the transmission line in order to provide an exceptionally low ground lead impedance between the variable attenuator and the driving circuit. The output of the variable attenuator is through two short leads which can be connected directly to the equipment under test. — **Electro-Mechanical Research, Inc., Ridgefield, Conn.**—TELE-TECH

Ultrasonic Generator

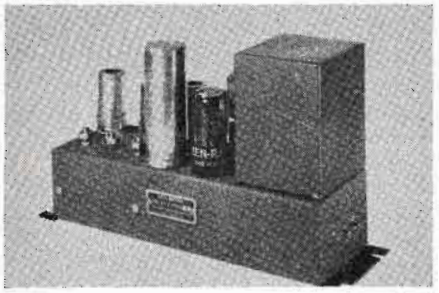
A new signal source of high accuracy has been designed for the ultrasonic frequency range. This new instrument,



known as the Sonaligner, is a very stable and accurate oscillator suitable for use in determining the pass band of narrow band ultrasonic filters. Outputs are developed at fundamental frequency with no beat oscillators. Frequency ranges are 10 KC to 220 KC in 13 bands. It has an output maximum of 2 volts from 600 ohms. Crystal check points are accurate to 0.01%. Timing "comb" may be used for accurate alignment of radar range circuits.—**Kay Electric Co., Pine Brook, N. J.**—TELE-TECH

Servo Amplifier

The 410-B is a 60 cps, servo amplifier designed to drive a motor with 5 watt output. It features controls on gain,



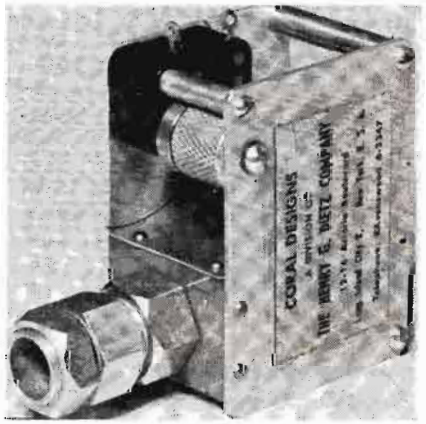
carrier phase shift, and damping, with the adjustments independent one from the other. With this range of adjustment, the 410-B can be used in all servo loops in this power class, for the performance can be optimized in each problem. Specifications are as follows: max. gain, 1000; phase variable from —20 to —140 degrees; internal pickup below 3 millivolts rms; moderate power supply requirements. Companion power supplies and modulators are available, and the 410-B itself can be obtained packaged to suit some particular spatial problem.—**Industrial Control Co., 26-02 Fourth St., Long Island City, N. Y.**—TELE-TECH

Transformers

Production of miniature and subminiature transformers to JAN and MIL specifications has been initiated. Designed specifically to meet the requirements of modern electronic gear where space and weight are at a premium, they are hermetically sealed transformers, radar deflection yokes and coil components, television flyback transformers, and television focus coils. Estimates will be furnished on submission of specifications and quantities.—**Tetrad Company, Inc., 4921 Exposition Blvd., Los Angeles 16, Cal.**—TELE-TECH

Air Flow Switch

An improved vane type pressure air flow switch for use in forced air cooling of electronic equipment has been devel-



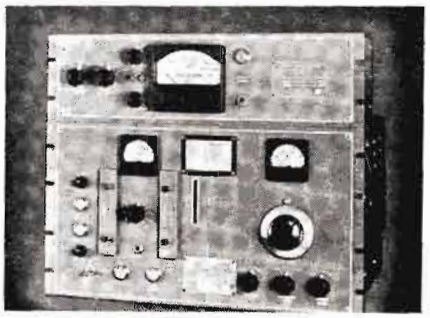
oped. The quantity of air required for forced-air-cooled tubes is specified for various types of service and often for various power levels. The flow switch is designed to operate a control relay to guard against tube failure in the event of blower failure or air-passage obstruction. It guards against air flow failure due to: dust precipitation blocking the air ducts caused by the tube radiators operating at high voltage, unclean air filter of obstructions blocking louvers in cabinet and stalling of the blower motor. It will operate on a minimum static pressure of 0.2 in. water gage. Electrical ratings of 5 amps at 250 v. ac are Underwriters' Laboratories approved.—**Coral Designs Div. of The Henry G. Dietz Co., 12-16 Astoria Blvd., Long Island City 2, N. Y.**—TELE-TECH

Coil Form Kit

A coil form kit has been assembled which is made up of representative samples of ceramic coil forms manufactured by the Cambridge Thermionic Corp. The box contains three each of five different ceramic coil forms. Each coil form is provided with a different powdered iron slug (high, medium and low frequency). Extra slugs of silver-plated brass are provided as alternates to the iron slugs. All necessary hardware is supplied with metal parts, non-ferrous and electroplated to meet military equipment requirements. A handy chart is also included for identifying slug types by color code and part number.—**Cambridge Thermionic Corp., 439 Concord Ave., Cambridge 38, Mass.**—TELE-TECH

Frequency Monitor System

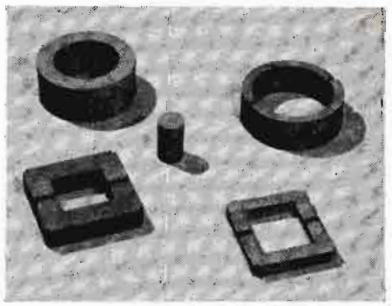
Designed as a secondary standard to monitor the frequency and shift of transmitter carrier outputs, a new fre-



quency and shift monitor system features the ability to measure the frequency shift of a mark and space (FC) signal both during setting up for traffic and under normal keying conditions. Stability is better than 2 cycles per MC over an ambient temperature range of 0-50°C. It requires crystals having a temperature coefficient of only 3 parts per million degree Centigrade. Its range is 2.5-30 MC with 10 crystal-controlled frequencies; there are separate panel trimmers for each. In addition, the use of an external oscillator is provided. The frequency shift range is 10-10,000 cps. Less than 100 millivolts r-f input is required. The frequency meter is specially designed with selectable normal and fast-acting damping factors, thus permitting frequency measurements of signals even while keying. Its accuracy is 1% for the ranges 0-200, 500, 2000, 5000; and 2% for the 0-20,000 cps range.—**Northern Radio Co., Inc., 143 West 22nd St., New York 11, N. Y.**—TELE-TECH

Noncritical Ferrites

Transformer cores, deflection yoke cores, antenna cores, and permeability tuning cores for television are now available in Ferroxcube 3 and 3C materials, which are nickel-free. These and other Ferroxcube electrical core materials are being manufactured at a new 60,000 sq. ft. plant at Saugerties, N. Y., which is devoted solely to the production of ferrite parts. Ferroxcube Corp. of America has acquired the equipment,



tools, dies, and manufacturing know-how of the former Ferroxcube Division of the North American Phillips Co.—**The Ferroxcube Corporation of America, 50 East 41st St., New York 17, N. Y.**—TELE-TECH

Lighthouse Tube

The GL-2C39A is a high-mu triode which can be used in radio communications and other military equipments. Its

nonmilitary applications include aircraft traffic and location controls, broadcast relay equipment, microwave test apparatus, and utility telemetering and communications systems. It can operate at full rating up to frequencies as high as 2500 MC. The maximum dc plate voltage is 1000 v. and the dissipation is 100 watts. **Tube Division, General Electric Co., Schenectady, N. Y.**—TELE-TECH

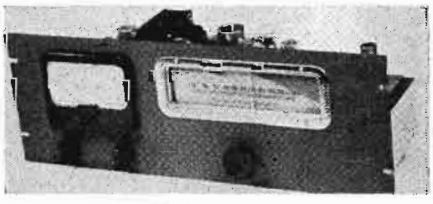
Precision Ceramics

A new steatite insulating ceramic can be milled, drilled, pressed, planed, lathe-turned, ground or worked by any other

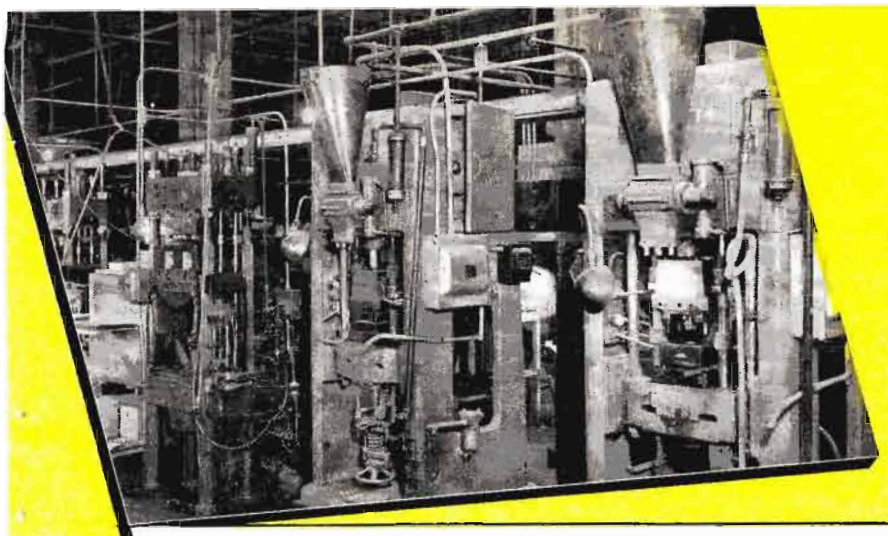
process applicable to metals. The development was achieved by extremely high firing of quality-controlled materials. These new ceramics combine the advantages of close-tolerance production with ideal electrical characteristics. Their hardness — crush resistance factor of 100,000 lbs. p.s.i.—facilitates high-speed precision production to meet JAN specs or manufacturers' requirements at low unit cost.—**Thor Ceramics, Inc., Bloomfield, N. J.**—TELE-TECH

FM Tuner

The HP-14 FM tuner was accurately engineered and designed to meet the most exacting requirements. Fourteen



tubes are used in its circuits and precise tuning is accomplished by means of a 4½ in. square meter. Permeability tuning is used in the FM front-end which provides high gain, high sensitivity, and extremely selective tuning. The output circuit may be operated directly into any load from 500 ohms to ½ megohm. Output level is approximately 3 v., governed by load into which tuner operates. HP-14 has an automatic squelch. When maximum sensitivity is required, the squelch may be switched out, allowing the full sensitivity of between 5 and 10 microvolts.—**Collins Audio Products Co., Inc., P. O. Box 368, Westfield, N. J.**—TELE-TECH



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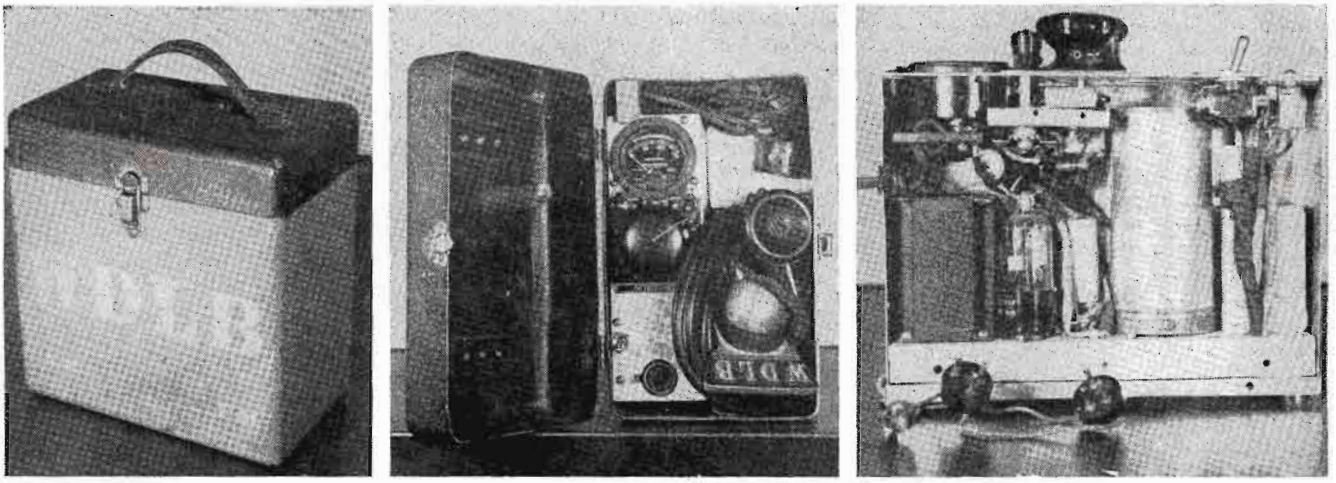


This small, easily-constructed remote amplifier is ideally suited to small station operation

Small Battery Remote Amplifier

By RUSSEL GRAMBSCH,
Chief Engineer, WDLB, WDLB-FM, Marshfield, Wis.

AN extra remote amplifier can be very useful, especially to a small independent local station. Many times, two remote broadcasts are so closely timed that it is impractical or impossible to handle them with a single remote amplifier. At other times the budget will allow only one man to take a remote. When an announcer handles a remote broadcast alone he needs an amplifier which is simple, compact, light, and rugged.

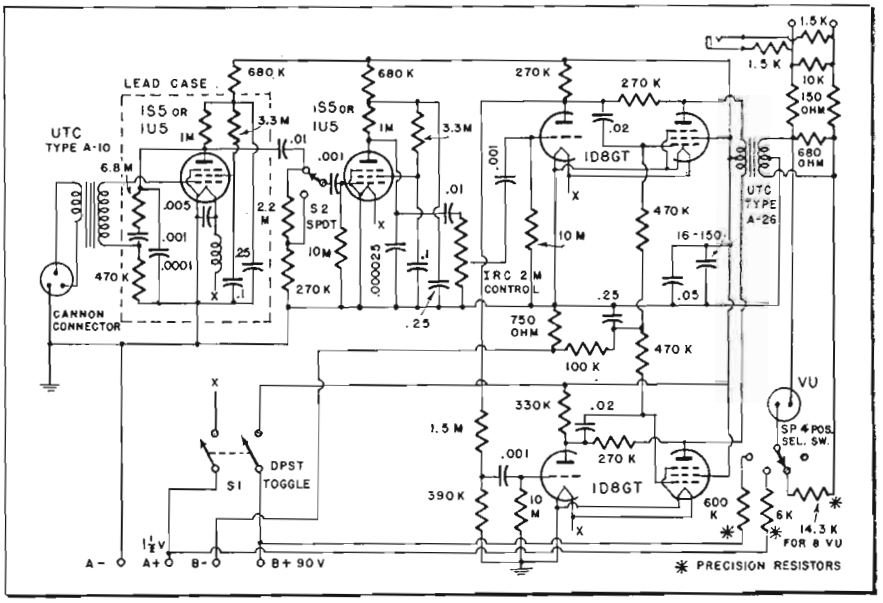
This unit is simple to install and operate, as it has only one microphone input and one gain control with self-contained batteries. The 'phone line coming from the remote consists of nine feet of lamp cord with a standard light cord female plug on the end. Where the phone line from the station terminates, a male receptacle is used. Some users may prefer other types of connectors, but these are used so that the phone line can be extended, when necessary, by using standard extension cords. (Editor's note: other types would seem preferable to avoid risk of plugging into ac power lines.) The unit is compactly installed in a ten-in. record carrying case with room for a small mike, cord, and phones and is lightweight.

