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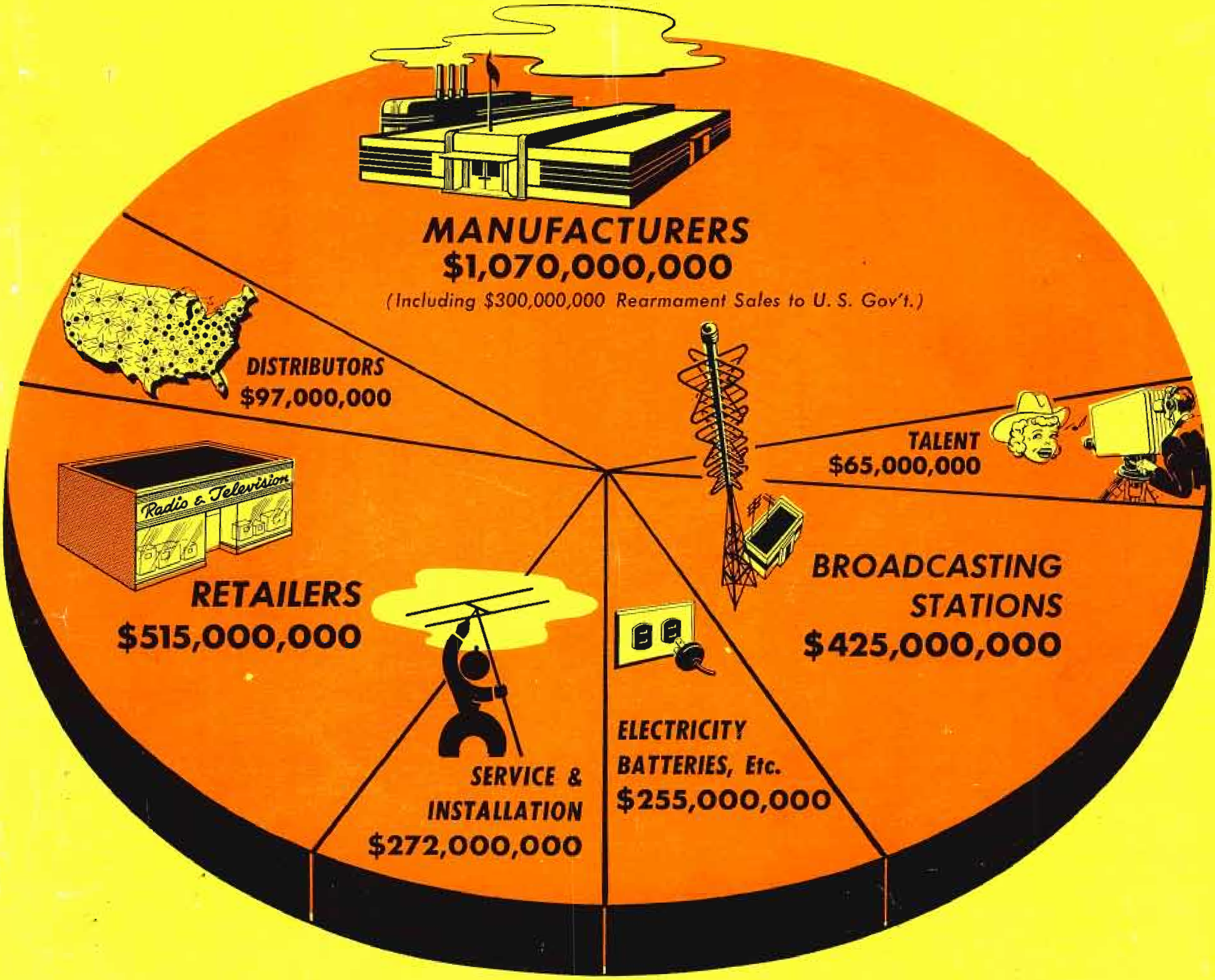
Formerly ELECTRONIC INDUSTRIES

TELEVISION • TELECOMMUNICATIONS • RADIO



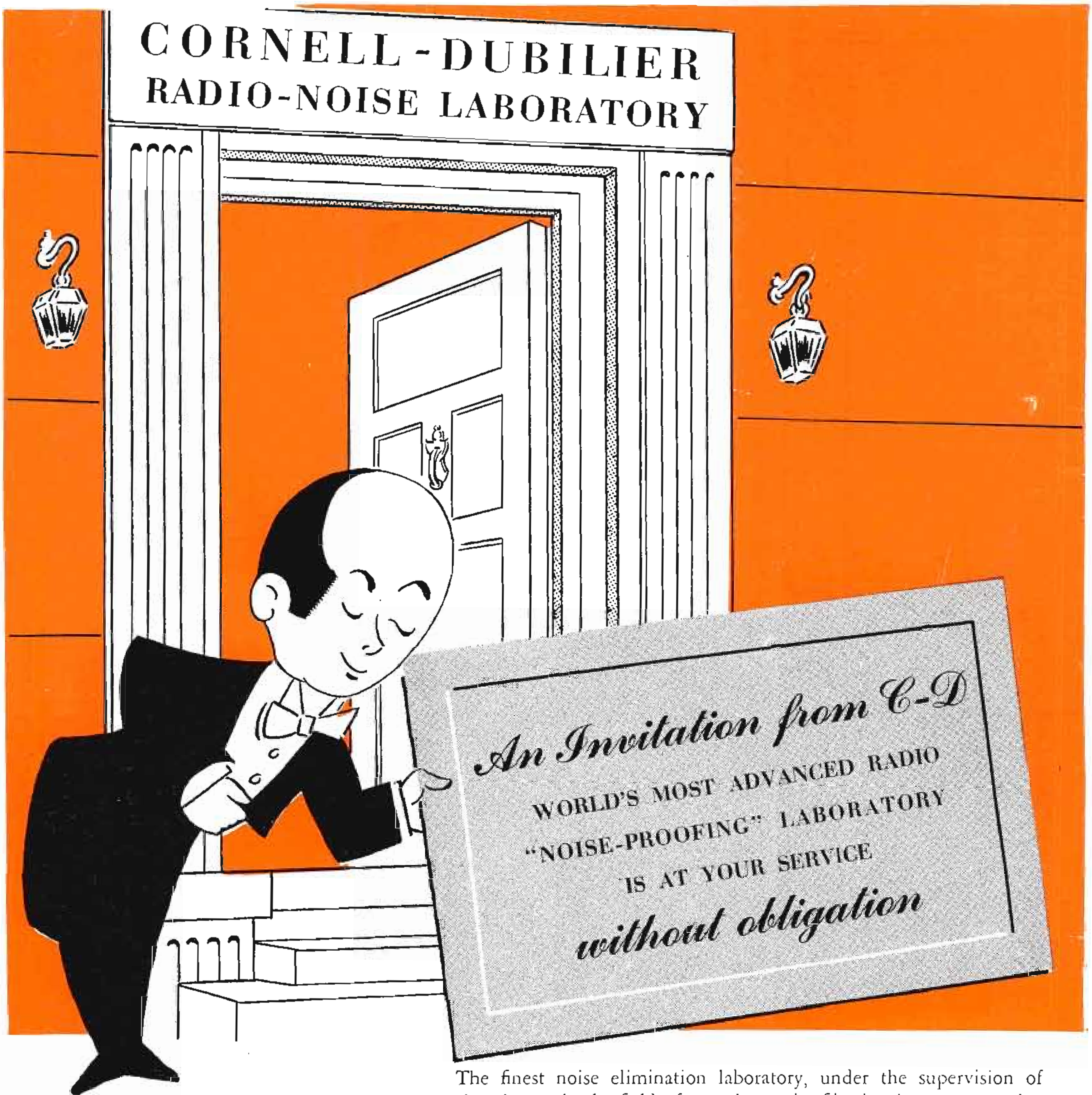
THE RADIO-TELEVISION BUSINESS IN 1949!

Estimated Dollar Income of Principal Industry Groups

(Totaling 2¾ Billion Dollars)

In This Issue—**Radio-TV Statistics**
How the Navy Buys
Trends in TV Design

January • 1949
CALDWELL-CLEMENTS, INC.



The finest noise elimination laboratory, under the supervision of the pioneer in the field of capacitor noise-filtering, is at your service.

A simple way to accept this invitation from Cornell-Dubilier: — send a sample of the equipment or appliance you want noise-proofed to *our* laboratory — make full use of its facilities — consult with our engineers as though they were on your own payroll. *That's the way to solve your noise and spark suppression problems quickly and efficiently.* There is absolutely no charge for this service.

No other capacitor manufacturer can equal C-D's thirty-seven years of experience in the design and manufacture of noise filters and spark suppression devices for every conceivable type of electronic and electrical equipment. Cornell-Dubilier Electric Corporation, Dept. J-19, South Plainfield, N. J. Other large plants in New Bedford, Brookline and Worcester, Mass., and Providence, R. I.

Make Your Product More Saleable With C-D Quietone Interference and Spark Suppressors

1910 1949

CORNELL-DUBILIER

WORLD'S LARGEST MANUFACTURER OF

CAPACITORS

MICA ★ DYKANOL ★ PAPER ★ ELECTROLYTIC

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TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

JANUARY, 1949

Editorial Contents

COVER: Seven principal industry groups will share radio and television's estimated 2¾ billion dollar income during 1949. See page 25 for statistics of 1948 radio production and sales.

DEPARTMENTS:

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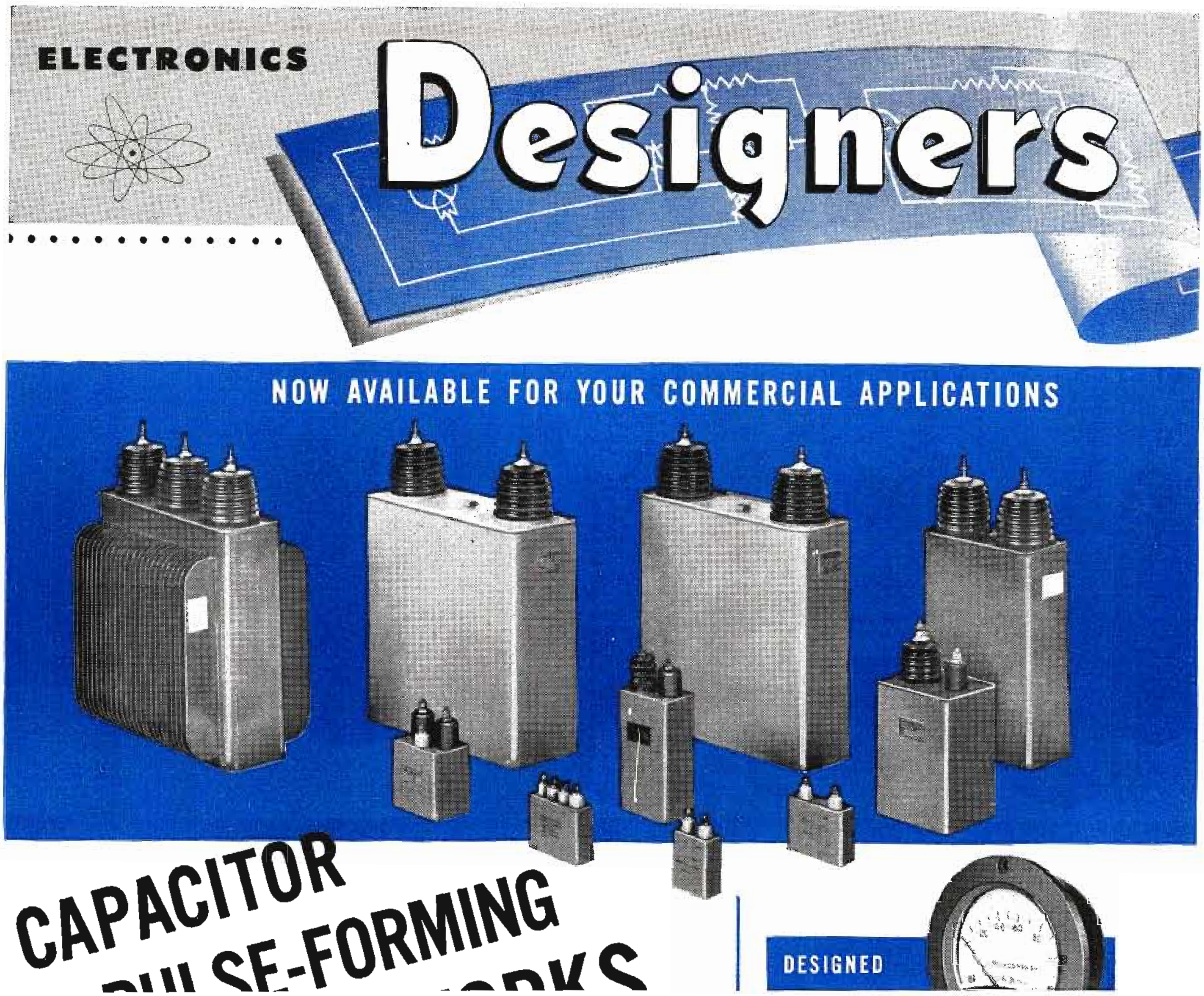

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Digest

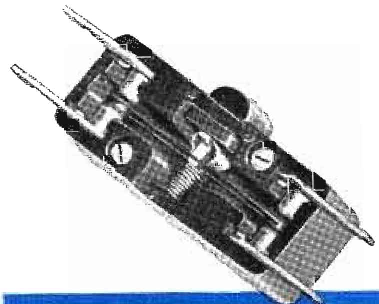
TIMELY HIGHLIGHTS ON G-E COMPONENTS

SIMPLIFY CONTROL WIRING WITH THESE TERMINAL BOARDS

Easy-action hinged covers protect control wiring, help give your product a neat appearance. Hook-ups are easy with the hard-gripping connectors. Simply strip the wire end, screw down the connector on the bare wire. Blocks are durable, too, constructed of strong Textolite with reinforced barriers between poles to insure against breakage. Marking strips are reversible—white on one side, black on the other. These terminal boards are available with 4 to 12 poles, 2 inches wide, 1¼ inches high. Send for bulletin GEA-1497C.

HOLDS OUTPUT VOLTAGE CONSTANT

This latest addition to G.E.'s line of automatic voltage stabilizers comes in 15-, 25-, and 50-va ratings. Output is 115 volts, 60 cycles. The small size of the unit makes it particularly applicable to shallow-depth installations in many types of equipment. You may have a job for this unit which will give you automatically stabilized output voltage at a low cost. There are no moving parts, no adjustments to make; long service is assured. Check bulletin GEA-3634B for more information about this and other G-E voltage stabilizers.



LOOKING FOR LIGHTWEIGHT SWITCHES?

Switchettes* are designed for applications which require a manually operated electric switch in a limited space. Though small, these switchettes are lightning fast in action and are built to withstand severe service. A wide variety of forms and terminal arrangements makes them particularly useful where special circuit arrangements are necessary. Switchette shown above has one normally open and one normally closed circuit, transferable when button is depressed. Check bulletin GEA-4888.

*Switchette is General Electric's trade name for these small snap switches.

FOR YOUR COOLING FANS

Here's a fractional-horsepower fan motor suitable for many uses because of its compact design, low servicing requirements, and extreme quietness. Long, dependable operation is assured by sturdy, totally enclosed construction. These Type KSP unit-bearing motors are of shaded pole type design with low starting torque characteristics especially applicable to fans. A continuous oil circulation system furnishes good lubrication. You can use simple, hubless, low-cost blades with the special mounting arrangement. Write for bulletin GEC-219.

General Electric Company, Section F642-19
Apparatus Department, Schenectady, N. Y.

Please send me the following bulletins:

☐ GEA-4996 Capacitor Pulse-forming Networks
☐ GEA-3634B Automatic Voltage Stabilizers
☐ GEA-5102 Panel Instruments
☐ GEA-4888 Switchettes
☐ GEA-1497C Terminal Boards
☐ GEC-219 Unit-bearing Fan Motor

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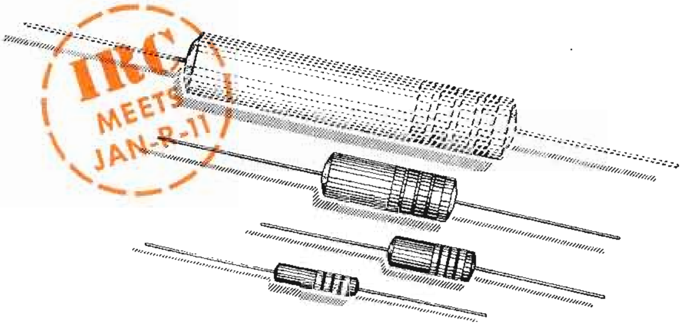
This ADVANCED IRC Resistor to Your Current Standards



You'll profit by a careful comparison of IRC's new, *advanced* Type BT to your present standards for resistor performance. This new fixed insulated composition resistor meets JAN-R-11 specifications, and marks the obsolescence of much current thinking on resistor performance.

COMPARE this new 1/3, 1/2, 1 and 2 watt resistor characteristic by characteristic. Note its performance curves in relation to Joint Army-Navy requirements. Conclusive proof of IRC's superior engineering and production techniques.

COMPARE the possibilities of this *advanced* resistor to your specific requirements. Its outstanding characteristics are particularly evident at high ambient temperatures, and it easily performs the rigorous requirements of television.

COMPARE the availability of the *advanced* BT. It has been in production for months . . . hundreds of thousands are being shipped daily.

COMPARE the test results shown here for the BTS 1/2 watt with the equally excellent performance curves for the BTR 1/3 watt, BTA 1 watt and BT-2 2 watt. Technical Bulletin B-1 gives *complete* information. Use the handy coupon. International Resistance Co., 401 N. Broad Street, Philadelphia 8, Pa. In Canada: International Resistance Co., Ltd., Toronto, Licensee.

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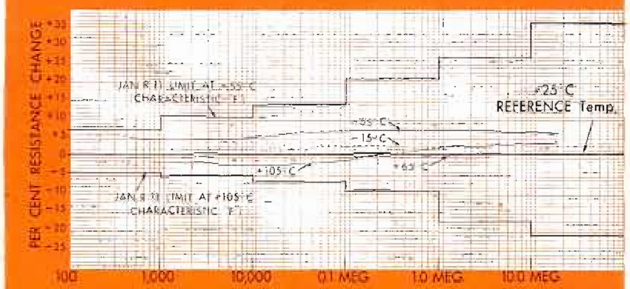
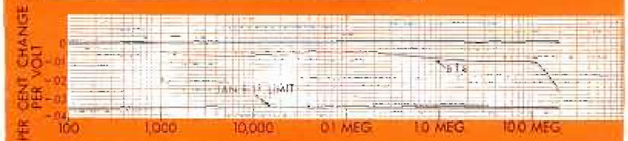
INTERNATIONAL RESISTANCE COMPANY

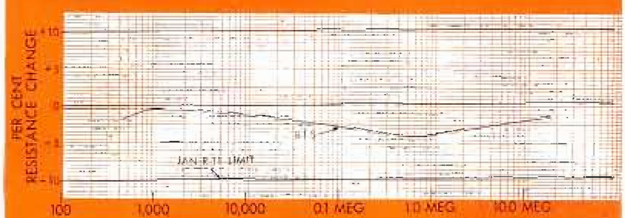
TEMPERATURE CHARACTERISTIC
IRC Type BTS ½ Watt



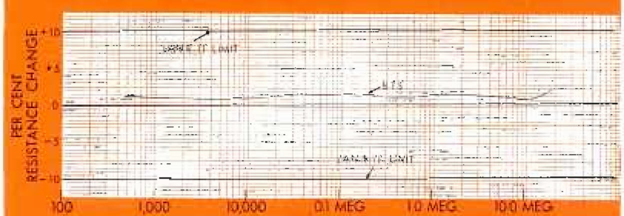
VOLTAGE CHARACTERISTIC
IRC Type BTS ½ Watt



1000 HOUR 40°C. LOAD LIFE
IRC Type BTS ½ Watt



250 HOUR HUMIDITY TEST
IRC Type BTS ½ Watt



SEND FOR TECHNICAL BULLETIN ➡

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

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

- ☐ Send me Technical Bulletin B-1
- ☐ Have your representative call—no obligation.

Name ____________________

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With more and still more telecasters it's Du Mont TV camera equipment because of outstanding

DEPENDABILITY

DU MONT Type TA-124-B

Image Orthicon Chains

➧ Many TV stations either on the air or under construction, are Du Mont-equipped throughout. That means the Du Mont Type TA-124-B Image Orthicon Chain for studio and remote pickups, alike.

But of even greater significance is the growing use of Du Mont cameras and auxiliary equipment by TV stations originally using other makes of equipment; by intra-store television demonstrations; by wired television installations; by movie producers experimenting with television production possibilities; by TV training schools; by government agencies both here and abroad.

The Du Mont advantages are many: Split-second action through quick set-up; finger-tip controls; superlative image pickup with precise electronic viewfinder checkup; accessibility for time-saving inspection and immediate maintenance; handy matched units, jiffy-connected, for all required power, synchronizing, amplifying and monitoring functions, plus the latest camera effects.

$$SD+QW=\frac{D}{FWFT}$$

(Simple Translation)

SUPERIOR DESIGN plus QUALITY WORKMANSHIP equals DU MONT

First With the Finest in Television

But the outstanding characteristic of this popular Du Mont Type TA-124-B Image Orthicon Chain is DEPENDABILITY. That, in the final analysis, is the all-important consideration. For "The show must go on," regardless.

➧ **Consult us on your TV plans and requirements. Literature on request.**

DU MONT *First with the Finest in Television*

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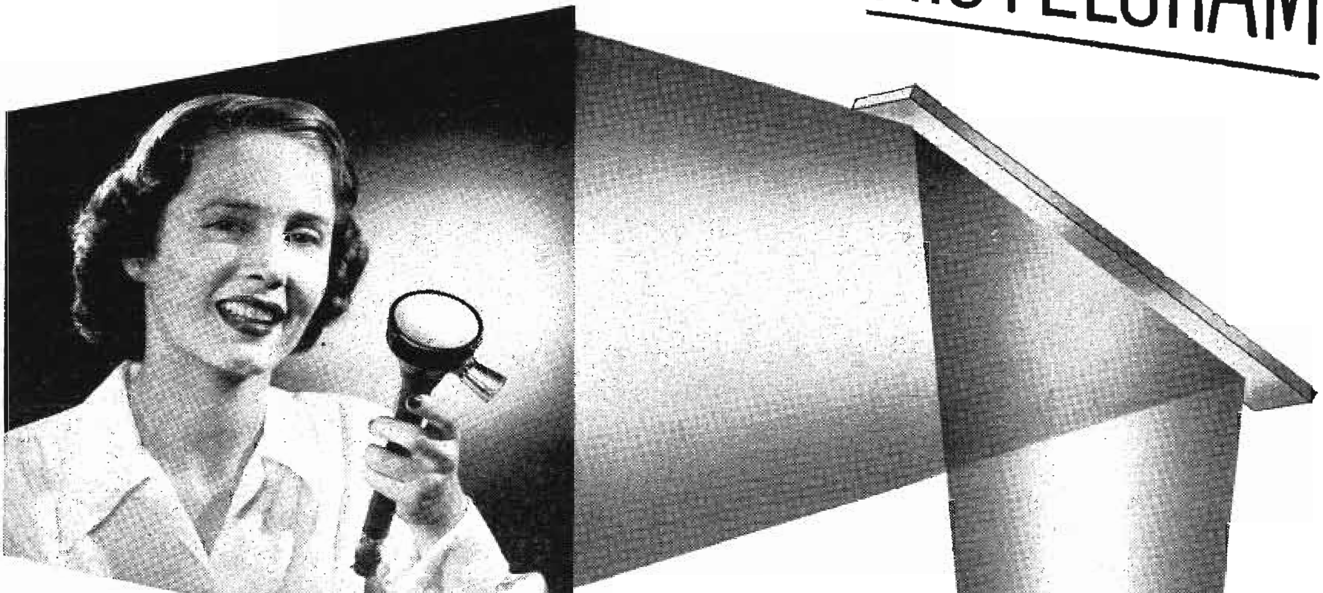
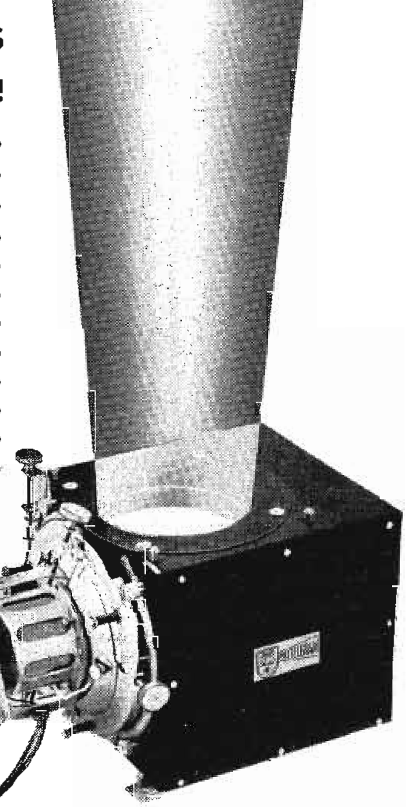
For Perfected Large-Size Home Projection- PROTELGRAM



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



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

.... 10 SIGNIFICANT FEATURES ....

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

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

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

NORTH AMERICAN PHILIPS COMPANY, INC. — Norelco

PROTELGRAM IS PICTURE PERFECTION IN PROJECTION

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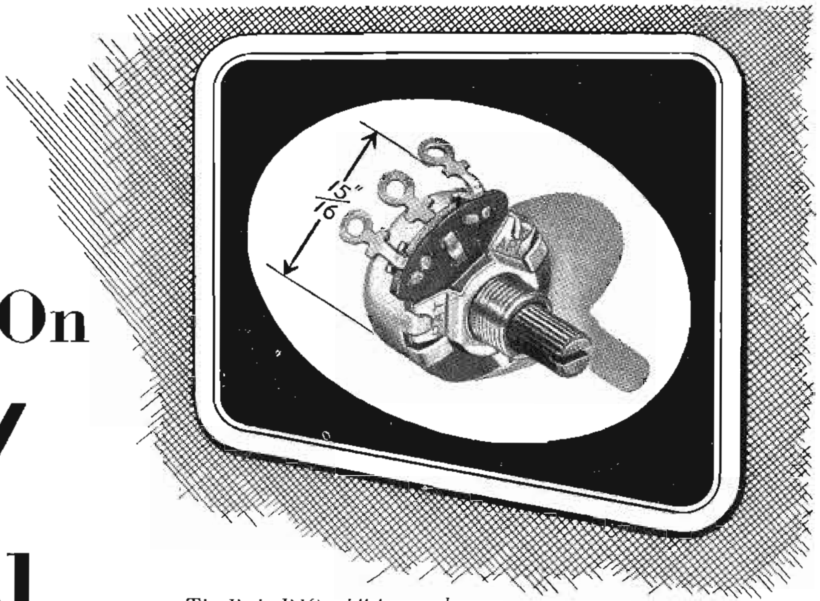
The Spotlight's On

P. R. MALLORY & CO. Inc. MALLORY

Midgetrol



The little BIG addition to the Mallory Line of Television Controls.

Mallory has done it again. Here is an all-new, revolutionary control that is perfect for television application. Only 15/16″ in diameter, it is Mallory's answer to the designer's cry for smaller and smaller controls.

Don't be deceived by its compact size. It's all Mallory through and through. For instance: Shaft is completely insulated from chassis. Good for higher voltage applications—can't get a shock. The insulated shaft is knurled for easy adjustment—has screw-driver slot for back panel applications. Thoroughly tested, the Mallory Midgetrol has come through with flying colors for television applications.

The Mallory Midgetrol is typical of Mallory superiority in controls. Today, Mallory has a control, carbon or wire-wound, required for any specific usage, for every television application.

The dependability of today's television receivers which is responsible for the great public demand has as one of its bases the precision performance built into Mallory controls by special skills, long experience and devotion to quality ideals.

And with all this superiority, Mallory offers service—quick delivery for both standard and special applications—and low price.

MALLORY CONTROLS FOR TELEVISION APPLICATION

1. For volume
2. For focusing
3. For height of picture
4. For linearity
5. For centering picture on tube, horizontal or vertical
6. For contrast or brightness
7. For horizontal and vertical "hold" controls
8. For audio tone control

You Expect More And Get More From Mallory

Precision Electronic Parts—Switches, Controls, Resistors

P. R. MALLORY & CO. Inc. MALLORY

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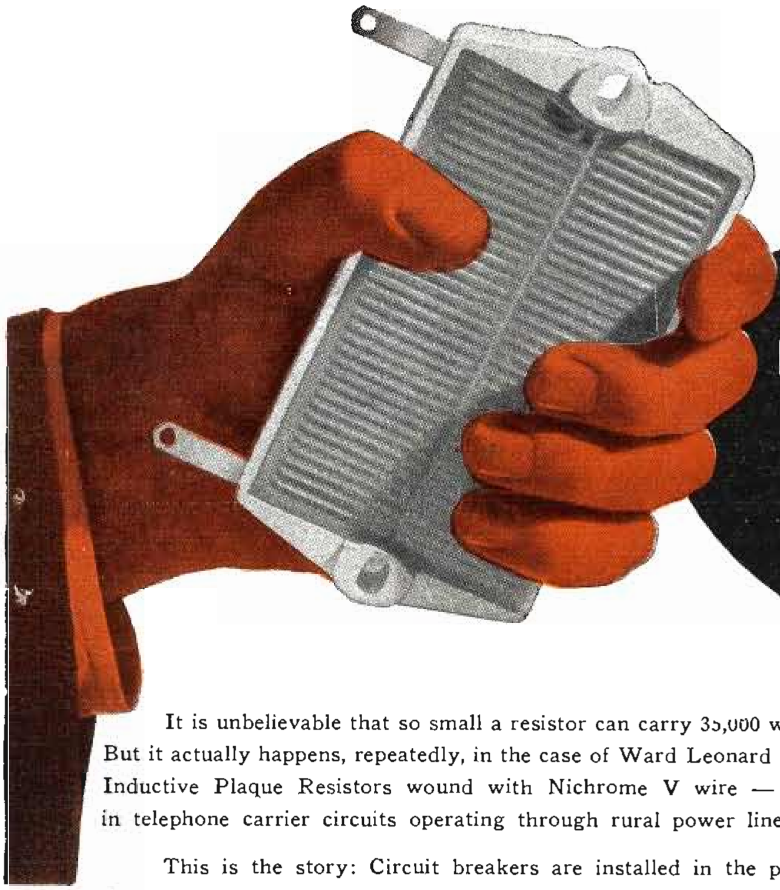


HAND-SIZE 50-OHM NICHROME* RESISTOR SHRUGS OFF 35,000-WATT WALLOPS!

It is unbelievable that so small a resistor can carry 35,000 watts! But it actually happens, repeatedly, in the case of Ward Leonard Non-Inductive Plaque Resistors wound with Nichrome V wire — used in telephone carrier circuits operating through rural power lines.

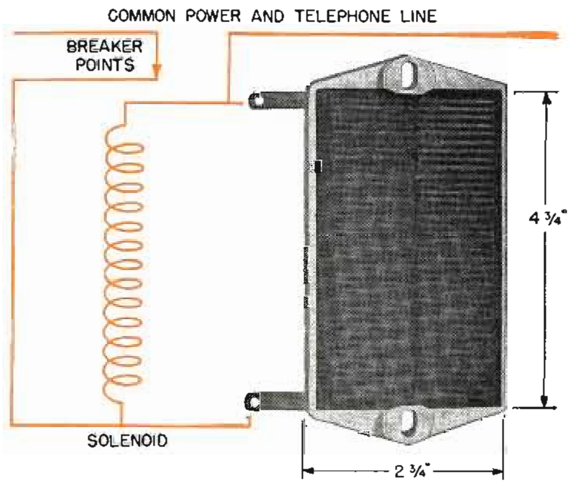
This is the story: Circuit breakers are installed in the power lines to protect them against "shorts" due to falling wires, etc. But the telephone carrier currents are blocked by the high impedance of the breaker solenoids. A low-impedance resistor is therefore used as a by-pass at each solenoid.

When a "short" occurs, the resistor must be momentarily able to carry amperage far in excess of its normal rating, because mechanical lag prevents the circuit breaker from opening instantly. The same applies when lightning, or accumulated static charges, discharge to the ground.

Tremendous strain is imposed upon the winding of the resistor during the instant of high current impact, yet it must stand up.

To assure maximum performance and dependability, Ward Leonard uses windings of Nichrome V. This superlative Driver-Harris alloy sustains tremendous voltage surges without loss of characteristics, retains its superb stability in spite of severe thermal shock, stays on the job even though "jolted" again and again . . . when a breaker makes several attempts to restore an open circuit.

Whatever *your* electrical resistance problems — conventional, unusual, or seemingly impossible of solution — send your specifications to us. We manufacture and draw the most complete line of electrical resistance alloys in the world.



Designed to protect telephone circuits that utilize power supply lines, this resistor, rated at 50 ohms and 125 watts, is intended normally to carry a current of about 1.6 amperes. In the event of short-circuit, however, it will tolerate 16 times this amperage, and a voltage increase producing 35,000 watts, for the fraction of a second required by a power line circuit breaker to operate. Cooling in less than a second after sustaining such an abnormal current impact, the winding, of .010 in diameter Nichrome V wire, remains unimpaired. In fact, this severe treatment can be administered for 3/100ths of a second per second for 3 successive seconds without damage to the resistor. Made by Ward Leonard Electric Co., Mount Vernon, N. Y.

SPECIAL PURPOSE ALLOYS SINCE 1899 — D-H — TRADE MARK REG. U. S. PAT. OFF.

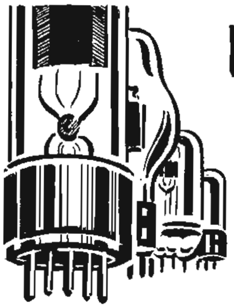
Nichrome is Manufactured only by

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco, Seattle
Manufactured and sold in Canada by
The B. GREENING WIRE COMPANY, LTD., Hamilton Ontario, Canada

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



TUBES

• TRANSMITTING • RECEIVING • INDUSTRIAL • SPECIAL PURPOSE

Guaranteed by WELLS

Brand new, standard make tubes by the thousands are ready for immediate delivery at the lowest prices in our history. Check this list for exceptional values in magnetrons, cathode ray tubes, voltage regulators, transmitting tubes and also neon, pilot and flashlight bulbs. Be sure to order enough for future needs directly from this ad or through your local parts jobber.