The circuit is a standard audio amplifier using push-pull 1D8s in the output. As the station uses fifty ohm microphones with three prong Cannon connectors, this type of input circuit is used. Inverse feedback, to aid in suppressing microphonics, is applied across R1 through T1 to the grid of V1. Also, to help in keeping the amplifier non-microphonic, the first tube is mounted in a lead case together with some of its circuit components. This lead case is one from an old Philco auto radio vibrator. 1S5 tubes are shown in the first and second stages, but 1U5s, which are newer tubes and less microphonic, can be used; however, the base connections are different. The choke shown in the filament circuit is made by wrapping about fifty turns of #28 wire on a large ½ watt high ohmage resistor. To attenuate certain high frequencies it was found necessary to add C2 to the first stage and C8 to the second stage.

The second stage, like the first, uses a 1S5 tube. It is shock mounted but has no feedback. The signal from the first stage would drive it into grid current during strong signal periods if the attenuator circuit, using R6 and R7, were not used. This network is isolated from dc by C6. It is to have R6 and R7 directly in the plate circuit of V1, since the

(*Continued on page 75*)

Circuit diagram of complete amplifier. Note input stage is mounted in lead shield



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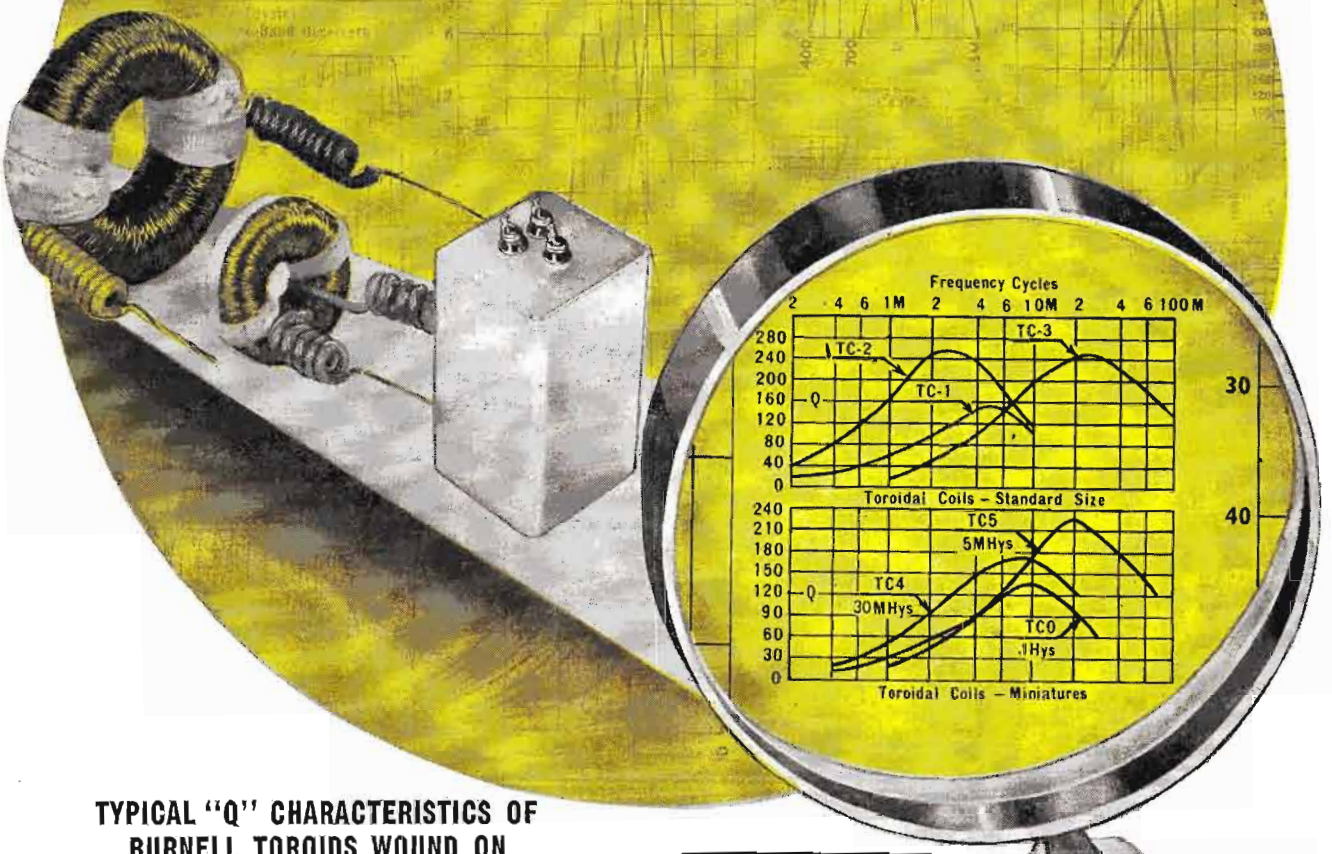

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TC-3 — 1 1/2" O.D. x 9/16"

MINIATURE SIZES
TC-0 — 7/8" O.D. x 3/8"
TC-4 — 1-3/16" O.D. x 9/16"
TC-5 — 1-3/16" O.D. x 9/16"

MAXIMUM INDUCTANCE
TC-1 — Ind.-Up to 10 Hys.
TC-2 — Ind.-Up to 100 Hys.
TC-3 — Ind. MHY-Up to 750
TC-0 — Ind.-Up to 2 Hys.
TC-4 — Ind.-Up to 10 Hys.
TC-5 — Ind. MHY-Up to 750

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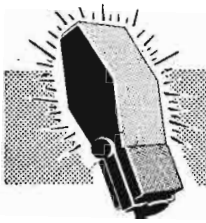


TELE-TECH's NEWSCAST

RCA Demonstrates the Latest Compatible Color-TV Advances

More than a million television set owners in the New York area during the week of July 9-14 had the opportunity of comparing FCC-CBS non-compatible color-TV on Channel 2, with the RCA-NBC compatible test broadcasts on Channel 4, during the morning hours.

On the NBC channel, they received clear, sharp, contrasty black-white pictures and followed the program with interest; on the CBS channel, a meaningless kaleidoscope of dancing dots and lines confronted the patient observer.

Hundreds of enthusiastic phone calls came to NBC, many testifying that the black-white reception of the color program was even better than standard black-white transmissions.

Meanwhile, at Radio City, the press and interested industry representatives were being shown the color transmission in full color on RCA's new 21-inch color tube which gives a color picture 12½ x 16½ in., in addition to color pictures on the 16-inch color tubes previously seen. Simultaneously, standard black-white receivers reproduced the color program as excellent black-white pictures.

Improved Colors and Circuits

The new RCA colors showed additional improvement in life-like tints, and were declared by critical observers to be equal or superior to any other color-TV system.

"Compatible color can be logically introduced into television broadcasting with advantage to everyone and loss to none," said RCA president Frank M. Folsom. "Proper introduction will assure a fertile base for a healthy growth of the entire television industry. During the coming months, the public will have an opportunity to see the RCA color system and judge its many advantages through our field tests. We also plan to send the color programs to other cities in network operation."

Dr. E. W. Engstrom, vice president in charge of research of RCA Laboratories, reported that since the showing of the RCA color television in Washington last December, a number of improvements have been achieved. He declared:

"We have refined and put into pilot-plant production our tri-color kinescope, details of which were turned over to the radio-television industry three weeks ago. We have improved the circuitry of studio equipment and receivers. And we have also improved the operation of our system.

Cooperation with NTSC

Dr. Engstrom said that during the course of the field tests, programs originating in New York will be checked over network facilities, radio relay and coaxial cable. He disclosed that RCA proposes to make field test signals and field test experience available to RCA licensees and to members of the panels of the National Television System Committee.

"Schedules for some of this are already being set," Dr. Engstrom declared. "Later during the summer when our transmissions become more regular we will keep the appropriate NTSC panel advised as to the times and conditions of transmissions. We have already provided specifications on the signals we are currently using. It is our plan to participate in the work of the NTSC in arriving at industry standards. This, of course, is for the purpose of seeking approval for the establishment of a compatible color-television system."

21-INCH TRI-COLOR TUBE

E. W. Engstrom, vice president in charge of research for RCA Laboratories, explains the RCA tri-color television picture tube to a group. He is holding a cut-away model of the 16-in. picture-size tube, which RCA is turning over to its licensees with complete manufacturing details. Below is RCA's newest 21-inch tri-color tube, which will afford the largest direct-view color TV pictures ever seen.

NTSC Panels Reorganized for Color-TV

The National Television System Committee, which recently released an "ad hoc" committee report on a new color television system, has reorganized and established nine new panels.

This reorganization is the first step of the NTSC in carrying out the program announced by Dr. Baker, chairman, in releasing the committee report for the development of recommended standards for an NTSC color system.

The NTSC ad hoc committee report (see July TELE-TECH, page 29), outlined "the broad framework of a new composite system of color television." The industry was subsequently called upon by Dr. Baker to take part in the development of the new color system by producing and testing equipment. This work, he said, would be coordinated by the NTSC panels of technical experts.

Appointment of Dr. Elmer Engstrom, vice president in charge of research, RCA Laboratories Division, as an additional vice-chairman of the NTSC also was announced by Dr. Baker.

The nine new panels and their chairmen and vice chairmen are as follows:

Subjective Aspects of Color—Dr. A. N. Goldsmith, of New York, chairman; D. E. Hyndman, of Eastman Kodak Co., vice chairman.

Color System Analysis—D. G. Fink, chairman; A. G. Jensen, Bell Telephone Laboratories, vice chairman.

Color Video Standards—A. V. Loughren, Hazeltine Electronics Corp., chairman; W. T. Wintringham, Bell Telephone Laboratories, vice chairman.

Color Synchronizing Standards—D. E. Harnett, General Electric Co., chairman; M. R. Briggs, Westinghouse Electric Corp., vice chairman.

Compatibility—Dr. D. E. Noble, Motorola Inc., chairman; Rinaldo DeCola, Admiral Corporation, vice chairman.

Field Testing—Dr. T. T. Goldsmith, Allen B. DuMont Lab., Inc., chairman; G. E. Gustafson, Zenith Radio Corp., vice chairman.

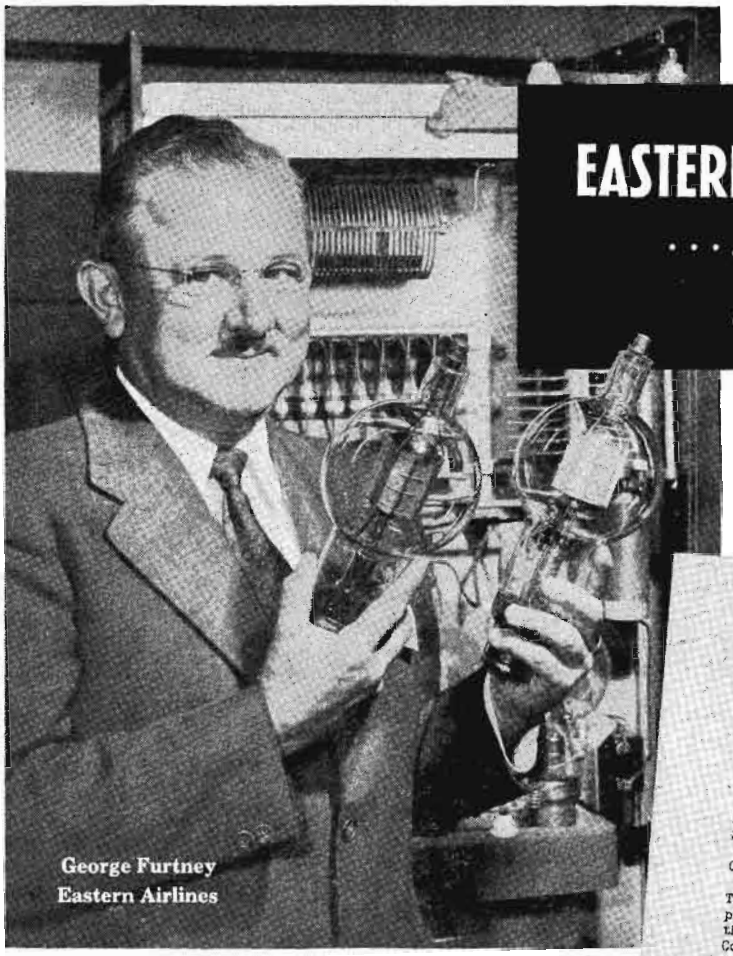
Network—Frank Marx, American Broadcasting Co., chairman; R. E. Shelby, National Broadcasting Co., vice chairman.

Co-ordination—David B. Smith, Philco Corp., chairman; I. J. Kaar, General Electric Co., vice chairman.

Definitions—Dr. R. M. Bowie, Sylvania Electric Products Inc., chairman; M. W. Baldwin, Jr., Bell Telephone Laboratories, Inc., vice chairman.

Dr. Albert F. Murray, contributing editor of TELE-TECH, has been added to the general committee as representative of Caldwell-Clements, Inc., with O. H. Caldwell, editor of TELE-TECH, as alternate.

Committee members will this month attend a series of color-TV demonstrations as follows: Aug. 6, GE, Syracuse, N. Y. Aug. 7, Hazeltine, Little Neck, N. Y. Aug. 8, RCA, Princeton, N. J. Aug. 9, Philco, Morrisville, Pa. Aug. 10, IRE Headquarters, New York City.