TYPE	PRICE
01A	.50
1B22	5.55
1R4/1294	.85
2J22	14.85
2J31	14.85
2J32	14.85
2J38	18.95
2J48	16.55
2J158	9.85
5J23	14.85
5J29	14.95
2C26	.55
2C26A	.70
2C34	.46
2C44	1.25
2E22	1.35
2X2/879	.75
3C24/24G	.49
3AP1/906P1	2.75
3BP1	2.75
3CP1	2.75
3E29/829B	3.95
3FP7	2.95
3HP7	2.95
5AP1	3.75
5BP1	2.85
5BP4	3.95
5GP1	6.55
5HP4	5.95
12HP7	10.95
6A6	.90
6B7	.99
6C21	19.95
6H6	.52
6J5	.52
6SL7	.65
6U5/6G5	.70
7A7	.70
7C4/1203	.45
7H7	.75
7Q7	.70
10	.52
10Y	.55
12A6	.35
12C8	.35
12SH7	.45
REL21	3.65
FG17	2.95
30/VT67 For	.95
33/VT33 Walkie Talkies	.95
34	.35
RK34	.45
39/44	.34
41/VT51	.55

TYPE	PRICE
VT52/45SPEC	.55
46	.85
76	.55
77	.55
78	.55
83	.85
83V	.95
100R	3.45
EF50/VT250	.65
VR78	.68
VR90	.70
VR92	.65
VR105	.70
VR150	.70
VT127 ENGLISH	.35
VT127A TRIODE	2.55
211	.65
217C	5.95
218	4.45
282B	4.35
250R	7.85
304TH	6.55
304TL	.90
305A	12.45
305B	6.75
316A	.55
350A	2.75
350B	2.55
371A	2.55
371B	2.55
388A	6.45
417A	19.85
GL434	2.95
446A	1.55
446B	1.55
GL471A	2.95
481	4.50
WL530	24.95
WL531	19.95
532A	3.55
GL559	3.75
WL681	19.95
700B	9.95
700C	9.95
700D	9.95
702A	2.95
707B	23.25
708A	6.55
710A	2.15
714AY	9.95
715B	7.95
717A	.90
721A	3.95
721B	3.95
724B	4.25

TYPE	PRICE
725A	19.95
726A	19.95
726C	19.95
801A	.80
803	7.75
805	5.75
807	1.20
810	7.95
813	7.85
814	3.75
826	.49
828	4.55
829B	3.95
830B	3.75
832	2.75
832A	3.50
837	1.25
838	3.25
841	.55
843	.55
860	2.55
861	34.50
864	.55
865	2.55
869	24.95
869B	28.95
872A	2.45
874	2.15
878	2.15
884	1.50
885	.85
930	1.10
954	.55
955	.55
956	.55
957	.55
1005	.45
2050	.75

TYPE	PRICE
1148	.40
1201/7ES	.95
1616	1.25
1619	.55
1624	1.25
1625	.45
1626	.45
1629	.45
1641/RK60	.65
2051	.95
7193	.35
8011	2.55
8012	4.35
8020	3.25
9001	.70
9002	.65
9003	.55
9004	.55
9006	.55
CEQ72	1.55
FG105	10.95
KU610	7.45
RK20A	4.95
12X825 2 AMP TUNGAR	2.95
RK34	.45
GL471A	.95
EF50	.70
HY615	1.25
704A	1.55
705A	2.15
707A	19.95
NEON BULBS FOR RADIO USE	
NE 15 Price Ea.	.06
NE-48	.24
NE-16	.24
NE-51	.06

PILOT AND FLASHLIGHT BULBS

STOCK NO.	MAZDA NO.	VOLTS	WATTS	BULB	BASE	EA. PRICE
350-40	64	6-8	E 3 CP	G-6	DC Bay	.07
350-50	1820	28	.1 Amp	T-3½	Min Bay	.12
350-31	57	12-16	1.5CP	G-4½	Min Bay	.08
350-42	Spec.	12	6 Watts	S-6	Cand Scr	.13
350-20	1446	12	.2 Amp	G-3½	Min Scr	.07
350-14	49	2	.06	T-3¼	Min Bay	.06
350-15	386	120	3 Watts	S-6	Can Bay	.11
348-22	PR-10	6	.5 Amp	B-3½	Min Flang	.05
350-18	1477	24	.17 Amp	T-3	Min Scr	.16
LB-101	323	3 (AIRCRAFT)		T-1½	953	.22
350-19	Proj. Bulb	120	500 W	T-20	Med Pf	1.45
LB-103	44 (Ruby)	6-8	.25 Amp	T-3½	Min Bay	.04
LB-102	1195	12-16	.50CP	RP-11	DC Bay	.14
LB-104	313	28	.17 Amp	T-3½	Min Bay	.11
LB-105	1816	13	.33 Amp	T-3½	Min Bay	.12
LB-106	12A	12	.09 Amp 11	T-2	Tel Base	.18
LB-107	24-A2 W E	24	.75 Amp 105	T-2	Tel Base	.18
LB-108	S 14 ARGON	105	2½ Watt	Med	Screw	.22

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Manufacturers: Write for quantity prices.

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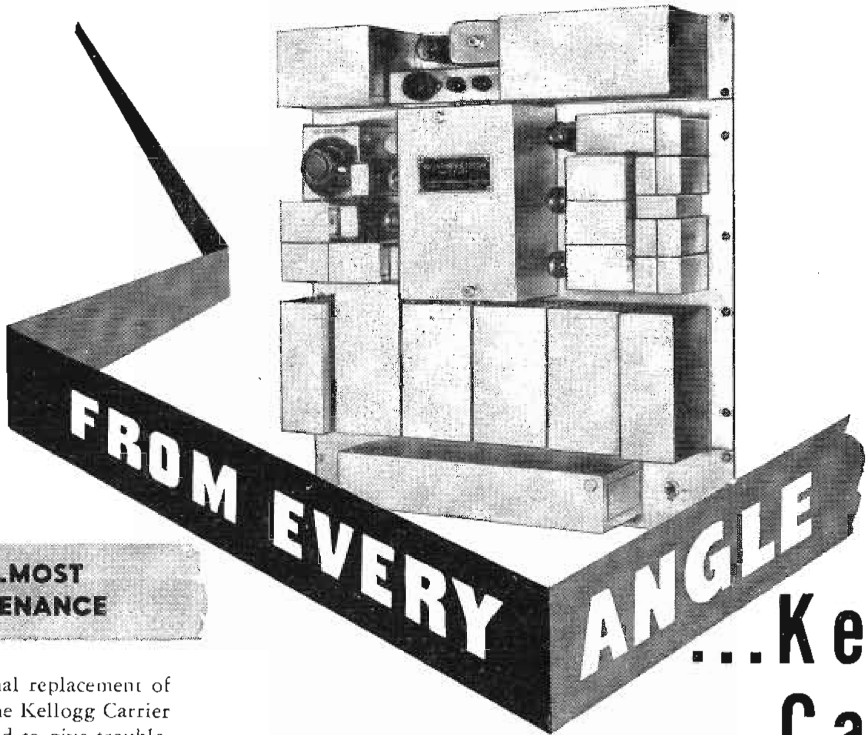

...Kellogg Carrier

NEEDS ALMOST NO MAINTENANCE

— except occasional replacement of a vacuum tube. The Kellogg Carrier is soundly designed to give trouble-free service.

REMAINS CONSTANT IN OPERATION

Built with high-quality components that resist humidity and heat, the Kellogg Carrier gives consistently dependable operation without adjustments under all conditions.

MANUFACTURER GUARANTEES PERFORMANCE

Kellogg, with years of experience in the Independent telephone equipment field, stands behind its products at all times.

EASY TO INSTALL AND ADAPT TO ALL REQUIREMENTS

All adjustments except voice and carrier output-level pre-set at factory. Mounts on any 19" rack, needs no oscillator synchronization, no frequency adjustments in the field. And the Kellogg No. 5A Carrier is designed on a flexible "unit" basis, for easy adaptation to various applications. Adding a second channel requires only a few external connections. (Models available, too, to meet every service need.)

GIVES LONG-HAUL PERFORMANCE AT SHORT-HAUL COST

The Kellogg No. 5A Carrier provides a 6db talking circuit over a circuit 30db long (measured at 11-KC). Thus, operation is possible through substantial lengths of high loss cable, such as 22-ga. exchange cable. Also, because this carrier can work over circuits which are long electrically, it does not usually require impedance matching devices for reducing reflection losses caused by junction of open wire and cable.

SAVES CONSTRUCTION COSTS, IMPROVES TRANSMISSION QUALITY

This single-channel carrier system permits transmission of two conversations simultaneously over a two-wire metallic circuit. Handles double traffic—*without* the expense of added lines, extra maintenance or heavier poles. This means a real saving, when you consider the cost of material and manpower today. Improves transmission quality too, by eliminating powerline hum.

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Chicago 38, Illinois
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ADDRESS: ____________________

CITY: ____________________ STATE: ______

TELE-TIPS

BIG BUSINESS—With radio-television now approaching the three-billion dollar mark (see front cover) it is interesting to compare the annual business done by some other major U. S. industries, such as: Paper \$5 billions; beverages \$4 billions; mining \$4 billions; dairying \$2½ billions; tobacco \$2 billions; chemicals \$4 billions; tires \$3 billions; films \$1½ billions; cotton \$3 billions; telephones \$2 billions; oil \$10 billions.

HOW GOOD IS A GOOD TV PICTURE?—While this has long been a subject for debate, R. D. Kell, Head of the Television Section at RCA Princeton Laboratories predicts a picture detail equivalent to approximately 85% of that achieved with 35 mm film as current equipment limitations are overcome.

HIGHER PRICES?—Steel, copper, tin, zinc and aluminum are being stockpiled for Government use; a fourth round of wage increases is in the offing; higher taxes are imperative to meet pension and health-plan promises; railroad freight rates are due to go up 6 to 8%, and parcel-post went up with the new year. All these must add up to increased cost of materials, indicating that from now on, inventories on hand will be worth more than money in the bank.

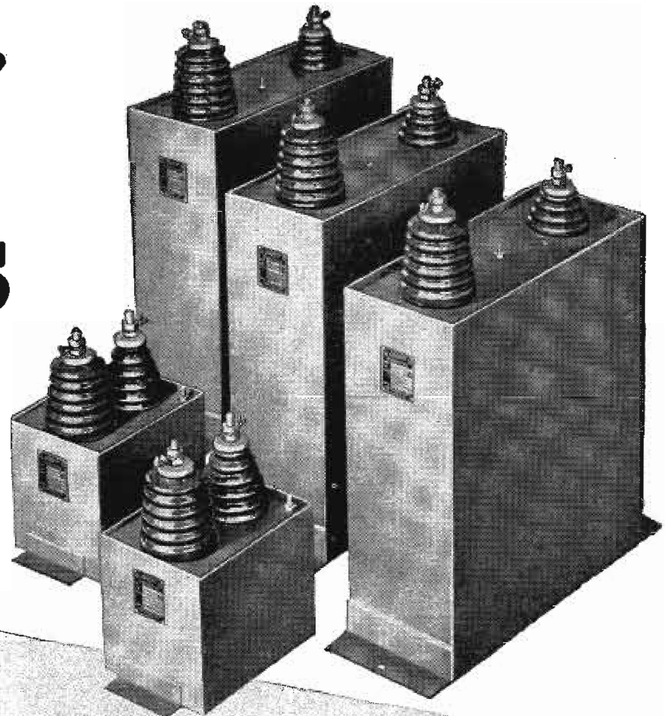
AC-DC!—Even the sacrosanct Electrical Code has felt the impact of TV. Code rules have long forbidden AC and DC lines in same conduit. But recently in DC sections of large cities, apartment dwellers have been so insistent on AC for television operation that authorities now permit AC cables to be pulled into existing risers along with DC feeders, where there's space and adequate insulation.

PROFITS FROM TV—Every radio man has had requests from lay friends for advice on what are the best television stocks to buy. Most of us simply throw up our hands and freely admit we dunno. But a Chicago group, Television Fund, Inc., 135 S. LaSalle St., Chicago, has made a scientific analysis of the situation and already shows quick gains. Consultants for the Fund include such well-respected TV names as Capt. W. C. Eddy, George P. Adair, Dr. William L. Everitt, and Dr. Frederick E. Terman.

Special

CAPACITORS

. . . engineered by AEROVOX



Aerovox Series 20 Hyvol impregnated and filled capacitors in ratings up to 50,000 v. in hermetically sealed welded steel cases.

Aerovox Series 26 stack-mounting Hyvol impregnated and filled capacitors in ratings up to 150,000 v. Laminated bakelite cases. Cast-aluminum terminal ends.

● For those extra-severe-service applications on the largest capacitors, as well as others, Aerovox units have the extra stamina that makes them last. Decades of specialization provide an experience background second to none in solving all kinds of capacitor problems; unexcelled production facilities assure QUALITY as well as quantity.

Aerovox capacitors are liberally engineered for their individual applications. Special multi-layer capacitor tissues . . . long-life, non-inflammable Hyvol impregnant and fill . . . constant filtration and testing of impregnant as regular production routine . . . thorough evacuation and impregnation . . . positive hermetic sealing—these facts of Aerovox craftsmanship spell long, trouble-free service.

Aerovox capacitors in daily use speak for themselves. No finer capacitors are built. Aerovox engineers stand ready to meet your most severe requirements.

Submit your capacitor problem. The tougher the better! Write for literature.

AEROVOX capacitors

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50 YEARS OF PROGRESS WITH KESTER SOLDER

The present type of cored solder used by industry was first made by J. F. Kester in 1899. From the simple beginning of its first application . . . a few soldered connections in the old hand-crank telephone . . . it has continued to grow by keeping pace with new techniques as demanded by industry. Today's modern production would not be possible without cored solder.

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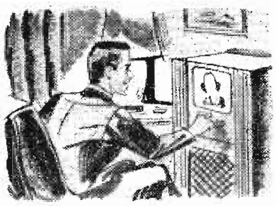
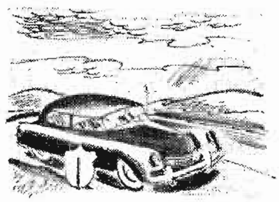
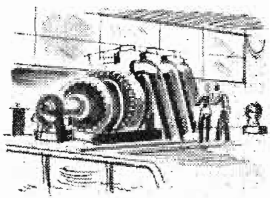


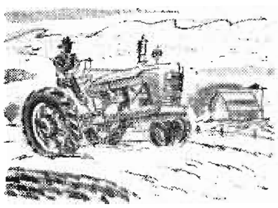
RADIO-TELEVISION—The early commercial, amateur, and professional builders of radios accepted Kester Rosin-Core Solder as standard. Then as now, Kester still leads in this field.



AUTOMOTIVE—Ever since its inception Kester Acid-Core Solder has been and still is the standard in the automotive field and for the trade. Mechanics and repairmen insist upon it.

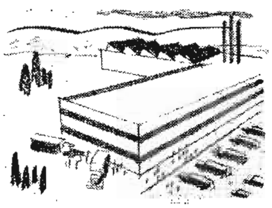


ELECTRICAL-ELECTRONIC—Kester makes a great variety of "specialized" core solders and solder preforms—even those suitable for the fine touch required in electronic work.



AGRICULTURAL—For a half century Kester Cored Solder has been the farmer's standard for maintenance and repair. He uses Kester because his soldering must be fast and reliable.

HOMECRAFT—In hobbycraft as well as home repair, good solder bonds are essential. Kester Metal Mender and Radio Solder are the standards for all homecraft workers.



INDUSTRIAL—Kester Cored Solders have met every requirement for the past half century. They have earned the reputation for and are recognized as standard for industry.

Over 100,000 Types and Sizes

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Free—Technical Manual. Send for Kester's new 28-page manual, "Solder and Soldering Technique." A complete analysis of the application and properties of soft solder alloys and soldering fluxes.

1899 50th Anniversary 1949

KESTER SOLDER

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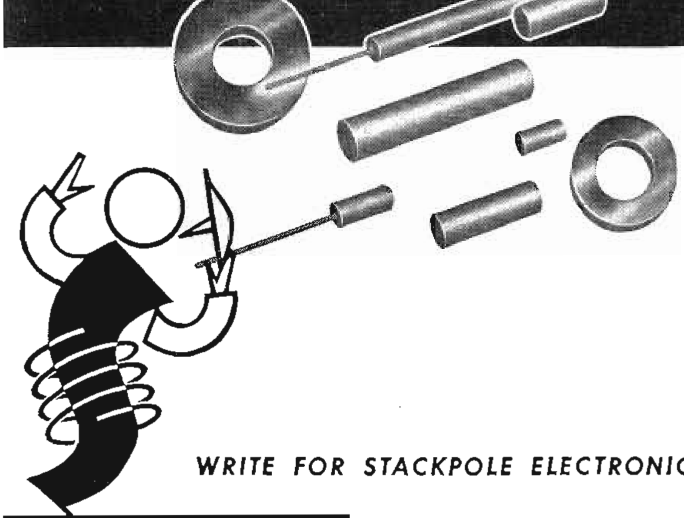
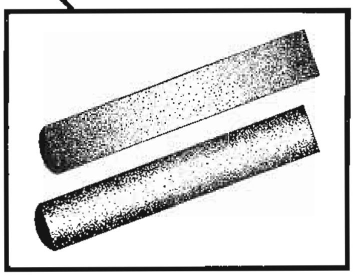
IT'S STACKPOLE FOR IRON CORES!



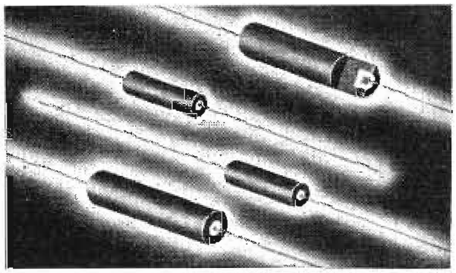
The rapid increase in the use of molded iron cores throughout electronic engineering has resulted in large part from Stackpole engineering that has made new and improved types available at attractive prices. In addition to dozens of standard broadcast, permeability tuning and high frequency types, Stackpole offers numerous others, a few of which are illustrated below.

WRITE FOR STACKPOLE ELECTRONIC COMPONENTS CATALOG RC-7



SIDE MOLDED

Extra density of pressure extends evenly the entire length of the core. Resulting uniform permeability makes Stackpole Side-Molded Cores outstandingly superior for tuning applications. Broadcast band and short-wave types available.



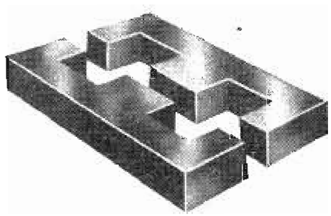
CHOKE COIL CORES

Ideal for audio, "hash," r-f chokes and others. Reduce coil dimensions and increase "Q." Insulated leads connect to coil and permit point-to-point wiring. Frequency ranges from 100 cycles to 175 megacycles.

TRANSFORMER CORES

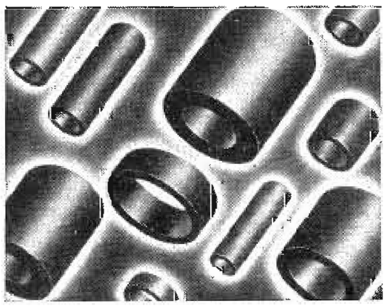
for filter coils in carrier frequency equipment.

Assure constant inductance over a given frequency range. Widely used where constant inductance, limited only by predetermined saturation point of core, is needed for various currents.



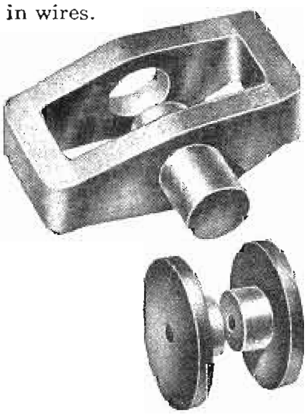
HIGH-RESISTIVITY CORES

Made of a special material showing resistance of practically infinity. Reduce leakage currents and noise troubles, minimize voltage breakdown possibilities between coils and core; and, where cup cores are used, eliminate heavily insulated lead-in wires.