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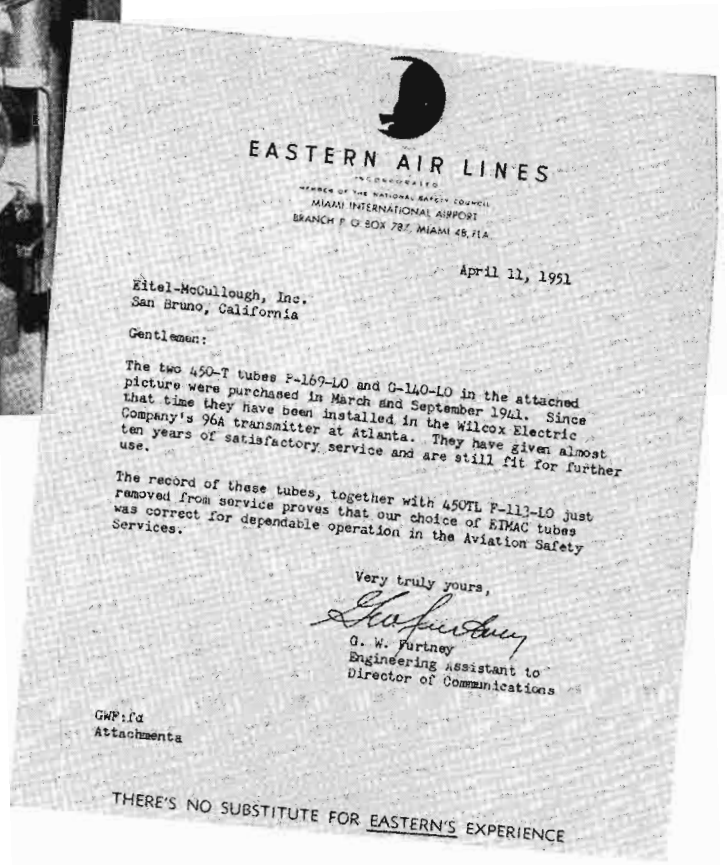

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The two 450-T tubes P-169-LO and G-140-LO in the attached picture were purchased in March and September 1941. Since that time they have been installed in the Wilcox Electric Company's 96A transmitter at Atlanta. They have given almost ten years of satisfactory service and are still fit for further use.

The record of these tubes, together with 450TL P-113-LO just removed from service proves that our choice of EIMAC tubes was correct for dependable operation in the Aviation Safety Services.

Very truly yours,

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The statement by George Furtney of Eastern Air Lines once more proves that the workhorses of modern commercial communication systems are the Eimac 450T type triodes. Their dependability is unchallenged.

The 450T is rated at 450 watts plate dissipation, 6000 max. plate volts, and 600 ma. max. plate current at frequencies as high as 40 Mc. They are widely used as either amplifiers, oscillators, or modulators. Complete data and application notes will be furnished upon request.

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WASHINGTON
News Letter

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

MEETING GOAL—The electronics-radio manufacturing industry has been meeting in an extremely excellent fashion the increasing requirements of the Armed Services in the national defense mobilization task, one of the three top officials of the Defense Production Administration told TELE-TECH'S Washington news bureau just before the August press deadline. This achievement has been particularly helpful to the military services and the DPA in the fact that it has meant the flood of new airplanes and tanks which, as they are rolling off the production lines, have had their electronics-radio-radar equipments always meeting the target dates of installation.

TELEVISION PROGRESS—Even with the mobilization difficulties of obtaining materials and metals, the television industry has demonstrated that it has been built on a most sound foundation. There is strong hope that the FCC "freeze" on new television station construction will be lifted finally late this fall. Chairman Wayne Coy has promised this to the industry in several recent pronouncements at television broadcasters' meetings. Two thousand stations is the goal for the nation.

SCARCE MATERIALS—While the scarce materials situation prevent its consummation as soon as the freeze is lifted, a number of new stations are ready to launch into construction with higher power and pooled use of antennas with existing stations. The FCC allocations hearings on channel assignments which commenced July 23 were slated to disclose blueprint for industry's immediate growth.

UHF CONVERTER DEMONSTRATION — Federal Communications Commissioners were greatly impressed with simplicity and relative inexpensiveness of equipment devised by a number of leading manufacturers for conversion of VHF television receivers for UHF reception at the Bridgeport, Conn., demonstration and the results mean FCC can go ahead with construction authorizations for UHF television stations.

YEAR OR MORE OFF—Both FCC and the radio-TV industry are cognizant of realities that it may take a long time to establish UHF video so extensively that present set owners will find it necessary to purchase new converter equipment. Credit goes to the Radio-Television Manufacturers Association, however, for the successful demonstration in which Capehart-Farnsworth, Crosley Division of Avco, General Electric, Hallicrafters, Philco, RCA-Victor Division, Stromberg-Carlson and Zenith exhibited with actual tests their equipment, the reception demonstrations being geared to the experimental transmissions of National Broadcasting Company's UHF station KC2XAK.

RTMA's NEW PREXY—Although he has occupied the presidency of the Radio-Television Manufacturers Association, only since April 1, Glen McDaniel has tackled a number of the industry's major problems in an energetic manner and has achieved remarkable success. Aided by the RTMA Tax Committee, he persuaded the House to reject any increase in the excise tax on radio and television sets and has good prospects of similar action by the Senate.

TAX RELIEF—It also appears probable that the RTMA chieftain convinced Congress of the imperative need of relief for the television and radio broadcast receiver industry of liberalized credit provisions for its purchasing public on Regulation W in the revised Defense Production Act. In national defense mobilization procurement, RTMA under Mr. McDaniel's leadership has organized "small business" manufacturers, both end-equipment and components, to secure a greater share of the military orders contracting.

UHF AERONAUTICAL—First installations, initially about 125 stations, under the joint program of the Air Force, Naval Aviation and Civil Aeronautics Administration to equip all CAA communication stations and centers with UHF facilities are slated to be completed before the end of this summer. Project will provide military services' aircraft and civilian air transport planes with ground contact through UHF frequencies in all sections of the country. Navy is at present using UHF equipment and Air Force has a newly designed airborne UHF transmitter-receiver set in production. UHF equipment for CAA stations is being supplied through the Air Force and Navy through its manufacturers under DO ratings.

HUGE INCREASE—Growth of Petroleum Radio Service—mobile, microwave and geophysical—has skyrocketed during past year. The number of transmitters in seven regions of nation increased 85% and users averaged a rise of nearly 40%. Atlantic Seaboard states recorded largest growth of any region, 175% in number of transmitters and 100% in number of users. Mushrooming of Petroleum Radio has intensified problem of frequency sharing which industry is solving through capable special and regional frequency coordinating committees.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington, Editor

Video Levels

(*Continued from page* 47)

The maintenance of constant set-up, at all times, is extremely important in order that brightness adjustments in receivers should not require changing. This is important in successive scenes in any one program, and it is equally important in successive programs, whether they originate in the same station or not. It is, therefore, urgent that all stations adopt uniform procedures and uniform instrumentation which will make possible accurate measurement of this and other video levels.

It is recognized that the proposed scales do not permit a high degree of accuracy in measurement, but universal use of the same methods and tools will at least provide the first step on the way toward achievement of uniformity.

The cathode ray oscilloscope has been regarded almost universally as the only suitable instrument for the measurement of video levels. Probably, the principal reason for this is that the television signal is a composite of several signals, each having levels that need accurate measurement individually and in their relationship to each other. Circuitry is rather well known which would make it possible to measure any of these quantities by means of a meter with the same advantages that are inherent in the use of audio level meters. However, it is not possible to provide simultaneous measurement of all the quantities in a single meter, and the circuit complexities involved in using several meters at each monitoring position would be greater than those associated with a CRO. Furthermore, because of inherent sluggishness, both electrical and mechanical, the meter system is incapable of indicating the presence or amplitude of isolated narrow peaks in the signal. It is also incapable of indicating any information about waveshape in the measured signal, and therefore fails as a monitor of quality.

Because the CRO does measure all levels simultaneously, at the same time giving detailed information about waveshape, and because it has no appreciable sluggishness, it can serve as a universal instrument for indicating both level and quality. Its use as a level indicator over such a long period has undoubtedly established an acceptance which would be difficult to change. In any case, there has been no definite trend as yet away from the use of the CRO in television monitors.

Post-war experience gained in the use of television equipment has

(*Continued from page* 60)

shown that the presentation on the face of a CRO tube is easily misinterpreted in the measurement of levels if there are any spurious overshoots in the signal. Overshoots may arise from any of several causes such as faulty circuits or tubes, or from a type of distortion introduced by single-sideband transmission circuits. Sometimes, the overshoots may arise in the measuring instrument (CRO amplifier) itself. It has been found that when spurious peaks are present, different operators do not interpret their significance in the same way. In measuring levels, one operator may discount the presence of the overshoots completely, while another may regard them as a part of the signal to be measured. In network operation, it is particularly important that levels be measured on the same basis at all monitoring points, and it is hardly less important in studio equipment. A desirable solution to the problem of uniformity is to make the measuring instrument insensitive to such spurious overshoots, and thus remove the human factor of interpretation.

To accomplish this result, the previously mentioned IRE Standard also includes a specification of a frequency characteristic for CRO's which are to be used for measuring levels only. This characteristic is reproduced in Fig. 5 from the IRE Standard. The bandwidth is considerably restricted and the "roll-off" at the upper end of the band is gradual. The resultant effect is to eliminate most of the higher frequency components in the signal, including most of the overshoots. Corners of the pulses in normal signals become rounded, but the amplitudes of blanking pulses and low frequency signal components are not affected. Because nearly all scenes contain at least a few relatively large areas of average contrast, the loss of high frequency response in the CRO amplifier does not often affect the accuracy of level measurement. Practical experience indicates that use of CRO's with this response characteristic does help to reduce operators' disagreements about levels.

It should be emphasized that this type of restricted bandwidth is not suitable for gauging the quality of a picture signal, but *only* for measuring levels, and then only to minimize the errors introduced by spurious overshoots. It is rather interesting to note that one early type of television studio monitor (RCA Type KE5, designed in 1936) employed CRO's with a restricted pass band very

(*Continued on page* 64)

NEWS . . .

Munitions Board Relay Committee

Commander Ralph T. Brengle, USNR, sales manager of Potter & Brumfield, Princeton, Ind., relay manufacturers, has been appointed chairman of the newly formed 13-man Relay Industry Advisory Committee of the Munitions Board.

R. T. Brengle

The Munitions Board coordinates procurement, producion and distribution activities of the Army, Navy and Air Corps within civilian industry. It has charge of the military aspects of industrial mobilization. It coordinates purchases and is responsible for standardization of specifications. It also decides what strategic materials are needed for stockpiling. Purchases, however, are made by another government agency, the Emergency Procurement Service.

Other members of this Relay committee are: Col. T. M. Natt, USAF, GOV'T chairman, Electrical Div., MB., Wash., D. C.; H. W. Pfeffer, president, Struthers-Dunn, Philadelphia, Edward Gillette, president, Allied Control, New York; Dan Dooley, vice-president, C. P. Clare & Company, Chicago; Emory Howe, Comar Electric Company, Chicago; John Rowell, sales mgr., Guardian Electric Co., Chicago; Joseph F. Clark, Leach Relay Company, Los Angeles; J. Crissinger, North Electric Mfg. Company, Galion, Ohio; James Roughan, sales manager, Price Electric Co., Frederick, Md.; Richard Fischer, president, Sigma Instruments, Boston, Mass.; A. C. Keller, Switching Apparatus Engineer, Western Electric Co., New York; Harold L. Olesen, Weston Electrical Instrument Corp. Newark, N. J.; F. H. Clark, Westinghouse Electric Co., Pittsburgh, Pa.

G. E. Pray Heads General Electrosonics, Inc.

General Electrosonics, Inc., 32 West 22nd St., New York, N. Y., has been organized to engage generally in the electronic field, specializing in ultrasonic, radar, loran and precision test equipment. The corporation will develop and manufacture radar and ultrasonic products for numerous applications in industry and medicine; develop and manufacture radar, ultrasonic and loran products for governmental use, and develop and manufacture precision test equipment. The developments and devices manufactured by the corporation will be sold by the corporation, as well as being manufactured on a contract and sub-contract basis for industry and government.

President Pray has served as assistant chief, radio receiver section, Naval Research Laboratory, Washington, D. C.; chief engineer of the Electric Service and Supply Company, Watervliet, New York; research engineer, R.C.A. Laboratories, Rocky Point, N. Y.; research engineer, Signal Corps, Laboratories, Ft. Monmouth, New Jersey; chief engineer, Airplane and Marine Instruments, Inc., Clearfield, Pa.; and President of Radio Sonic Corporation, New Rochelle, New York.

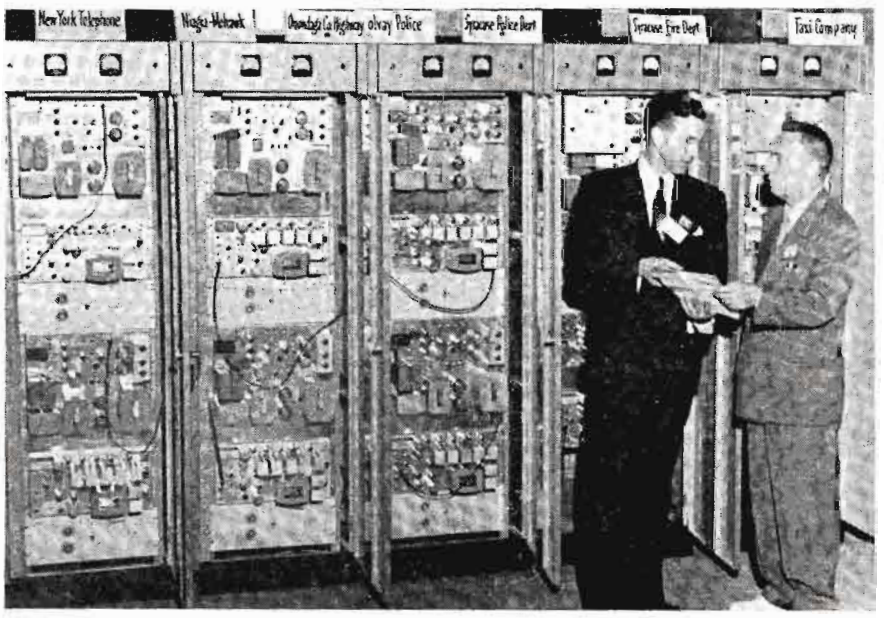
Safety Council Reports Injury Rate Down

American workers were a lot safer in 1950, according to a report of the National Safety Council. Industrial injury rates for last year, released by the Council in advance of the 1951 edition of its annual statistical yearbook, "Accident Facts," show a substantial reduction in both the frequency and severity of 1950 accidents as compared with 1949. Twenty-nine of the 40 basic industry classifications reduced their frequency rates, and 23 reduced severity rates.