SLEEVE CORES

By permitting use of smaller cans of less critical and less costly materials, these cores assure a high order of tuning efficiency in greatly reduced size. In some instances, it may not even be necessary to use cans.

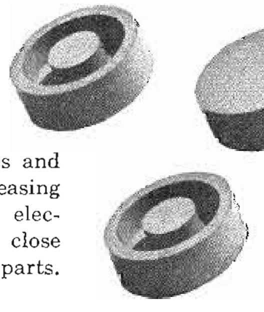


TELEVISION CORES

From horizontal deflection and flyback transformer cores to I.F. and other types, Stackpole offers a complete line. The types illustrated here assure remarkably uniform results, save on assembly costs.

CUP CORES

These unique, self-shielding units are available in a wide range of shapes and sizes and are finding steadily increasing use throughout modern electronics. Can be mounted close to chassis or other metal parts.



ELECTRONIC COMPONENTS DIVISION

STACKPOLE CARBON COMPANY, St. Marys, Pa.

The farmer in the field and his wife at home will be able to converse with eose by using these new, lightweight transceivers equipped with Sylvania sub-miniature tubes!

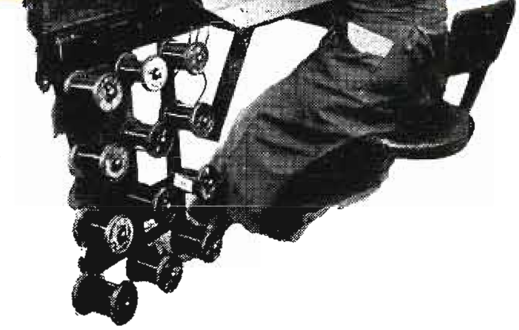
Tiny Sylvania sub-miniature radio tubes, smaller than a lady's little finger, are big reasons why the Citizens Radio Transceiver measures only 6" long, not quite 3" wide, 1 1/4" deep, and weighs only eleven ounces!

Sold in sets of two, these tiny two-way transceivers with a range of several miles are tuned to 465 mc. Among the many who want these handy units are police and fire departments, surveyors, farmers, hunters, industrial users, rangers and those who wish boat-to-home and auto-to-home communications.

Sylvania's extensive radio tube research and manufacturing skill have made Sylvania sub-miniature tubes the choice of Citizens Radio Corporation, Cleveland, for this revolutionary, civilian transceiver. Sylvania Electric Products Inc., Radio Tube Division, Emporium, Pennsylvania.

SYLVANIA ELECTRIC

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



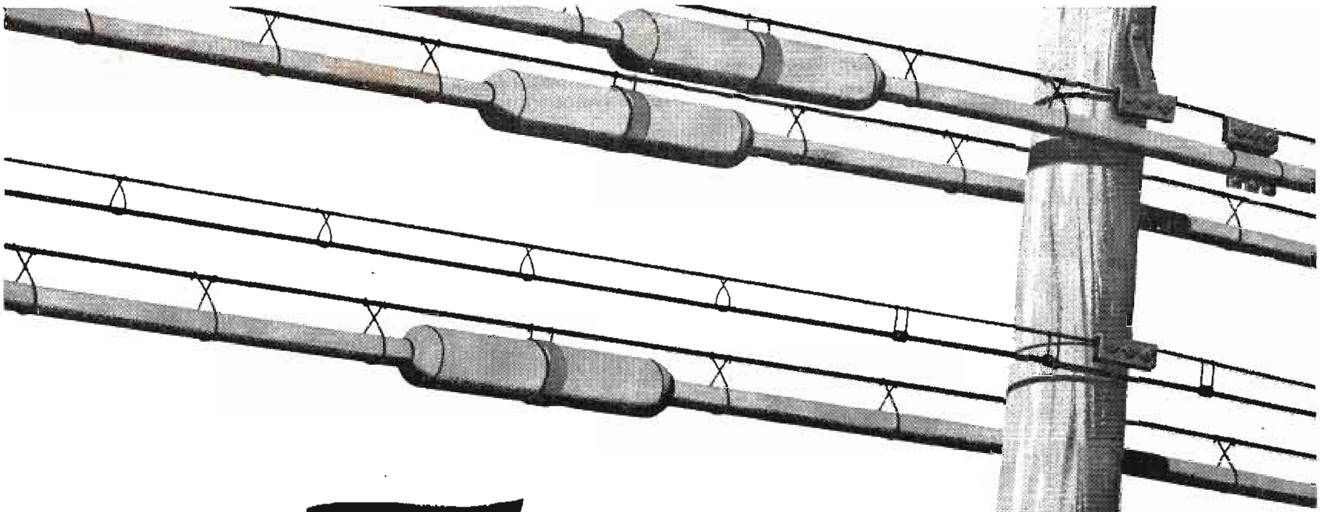
FORMVAR MAGNET WIRE, insulated with vinyl acetal resin varnish, is abrasion resistant. Under heavy winding tension it elongates to the breaking point of the copper wire without cracking or rupture of insulation. The Formvar film will not become brittle after prolonged exposure to high operating temperatures*. Space factor is identical with plain enamel.

Formvar resists moisture and treating solvents such as petroleum naphtha and coal tar derivatives. In dielectric strength, it withstands 1000 volts per mil. (.001″) of insulation. For complete detailed information on magnet wire and coils, write Anaconda Wire and Cable Company, 25 Broadway, New York 4, N. Y. or 20 N. Wacker Drive, Chicago 6, Illinois.

*Based on AIEE temperature rating this is a class A material capable of withstanding a "Hottest-spot" temperature of 105° C which is a rise of 65° C over an ambient of 40° C.

ANACONDA

LOOK TO *Anaconda* FOR ENGINEERED MAGNET WIRE AND COILS



The case of the Creeping Sleeve

Lead sheathing on telephone cable meets many stresses — the tug of its own weight, wind pressure, contraction and expansion from cold and heat. Then, too, there's the pressure of nitrogen gas put in Long Distance cable to warn of sheath breaks and keep out moisture.

And, sometimes, lead is subject to "creep"— a permanent stretching — even when the stress is but a fraction of the normal tensile strength. Creep is especially likely at the lead sleeves used where two lengths of cable are joined. The sleeve may stretch and break open exposing telephone circuits to the elements.

So Bell Laboratories scientists have developed methods to test and control creep. In a special testing room, weights are applied to scores of samples of lead, under controlled conditions. Exact records of the amount of creep are obtained with a precision instrument.

Years of careful study have produced a lead composition which resists creep and yet has all the other properties required of sleeves. This means better telephone service for you and helps give that service at lowest possible cost. It is an example of the way Bell Telephone Laboratories scientists study and improve every part of the great telephone plant.

BELL TELEPHONE LABORATORIES

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

TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

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

CUTTING TV RECEIVER COSTS—All production is becoming more cost conscious each season. The one obvious method is to reduce the number of parts—preferably taking out whole stages. The loss of half a dozen tubes in a set will certainly cut costs, especially when a nice, new, undefined name for the part of the circuit that remains will make up for the inferior operation!

Real economy, however, has been found in some plants by re-engineering assembly methods, and the replacement of obsolete operations and equipment. The cost of components and assembly in a receiver does not bulk large considering the consumers cost. Costs saddled on installation and service men by requiring much time and expense in building up the signals to a usable level constitute the most expensive penny-saving item imaginable. More tubes, not less, may prove to be cheapest in the end. The public is concerned with total installed cost—not numbers of tubes.

HIGHER POWER, BETTER RECEPTION—Teleset prices will always remain high as long as licensing authorities continue to consider that the present height X power relations, based on early guesses, are still sacred. Authorizing greater heights and more power with a proviso that interference between same channel stations would not increase, would whet engineering activity in developing horizon-limiting arrays. Everyone would benefit from even a tenfold signal gain.

Higher power all round will not change present interference areas or conflicts as between transmitters. But higher powers in TV — as in AM and FM — will mean better customer reception and tremendous savings in customer equipment and customer investment.

SUBMINIATURIZATION GAINS—Since the unveiling of the wartime subminiature tubes used in the proximity fuze, dozens of other tiny tubes have been developed for varied radio uses. Sylvania's R. K. McClintock cites a computer unit which by employing subminiature tubes and resistors, wafer capacitors, printed circuits, and ceramic-plate sub-assemblies, can be used to replace a unit about ten times its size. Measuring only 2 in. in diameter and 2½ in. high, with a weight of 4½ ounces, it contains 11 subminiature thryratrons, 80 resistors and 23 capacitors. But there are still many engineers unfamiliar with the fact that subminiature tubes exist having characteristics comparing favorably with tubes in general use.

PAN-AMERICAN TV STANDARDS—British television manufacturers are vigorously going after export business in the Americas, both North and South. Envisioning sales of 200,000 telesets in Canada, the British E.M. & I is smartly yielding there to our familiar U. S. standards, recognizing that 80-MC waves observe no territorial boundaries.

But for South and Central America, the British will avoid 525-line scanning and introduce their own 405 lines, 25 frames per second, with vertical polarization, and strongest signals on whites,—all pretty much the reverse of U. S. practice! If such foreign standards once get a foothold in the Western Hemisphere, the resulting situation will make future sales of U. S. equipment more complicated. And it will block the eventual dream of a Western Hemisphere Network,—now apparently remote, but perhaps nearer than we think!

From every aspect, U. S. TV standards should be pushed throughout South America without delay.

SPEAKING OF STATISTICS — AS OF JANUARY 1, 1949, THERE WERE:

Total AM Broadcast Stations Authorized	2,200
AM Broadcast Stations Operating	1,900
Total FM Stations Authorized	1,100
FM Stations Operating	750
Total Television Stations Authorized	124
Television Stations Operating	46

Population Served by TV Programs
Jan. 1, '49 65 millions (42 cities in 28 states)
Dec. 31, '49 95 million people

Total special service stations: marine, aeronautic, railroad, industrial, public safety, etc.	135,000
Radio operators licensed	550,000
Amateur stations	85,000
FM sets made during 1948	1,600,000
Record-player units of all types in use	21,000,000

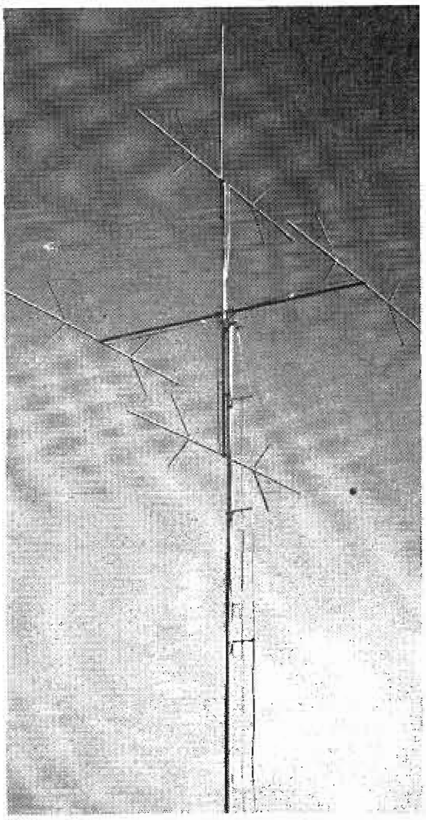
For complete statistics on radio manufacturing and sales, 1922 through 1948; the radio industry, radio sets in U. S. and world, etc., see page 25.

Trends in Television and

Engineering design boards now carry new circuit arrangements and show production methods that offset growing tendency of more complicated features

By ***RALPH R. BATCHER,*** *Consulting Editor, TELE-TECH*

WHILE, in closing the books for 1948, the radio manufacturing industry is confronted with unusual situations that upset accurate anticipation of what 1949 will show as to the buying tendencies of the public, the technical changes being studied in the laboratories are easier to set down. In almost every field there are still-unanswered merchandising questions; for instance the big question is: how will the public's wants this year be divided between AM, FM and TV receivers? Then, whereas in the past a manufacturer has had to figure out only how many record changers the public would need, now this matter is complicated by the question — what speed, 33, 45 or 78? Must more than one speed be provided? And should built-in filters be included? To what extent must a recorder be added to a combination job? Should it be wire or tape? These questions and others, while not primarily technical, are influencing engineering thinking.

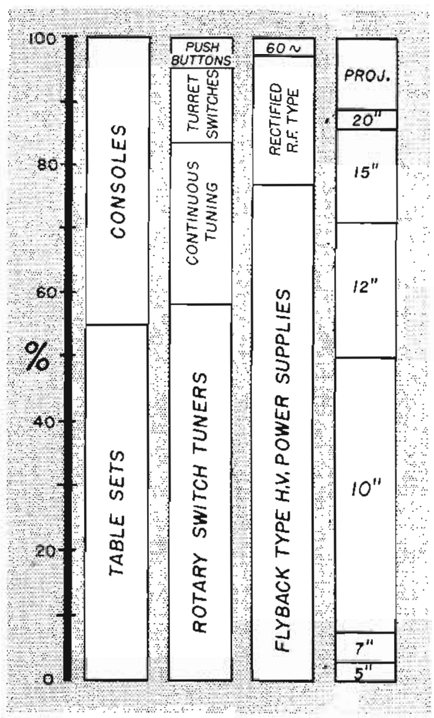


New high gain TV antenna (RCA) developed to give greater signal in critical locations

Before summarizing trends in television receiver design, the field where most engineering activity is taking place, a brief summary of some projected changes in older receiver types might be given. First, in the matter of tubes, miniature types are gaining a somewhat stronger foothold each year in all types of receivers. These tubes represent a wartime development, necessitated by improved characteristics at higher frequencies. Miniature tube types are now available for most circuit needs, at prices which are in general competitive with metal types, by reason of production methods that have been improved during the year. The problems introduced by closer working tolerances and somewhat different assembly technics have been worked out. Most of the miniature tubes are essentially identical with their octal prototypes insofar as the electrode assembly is concerned, both as to the size and spacing of the elements. The difference therefore is usually only in the outer envelop and basing.

Ultimately one can surmise that the more economical utilization of raw materials in the miniature types, the possibility of better degassification by RF bombardment, the greater ease in packing, shipping and storing and the possibility of smaller space requirements in cabinets will account for a greater swing to this type this year. In television and FM receivers, 1948 designs called for the production of metal and miniature types in about equal numbers.

The survey of the course in AM receiver construction has brought forth no contemplated unusual changes (beyond styling variations) that were not found in 1948 models. This is a natural result of nearly three decades of progress. There is no mystery about how to attain any degree of fidelity, sensitivity and selectivity that is needed. Such knowledge has released much of the design abilities of engineers to other problems, such as frequency modulation receivers. During recent years the several methods of FM detection have each collected its own adherents among designers. Of these the original discriminator circuit with



Breakdown of television set design trends shows styles and features of models offered

Radio Receiver Design

limiting is apparently holding its own with the ratio detector.

It seems that the oft heralded streamlined production methods for complete chassis using printing, plating or stamping processes will not gain much headway during 1949. Numerous experiments based on many of these processes all point to the same trouble — attempts to fabricate all resistance, capacitance and wiring components on a chassis at one time have about the same advantages that cooking all items of a dinner at the same operation in one pan would have. One reason is that these components are made in such quantities with automatic methods that their excellence and price can hardly be duplicated even with the so-called one-shot printing methods, even though all these components have to be individually wired in.

This conclusion does not hold however when it comes to certain unit assemblies of resistance networks or even resistance-capacitor combinations on plaques used as stage coupling (or decoupling) units, which provide simple space saving sub-assemblies and are used in increasing hold in the case of high frequency coils or groups of coils stamped or printed on insulating plates. These also seem to provide a simple method of fabricating inductances where close tolerances are needed.

A continued swing to ceramic bypass capacitors for complicated circuits has been noted. In some '49 sets announced, ceramic units about equal in number the combined number of mica and wound paper capacitors together.

In spite of the above adherence to the time-honored production line methods of assembly, unusual interest is being given to the simplification of wiring, both as an item of reduced manufacturing cost, and one of easier servicing. This is done by complete studies of the best placement of parts. Economies are also effected by serious re-examination into the value of each component in the circuit.

However a few farsighted designers have been throwing away strict adherence to time-honored television reception methods and are introducing variations which before long may introduce cheaper sets. The writer recently noted excellent performance of a receiver operating in the marginal area, that used only about a dozen tubes. Moreover there are several methods of attacking this problem that are being studied and the production program for 1950 may contain models with much fewer tubes.

Experienced designers do not fall for every "cuts out a tube" idea, however. Actually, the cost of a tube and socket are often less than the higher quality, more efficient components that may have to be added to maintain adequate sensitivity, selectivity or band width. Therefore in many cases it is false economy to try to do much cutting without a thorough analysis of all conditions. This includes a study of the total cost to the user. A set that is inferior to others in the matter of being able to operate in areas where signals are weak, may serve admirably if an elaborate (and expensive) antenna installation is made. The saving of the cost of an extra stage is far outweighed by the larger installation costs. This group of designers believes that the set of the future can use any kind of antenna wire to provide a satisfactory signal.

There are many who believe that a good antenna will permit almost any kind of receiver to operate. Certainly in many important areas a high gain, wide band antenna is a "must." The availability of better engineered designs of dipole for home receivers can extend the service area of a station remarkably. Arrangements have been shown, that give a worthwhile gain over simpler systems. For example a new antenna was recently described at the FCC trophospheric conferences. The array is unidirectional with a large (possibly 20:1) front-to-ratio, requires no adjustment or switching to operate effectively on any channel, and has a gain of two or three over the normal dipole.

Many ingenious circuit methods have come to light recently that eliminate a few resistors and a capacitor or so, without detracting from operation. These are real savings. No small part of a television receiver circuit consists of resistors and capacitors that form interstage isolation filters. These items are relatively inexpensive but they contribute to the complexity. The use of B supply sources having the best regulation characteristics is proving worth while here. Selenium rectifiers, often in the voltage multiplying, transformerless circuits are receiving serious consideration in several additional designs this year, because of better regulation.