The accident frequency rate for employees in all industries submitting company reports to the Council, based on the number of disabling injuries per 1,000,000 man-hours, was 9.3 in 1950; a reduction of 8% from the year before.

The communications industry again led all other industries by turning in the lowest employee frequency rate. Its rate was 2.05—a 4% reduction from 1949. Aircraft manufacturing again ranked second with 4.17, followed by the electrical equipment industry with 4.28 and steel with 4.63.

GE SUPPLIES MOBILE EQUIPMENT FOR CIVIL DEFENSE



Radio equipment being built by General Electric for installation in a trailer to be used by Civil Defense officials as the hub of an emergency communications system in Onondaga County, N. Y. This mobile communications CD center will be in contact with various Civil Defense agencies, many of which now operate their own two-way radio systems. It will also be tied into the telephone system and the amateur radio network. Neal F. Harmon (left), C-E civil defense coordinator at Syracuse, discusses system with Harvey S. Smith, Onondaga County civil defense director.

Coming Events

August 15-18—Associated Police Communication Officers, 1951 Conference, Everglades Hotel, Miami, Fla.

August 17-18—IRE Emporium Section, 12th Annual Summer Seminar, Sylvania Electric Products, Inc., Emporium, Pa.

August 22-24—7th Annual Pacific Electronic Exhibit, 1951 IRE Western Convention, Civic Auditorium, San Francisco, Calif.

September 10-14—Sixth National Instrument Conference and Exhibit, Sponsored by Instrument Society of America, Sam Houston Coliseum, Houston, Texas.

September 11-13—National Electronic Distributors Association, 1951 Convention and Show, Cleveland, Ohio.

October 2-4—Association of American Railroads, Communications Section, Annual Convention, Chateau Frontenac Hotel, Quebec, Canada.

October 22-24—Seventh National Electronics Conference, Edgewater Beach Hotel, Chicago, Ill.

October 29-31—1951 Radio Fall Meeting, RMA of Canada, RTMA Engineering Dept., and the IRE, King Edward Hotel, Toronto, Canada.

(*Continued from page* 62)

similar to that in the present IRE Standard. In later versions (RCA Types 542 and TM5) the pass bands were extended to several megacycles to make them more suitable for judging quality. Present design trends are to make both types of frequency characteristic available by switching.

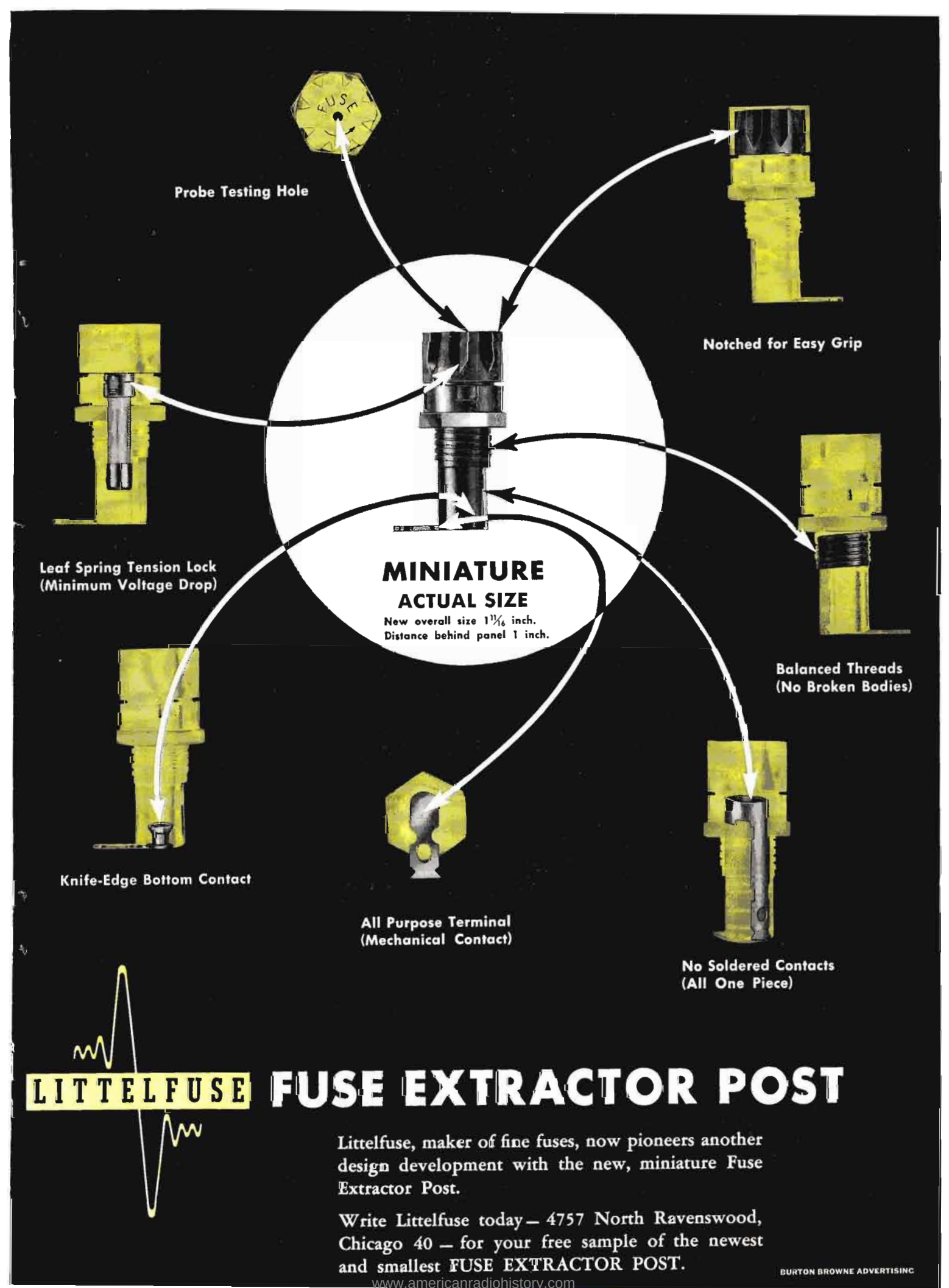
To illustrate the effect of reducing the frequency response, several oscillograms are reproduced in Figs. 6 to 9 inclusive. The wide-band CRO used to obtain the pictures in Figs. 6 and 8 was an RCA type 715B. The narrow-band CRO used to obtain the pictures in Figs. 7 and 9 was a modified TM5B Master Monitor. The signal source in every case was a TK1B Monoscope Camera. Overshoot distortion for Figs. 8 and 9 was produced artificially, and is more severe than is usually encountered, but nevertheless, it serves to show the effect of the restricted band pass of the CRO. Horizontal sweep rate in each case is at one-half of scanning line frequency.

A discussion of methods by which the RCA TM5A and B Master Monitors may be modified to provide the IRE roll-off characteristic will be made available at a future date.

1. Standard, 50 IRE 23.S1—Television: "Methods of Measurement of Television Signal Levels, Resolution, and Timing of Video Switching Systems, 1950." This standard was published in the May, 1950 issue of Proceedings of the IRE. Reprints may be purchased from the Institute of Radio Engineers, 1 East 79th Street, New York City, for $10.70 each.

Allen Succeeds Plummer as FCC Chief Engineer

Edward W. Allen, Jr., former chief of the FCC technical research division, has been appointed chief engineer of the Commission. He succeeds Curtis B. Plummer, who became chief of the new broadcast bureau. Native of Portsmouth, Va., Allen received his electrical engineering degree from the University of Virginia in 1925 and an LL.B. from George Washington University in 1933. He was a student engineer and research assistant with Westinghouse Electric & Manufacturing Co. from 1925-27 and in 1929-30 he was assistant engineer with the Chesapeake & Potomac Telephone Co., Washington. He entered Government service in late 1930 with the U. S. Patent Office and on April 16, 1935, was transferred to the FCC as assistant technical engineer on the special telephone industry investigation staff. A year later he was made an assistant telephone engineer on the Commission's regular engineering staff. Allen was made chief of the technical information division, now the technical research division, Feb. 24, 1946. He played an important role in the allocation of FM in the 88-108 MC band.



LITTELFUSE

FUSE EXTRACTOR POST

Littelfuse, maker of fine fuses, now pioneers another design development with the new, miniature Fuse Extractor Post.

Write Littelfuse today — 4757 North Ravenswood, Chicago 40 — for your free sample of the newest and smallest FUSE EXTRACTOR POST.

BURTON BROWNE ADVERTISING

"Junction" Transistors Developed by Bell Laboratories

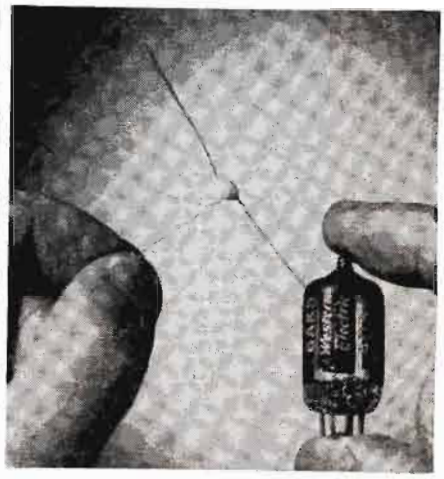
Ability to control the degree of impurity in germanium has led to the development of a new "junction" type transitor that exhibits some remarkable electrical properties. This Bell Telephone Laboratories Inc. development program, under the direction of J. A. Morton, has borne out Dr. William Shockley's prediction of the new type made more than two years ago. Dr. Shockley, it will be remembered, developed the original "point contact" transistor which, incidentally, because of the great increase in performance uniformity achieved, is being put to trial use in the Bell System early next year.

Junction transitors are encased in a hard plastic bead about 3/16 in. in diameter and occupying about 1/400 of a cu. in. of space. Their operation is accompanied by extremely small power consumption and relatively high efficiency. For example, as an audio oscillator 6 μamps at 0.1 volt might be required. This represents 0.6 μwatt of power which contrasts sharply with the watt or more required to heat the cathode in an ordinary receiving type tube.

Design of these new units can be varied to permit power dissipations up to two watts. Static characteristics are nearly ideal so that Class A efficiencies of 48 or 49 out of a possible 50% can be realized. Class B and C operation efficiency is correspondingly high reaching as much as 98%. Input and output impedances are always positive, whether the transitor is connected grounded-emitter, grounded-base or grounded-collector. This permits a great deal of freedom in circuit design and makes it possible, by choosing the appropriate connection, to obtain a considerable variety of input and output impedances.

Vibration tests in the audio frequency range produce no measurable microphonic noise. Other salient characteristics are its relatively low noise figure (1000 times less than that of its predecessor), and its high gain.

While studies indicate that collector capacitance limits the frequency response at full gain to a few kilocycles, it is possible by using a suitable impedance mismatch to maintain the frequency response flat to at least one megacycle while still obtaining a useful amount of gain. At 1000 cps, most of the units measured so far have a noise figure between 10 and 20 db. Power gains of the order of 40 to 59 db per stage have been obtained.

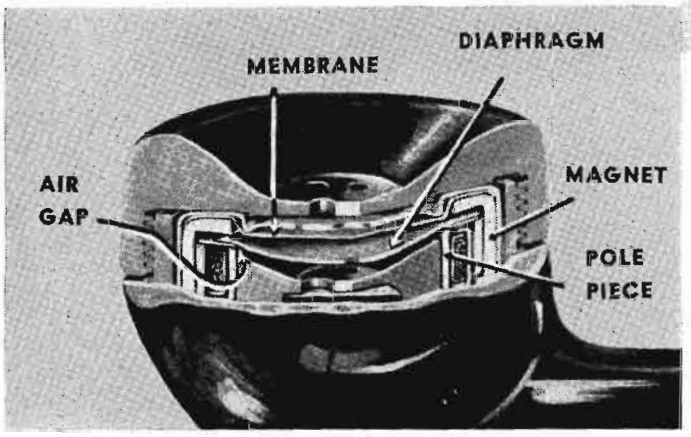


BTL's new "junction" transistor

C-D Sales Gain

Consolidated net sales of Cornell-Dubilier Electric Corporation and its subsidiaries for the three months ending March 31, 1951, totalled $9,224,746; a gain of 69% over net sales of $5,436,-316 for the three months ending March 31, 1950. Net income for the quarter ending March 31, 1951, amounted to $606,508 after all charges, including provision of $1,326,500 for income taxes, equal—after preferred dividend requirements—to $1.39 per share of outstanding common stock. For the corresponding period in 1950, net income amounted to $246,141 after provision of $150,800 for income taxes.

Easy on the ear



More naturally than ever, your voice comes to the ear that listens through the latest telephone receiver developed at Bell Telephone Laboratories. The reason: a new kind of diaphragm, a stiff but light plastic. Driven from its edge by a magnetic-metal ring, the diaphragm moves like a piston, producing sound over all of its area. Effective as are earlier diaphragms of magnetic-alloy sheet, the new one is better, gives more of the higher tones which add that personal touch to your voice.

To work the new receiver, telephone lines need deliver only one-third as much power. So finer wires can do the job. This is another new and important example of the way scientists at Bell Telephone Laboratories work to keep down the cost of telephone service, while the quality goes up.

BELL TELEPHONE LABORATORIES

WORKING CONTINUALLY TO KEEP YOUR TELEPHONE SERVICE ONE OF TODAY'S GREATEST VALUES

SHOCK TESTING

(*Continued from page 37*)

The maximum stress in the beam is proportional to this maximum acceleration. As a general rule, the maximum stress in rigid structural elements of the equipment tends to be proportional to the maximum acceleration of the elevator. The maximum stress in flexible elements tends to be proportional to the change in velocity of the elevator.

Since the velocity change experienced by the elevator has a known relation to the height from which the elevator is dropped, a shock test may be completely defined by the height of free fall and the maximum acceleration of the elevator. Any other parameters tend to be irrelevant, except insofar as the frequency of the impulse which arrests the elevator is used as a reference to determine whether the beam should be considered stiff or flexible. If the natural frequency of the beam-load system is approximately equal to the impulse frequency, the stress in the beam is magnified somewhat by a condition having some resemblance to resonance. This effect is quite moderate, as indicated in Fig. 15.