Intercarrier modulation circuits, considered to be one of the most promising cost saving systems in receiver design has received a steady but heretofore not phenomenal growth. As a result of intensive research in many laboratories, coupled with actual investigations of results obtained on several receivers with intercarrier control methods that have widespread use in many areas, the doubts accorded this system at the start have been largely allayed. In fact there are many advantages, not fully realized before, that will make the use of this system a "must" before long. Advantages of simplified timing, more freedom from the effects of oscillator drift and less interchannel cross talk are marked, in addition to the obvious substan-

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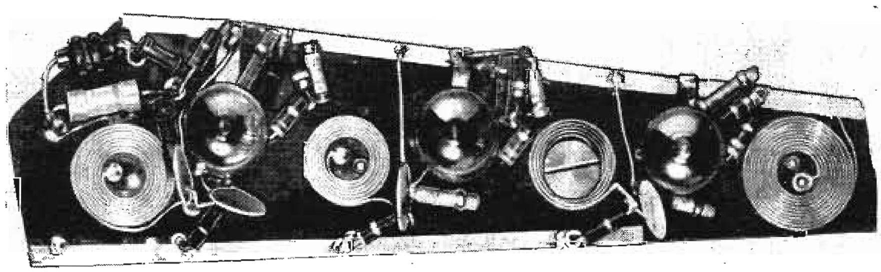
Video IF (Franklin) shows simplicity of stamped circuit components with miniature tubes



tial savings in receiver costs. A continued extension of this principle to other makes is scheduled for '49, with the consequent reduction in the size of the set by about four tubes.

Another circuit trend is that of using direct coupling in the video amplifier stages. This arrangement, while not new, contributes greater video gain, and is more economical of parts. Besides this arrangement brings about the elimination of the dc restoration tube.

The dissatisfaction held by many designers about the present video intermediate frequencies may result in the selection of a higher frequency (probably in a range near 42 MC) as standard at some later date if an agreement is reached in the RMA committees studying the problem. Many factors and checks are necessary in making such a change.

Unusual changes are taking place in the RF tuning systems. The front end of most receivers have undergone many changes and the end is still not in sight. Rotary switch types of tuning, now used in about 60% of the models, will continue in popularity with several new designs available. Second and third choices at present are the continuous tuning and turret switch type tuners. A new form of push-button tuner recently introduced is also receiving some attention. Permeability tuning in television receivers may become more common.

The big problem this year will be picture size. Projection jobs did not make the headway last year that was expected earlier (at least for home use). Dealers have found, however, that no purchaser ever complained about getting a set with too large a picture. The new 16" metal tubes are expected to take over the popularity now held by 10" tubes. When this happens the 12" tube will also lose out in many designs, all favoring the larger tubes.

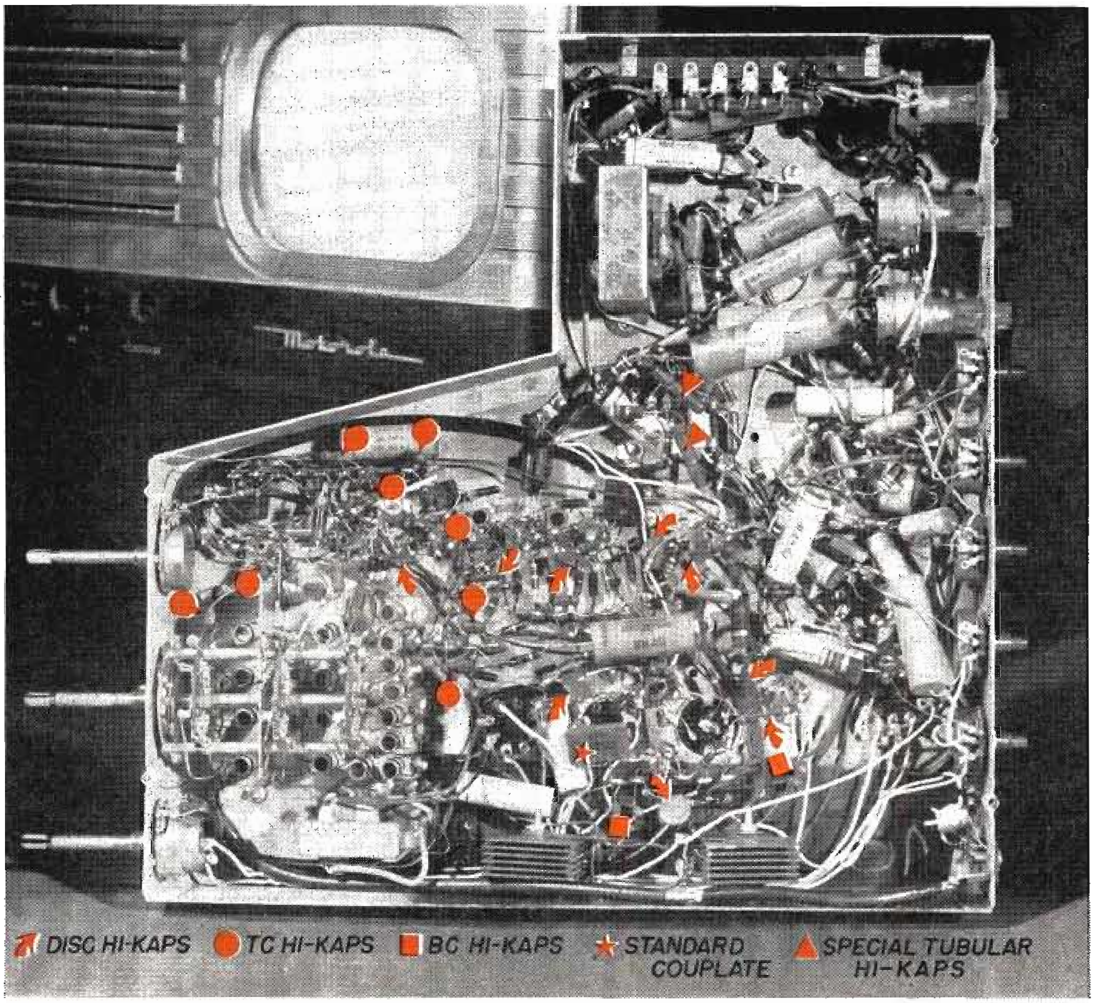
Far-sighted designers are not forgetting projection arrangements and the announcements of several new systems are expected shortly. A characteristic of projected pictures not yet fully appreciated is that of reduced eye strain.

A great deal of circuit complexity is usually found in scanning circuit control arrangements. Much simplification of the synchronization systems in use are expected, resulting in the elimination of from one to three tubes. The use of L-C combinations as tuning elements in the horizontal sweep control has been reported favorably.

Another development is a transformerless horizontal sweep, eliminating one expensive item in the circuit, but introducing new problems in obtaining a high voltage source for the tube — since the flyback voltage source is used in four out of five designs at present.

The quantity production of 16" cathode ray tube sets will introduce new problems. Complete independence of the focusing and modulation characteristics can be achieved only by strict adherence to precision

(*Continued on page 52*)



Ceramic capacitors, (Centralab types) in several styles reduce complexity of this TV chassis by reduction of space requirements

U. S. Radio Statistics, 1949

Radio-television output during 1948 and complete home-set census; production and use tabulated for radio industry's past 27 years

THE RADIO-TELEVISION INDUSTRY

Data Covers Year Ended December 31, 1948	Total Investment	Annual Gross Revenue	Number of Employes	Annual Payroll
Radio manufacturers (1200)	$ 70,000,000	$ 600,000,000	100,000	$190,000,000
Radio distributors, dealers, etc.	325,000,000	1,500,000,000	125,000	275,000,000
Broadcasting stations (2000) including talent costs	150,000,000	400,000,000	*23,000	170,000,000
Commercial communication stations	60,000,000	....	15,000	10,000,000
Listeners' radio and TV sets in use (75,000,000)	3,500,000,000	....	.....	†550,000,000

* Regular staff—not including part-time employes, artists, etc., who number at least 30,000 more.
† Annual operating expense for listeners' sets, for tube replacements, electricity, servicing, etc.

ANNUAL BILL OF U. S. FOR RADIO-TV

Sales of time by broadcasters, 1948	$385,000,000
Talent costs	70,000,000
Electricity, batteries, etc., to operate 75,000,000 radio and TV receivers	250,000,000
14,000,000 home radio receivers, at retail value	600,000,000
850,000 television receivers, at retail value	300,000,000
Phonograph records, 250,000,000	233,000,000
Radio repairs and supplies:	
70,000,000 replacement tubes	95,000,000
Radio-TV parts, accessories, etc.	125,000,000
Labor	100,000,000
TOTAL	$2,158,000,000

RADIO SETS IN U. S.; WORLD

	January 1, 1949
United States homes with radios	40,000,000
Secondary sets in above homes	19,000,000
Sets in business places, institutions, etc.	5,000,000
Automobile radios	11,000,000
TOTAL sets in United States	75,000,000
Total radio sets in rest of world: North America, 5,500,000; South America, 5,500,000; Europe, 48,500,000; Asia, 7,000,000; Australia, 3,000,000; Africa, 1,500,000	71,000,000
TOTAL sets in world	146,000,000

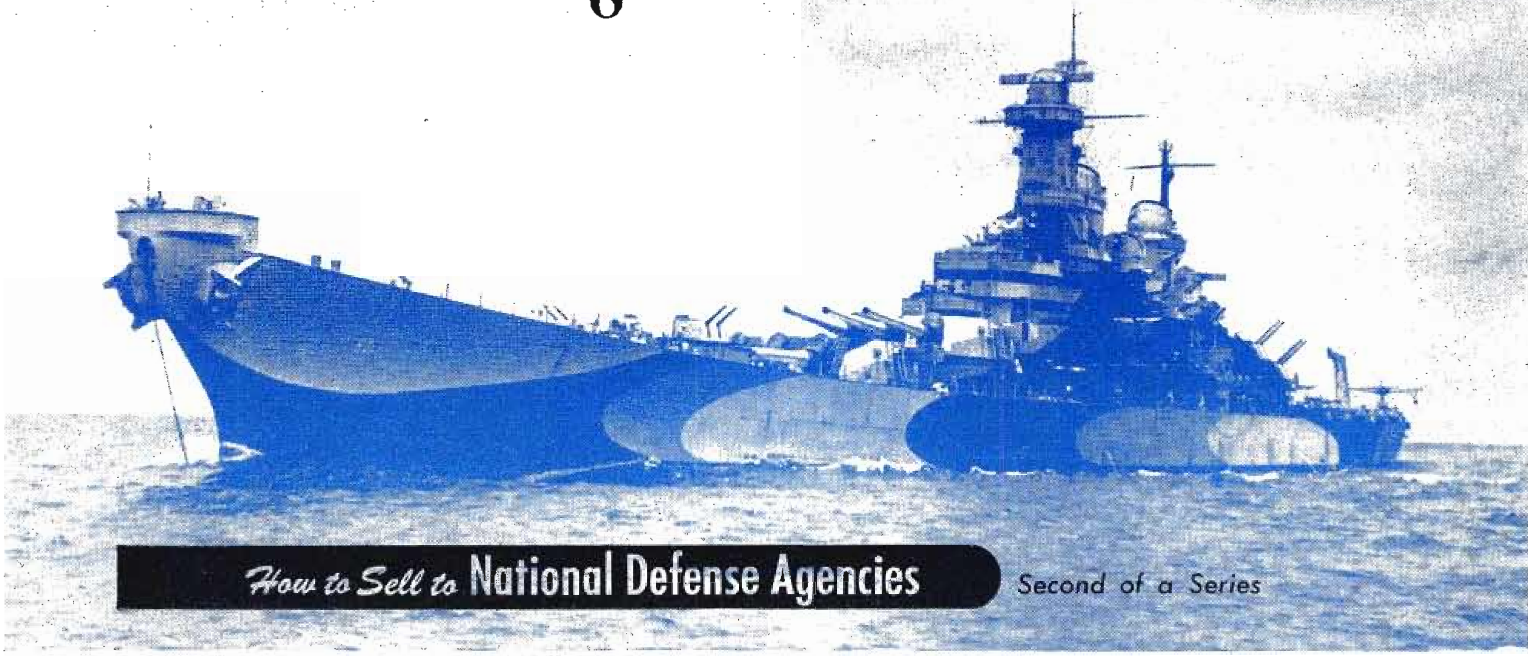
PRODUCTION OF CIVILIAN RADIO SETS — 1922 TO 1948

	Total Civilian Radio Sets Manufactured		Total Civilian Tubes Manufactured		Automobile Sets Manufactured		Total Radio Reception Equipment	Auto Sets in Use	Homes with Radio Sets	Total Radio Sets in Use in U. S.	At Close of
	Number	Retail Value	Number	Retail Value	Number	Retail Value	Value	Number	Number	Number	
1922	100,000	$ 5,000,000	1,000,000	$ 6,000,000	....	....	$ 60,000,000	....	260,000	400,000	1922
1923	550,000	30,000,000	4,500,000	12,000,000	....	....	151,000,000	....	1,000,000	1,100,000	1923
1924	1,500,000	100,000,000	12,000,000	36,000,000	....	....	358,000,000	....	2,500,000	3,000,000	1924
1925	2,000,000	165,000,000	20,000,000	48,000,000	....	....	430,000,000	....	3,500,000	4,000,000	1925
1926	1,750,000	200,000,000	30,000,000	58,000,000	....	....	506,000,000	....	5,000,000	5,700,000	1926
1927	1,350,000	168,000,000	41,200,000	67,300,000	....	....	425,600,000	....	6,500,000	7,000,000	1927
1928	3,281,000	400,000,000	50,200,000	110,250,000	....	....	690,550,000	....	7,500,000	8,500,000	1928
1929	4,428,000	600,000,000	69,000,000	172,500,000	....	....	842,548,000	....	9,000,000	10,500,000	1929
1930	3,827,800	300,000,000	52,000,000	119,600,000	34,000	$ 3,000,000	496,432,000	....	12,048,762	13,000,000	1930
1931	3,420,000	225,000,000	53,000,000	69,550,000	108,000	5,940,000	300,000,000	100,000	14,000,000	15,000,000	1931
1932	3,000,000	140,000,000	44,300,000	48,730,000	143,000	7,150,000	200,000,000	250,000	16,809,562	18,000,000	1932
1933	3,806,000	180,500,000	59,000,000	49,000,000	724,000	28,598,000	300,000,000	500,000	20,402,369	22,000,000	1933
1934	4,084,000	214,500,000	58,000,000	36,600,000	780,000	28,000,000	350,000,000	1,250,000	21,456,000	26,000,000	1934
1935	6,026,800	330,192,480	71,000,000	50,000,000	1,125,000	54,562,500	370,000,000	2,000,000	22,869,000	30,500,000	1935
1936	8,248,000	450,000,000	98,000,000	69,000,000	1,412,000	69,188,000	500,000,000	3,500,000	24,600,000	33,000,000	1936
1937	8,064,780	450,000,000	91,000,000	85,000,000	1,750,000	87,500,000	537,000,000	5,000,000	26,666,500	37,600,000	1937
1938	6,000,000	210,000,000	75,000,000	93,000,000	800,000	32,000,000	350,000,000	6,000,000	28,000,000	40,800,000	1938
1939	10,500,000	354,000,000	91,000,000	114,000,000	1,200,000	48,000,000	375,000,000	6,500,000	28,700,000	45,300,000	1939
1940	11,800,000	450,000,000	115,000,000	115,000,000	1,700,000	60,000,000	584,000,000	7,500,000	29,200,000	51,000,000	1940
1941	13,000,000	460,000,000	130,000,000	143,000,000	2,000,000	70,000,000	610,000,000	8,750,000	29,700,000	56,000,000	1941
1942	4,400,000	154,000,000	87,700,000	94,000,000	350,000	12,250,000	360,000,000	9,000,000	30,800,000	59,340,000	1942
1943	....	....	17,000,000	19,000,000	....	....	75,000,000	8,000,000	32,000,000	58,000,000	1943
1944	....	....	22,000,000	25,000,000	....	....	85,000,000	7,000,000	33,000,000	57,000,000	1944
1945	500,000	20,000,000	30,000,000	35,000,000	....	....	105,000,000	6,000,000	34,000,000	56,000,000	1945
1946	14,000,000	700,000,000	190,000,000	200,000,000	1,200,000	72,000,000	900,000,000	7,000,000	35,000,000	60,000,000	1946
1947	17,000,000	800,000,000	220,000,000	260,000,000	2,500,000	150,000,000	1,100,000,000	9,000,000	37,000,000	66,000,000	1947
1948	14,000,000	600,000,000	200,000,000	230,000,000	2,800,000	200,000,000	950,000,000	11,000,000	40,000,000	74,000,000	1948

Figures for sets give value with tubes in receivers. In normal years, replacement tubes have run 25% to 40% of total tube production. All figures are at retail values. (Statistics Copyrighted by Caldwell-Clements, Inc.)

Selling to the NAVY

How to Sell to **National Defense Agencies** — Second of a Series



A battlewagon like famed U. S. S. Missouri uses large amount of communications and radar equipment

How vast quantities of radio-electronic equipment are bought from suppliers by the U. S. Navy for its aircraft, ships, submarines and shore stations

By ROBERT HERTZBERG, Contributing Editor, TELE-TECH

ANY radio-electronics manufacturer who has not sold merchandise to the Navy should certainly hasten to obtain a copy of a very informative 40-page booklet entitled "Selling to the Navy". It costs 15 cents and should be ordered from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., *not* from the Navy Department. A postal note is suggested as the most convenient form of remittance; stamps are not acceptable and coins have a habit of getting lost in the mails.

Navy procurement closely parallels Army procurement as described in the October issue of TELE-TECH, since all the armed services are now operating their buying activities under the provisions of Public Law 413, 80th Congress. "Invitations for Bids", accompanied by detailed specifications of the desired equipment, are sent out to potential suppliers, who then submit sealed bids. The lowest responsible bidder gets the order. Negotiated contracts, as in the Army, are arranged for experimental, developmental, research, and other types of procurement which do not readily lend themselves to formal advertising.

The focal point of interest of a contract-hungry sales engineer is definitely the Navy Department Building located at 18th Street and Constitution Avenue, Washington, D. C. The offices of the following important bureaus are concentrated here:

Bureau of Aeronautics—Procures much aeronautical equipments, including aeronautical electronic items. (The "United States Air Force" is divorced from the United States Army and is a separate entity, but Naval aviation remains part of the United States Navy. This is an important distinction and must be remembered in all dealings with the various Armed Forces.)

Bureau of Ships — Procures all ships, major ship components and shipboard electronic equipments.

Office of Naval Research — The "lab" end of the Navy.

Bureau of Ordnance — Procures guns and related supplies, including fire control equipment. Relatively, a smaller customer than the other bureaus, but not to be overlooked because some electronic methods enter into the complicated science of fire control.

Bureau of Supplies and Accounts —Procures common-use items and items assigned by other bureaus. Coordinates the operation of the Navy Supply System.

Specific activities have been established under the Navy Supply System for the purpose of reviewing the on-hand inventories of repair parts of the Navy and as a result of this review, determining the quantities of items to buy from industry to replace the items used by the Navy. The activities which make these determinations are designated Supply Demand Control Points.

There are two Supply Demand Control Points of major interest to radio-electronic firms: the Aviation Supply Office, Oxford Avenue and Martin's Mill Road, Philadelphia, Pennsylvania, near public transportation in North Philadelphia, and the Electronic Supply Office, U. S. Naval Supply Depot, Great Lakes, Illinois, a short distance from Chicago. These control points are under the respective commands of Rear Admiral John E. Wood, Supply Corps, U. S. Navy, Aviation Supply Officer, and Commander Thomas J. Montgomery, Supply Corps, U. S. Navy, Electronic Supply Officer. Manufacturers and suppliers should make their acquaintance.

Are You After Navy Business? Here's What to Do

1. Get a copy of the booklet "Selling to the Navy" from the Government Printing Office.

2. Write individual letters to the Bureau of Ships, the Bureau of Aeronautics, the Bureau of Ordnance, the Bureau of Supplies and Accounts and the Bureau of Naval Research, all in Washington, to the Aviation Supply office, Philadelphia, Pa., and to the Electronic Supply Office, Great Lakes, Ill., asking to be put on their mailing lists.

3. Handle all correspondence, invitations to bid, etc., very carefully, with special regard for the instructions in fine print on the invitation forms.

4. Do some leg work. Visit the Bureaus' offices, meet the men handling the Navy's buying, and find out what's going on.

The determinations of "what to buy" can be described in simple terms. Suppose for instance the Bureau of Ships or the Bureau of Aeronautics decides that a certain shipborne or airborne radio receiver is obsolete and needs to be replaced. The engineers in the Bureau concerned will design the new radio set or the design work will be let out on a negotiated contract to some independent laboratory or manufacturer. The Office of Naval Research may be consulted and its facilities and experience utilized. After a satisfactory receiver has been approved, probably in pilot model form, the Bureau prepares detailed specifications and "invitations to bid" are issued to interested manufacturers. The bid of one firm is accepted and a contract is issued. The manufacturer produces, the sets get to Navy warehouses, the manufacturer is paid and the transaction is finished. This is an over-simplification of the procedure. However, in substance, it describes the procure-

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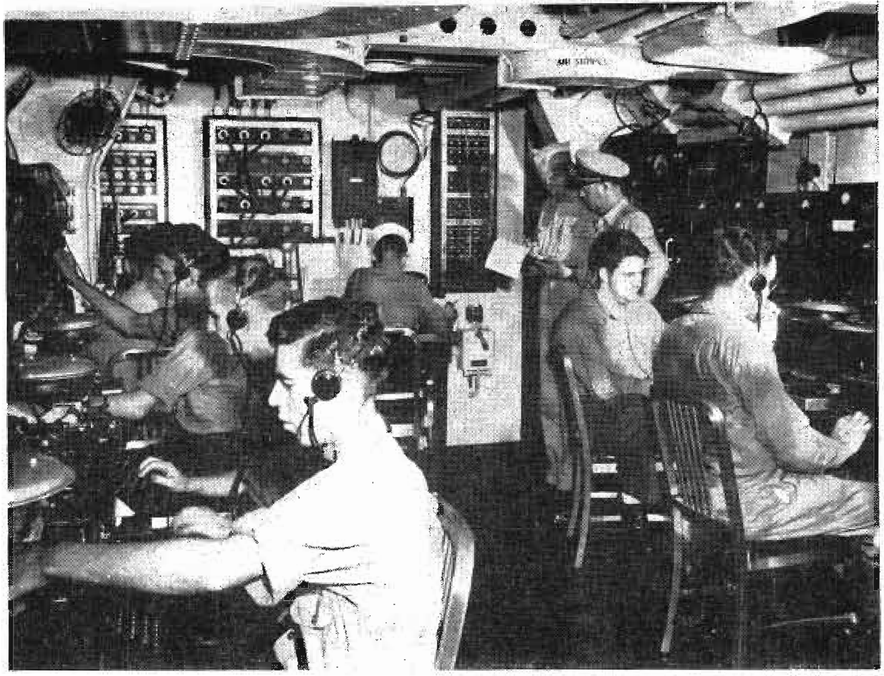
Looking up from the flight deck of the U. S. S. Lexington at the myriad radio-radar facilities, common to modern aircraft carriers. Antennas in this photo are used for the following purposes: 1, 2 and 3) radio communication; 4) fire control radar; 5, 6, 7, 8 and 9) radio communication; 10) air search and height finder radar; 11) radio communication; 12) radar test equipment; 13) surface search radar; 14) radio communication; 15) homing beacon; 16, 17, 18, 19 and 20) radio communication; 21) air search radar; 22) homing beacon; 23) air search radar; 24 and 25) radio communication; 26) identification radar; 27 and 28) radio communication. Here is one reason why the Navy is such a good customer for manufacturers of radio and electronic equipment

SELLING TO NAVY

(*Continued from preceding page*)

ment function adequately enough.

Once a piece of electronic equipment becomes Navy standard, for use as shipborne or airborne equipment in the service, the responsibility for maintaining adequate stocks of repair parts to support the equipment passes to the Aviation Supply Office for airborne equipment and to the Electronic Supply Office for shipborne equipment. These control points receive requisitions from supply points all over the country, coordinate them, do the necessary purchasing and instruct suppliers as to the destination of various lots of their products. A supplier gets one contract with one set of shipping instructions, rather than a dozen different orders for individual warehouses.



Nerve center of every naval vessel is the "shack"—a maze of men, cable and typewriters

A manufacturer or other supplier who wants to get on the mailing lists for invitations to bid can do so very easily. He should write directly to EACH of the bureaus and supply offices mentioned, enclosing with his letter copies of all available catalogs or other literature describing his products. In addition, he should state what specialized Navy equipment he is prepared and able to make, what his over-all technical and production facilities are, etc. He should assume that the Navy knows nothing about him but is willing to learn, so he should present a good case.

If the descriptive information is insufficient in the opinion of the particular Bureau concerned to establish the status of the concern as an acceptable prospective bidder, or does not permit an accurate determination of the type of material on which it seeks to bid, a form for filing the required data will be sent to the manufacturer. A questionnaire very much like the one published on page 25 of the October issue must also be answered. This is all part of the inevitable paper work connected with government purchasing and it must be handled meticulously or not at all. Remember, the Navy procurement requirements are based upon Public Law and the many necessary regulations safeguard both the Government and the potential source of supply. The Navy wants to protect the supplier both as a businessman and as a citizen besides protecting the Navy, as one would protect any organization purchasing material on a large scale. In this connection, the statement has sometimes been made that the Navy is a "tough customer". It is not. It attempts to do business in a businesslike manner, with both parties living up to the contractual agreement.

Once a concern has qualified, it will without further action on its part begin to receive invitations to bid on articles it is able to make or supply. If the firm does not bid after three or four invitations, the Navy Department will assume that it is not interested, and it may remove its name from the mailing list.

Air arm represents large slice of the Navy's radio-electronic purchases. As importance of aviation increases, this market will become bigger

Synchronization of TV Carriers to Reduce Co-Channel Interference

By *ALBERT FRANCIS*

Controlled frequencies improve marginal area reception

AT the RCA Laboratories in Princeton a research group, headed by Ray D. Kell, has demonstrated the elimination of that form of television interference known as "beats between carrier frequencies." This difficulty is noticed on television screens when the signals from a distant transmitter on the same channel as the desired signal are received at a slightly different frequency. The interaction of the two carriers produces a beat frequency which is seen as alternate black and white bars across the picture. Some refer to this as the "Venetian blind effect". If the two carriers are of the same frequency there is no beat and hence no bars. Of course this does not mean that all other forms of television interference have been eliminated but this development opens the door to closer spacing, without interference, of TV transmitters and therefore the assignment by the FCC or more stations in a given area, or reduced interference between the stations now operating.

With a spacing of 150 miles between stations operating on the same channel why is there interference? Have we not been told that TV frequencies are mostly line-of-sight and usually do not travel much beyond, say, 60 miles? Yes, that is the early and simplified view, but we have learned more about tropospheric propagation and now know that atmospheric conditions, especially temperature inversions, can form "ducts" that conduct these very-high-frequencies over much longer distances. This then is the reason why, in Princeton, WNBW, Washington, puts interfering bars in the picture being received from WNBT, New York City. Both TV stations are on the same channel, Ch. 4. But Princeton is now spared this form of interference as long as Kell has his carrier synchronizing method in operation.

This equipment has been in operation for some weeks and has been demonstrated to the Joint Tech. Advisory Committee who were favorably impressed and to the FCC, who expressed much interest. It was first discussed at the FCC engineering conference in Washington Dec. 2 by Mr. Kell.

The equipment at the RCA Labs. consists of two narrow-band superheterodynes. A single local oscillator injects voltage in each mixer. The outputs of the two IF amplifiers are combined in a phase discriminator so that the output voltage is a measure of the phase difference of the incoming carrier frequencies. This output voltage is used to frequency modulate, by means of an R-C oscillator a 1,000 cycle tone which can be shifted plus or minus 300 cycles. This frequency modulated tone, transmitted over an ordinary telephone line to one of the controlled transmitters, is used to hold its carrier at zero beat with the other TV transmitter.

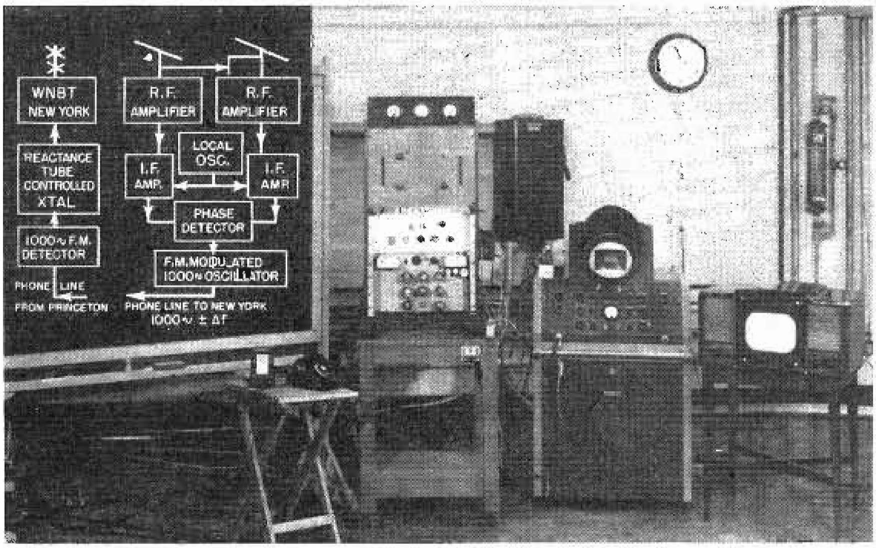
At Princeton, the New York signal is received on a dipole with reflector so that Washington signals are not strong enough to affect the circuits. A directive antenna is also used to receive from Washington. However some New York signal is picked up but it is removed by introducing into the antenna transmission line some voltage from the NYC transmitter, correctly adjusted as to phase and amplitude, to effect cancellation.

At the New York transmitter the tone received by telephone line is reconverted by a frequency discriminator to a DC voltage which is applied to a reactance tube connected so as to shift the transmitter's crystal frequency by plus or minus 300 cycles. The result is that the carrier frequency of WNBT will follow that of WNBW in Washington so closely that no beats should be visible on TV receivers located where signals from these two transmitters are being received. A block diagram of the system and a photograph of the equipment used is shown below.

If barely visible bars are seen under non-synchronized conditions, then this interference can be increased from five to ten times and still give only barely visible bars when synchronism is employed. This is the value of improvement for the most unfavorable phase relationship, that of 0° or 180°. With the most desirable phase relation, 90° or 270°, an improvement of 30 fold is experienced. Conservative JTAC mentions an improvement of about 15 db. Their report points out that since there is twice as much power

(*Continued on page 60*)

(Left) Block diagram of the co-channel carrier synchronizing system used to minimize "Venetian Blind" interference effects. (Right) Equipment used for WNBW and WNBT tests



Oscillator Power Variation

Amount of coupling and VSWR are determining factors with mismatched feeder line loads

By L. S. SCHWARTZ, *Hazeltine Electronics Corporation, Little Neck, L. I.*

IN considering the power variation caused by pulling, it is evident that the maximum power change or percent power variation will occur when the susceptance of the oscillator is zero. An understanding of this is helped by studying an equivalent circuit for the loaded oscillator as in Fig. 1.

Assume that the equivalent of the tube and oscillator cavity conductance is g and that the oscillator itself is resonant at some frequency f_o. If the oscillator is connected to a line of length l and conductance g_o and assuming that the line is also terminated in g_o, it follows that there will appear a conductance of g_e in parallel with g and that this conductance is g_o transformed through the coupling between the oscillator and the line.

If a voltage standing wave ratio

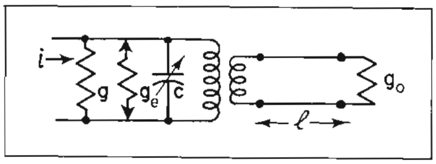


Fig. 1: Equiv. circuit of loaded oscillator

(VSWR)β is set up at the input terminals to the line and if the position of the minimum is moved along the line as would be the case for changes in the length l of the line, then the conductance presented to the input terminals of the line will vary between the limits of g_o/β and βg_o as in Fig. 2. This variation in load conductance will be transformed into the oscillator circuit as $g_e/\beta < g_e < \beta g_e$ giving a maximum change in load conductance of $(\beta - 1)g_e$. An attempt will not be made to derive an

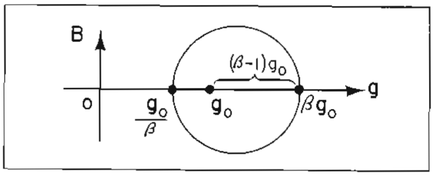


Fig. 2: Admittance variation with change in the position of the standing wave minimum

expression for the power variation in terms of easily measurable parameters. The starting assumption is that for small values of β the oscillator will behave as a constant current generator.

Since we are considering changes along the g axis only of the admittance diagram, the equivalent circuit we are concerned with is as in Fig. 3. If power relations for this circuit are to be set up, then we must regard g as the equivalent conductance of the oscillator tank circuit and its tube while cold plus the dynamic conductance of the tube while hot. Then the total power supplied by the oscillator is:

$$P_t = e^2(g+g_e) = \frac{i^2}{g+g_e}$$

and the power in the loading conductance is:

$$P_e = e^2 g_e = \frac{g_e P_t}{g+g_e} = \frac{g_e}{(g+g_e)^2} i^2$$

Differentiating the expression for P_e and replacing differentials by differences, we have that

$$\Delta P_e = i^2 \frac{g - g_e}{(g+g_e)^3} (\Delta g_e)$$

So that

$$\frac{\Delta P_e}{P_e} = \frac{(g-g_e)}{(g+g_e)} \frac{(\Delta g_e)}{(g_e)} = \frac{(g-g_e)}{(g+g_e)} (\beta - 1)$$

Hence,

$$\frac{\Delta P_e}{P_e} = \frac{g-g_e}{g+g_e}(\beta - 1) = \left[\frac{1-\frac{g_e}{g}}{1+\frac{g_e}{g}}\right](\beta - 1)$$

The problem now is to express the power variation as a function of quantities which can be readily measured. It might appear that this

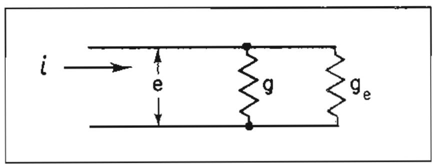


Fig. 3: Equiv. oscillator circuit at resonance

could be done by introducing the loaded and unloaded Q of the oscillator circuit. Suppose that we try this. The unloaded Q of the oscillator is WC/g and the loaded Q is WC/g+g_e. Designate these two

Fig. 4: Cross section of 2.5-in. reentrant cavity oscillator

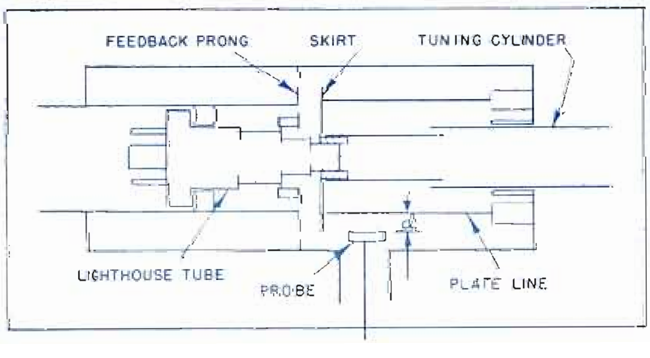
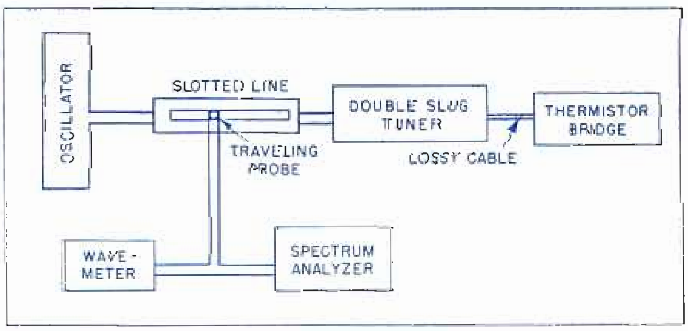


Fig. 5: Block diagram of oscillator and measuring apparatus



and Frequency Pull-In

quantities by Q_u and Q_L respectively. Therefore,

$$\frac{Q_u}{Q_L} = \frac{g_e + g}{g} = \frac{g_e}{g} + 1$$

From which

$$\frac{\Delta P_e}{P_e} = \left[\frac{2Q_L}{Q_u} - 1\right](\beta - 1)$$

Now note that this Q_u and Q_L are the unloaded and loaded Q's for a circuit which is actually oscillating and is not, therefore, "cold". Unfortunately, however, ready means are not at hand for determining Q's for a circuit in this condition, so we must express $\Delta P_e/P_e$ in another way. This is done by introducing the concept of τ, the percentage of critical coupling. For 100% critical coupling, $g_e = g$ and $P_{max} = i^2/4g$. For any less coupling, $P = i^2 g_e/(g+g_e)^2$.

$$\therefore \tau = \frac{P}{P_{max}} = \frac{4g/g_e}{(g+g_e)^2} = \frac{4g_e/g}{(1+g_e/g)^2} = \frac{4\alpha}{(1+\alpha)^2}$$

Where $g_e/g = \alpha$. Solving for α gives:

$$\alpha = \frac{4}{\tau} - 2 \pm \sqrt{\left(4 - \frac{16}{\tau}\right) + \left(\frac{16}{\tau^2} - 4\right)}$$

So

$$\alpha_1 = \left[\frac{2}{\tau}(1 - \sqrt{1-\tau}) - 1\right] \ldots\ldots (1)$$

$$\alpha_2 = \left[\frac{2}{\tau}(1 + \sqrt{1-\tau}) - 1\right] \ldots\ldots (2)$$

Substitutions of solutions (1) and (2) in

$$\frac{\Delta P_e}{P_e} = \frac{1 - g_e/g}{1 + g_e/g}(\beta - 1)$$

yields

$$\frac{\Delta P_e}{P_e} = \pm (\beta - 1)\sqrt{1-\tau} \ldots\ldots (3)$$

where the minus sign results from solution (2) and must be used for coupling beyond critical as a study of the following equation will show.

$$\frac{\Delta P_e}{P_e} = \left[\frac{2Q_L}{Q_u} - 1\right](\beta - 1)$$

Equation (3) demonstrates that the percentage power variation is given by the VSWR and the percentage of critical coupling.