In considering shock tests of equipment mounted upon shock or vibration mounts, three frequencies are significant; viz., (1) the natural frequency of structural elements of the equipment, (2) the frequency associated with the stopping of the elevator, and (3) the natural frequency of the system consisting of equipment and shock or vibration mounts. The analysis may be carried out in two separate and discreet steps. The chassis of the equipment and its mounts are first considered analogous to the beam-load system shown in Fig. 4. Since the natural frequency of an equipment on its mounts usually is relatively low, the frequency ratio on the abscissa of Figs. 15 and 16 is small. The maximum acceleration experienced by the chassis of the equipment then becomes directly proportional to the change in velocity of the elevator table and inversely proportional to the natural frequency of the equipment on its mounts. Considering now the combination of systems comprised of the mounted equipment and a beam-load system within the equipment, the force which is applied to the equipment to arrest its downward motion is applied by the mount. The mount may then be considered analogous to the shock testing machine, and the natural frequency of the equipment-and-mount assembly may be substituted for the frequency in the denominator of the ratio which forms the abscissa of Figs. 15-16. This frequency probably is small compared with the natural frequencies of structural elements of the equipment, and the frequency ratio in the abscissa of Figs. 15 and 16 becomes large. The maximum acceleration experienced by the structural elements then tends to become equal to the maximum acceleration experienced by the chassis of the equipment, which in turn is proportional to the change in velocity of the elevator table. It thus appears that, for mounted equipment, the severity of the shock is proportional to the change of velocity of the elevator; i.e., to the height of free fall of the elevator.

Conclusions

The following conclusions may be drawn as a result of the foregoing discussion:

1. The severity of a shock test is indicated, in general, by the maximum stress induced in structural members of the equipment undergoing test. This stress tends to be proportional to the maximum acceleration experienced by loads carried

by the structural members, but not necessarily proportional to the maximum acceleration experienced by the elevator of the shock testing machine.

2. The maximum stress in relatively rigid members of the equipment tends to be proportional to the maximum acceleration of the elevator, whereas the maximum stress in relatively non-rigid members tends to be proportional to the velocity change of the elevator, or to its height of free fall. In specifying a shock test, it is adequate to call for a designated maximum acceleration of the elevator as obtained from a designated height of free fall.

Figure Credits

Fig. 11. Raytheon Mfg. Co. photo. Fig. 12. From "Response of Damped Elastic Systems to Transient Disturbances", by R. D. Mindlin, F. W. Stubner and H. L. Cooker, Proc. SESA, Vol. V, No. 11, Addison-Wesley Press, Inc.

REFERENCES

3. The velocity change is the time integral of the acceleration. This integral cannot be evaluated, however, unless the exact shape of the acceleration-time diagram is known. Uncertainties as to this exact shape makes it undesirable, in general, to specify shock in terms of duration of the acceleration pulse.

4. If the acceleration is expressed as a dimensionless multiple of the gravitational acceleration, in g units, the weight of the load is used. If the acceleration is expressed in dimensional units (in./sec.^{2} or ft./sec.^{2}), the mass of the load is used.

Radiomarine Installs Radar Aboard "Constitution"

The 1250th postwar commercial shipboard radar manufactured by the Radiomarine Corporation of America has been installed on board the American Export Line's newest 29,500-ton ocean greyhound, the S.S. Constitution. It is of postwar design, operating on the super-high frequency X-band, with a range from 75 yards to 40 miles.

Groth to Erie Resistor

Gordon Groth has been appointed executive vice-president of the Erie Resistor Corporation, Erie, Pa., announces G. Richard Fryling, president of the firm. For the past two years, Mr. Groth has been president of the Electra Manufacturing Company of Kansas City, Mo. Prior to that time he was general manager of the Pennsylvania Rubber Company of Jeannette, Pa. He has also been connected in an executive capacity with the Carnegie Illinois Steel Company. Mr. Groth's experience and his association activities have given him thorough familiarity with the automotive, communications and electrical manufacturing industries. In these fields are the main customers for custom molded plastics parts and radio, television and radar parts manufactured by Erie Resistor Corporation.

IRE Technical Papers

(*Continued from page* 39)

Massachusetts Institute of Technology.
"Synthesis of Cascaded 3-terminal R-C Networks with Transfer Ratios That Contain Complex Zeros" by H. L. Krauss, F. Hopkins, E. L. Sparrow and P. F. Ordung —Yale University.
"Network Synthesis Using Tchebycheff Polynomial Series" by Dr. S. Darlington—Bell Telephone Laboratories.

Handling and Utilization of Information

Dr. Archie R. Tunturi, University of Oregon Medical School, will speak on: "The Auditory Cortex and Information Theory."
Dr. Bernard M. Oliver, Bell Telephone Laboratories, will speak on: "Exploitation of Message Statistics."
Dr. R. Fano, Massachusetts Institute of Technology, will speak on: "The Performance of Communication Systems in the Presence of Noise."

FRIDAY, AUGUST 24

Vacuum Tubes

"Electron Tube Reliability" by E. Finley Carter—Sylvania Electric Products Inc.
"Storage Tubes of Progress" by Andrew V. Haeff—Hughes Aircraft Company.
"Review of Recent Developments in Klystrons" by Dr. Russell H. Varian—Varian Associates.
"Survey of Traveling Wave and Related Vacuum Tube Devices" by Dr. L. M. Field —Stanford University.

Special Equipment

"The Bennett Radio Frequency Mass Spectrometer" by Prof. G. S. Hewitt—University of Arkansas.
"A High Speed Camera with Electronic Controls" by Dr. R. Bowersox—Jet Propulsion Laboratory, California Institute of Technology.
"A High Speed Recording Potentiometer" by C. Nylkema and Dr. R. Bowersox—Jet Propulsion Laboratory, California Institute of Technology.
"A Single Sideband Communications System" by John F. Honey—Stanford Research Institute.

Antenna Applications

"An Organ Pipe Scanner" by G. D. M. Peeler, K. S. Kelleher and H. H. Hibbs—Naval Research Laboratory.
"A Broadband Microwave Quarter-Wave Plate" by Alan J. Simmons—Naval Research Laboratory.
"Modified Magic Tee Phase-Shifter" by Richard H. Reed—Hughes Aircraft Company.
"Polarization Switch and Universal Horn" by Sanford Hershfield—The Glenn L. Martin Company.

Computors

"The ERA 1101 Digital Computer" by John L. Hill—Engineering Research Associates.
"Man-machine Communication in the Computer Field" by Bernard S. Benson—Benson-Lehner Corporation.
"Reduction of vonNeumann's Constant in Electronic Computing Equipment" by R. G. Canning—Naval Air Missile Test Center.
"The Maddida 44A Computer" by C. B. Dennis—Northrop Aircraft.
"Performance of Electronic Components in the SWAC" by Edward Lacy—National Bureau of Standards, Los Angeles.

Astron Capacitors

Astron Corp., 255 Grant Ave., East Newark, N. J., manufacturers of capacitors and noise suppressors, are now packing their products in distinctive new red-and-black cartons. "Metalites", the metallized paper capacitors which have earned a reputation for self-healing efficiency and light weight, are being sold in these new cartons; also many of Astron's varied line of dry electrolytics, as well as other Astron products. Latest Astron catalog may be had by writing the company.

MILITARY CONTRACT AWARDS

Manufacturers who have received contract awards for producing of radio-radar-electronic equipment for the Armed Services are listed below by name, city and equipment. Subcontractors interested in bidding on performance of any part of each contract should sell their services to these prime contractors. This list, which is current up to our press time, covers the period from June 6 to June 27.

Adapters

Smoot Holman Co., Inglewood, Calif.; White Tuning Corp., N. Y. City; Stevens Walden, Worcester, Mass.

Antennas

Blaw-Knox Co., Pittsburgh, Pa.; Dayton Aircraft Products, Dayton, Ohio; Wilcox Electric Co., Kansas City, Mo.

Antenna Coupling Units

Technical Material Corp., Mamaroneck, N. Y.

Amplifier Assemblies

Air King Products Co., Brooklyn, N. Y.; Coast Industries, N. Y. City; Wickes Engineering & Construction Co., Camden, N. J.

Cable

American Flange & Mfg. Co., N. Y. City; Collyer Insulated Wire Co., Pawtucket, R. I.; Crescent Insulated Wire & Cable Co., Trenton, N. J.; Hackensack Cable Corp., Hackensack, N. J.; Federal Telephone & Radio Corp., Clifton, N. J.; Phelps Dodge Coffin Products Corp., N. Y. City; J. & H. Smith Mfg. Co., N. Y. City; Simplex Wire & Cable Co., Cambridge, Mass.; Western Electric Co., N. Y. City.

Circuit Breakers

Avon Electric Supplies, Inc., New York, N. Y.; Graybar Electric Co., Phila., Pa.; Electric Supply Corp., Chicago, Ill.; I-T-E Circuit Breaker Co., Phila., Pa.

Connectors

American Gas Accumulator Co., Elizabeth, N. J.; Bendix Aviation Corp., Scintilla Magneto Division, Sidney, N. Y.; Cannon Elec., Los Angeles, Calif.; Continental Electronics Co., Brooklyn, N. Y.; Kings Electronics Co., Tuckahoe, N. Y.; General Electric Supply Corp., Dayton, Ohio.

Crystal Units

Downing Crystal Co., Baltimore, Md.; General Electric Co., Syracuse, N. Y.; K. C. Molded Plastics Co., Kansas City, Mo.; Keystone Electronics Co., Stamford, Conn.; James Knights Co., Sandwich, Ill.; Midland Mfg. Co., Inc., Kansas City; August E Miller, North Bergen, N. J.; Monitor Products Co., South Pasadena, California; Petersen Radio Co., Council Bluffs, Iowa; Scientific Radio Prods., Inc., Omaha, Neb.; Standard Crystal Co., Kansas City, Kans.

Electron Tubes

Bomac Labs., Inc., Beverly, Mass.; General Electric Co., Schenectady, N. Y.; Hytron Radio & Electronics Corp., Salem, Mass.; Kemtron Electron Products, Inc., Salem, Mass.; Radio Corp. of America, Camden, N. J.; Sylvania Electric Products, Inc.; N. Y. City; Tung-Sol Lamp Works, Newark, N. J.; Western Electric Co., N. Y. City.

Generators

Belden Mfg. Co., Chicago, Ill.; Bendix Aviation Corp., Bendix Radio Div., Towson, Md.; Consolidated Diesel Elec. Corp., Stamford, Conn.; Enterprise Division, General Metals Corp., San Francisco, Calif.; Eicor, Inc., Chicago, Ill.; International Fermont Machine Co., Inc., Mfg. Division, Ramapo, N. Y.; Lycoming Spencer Div., Avco Mfg. Corp., Williamsport, Pa.

Hydrogen Thyratrons

Kuthe Laboratories, Inc., Newark, N. J.; Sylvania Electric Prod., Electronics Div., Boston, Mass.

Indicators

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.; General Electric

Company, Schenectady, N. Y.; Kearfott Co., Little Falls, N. Y.; Kollsman Instrument Corp., Elmhurst, N. Y.; The Lackner Co., Cincinnati, Ohio.

Inverters

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.; Jack & Heintz Precision Industries, Cleveland, Ohio.; Leland Elec. Co., Dayton, Ohio.; Royal Electric Co., Jamestown, Ohio.

Power Plants

Fairchild Engine Div., Farmingdale, N. Y.; Royal Electric, Inc., Jamestown, Ohio; Sorensen & Co., Stamford, Conn.

Radar

Gibbs Mfg. & Research Corp., Janesville, Wis.; Transducer Corp., Boston, Mass.; Transomatic Corp., Flemington, N. J.

Radio Sets

Espey Mfg. Co., New York, N. Y.; The Link Aviation, Inc., Binghamton, N. Y.

Recorder Assemblies

American Time Products, Inc., New York, N. Y.; Link Aviation, Binghamton, N. Y.

Rectifiers

McColpin Christie Corp., Ltd., Los Angeles, Calif.; P. R. Mallory & Co., Inc., Indianapolis, Ind.

Regulators

Air Research Mfg. Co., Los Angeles, Calif.; Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.; International Spare Parts Corp., L. I. City, N. Y.; General Electric Co., Dayton, Ohio; Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Relays

Hartman Electrical Mfg. Co., Mansfield, Ohio; Leach Relay Co., Los Angeles, Calif.; Standard Electrical Products Co., Dayton, Ohio.

Switches

G. & W. Electric Specialty Co., Chicago, Ill.; United States Instrument Corp., Summit, N. J.

Test Equipment

The Magnavox Co., Fort Wayne, Ind.; Servomechanism, Inc., Mineola, N. Y.; The Sperry Corp., Great Neck, N. Y.; Sun Electric Corp., Chicago, Ill.; Westinghouse Elec. Corp., Dayton, Ohio.

Transformer

American Gas Accumulator Co., Elizabeth, N. J.; Bendix Radio Division, Bendix Aviation Corp., Baltimore, Md.; Jeffries Transformer Co., Los Angeles, Calif.; Larkin Lectroproducts Corp., Pine Bluff, Ark.; Peerless Electric Products Div., Beverly Hills, Calif.; Sola Electric Co., Chicago, Ill.; Utah Radio Products Co., Huntington, Ind.

Transmitters

U. S. Gauge Division, American Machine & Metals, Sellarsville, Pa.

Tuning Units

Bendix Radio Div., Bendix Aviation Corp., Towson, Md.; Sylvania Electric Products, Inc., Buffalo, N. Y.

Voltmeters

Hewlett Packard Co., Palo Alto, Calif.; Westinghouse Electric Corp., Dayton, Ohio.

Waveguides

Airtron, Inc., Linden, N. J.; N. R. K. Mfg. & Engineering Co. Chicago, Ill.; Western Electric Co., N. Y. City.

Wire

Western Electric Co., N. Y. City.

Du-Co Ceramics Expands

Du-Co Ceramics Company, Saxonburg, Pa., announces the near completion of its expansion program which has increased its floor space to more than 21,000 sq. ft.

PERSONNEL

John Ward Dawson, formerly in charge of equipment engineering for the Stanford Research Institute, has been appointed chief engineer for the electronics division, Sylvania Electric Products Inc.

E. W. Ritter, manager of the Westinghouse Company's new electronic-tube division, has been made a vice-president. Mr. Ritter has had long experience in the development, design, and manufacture of electronic tubes, and heads a division which, upon completion of three new plants, will employ 3,000 persons in the manufacture of such tubes. Two of the plants will be near Elmira, N. Y., and the third will be at Bath, N. Y.

Gilbert Bryan Devey, employed by the Office of Naval Research, Washington, D. C., has been named Navy Department representative and consultant to the Physical Security Equipment Agency.

W. G. (Bill) Henke, formerly test-equipment design engineer of Admiral Corp., has joined Tele-Vogue, Inc., 1735 Belmont Ave., Chicago 13, Ill., as co-ordinator of engineering.

Dr. Harry F. Olson, director of the Accoustical Research Laboratory of RCA Laboratories, Princeton, N. J., has been elected president of the Acoustical Society of America for the year 1952.

T. Kevin Mallen has been elected chairman of the board of Ampex Electric Corp., San Carlos, Calif. Since joining the Ampex organization early in 1949 Mallen has served as general manager in reorganizing the manufacturing and marketing phases of the company's fast-growing magnetic tape recorder business.

Chris J. Witting has been named director of the Du Mont television network and of the three Du Mont owned and operated stations—WABD in New York, WTTG in Washington and WDTV in Pittsburgh.

E. C. Quackenbush has been appointed to head the engineering department of the newly created eastern division of Cannon Electric Development Co. of Los Angeles, Cal. Mr. Quackenbush is a well-known electrical engineer and specialist on "AN" and other types of electrical connectors and is a member of the Institute of Radio Engineers and the American Society of Metals. The new plant of the Cannon Electric Co. is located at 191 Kimberly Street, New Haven, Conn., on Highway No. 1, in East Haven.

Remote Amplifier

(*Continued from page* 54)

change in dc voltage would be transmitted for a short time to V2, when S2 is switched. R8 is a 10 megohm so as to obtain a relatively large bias for V2.

A standard 2 megohm IRC control is used as a gain control. This is used instead of the controls usually used in broadcast work, because of its smaller size.

The output circuit uses two 1D8's tube in push-pull. The triode section of the first 1D8 is a conventional amplifier with a 10 megohm grid resistor. This is coupled to the 1D8's triode, (V4) through R26 and R27 plus C17, for phase inversion. It will be noted that there is no condenser in the circuit from the plate of the first triode to ground, this is to keep phase shift in the phase invertor at a minimum; the dc current flow is small. Inverse feedback is applied from the plate to the grid of the pentode section of the 1D8s by connecting R13 and R30 respectively between the plates of the 1D8s. The bias for the pentode sections is obtained from a resistor (R23) in the B— circuit.

The output transformer has its secondary grounded by connecting the 125 ohm tap to the chassis. This is done so that the meter can be switched for checking the batteries without using a large complicated switch. A pad is connected between the transformer and the 600 ohm line. The load on the secondary is less than 600 ohms to lower the pri-

(*Continued on page* 78)

SELF-FOCUSING TUBE

James B. Lindsey, V.P. in charge of Thomas Electronics Inc., Engineering Staff and Development Laboratories holds the new Thomas Automatic, self-focusing electrostatic TV picture tube. R. E. Burrows, sales manager for Thomas, holds the focus coil and potentiometer which, with the new tube, are no longer necessary components within the set.

THE MASTER
HI-FREQUENCY, HI-POT TESTER

Used Successfully in
testing insulation in electrical and electronic applications.

For testing radio, x-ray, neon and electronic tubes, rubber linings of tanks and electrical insulations on wires, cables, shafts, propellers, etc. Instantly locates microscopic leaks or breaks.

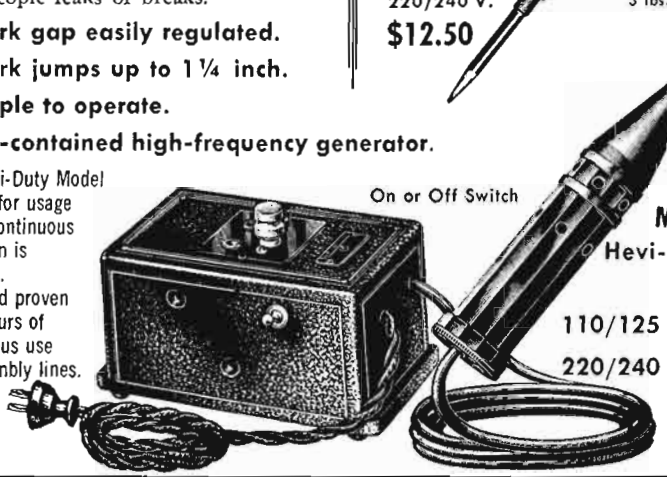
- **Spark gap easily regulated.**
- **Spark jumps up to 1¼ inch.**
- **Simple to operate.**
- **Self-contained high-frequency generator.**

A one-piece portable bakelite housing contains mechanism.

MODEL M-6
110/125 V.–
$11.35
A.C. or D.C.
220/240 V.
$12.50

Shipping weight 3 lbs.

The Hevi-Duty Model is ideal for usage where continuous operation is required. Used and proven for 2 hours of continuous use on assembly lines.



On or Off Switch

MODEL M-5
Hevi-Duty Model
A.C. or D.C.
110/125 V.—$27.50
220/240 V.—$29.00

Shipping weight approx. 5 lbs.

MASTER APPLIANCES, INC.
1600 FACTORY AVENUE • MARION, INDIANA

FM-AM
SIGNAL GENERATOR
TYPE 202-B
54-216 Megacycles

Specifications:

RF RANGES: 54-108, 108-216 mc. ±0.5% accuracy. Also covers 0.4 mc. to 25 mc. with accessory 203-B Univerter.

VERNIER DIAL: 24:1 gear ratio with main frequency dial.

FREQUENCY DEVIATION RANGES: 0-24 kc., 0-80 kc., 0-240 kc.

AMPLITUDE MODULATION: Continuously variable 0-50%, calibrated at 30% and 50% points.

MODULATING OSCILLATOR: Eight internal modulating frequencies, from 50 cycles to 15 kc., available for FM or AM.

RF OUTPUT VOLTAGE: 0.2 volt to 0.1 microvolt. Output impedance 26.5 ohms.

FM DISTORTION: Less than 2% at 75 kc. deviation.

SPURIOUS RF OUTPUT: All spurious RF voltages 30 db or more below fundamental.

AVAILABLE AS AN ACCESSORY
is the 207-A Univerter, a unity gain frequency converter, which in combination with the 202-B instrument provides additional coverage of from 0.1 to 55 megacycles.

Write for Catalog H

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BEAT FREQUENCY GENERATOR
AND OTHER DIRECT READING INSTRUMENTS

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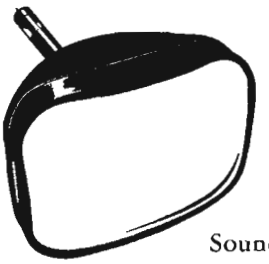

Soundcraft rectangular **television filter tubes are** available in 16", 17" and 20" sizes. You can use and recommend them with assurance because they are backed by the greater integrity and experience of the Reeves name, a foremost manufacturer in the electronics and recording field throughout the country for twenty years.

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EXPORT—REEVES EQUIPMENT CORPORATION
10 EAST 52nd STREET, NEW YORK 22, N. Y.

LETTERS...

Transmitted Signal Should Be Standardized

Editors, TELE-TECH:

Referring to your July editorial on color television:

I do not believe that it is the "system" which should be standardized but rather the transmitted signal. Naturally a standard signal does define in a broad way what must be done at the broadcasting station to produce it and what must be at the receivers to use it. However, there should be flexibility in the means to construct the standard signal and flexibility in design of receiver apparatus which will respond to the standard signal. Thus the "system" can best be defined in terms of the standard signal. More appropriate and meaningful words might be that what we are striving for is *industry standards* for compatible color television.

Very truly yours,
E. W. ENGSTROM

Vice-president in charge of Research
RCA Laboratories, Princeton, N. J.

Vice-chairman National Television System Committee

Test Color-TV in Crucible of Public Opinion

Editors, TELE-TECH:

Referring to your July editorial on "A United-Industry Compatible Color-TV System":

The RCA trichromatic tube, of course, will lend itself to the CBS system and I note that RCA has displayed a 20-in. model, so RCA has no monopoly on the size of the color display, despite what they would lead one to believe in their June 9, 1951, announcement. Unless something comes along better, I am inclined to believe that the final choice will be dependent upon the system which makes best use of the trichromatic tube since the element of size of picture disappears with its use.

You state, in the sixth paragraph of your editorial, "Several practical compatible systems and partial systems have been developed and made ready for demonstrations." As far as I know, the RCA system has been developed only to the point of demonstration to the press and industry. Neither the RCA (nor anyone else) has indicated to the Commission, that it is prepared to demonstrate a color system that will meet the criteria and other considerations that the Commission has established for a color system and which have been again set forth in the public notice of June 11, 1951, and where in Paragraph 6, the question, "Is there any possibility of a different color system being adopted in the near future," has been answered.

It will be interesting to observe the

reaction as the CBS sequential color-TV system is tested in the crucible of public opinion. I think we all should be patient and fair, since no TV system probably ever before started under such adverse circumstances as exist today.

GEORGE E. STERLING,
Commissioner
Federal Communications Commission,
Washington, D. C.

Get Public and Advertisers Acquainted with Color-TV

Editors, TELE-TECH:

I read with interest and not much enthusiasm your editorial in the July issue of TELE-TECH. My own feeling is that it's too early in the color field to get interested in your editorial. Eventually the points you make will probably be carried out but I think that greater progress will be made if the present system which has been approved be allowed to show itself and develop. New processes must not be kept in the research laboratories too long. The public, industry, trade, and in this case, advertisers, should become acquainted with this great new medium of color television and help supply some of the finances and ideas to develop it even further. There has been too much delay and stalling on the subject of color television and I have felt right along that the FCC was sound in its decision of getting color out into the hands of the public.

Competition and the economic situation will take care of progress and if someone has as good or a better system, I'm sure that no one will hold him back.

I witnessed the first commercial color television broadcast put on by Columbia. Sixteen advertisers showed their products and demonstrated the tremendous possibilities of this new medium. If Columbia and these manufacturers and some people who are willing to put down their own money for color sets, want to work with this medium and back it with their ideas and money, so much the better. This country has made its greatest strides when men with ideas and money are given an opportunity to try out their ideas and spend their money to develop an art. Columbia, with the fair backing of the FCC and a lot of advertisers, will demonstrate that a good start has been made.

EDGAR KOBAK
Radio-TV Consultant, 341 Park Ave.,
New York 22, N. Y.

Remote Amplifier

(*Continued from page 75*)

mary impedance. Phones are connected to the line through two resistors.

The chassis is made of aluminum salvaged from old transcription. First draw the chassis on the transcription, then cut out. If the coating cannot be readily removed dip in boiling water. The completed unit measures 3 x 9 x 6⅝ in. The 2⅞ x 8⅞ in. chassis has the front and rear extending down ⅞ in. and the ends ⅜ in. The back and sides are formed of one piece. The front is one piece which is bent over ½ in. on the top and the ends. The bottom is bent up ⅜ in. on the front, the back, and the sides. The top panel is 3 x 9 in. The unit is put together with bolts and sheet metal screws. In order that the lead case can be opened without removing the top panel, the outer can which was held to its base by three screws is secured with two opposite sides and a hole is drilled in the rear of the amplifier case so that the back screw can be removed.

The control R14, switch S3, and some associated parts, are mounted on a metal platform about 2½ x 3 in. The output pad, series resistors for the phones, and output line are installed on a 2 x 3 in. piece of fibre.

In mounting the unit in the record case the two B batteries are laid in the bottom with a piece of gasket material above and below. A sheet of aluminum is then laid on them. To the rear, on this panel the amplifier rests, held in place by two small blocks of wood. The A battery fits in the corner with a piece of aluminum over it.

IRE EXHIBITORS (*Continued from page 39*)