H. A. Wheeler has shown that the frequency pulling is given by:

$$\Delta f_o = \frac{f_o}{4}\left(\frac{1}{Q_L} - \frac{1}{Q_u}\right)\left(\beta - \frac{1}{\beta}\right)$$

where in this case Q_u and Q_L are determined for a "cold" (non-oscillating) oscillator. Actually, this formula applies equally well for the "hot" (oscillating) condition since the difference between $1/Q_L$ and $1/Q_u$ is the loss factor for the coupling, a factor which is the same whether the circuit is oscillating or not. The expression may be transformed into one which involves the percentage of critical coupling in place of Q_L. It is done by substituting for Q_u/Q_L its equal in terms of g_e/g.

$$\frac{g_e}{g} = \alpha = \frac{2}{\tau}\left(1 \mp \sqrt{1-\tau}\right) - 1$$

and

$$\frac{g_e}{g} = \left(\frac{Q_u}{Q_L} - 1\right)$$

so that

$$\frac{\Delta f_o}{f_o} = \frac{1}{4Q}\left[\frac{2}{\tau}(1 \mp \sqrt{1-\tau}) - 1\right]\left(\beta - \frac{1}{\beta}\right) \cdot\cdot (4)$$

Consider the physical significance of the $\pm$ signs before the radical $\sqrt{1-\tau}$. The minus applies to the case of coupling between 0 and 1, that is to undercoupling, because the frequency pulling is actually 0 for $\tau = 0$, and this is shown by the mathematics. Thus, the limit of $1 - \sqrt{1-\tau}/\tau$ as τ approaches 0 is 1/2. Therefore, for $\tau = 0$, $\Delta f_o/f_o = 0$ as is required, and the formula for the undercoupled case is:

$$\frac{\Delta f_o}{f_o} = \frac{1}{4Q_u}\left[\frac{2}{\tau}(1 - \sqrt{1-\tau}) - 1\right]\left(\beta - \frac{1}{\beta}\right)$$

The plus sign applies to overcoupling, that is for coupling beyond critical. At this point a clarifying remark on the physical meaning of overcoupling is in order. As a coupling probe is inserted deeper and deeper in an oscillator cavity, more and more power is extracted until a maximum is reached. Beyond this point less and less power is extracted and the oscillator is said to be overcoupled. In the overcoupled region one would expect the frequency pulling to continue using, and experimentally it is found that this

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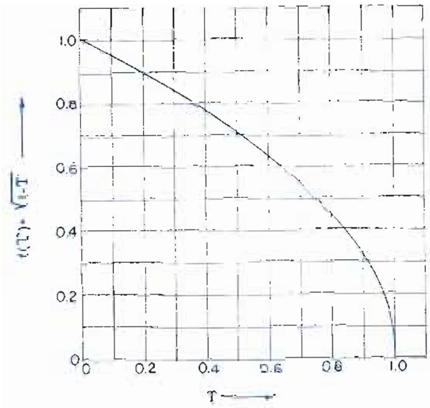


Fig. 6: $f(\tau)$ vs τ, the % of critical coupling

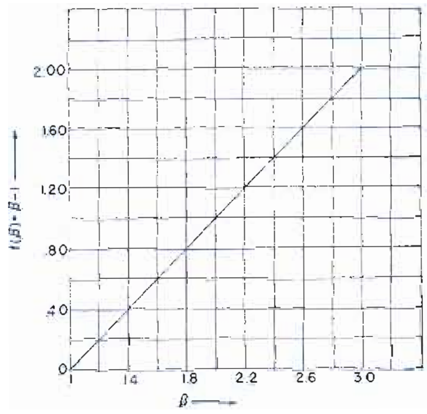


Fig. 7: $f(\beta)$, vs β, voltage standing wave ratio

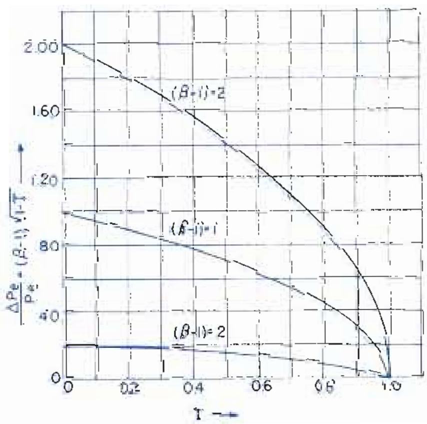


Fig. 8: $\Delta P_e/P_e$ vs τ, where $\Delta P_e/P_e$ is the % variation in power output from oscillator

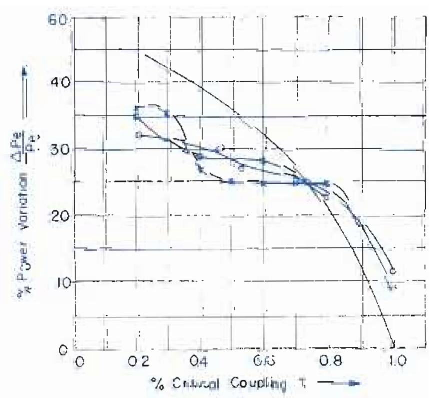


Fig. 9: Power variation vs critical coupling. Plotted points were obtained on three RCA Lighthouse tubes (2C42) at one frequency (β = 1.5) Smooth curve is graph of formula

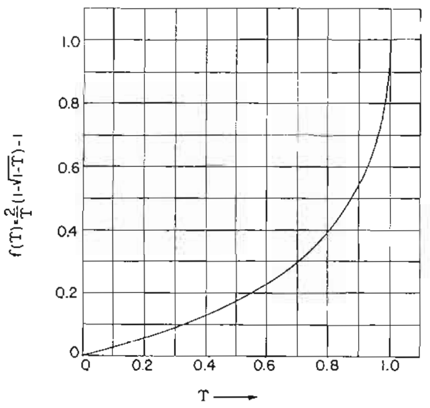


Fig. 10: Plot of $f(\tau)$ vs τ

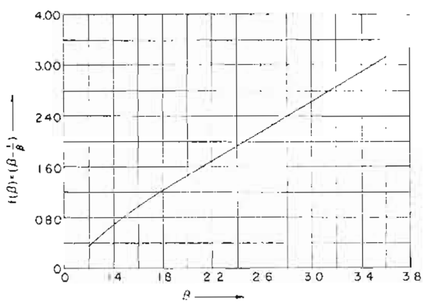


Fig. 11: Plot of $f(\beta)$ vs β

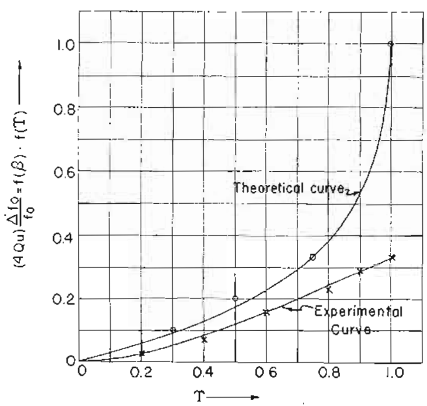
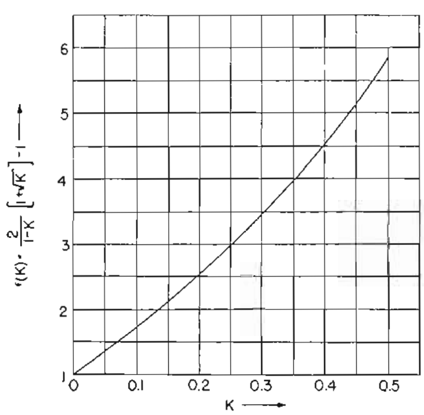


Fig. 12: Frequency pulling vs % critical coupling. Circles are experimental data for 2.5-in. oscillator non-capacity loaded and crosses indicate capacity loading



happens. Now suppose one defines $K = 1 - \tau$ where K is the percentage of coupling beyond critical, and τ, as defined before, is the percentage of power coupled out of the oscillator, then

$$\frac{\Delta f_o}{f_o} = \frac{1}{4Q_\mu}\left[\frac{2}{1-K}(1+\sqrt{K})-1\right]\left(\beta-\frac{1}{\beta}\right)$$

and it is seen that the pulling increases without limit as K increases.

It must be emphasized that in equation (4) Q_u is the unloaded Q for the oscillatory condition and, therefore, cannot be readily determined. This equation, however, serves two useful functions. One is that it enables one to find quickly the trend of frequency pulling and the exact amount for any coupling if the pulling is known for one value of coupling and VSWR. The other is, knowing the pulling for a given coupling and VSWR, one can determine the "hot" unloaded Q which would inform one as to the part the dynamic plate resistance plays in altering the value of the "cold" unloaded Q. Further, knowledge of Q_u (hot) will yield Q_L (hot), and this information may throw light on the anomalous effect of large reductions in pulling with comparatively small changes in loading capacity.

Finally, the frequency pulling may be expressed in terms of the percentage power variation. In equation (3) one may solve for

$$\tau = \left[1-\left(\frac{\Delta P_e}{P_e}\right)^2\right] \Big/ (\beta-1)^2$$

Substituting this for τ in equation (4), yields

$$\frac{\Delta f_o}{f_o} = \frac{1}{4Q_\mu}\left[\frac{(\beta-1)-\left(\frac{\Delta P_e}{P_e}\right)}{(\beta-1)+\left(\frac{\Delta P_e}{P_e}\right)}\right]\left(\beta-\frac{1}{\beta}\right) \quad \ldots (5)$$

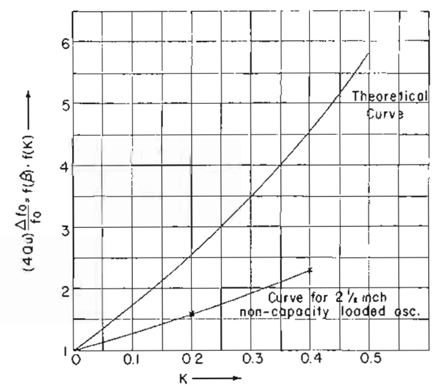


Fig. 13: (Left) $f(K)$ vs K, where $K = 1 - \tau$
Fig. 14: (Above) Frequency pulling as a function of % coupling beyond critical

which is the frequency pulling in terms of the percentage variation in output power.

An analysis of the function $\Delta P_e/P_e = (\beta - 1)\sqrt{1-\tau}$ is assisted by plotting separately $\sqrt{1-\tau}$ and $(\beta - 1)$, the curves for which are shown in Figs. 6 and 7. In Fig. 8 the product of these curves shows that $\Delta P_e/P_e$ vs. τ is a family of curves which for $\tau = 0$ begin at any finite value, including 0, and which all terminate at $\Delta P_e/P_e = 0$ for $\tau = 1$. In other words the percentage power variation is a minimum at optimum coupling. When $\beta = 1$, the condition for impedance match of the transmission line to its load, $\Delta P_e/P_e = 0$ for all values of τ between 0 and 1.

In Fig. 9 a curve is drawn by means of the relation $\Delta P_e/P_e = (\beta - 1)\sqrt{1-\tau}$ for $\beta = 1.5$. Empirical curves from data on three RCA Lighthouse tubes (2C42) are compared with the theoretical curve. It is seen that there is rather good agreement between the computed and the measured values for large percentages of critical coupling, but that this agreement deteriorates for small values of coupling. It should be emphasized that the relation $\Delta P_e/P_e = (\beta - 1)\sqrt{1-\tau}$ seems to hold approximately for values of β not exceeding 3. For larger values non-agreement with empirical data should be anticipated.

A word is in order as to the procedure employed in obtaining the data of Fig. 9. The coupling is varied by changing the depth of insertion of a capacity probe into the cavity of a reentrant oscillator as shown in Fig. 4. The power variation ensues from shifting the phase of a voltage standing ratio of 1.5 through the extremes of its cycle. This is done for values of between 0 and 1. The method may be seen from Fig. 5.

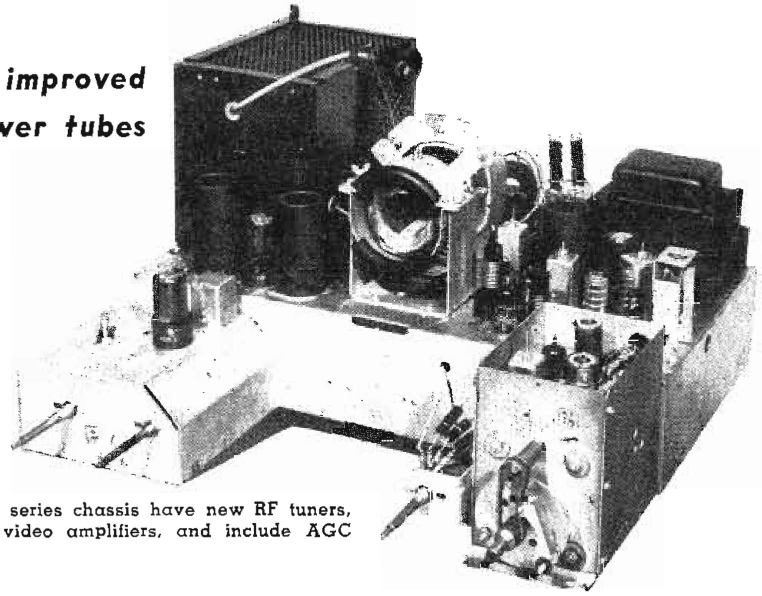
The function $(4Q_u)\Delta f_o/f_o = [\frac{2}{\tau}(1-\sqrt{1-\tau})-1](\beta - 1/\beta)$ is studied by plotting the curves $f(\tau) = [\frac{2}{\tau}(1-\sqrt{1-\tau})-1]$ and $f(\beta) = (\beta - 1/\beta)$ shown in Figs. 10 and 11 and multiplying these to give $(4Q_u)\Delta f_o/f_o$ in function of τ as in Fig. 12. This graph was drawn for $f(\beta) = 1$. For any other value of $f(\beta)$ the ordinates would be multiplied accordingly. It is apparent that except for very small values of VSWR, the frequency pulling is linearly proportional to β. Further, it is evident that frequency pulling, in the particular example given, is re-

(Continued on page 57)

Video Receiver Circuits Simplified

New television chassis designs feature improved circuit performance and require fewer tubes

By D. D. COLE, Chief Engineer, Home Instrument Dept., RCA Victor Division, Camden, N. J.



RCA type 8T24 series chassis have new RF tuners, direct coupled video amplifiers, and include AGC

IN preparation for meeting the 1949 demand predicted by market analysts, totalling more than 2 million sets, television receivers are undergoing a design streamlining operation in many companies. RCA postwar designs were aimed at assuring that the engineering aspects were right before applying any methods for making them cheaper, with the result that the designs are classed in the most highly-engineered group.

The 1949 models, recently announced, are of interest therefore to indicate one example of a trend toward the application of new principles and circuits in obtaining greater simplicity. The resulting sets, the 8T24 series, although containing 6 less tubes, incorporate several new operating features and have a threefold gain in sensitivity. These 10″ models have a new RF tuning unit, automatic gain control and a direct-coupled video amplifier, which does away with a DC restoration tube.

A new RF amplifier and converter system uses two 6AG5 tubes (instead of the previous 6J6 twin triodes connected push-pull) which accounts for more sensitivity in this section. It has a tuned input circuit, (increasing the gain about 70%). The RF unit starts out with an "elevator" circuit accommodating with a simple change in connections either a balanced or a coaxial down lead. There has been a notable reduction in the type of interference caused by both sections of the dipole acting in unison to pick up a lower frequency signal in the manner of an ordinary antenna and ground. By the use of a bifilar winding on the input circuit, these push-push signals are bucked out, while push-pull signals are not attenuated.

At the same time a ten-fold reduction in oscillator radiation (over previous models) has been accomplished, partly by the use of double shielding of the oscillator stage, and by attention to all means whereby oscillator energy was radiated.

The unusual selectivity is due to the RF unit having four tuned circuits, including one having the properties of an M-derived high-pass filter having maximum attenuation at the intermediate frequency (down 2000 times), followed by a π type low-pass circuit. A sharp cutoff above the signal frequency is provided to cut out FM and other spurious signals that give trouble in some areas. The image attenuation is on the range of 2500 to 20,000 to one depending on the frequency. Finally the RF unit is link-coupled to the IF. Overall band width is 4 MC.