Herman E. Held, San Francisco, Calif.
Hermetic Seal Products Co., Newark 7, New Jersey.
Helipot Corporation, South Pasadena, Calif.
James P. Hermans Company, San Francisco, Calif.
Hewlett-Packard Company, Palo Alto, Calif.
J. T. Hill Sales Company, Los Angeles, Calif.
The Russ Hines Company, San Francisco, Calif.
W. C. Hitt Co., Los Angeles, Calif.
Hoffman Radio Corporation, Los Angeles, Calif.
Hycor Company, Inc., North Hollywood, Calif.
The Indiana Steel Products Company, Valparaiso, Ind.
The Institute of Radio Engineers, New York, N. Y.
International Rectifier Corporation, Los Angeles, Calif.
Kaar Engineering Company, Palo Alto, Calif.
Kalbfell Laboratories, Inc., San Diego, Calif.
Karp Metal Products Co., Inc., Brooklyn, N. Y.
Harold A. Kittleson, Los Angeles, Calif.
The James Knights Company, Sandwich, Ill.
James B. Lansing Sound, Inc., Los Angeles, Calif.
Harry A. Lasure Company, Los Angeles, Calif.
Lenkurt Electric Co., Inc., San Carlos, Calif.
Lenz Electric Mfg. Co., Chicago, Illinois.
Dean Lewis Associates, San Francisco, Calif.
Littlefuse Incorporated, Chicago 40, Illinois.
Logan Sales Company, San Francisco, Calif.
McIntosh Engineering Laboratory, Inc., Silver Spring, Md.
Magna Electronics Company, Los Angeles, Calif.
Magnecord, Incorporated, Chicago, Ill.
Marconi Instruments Limited, New York, N. Y.
Marion Electrical Instrument Co., Manchester, N. H.
G. S. Marshall Company, Pasadena, Calif.
Master Mobile Mounts, Inc., Los Angeles, Calif.
Merit Transformer Corporation, Chicago, Ill.
Gerald B. Miller Company, Hollywood, Calif.
J. W. Miller Company, Los Angeles, Calif.
Motorola Inc., Communications & Electronics Div., Chicago, Ill.
National Company, Inc., Malden, Mass.
Neely Enterprises, Los Angeles, Calif.
Newcomb Audio Products Company, Hollywood, Calif.
Harold L. Newnan, San Francisco, Calif.
The J. M. Ney Co., Hartford, Conn.
Nickerson & Rudat, San Francisco, Calif.
L. A. Nott & Co., San Francisco, Calif.
Ohmite Manufacturing Company, Chicago, Ill.
Perlmuth-Colman and Associates, Inc., Los Angeles, Calif.
Permoflux Corporation, Chicago, Ill.
Polytechnic Research and Development Company, Inc., Brooklyn, N. Y.
Potter & Brumfield, Princeton, Ind.
Radio Corporation of America, RCA Victor Division, Camden, N. J.
Radio Receptor Company, New York, N. Y.
Raytheon Manufacturing Company, Newton, Mass.
E. V. Roberts & Associates, Los Angeles, Calif.
Sangamo Electric Company, Springfield, Ill.
Walter L. Schott Co., Los Angeles, Calif.
Scintilla Magneto Division, Bendix Aviation Corporation, Sidney, N. Y.
Servo Corporation of America, New Hyde Park, N. Y.
Sierra Electronic Corporation, San Carlos, Calif.
Simpson Electric Company, Chicago, Ill.
Sola Electric Company, Chicago, Ill.
Sorensen & Co., Inc., Stamford, Conn.
Sperry Gyroscope Company, Div. of The Sperry Corporation, Great Neck, N. Y.
Sprague Electric Company, North Adams, Mass.
Standard Coil Products Co., Inc., Los Angeles, Calif.
Carl A. Stone Associates, Los Angeles, Calif.
Conrad A. Strassner Company, Los Angeles, Calif.
Surprenant Mfg. Co., Boston, Mass.
Sylvania Electric Products Inc., New York, N. Y.
Tektronix, Inc., Portland, Ore.
Telebeam Industries, Napa, Calif.
Tetrad Co., Inc., Los Angeles, Calif.
Transformer Engineers, Pasadena, Calif.
Triad Transformer Mfg. Co., Los Angeles, Calif.
Tung-Sol Sales Corporation, Los Angeles, Calif.
The Turner Company, Cedar Rapids, Iowa.
U. S. Engineering Company, Glendale, Calif.
J. C. van Groos, Hollywood, Calif.
Varian Associates, San Carlos, Calif.
V-M Corporation, Benton Harbor, Mich.
Waldes-Kohinoor, Inc., Long Island City, N. Y.
Western Gold & Platinum Works, San Francisco, Calif.
Western Lithograph Company, Los Angeles, Calif.
Westinghouse Electric Corporation, Pittsburgh, Pa.
Workshop Associates, Needham Heights, Massachusetts.
Raymond Rosen Engineering Products, Philadelphia, Pa.
William J. Purdy Company, San Francisco, Calif.
Don C. & William H. Wallace, Los Angeles, Calif.
Ash M. Wood Company, El Monte, California.

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DIVISION OF THE SPERRY CORP.
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Needed Immediately for Long Range Research Program

Admiral Corporation, one of America's largest electronic and appliance manufacturers, needs electronic engineers for long range research program covering both consumer as well as governmental projects. Project and senior project engineers with minimum of two to five years' experience needed immediately. Top pay with excellent opportunities for advancement. Send resume of experience and education to Engineering Personnel Manager . . .

Admiral Corporation
Dept. T, Chicago 47

Engineering Opportunities in Westinghouse

Wanted:

DESIGN ENGINEERS.
TECHNICAL WRITERS.

Must have at least one year's experience. For work on airborne radar, shipborne radar, radio communications equipment: micro-wave relay or micro-wave communications.

Good pay, excellent working conditions; advancement on individual merit; location Baltimore.

Send resume of experience and education to: Manager of Industrial Relations.

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2519 WILKENS AVE., BALTIMORE 3, MD.

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RESEARCH AND DEVELOPMENT LABORATORIES
CULVER CITY, CALIF.

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UNUSUAL ENGINEERING OPPORTUNITIES

We offer good pay, excellent working conditions, permanent jobs with highly professional staff. This is your chance to join a nationally recognized research, development and design organization offering many opportunities for further advancement. We are interested in engineers with scientific attitude to work with a skillful staff of similar frame of mind. Our work does not depend on defense alone. Plant is located in the East.

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480 Lexington Ave., New York 17

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ELECTRONICS ENGINEERS — At all salary and experience levels.

RESEARCH ON: Antennae, Servomechanisms, Microwave ccts. and other phases of communications and navigation equipment.

PRODUCTION DESIGN OF: Military and commercial communications and navigation equipment.

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TECHNICAL WRITERS — Knowledge of radar fundamentals or radio required. Work closely with engineers to gather material for instruction and maintenance manuals. Base salaries from $3400 to $4300.

LABORATORY TECHNICIANS — Require knawledge of radio fundamentals and skill in use of measuring instruments and laboratory equipment. Previous industrial experience essential. Salaries fram $262 to $321 per month.

BASE SALARIES FOR ALL POSITIONS LISTED ABOVE ARE SUPPLEMENTED BY UP TO 30% FOR REGULARLY SCHEDULED 48-HOUR WEEK.

Housing is no problem in Baltimore.

Excellent group insurance and family hospitalization plan.

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BENDIX RADIO DIVISION of
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Good suburban living facilities available 15 minutes from center of Washington.

Experience in one or more of the following fields required:

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- **Pulse Circuits**
- **Missile Guidance**
- **Sonar Equipment**
- **Radar**
- **Electronic Sub-miniaturization**
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- **Quality Control**

These are permanent positions with real opportunities for advancement in position and pay.

All replies will be held confidential.

Send inquiries to:

W. A. Busch, *Personnel Director*

MELPAR, INC.

452 Swann Ave., Alexandria, Va.

BULLETINS

Two-Way Radio

The RCA Mobile Communications Section has announced the availability of a new brochure which gives information about two-way radio systems for the transportation industry. It tells how to obtain a permit from the FCC, and contains helpful information to determine whether it is practical to use two-way radio for any particular application. RCA nation-wide installation and service facilities are also described.

"Two-way Radio for the Transportation Industry" (Form 2 J8020) is available without charge to those who address requests, on company letterhead, to the Advertising Section, Engineering Products Dept., Radio Corporation of America, Camden, N. J.

Engineering Facilities

A new illustrated brochure entitled "This is Bendix" describes the research, engineering and production facilities at Bendix Radio. Requests for the brochure should be addressed to: Public Relations Dept., Bendix Radio Division, Bendix Aviation Corp., Baltimore 4, Md.

Magnetic Tape Equipment

Magnecord, Inc., of Chicago, makers of magnetic tape recording equipment for professional, use have issued an illustrated catalogue in describing their line and their facilities for building special equipment to individual requirements. The catalogue covers Magnecord conversion and adaptation equipment. All equipment is coded, and a special page lists and describes such accessories as special switches, spooling mechanisms and adapter panels. Requests for copies should be directed to Magnecord, Inc., 360 North Michigan, Chicago, Ill.

Glass Products

"Glass in the Design of Electrical Products" is the subject of a new booklet recently published by the Corning Glass Works, Technical Products Div., Corning, N. Y.

Temperature Conversion Chart

Publication of an easy reference chart for use in converting temperatures has been announced by the Stevens Manufacturing Co., Inc. Printed in two colors on stiff plasticized board, and 3-hole punched for use in binders, the chart can be used to convert temperatures from —70° to +650°, either Fahrenheit or Centigrade. The reverse side lists major types of Stevens thermostats, their applications and general performance characteristics. Charts are available on request to Stevens Manufacturing Co., Inc., 69 S. Walnut Street, Mansfield, Ohio.

TV Receiver Filter

The TV-300-54 high pass television filter is described in a new bulletin released by R. L. Drake Co., 11 Longworth St., Dayton 2, Ohio. It has been designed to attenuate r-f interference from police radio stations, etc., in the region of the new higher i-f's being incorporated in some of the late model receivers.

Production Facilities

Gray Research & Development Corp., Inc., 16 Arbor St., Hartford 2, Conn., has issued a brochure describing its research, engineering, design and development facilities.

Phono Cartridge Manual

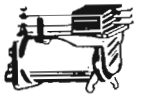
Listing over 1,500 phonographs, radio-phonograph combinations and radio-television-phono combinations using Shure crystal and ceramic cartridges, Shure Brothers, Inc., 225 West Hudson St., Chicago 10, Ill. has issued replacement manual No. 66. In addition to all the current models, the listing goes back to brands dating from 1938 and includes 123 manufacturers.

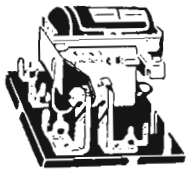
Tele-Tech

Advertisers - August 1951

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.

RELAYS FOR EVERY PURPOSE





RECENT ADDITIONS TO OUR STOCK OF OVER A MILLION RELAYS . . .

Each relay is brand new, standard make, inspected, individually boxed and fully guaranteed.
This is only a partial list. Write or wire us for information on types not shown.

STANDARD DC TELEPHONE RELAYS

Stock No.	Voltage	Ohmage	Contacts	Unit Price
R-868	30/162 VDC	3300	1C	$1.90
R-873	6	12	3C, 3A Micalex	3.00
R-918	52/228 VDC	6500	1C	3.60
R-852	52/228 VDC	6500	1C, 1A	1.55

SHORT TELEPHONE RELAYS

R-907	24/32 VDC	3500	1C	2.00
R-914	110 VAC	200	3B	2.50
R-908	6 VDC	15	4A @ 4 amps.	1.50

KEYING RELAYS

R-850	12 VDC	450	1A @ 1.5 amps.	1.50
R-935	28 VDC	1000	1C @ 1.5 amps.	1.65
R-949	2.4 VAC		1A @ 5 amps.	1.95
R-891	24 VDC	475	1C @ 5 amps.	1.45
R-858	27.5 VDC	250	1A Dbl. Brk.	1.45
R-833	6.5 VDC	1300	2C	3.05
R-960	24 VDC	230	3C @ 15 amps.	2.95
R-828	6/8 VDC	42	1A	1.50
R-855	110 VAC	160	1A Dbl. Brk. @ 15 amps.	3.25
R-948	110 VAC	330	3A @ 15 amps.	3.00
R-924	12 VDC	72	1C Dbl. Brk.	1.65
R-950	2.4 VAC	...	1A @ 8 amps.	2.25
R-978	6 VAC	1.7	1A 1B @ 1.5 amps.	1.95
R-979	6 VAC	1.7	2A @ 1.5 amps.	1.95
R-917	18 VAC	31	1A @ 12 amps.	3.25
R-965	24/30 VAC	38	1A 1B @ 1.5 amps.	1.95
R-966	24/30 VAC	38	2A 2B @ 1.5 amps.	2.25
R-967	24/30 VAC	38	2A 3B @ 1.5 amps.	2.40
R-968	24/30 VAC	38	1A 5B @ 1.5 amps.	2.55
R-969	24/30 VAC	38	1A 6B @ 1.5 amps.	2.70
R-974	24/30 VAC	48	1A 1B @ 1.5 amps.	2.25
R-971	24/30 VAC	48	1A 2C @ 1.5 amps.	2.40
R-973	24/30 VAC	48	2A @ 1.5 amps.	2.25
R-970	24/30 VAC	48	2A 1C @ 1.5 amps.	2.40
R-975	24/30 VAC	48	1B 1C @ 1.5 amps.	2.40
R-976	24/30 VAC	48	2C @ 1.5 amps.	2.55
R-977	24/30 VAC	48	3A 1C @ 8 amps.	2.70
R-883	115 VAC	1200	1A 1C 1D	2.00
R-853	6/8 VDC	30	2A @ 10 amps.	1.55
R-875	6/8 VDC	240	1A @ 12 amps. 1C @ 1.5 amps.	1.50
R-830	24 VDC	330	2A	1.45
R-832	24 VDC	375 C.T.	1A @ 15 amps.	1.70
R-959	24 VDC	747	2C	1.50
R-929	24 VDC	425	1A Dbl. Brk.	1.25
R-982	12 VDC	24	1A Dbl. Brk.	1.55
R-947	12/24 VDC	320	1C @ 3 amps.	1.25
R-900	24 VDC	95	1A Dbl. Brk. @ 20 amps.	1.55
R-926	24 VDC	95	4C @ 15 amps.	3.55
R-983	24 VDC	265	3A	1.65
R-984	24 VDC	375	1C	1.65
R-878	24 VDC	375	1C Micalex	1.65
R-871	18/24 VDC	2000	2C	1.65
R-936	28 VDC	1000	1C @ 1.5 amps.	1.65
R-829	12/18 VDC	270	1A	1.45
R-905	32 VDC	1500	1C Dbl. Brk. @ 15 amps.	3.25
R-869	115 VDC	600	1A Dbl. Brk.	2.25
R-963	220 VAC	...	2C-1A Dbl. Brk.	7.50
R-928	350 MA	1.75	1C @ 6 amps.	1.25
R-953	12 VDC	65	1A @ 100 amps.	4.95
R-955	12 VDC	65	1B @ 100 amps.	4.95
R-954	24 VDC	160	1A @ 100 amps.	4.95
R-876	12 VDC	175	2A 1B	1.60
R-882	24 VDC	300	1A	3.00
R-860	48 VDC	3000	2A @ 1 amp. 230 v	2.60
R-923	24 VDC	1050	2C	2.75
R-958	60 VDC	1550	2A @ 12 amps.	1.50

W-E TYPE "E" RELAYS

Stock No.	Voltage	Ohmage	Contacts	Unit Price
R-910	...	6/35/35	2A Split Cont.	$3.50
R-904	...	35/175	1A	1.25
R-981	12 VDC	270	2B-2C	1.50
R-870	24 VDC	2600	1A	1.30
R-863	48 VDC	4000	3A	2.00

SLOW ACTING

R-897	6 VDC	150	1A Slow Break	2.65
R-865	24 VDC	200	1C Slow Break	1.75
R-934	24 VDC	3000	2B Slow Break	2.95
R-962	6 VDC	150	1A Slow Make	2.65

DIFFERENTIAL RELAYS

R-849	220/250 VDC	8000	2C	3.65

SEALED RELAYS

R-861	32 VDC	8000	1B	4.00

VOLTAGE REGULATORS

R-986	6 VDC	...	3 Terminal	2.25
R-886	6 VDC	1	with 15 ohm 50 watt	1.95

CONTACTORS

R-890	24 VDC	60	1A @ 10 amps.	3.45
R-916	24 VDC	80	1A @ 25 amps.	2.95
R-885	24 VDC	120	1A @ 25 amps.	3.00
R-845	220 VAC	...	3A	6.95
R-838	90/120 VDC	925	2A	4.50
R-842	115 VDC	925	3A	5.50
R-840	115 VDC	1200	2A—Size 1	5.50
R-843	115 VDC	1200	3A	4.50
R-841	115 VDC	1200	3A-1A (Aux.) Size 2	40.00
R-844	115 VDC	1200	3A-1B (Aux.)	4.50
R-980	24 VDC	6	1A @ 250 amps.	5.50
R-942	24 VDC	30	1A @ 200 amps.	3.95
R-888	115 VAC	32	2A Dbl. Brk. Size 1	7.50
R-903	24 VDC	65	1A @ 200 amps.	5.50
R-938	24 VDC	70	1A @ 200 amps.	5.50
R-939	24 VDC	40	2A @ 200 amps.	7.50
R-854	24 VDC	100	1A @ 50 amps.	4.05
R-933	24 VDC	100	1A @ 50 amps.	4.75
R-881	24 VDC	150	1A	2.50
R-944	115 VAC	40	4A (1B-Remote)	4.50
R-943	115 VAC	100	4A-4B @ 10 amps.	6.75
R-941	14 VDC	12	1A @ 200 amps.	4.05
R-956	28 VDC	160	1A Dbl. Brk. @ 50 amps.	4.05
R-880	18/24 VDC	375 C T	1A Dbl. Brk.	2.50
R-889	18/29 VDC	180	1A Dbl. Brk.	2.50
R-899	24 VDC	70	1C @ 50 amp. 1B Aux.	2.50
R-898	28 VDC	8	1A @ 200 amps.	4.50
R-909	24 VDC	11	1A @ 250 amps.	5.50
R-937	24 VDC	150	1A @ 50 amps.	4.75

Stock No.	Voltage	Ohmage	Contacts	Unit Price
R-831	7.5/29 VDC	6.5	1A @ 250 amps.	$5.50
R-925	24 VDC	100	1A @ 50 amps.	4.05
R-940	24 VDC	132	1A @ 200 amps.	5.50
R-879	24 VDC	150	1A @ 50 amps.	3.75
R-874	24 VDC	140	1A Dbl. Brk. @ 25 amps.	2.00
R-945	12 VAC	1	2A @ 30 amps.	3.25
R-946	125 VDC	3200	2A @ 30 amps.	2.75
R-860	115 VAC	175	2A @ 30 amps.	5.95

MIDGET RELAYS

R-857	24 VDC	260	1D	1.75
R-912	4/5 VDC	20	3A-1C Ceramic	1.45
R-921	6.7 VDC	18	1A Dbl. Brk. @ 10 amps.	1.45
R-922	12 VDC	75	1A Dbl. Brk. @ 10 amps.	1.45
R-893	14 VDC	150	1A, 1C	2.50
R-895	14 VDC	150	2A, 1B, 1C	2.50
R-896	24 VDC	260	2A	2.50
R-894	24 VDC	260	3A, 1C	2.50
R-856	18/24 VDC	300	1B	1.45
R-913	6 VDC	20	3A, 1C Ceramic	1.45
R-915	12 VDC	70	1A Dbl. Brk. @ 10 amps.	2.00
R-834	6 VDC	20	3A, 1C	1.45

SPECIAL RELAYS

R-846	5/8 VDC	19	1C Coax	6.95
R-920	6 VDC	18	1A @ 25 amps.	1.25
R-931	Min. 1.5 Ma.	150	1C	7.50
R-927	220 VAC	2500	1A @ 5 amps.	15.00
R-951	115 VAC		⅜" Stroke	1.45
R-887	.5 Adj. 1.5 Amp.	40	2 Pole 2 Pos.	27.50
R-932	6 V @ 112 amps 12 V. @ 56 amps. 24 V. @ 28 amps.			4.25
R-930	25/50 VAC 25 ea. coil		2B-1H @ 8 amps. 1A @ 12½ amps.	3.75
R-972	40/50 VAC		1B @ 12½ amps. 1 MBM @ 1½ amps.	3.25
R-256	26 VDC	65	2B-1A @ 1KW	10.95
R-906	40 VDC	600	1A @ 30 amps.	3.95
R-864	24/24 VDC	95/95	1A,1B,1C/1A,1B,1C	5.50
R-847	10/15 VDC	70	4C	4.75
R-964	220 VAC		2A Dbl. Brk. @ 3 KV	8.95
R-952	24 VDC	175	1A-Grounded	2.95
R-884	12 VDC	670	2A	
	28 VDC	230	12 Pos. Rotary	12.95
R-902	115 VAC		1A @ 25 amps. 440 VAC 1A @ 2 amps 300 VDC 1A @ 5 amps. 115 VAC	87.50
R-866	Adj. from 1 Ma.	6200	1C	17.50
R-957	12 VDC	.5	1B 2 Aux. Cont.	1.50
R-919	6/8 VDC	50	1C	5.25
R-911	40 VDC	200	1C @ 20 amps. 1A Mom.	7.95

TYPE 82

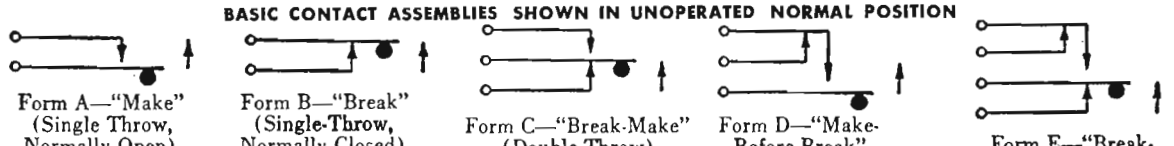
Stock No.	Voltage	Ohmage	Descriptive Information	Price
R-809	28 VDC	7	360° Rotation in 12 steps with 7" lg. shaft	$2.45
R-766	28 VDC	4/230	360° Rotation in 12 steps with 2⅜" lg. shaft and 8-6 Terminal Wafers mounted on 12" x 5" Terminal Board with 63 Screw Terminals plus lugs	4.90

ROTARY RELAYS Type 76-77 14 VDC—2 Ohm Energizing, 125 Ohms Holding Coil 30° Rotation ½" Long Shaft.

Stock No.	First Wafer Circuit 1	Circuit 2	Circuit 3	Term*	Second Wafer Circuit 1	Circuit 2	Circuit 3	Circuit 4	Term	Price
R-877	1 NC	1 NC	.....	4	1 NO	1 NO	1 NO	SPDT	9	$2.25
R-892	3 NO	.....	.....	4	SPDT	SPDT	Ceramic		6	2.40
	28 VDC—7 Ohms Energizing, 250 Ohms Holding Coil 30° Rotation ¼" Lg. Shaft									
R-711	SPDT	2 pole reversing	.....	8	With Coupling					2.05
R-712	1 NC	1 NC	1 NC	6	.....	.....	.....	.....	.....	2.05
R-573	2 pole reversing	.....	.....	5	.....	.....	.....	.....	.....	2.05
R-901	2 NO-1 NC	.....	.....	4	SPDT	SPDT	3 NC	.....	10	2.25
R-616	1 NC	1 NC	.....	4	1 NC	1 NC	1 NC	1 NO	8	2.40

* NOTE: Number of terminals excludes those required for operation of relay.

BASIC CONTACT ASSEMBLIES SHOWN IN UNOPERATED NORMAL POSITION



Form A—"Make" (Single Throw, Normally Open)

Form B—"Break" (Single-Throw, Normally Closed)

Form C—"Break-Make" (Double-Throw)

Form D—"Make-Before-Break"

Form E—"Break-Make-Before-Break"

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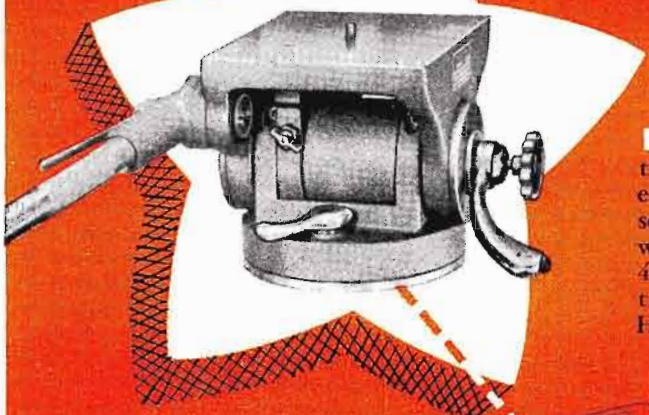
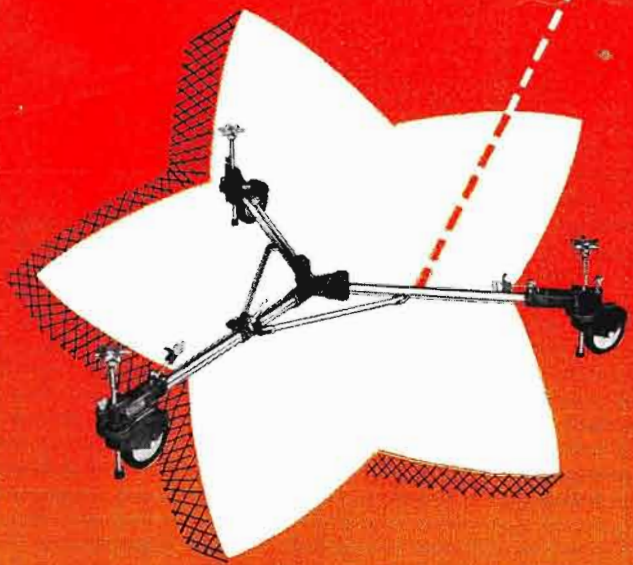


FRICTION HEAD Most TV studios rely on the Houston-Fearless Friction Head for smooth, easy panning and tilting. Pans & Tilts on grease-sealed ball bearings. Can be panned a full 360° with any degree of drag. Tilts 45° forward and 45° backward, accurately counter-balanced at all times. Brakes provided. Handle adjustable. Fits Houston-Fearless tripod, pedestal or dolly.

ALL-METAL TRIPOD
Combines extreme ruggedness, adaptability, rigidity, ease of operation and portability not found in any other tripod. Offers many exclusive, valuable features. Legs level automatically, cannot slip. Calibrations on legs simplify equalizing. Positive wedge locking device operates quickly, easily. Convertable spike and rubber-pad feet. Accommodates all standard heads.



TRIPOD DOLLY Provides convenient mobility for tripod-mounted television cameras. Rubber-tired wheels swivel for easy steering. Or, all three wheels can be locked in parallel position, enabling dolly to track in a straight line for rolling dolly shots. Stabilizer screws can be applied against floor for maximum steadiness. Sturdy construction. Folds quickly and compactly.

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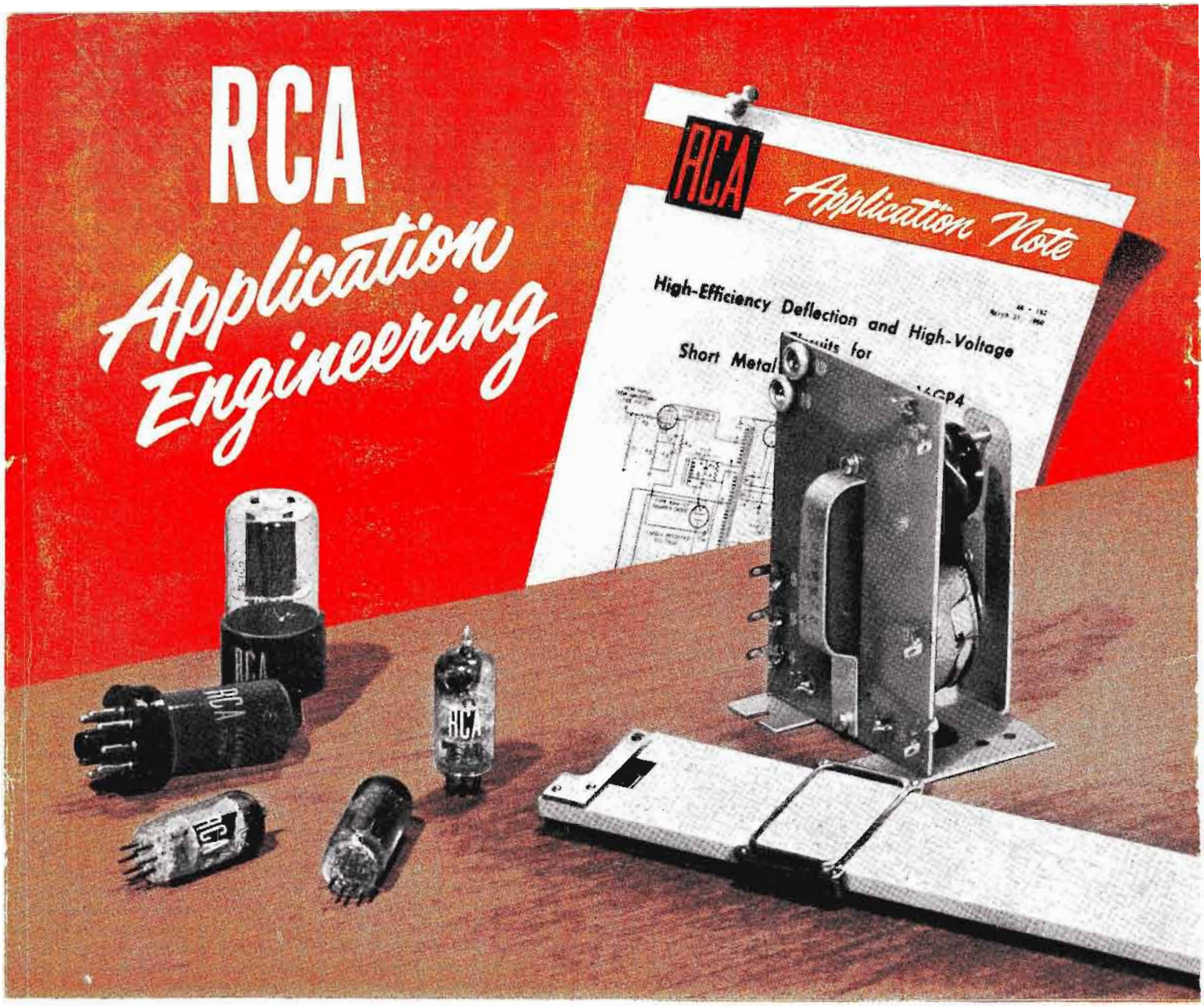

Preface to a Better Product . . .

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