The two stage direct coupled video amplifier represents a saving in components. It uses one twin triode instead of two pentodes and eliminates the DC restoration diode, since steady picture brightness levels are carried through to the kinescope by a direct path. Automatic gain control signals are supplied along with sync signals from this video amplifier. The user will note some operating features with AGC. For one thing there will be less need for manipulating the contrast control, and (if the DC component of the signals transmitted by various transmitters are kept within some standardized range) brightness control manipulations are likewise minimized. The circuit permits changing the peak-to-peak amplitude of the video signal while maintaining the black level at the right point on the kinescope characteristics. Ordinarily a gain "change" requires a readjustment of "brightness". Whereas before, the contrast control was connected to serve as a manual gain control for the video IF, now it provides the video amplifier gain adjustment. The effectiveness of this picture control is thus greater at high video signal levels, making it impossible to overload the receiver by making picture control adjustments. Likewise it is impossible to turn the control to the complete elimination of the raster on the screen. The second detector operates at a higher level, which has the effect of opening up the contrast range at the "white" end, thus operating on a more favorable part of the kinescope's characteristic.

The biggest step toward simplification is in the scanning circuits with their associated synchronizing arrangements. The sweep system is similar to that used in a previous model (721TS). Sine wave stabilizing circuits are used in the scanning system. A pulse fed back from the horizontal output tube is superposed on the incoming sync pulse. The resulting waveform is sensitive to phase changes between the two, and is applied through a control tube to affect the bias on the oscillator grid pulling it into phase with the sync pulses.

Collinear Coaxial Array

Design and construction details of a conveniently short vertical transmitting antenna for use in urban radio-telephone services

By R. G. ROWE, R. G. Rowe Associates, Niagara Falls, N. Y.

FOR the new 152-162 MC urban mobile radio-telephone services, a conveniently-short vertical collinear coaxial array provides considerable gain in radiated power over a simple dipole without impairing the desired omni-directional characteristics of the radiating system. Formulae and tabulations have been developed to enable calculation not only of the gain to be expected from the successive addition of collinear in-phase half-wave elements at specific inter-center spacings, but also the order of magnitude of the radiation resistance for specific element combinations. However, little can be learned from these relations as to physical construction of such an array because of the complex interdependence of many element length parameters.

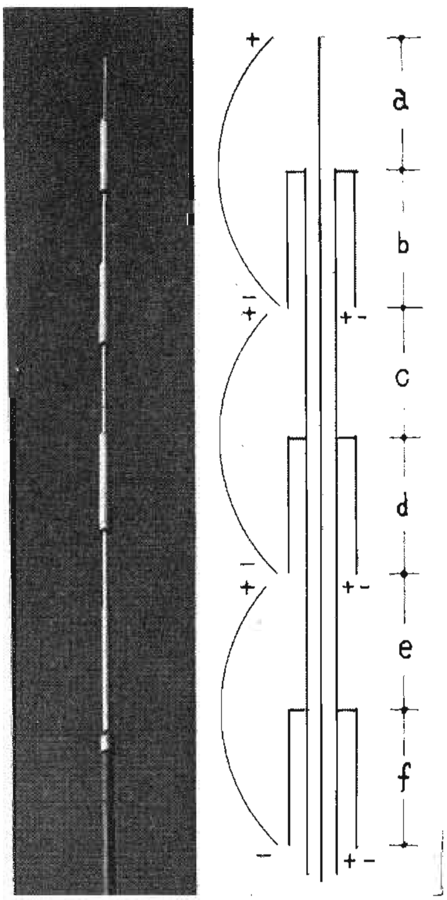


Fig. 1: Diagram (right) shows current direction and distribution on antenna array (left)

In the array shown in Fig. 1, only the top element is directly driven. The remaining half-wave elements are coupled to the driven element and to each other by the $\lambda/4$ transformers formed by the inner wall of each skirt and the outer wall of the supporting pipe or tube, which provide the 180° phase reversal that is required for in-phase excitation of each half-wave section. The approximate distribution and direction of current on this type of array are shown.

In theory it may be generalized that, due to end effect of the relatively large diameter skirts, the outer radiating length of each skirt must be shortened to perhaps 0.80 to 0.90 quarter-wavelengths for self-resonant operation. On the other hand the inner length of the skirt must be some 0.95 to 0.98 quarter-wavelengths at the operating frequency, to provide a precise 180° phase reversal.

These requirements are easily met by the introduction of a dielectric slug in the transformer, as for example such as is shown in Fig. 2. By proper selection of dielectric length "d", the electrical length of the transformer may be increased over that of the outside skirt, because the wave velocity in the dielectric is less than the free space velocity. The addition of a small air capacitor between the outside of the supporting tube and the inside of the skirt should also produce this end result.

The design and construction of a three section collinear coaxial array has been developed which provides a measured gain only slightly lower than the theoretical gain without resorting to separate tuning of the outside and inside of the skirts. As in most antenna work, the length of the radiating portion of the elements, within limits, is critical only insofar as it affects phasing and input impedance. Here the phasing is adjusted by skirt length and position on the supporting tube, and the input impedance is matched to the transmission line by a $\lambda/4$ transformer.

The whip (or top) quarter-wave section, of ½-in. O.D. aluminum tube is cut 18-in. in length. A 4-in. length of the same tubing slotted to slip over the top of the whip, as in Fig. 3, provides length adjustment. The top is sealed to prevent its filling with water, and the lower end is plugged with a bar of aluminum, turned to press-fit the I.D. of the whip tube. The whip is mounted on the disc of the top skirt by two stacked discs of ¼-in. thick polystyrene; turned, drilled as in

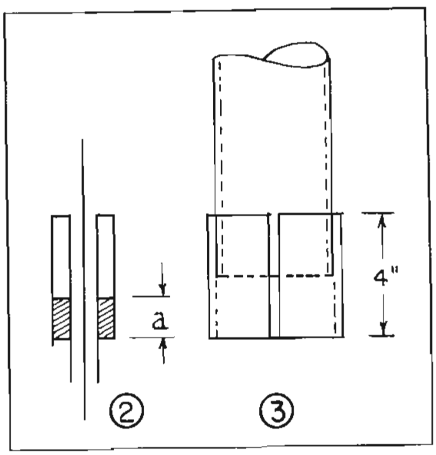


Fig. 2: Dielectric slug length (d) determines the effective radiating length of each skirt
Fig. 3: Section of slotted tubing permits adjusting the height of top quarter wave section

for 152 Megacycles

Fig. 6 and assembled as in Fig. 7. A thin gasket interposing the polystyrene and the aluminum disc provides a watertight seal.

In order to connect the outer braid of the coaxial line of the top skirt, a brass rod is turned to slip-fit the I.D. of the supporting pipe and drilled to permit insertion of the line. After the line is pulled through the hole, the braid is flared and soldered to the top of the brass sleeve. A soldering lug, under the 10-32 bolt which mounts the whip to the polystyrene insulator, serves to connect the center conductor of the coaxial cable to the base of the whip.

Three polystyrene discs, having the same dimensions as the aluminum washers detailed in Fig. 4, are required to space the three skirts coaxially from the supporting tube. In the experimental antenna these were made to drive-fit the bottom end of each skirt and slip-fit the supporting tube, necessitating no screw attachment.

This fully adjustable antenna was tuned for maximum gain at 152.15 MC by exciting it with a crystal-controlled transmitter and measuring the field strength with the apparatus shown in Fig. 8. The Field Strength Meter employed a Premax DSH-118 quarter-wave Marconi type antenna which was permanently mounted on the metal roof of one of the mobile units. This antenna was coupled through its associated 50 ohm coaxial cable and a tuned circuit to the 5 milliampere vacuum-type thermo-couple, calibrated for square-law operation on direct current, so readings were directly proportional to power. The mobile unit was parked in the clear at a distance of some 4 wavelengths from the transmitting antenna. The bottom end of the 12 foot supporting tube of the transmitting antenna was at ground level during all measurements.

It will be noticed that a total of six variables obtains: namely the lengths of each of the six ¼ wave sections of the array. The adjustment procedure followed embodied the time-consuming and repetitious process of holding five of the variables constant while taking one of the variables through a series of changes in length and observing the field strength readings. During the adjustment process it was generally observed that small changes in skirt lengths b, d and f (Fig. 1) were more influential in modifying signal strength than small changes in lengths a, c and e. A further observation was that this type of antenna could not merely be cut and constructed, but required careful tuning to produce gains approaching the theoretical. Many of the measurements revealed that an improper skirt length, particularly in the top skirt, would reduce the field strength below that of a simple reference dipole, because of incorrect phasing which concentrated the energy in undesired side lobes.

The final dimensions for maximum gain, (see lettering of Fig. 1), were: a, 19 (not including insulator); b, 19.5; c, 18.5; d, 18; e, 18.5; f, 17.25 inches.

With the three sections tuned for maximum signal strength, the measured gain approximated the theoretical gain. This was done by first shorting out the two bottom skirts and measuring the signal

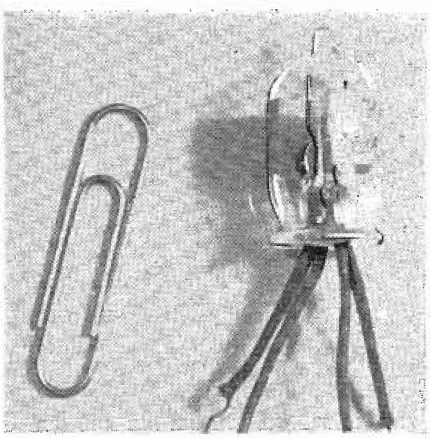


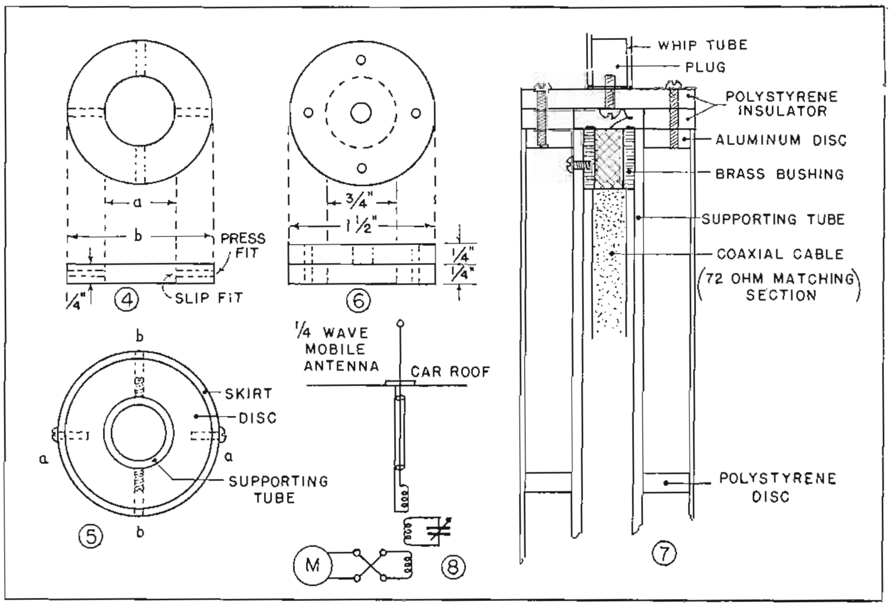
Fig. 9: A 5 ma vacuum-type thermo-couple for 152.15 MC field strength measurements 152.15 MC

strength produced by the single top coaxial dipole section. The bottom skirts were progressively cut in and new field strength readings taken, after first adjusting the transmitter power input to be equal for each measurement. The theoretical power gains for collinear half-wave elements at one-half wave center-to-center spacing as compared with the measured power gains of the subject array were found to be, for two elements 1.8 DB, 1.7 DB for theoretical and measured values respectively, and for three element 3.3 DB, 2.9 DB respectively.

For the array to produce the characteristic maximum gain calculated from theory, the currents in each dipole must be equal in mag-

(*Continued on page* 60)

Fig. 4: Dimension details of aluminum discs required to couple skirts to supporting tube
Fig. 5: Holes in skirt mate with disc holes and both assemble to supporting tube as shown
Fig. 6: Size detail of two polystyrene discs used to mount the whip on disc of top skirt
Fig. 7: Gasket seal between plastic and aluminum discs makes whip assembly watertight
Fig. 8: Schematic circuit diagram of the apparatus used for field strength measurement



A Front End for Television Receivers

Design, construction, and performance details on new two tube GE tuner assembly

THE primary function of a television tuner unit is to give selection to a desired number of frequencies, a rejection to all other frequencies, and provide amplification of the desired band of frequencies. For good reception, the signal should be free of noise developed by the television receiver, should be free of interfering signals, and have good band pass characteristics.

From observation, if a signal to noise ratio of ten to one or better is obtained then the quality of the picture is useable; but to obtain the best detail possible the noise should not exceed 3% of the picture signal. Keeping this in mind then, the noise generated by the receiver should be kept to an absolute minimum since it limits the minimum signal for good operation. The noise generated in a television receiver comes almost entirely from the RF tuner unit.

Interfering signals may be classed in two groups; those in the television channel that is being received, and all other frequencies comprising the other group. Very little can be done to the tuner unit to reject the signals that fall in the television channel being received, especially if they are fed from the antenna, but some rejection to these signals can be obtained by proper antenna design and location. If they are signals picked up by the transmission line alone then by balancing out the in-phase signals in the input circuit, any interference in the picture will be eliminated.

It is good engineering practice to attenuate the audio carrier 40 DB with respect to the picture signal to prevent loss of detail of the picture. With this as a reference for all interfering signals, we can say that they must be at least 40 DB down from the picture signal if we wish to prevent loss of detail. In some localities the interfering signals may be as high as one thousand times the signal strength of the desired signal, which means that if we are going to receive the picture signal without loss of picture detail the receiver must attenuate the undesirable signal at least 100 DB. This value is not difficult to obtain for those frequen-

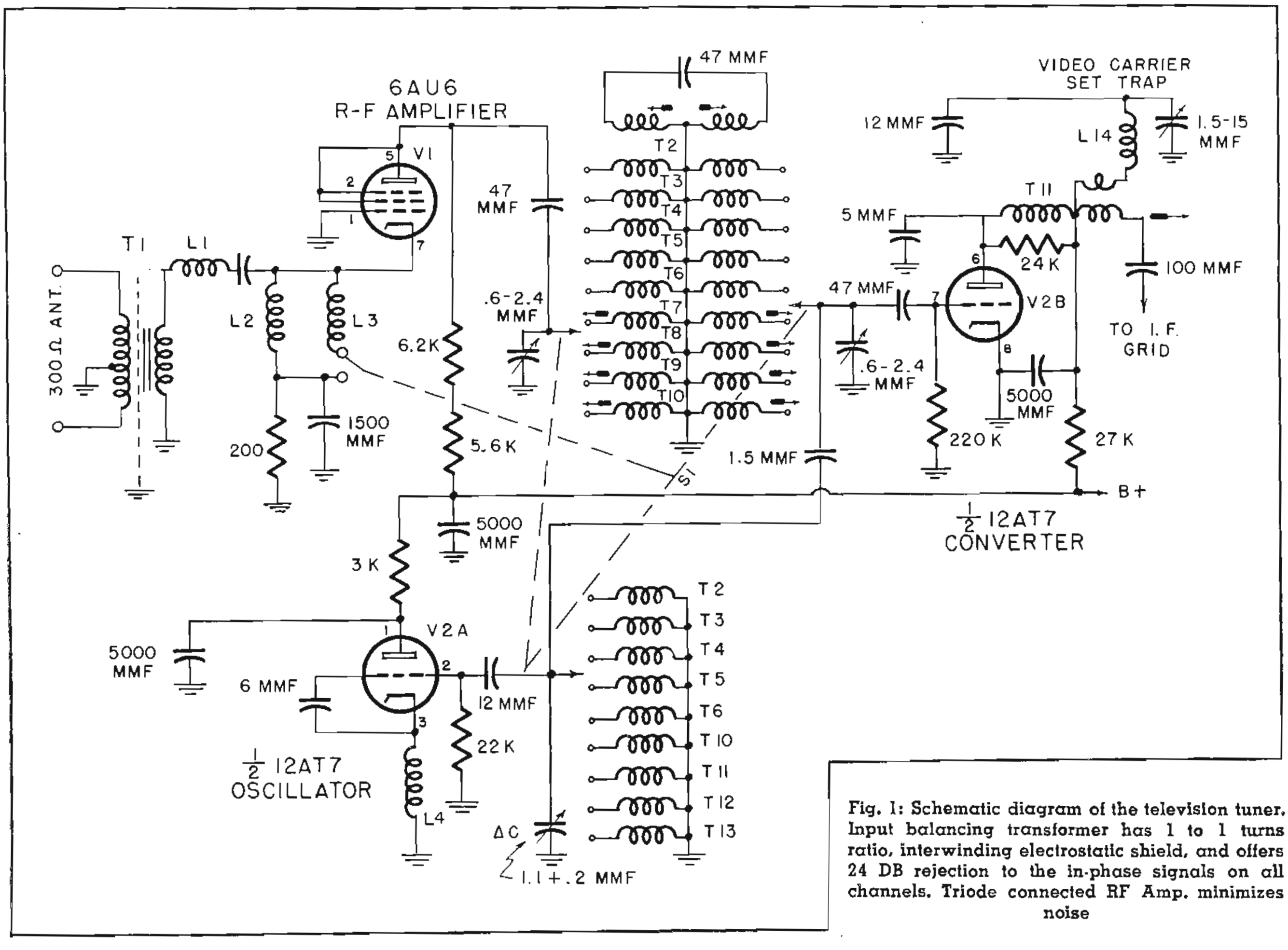


Fig. 1: Schematic diagram of the television tuner. Input balancing transformer has 1 to 1 turns ratio, interwinding electrostatic shield, and offers 24 DB rejection to the in-phase signals on all channels. Triode connected RF Amp. minimizes noise

By J. O. SILVEY,
General Electric, Receiver Div., Syracuse

cies that are rejected by both the RF and IF amplifiers, but for those frequencies the RF amplifier alone must reject, this is a difficult problem. Frequencies such as the IF frequency, the image frequency of the oscillator, and the second and third harmonics of the oscillator ± the IF frequency all must be rejected. Some of these frequencies are more important than others. With an IF frequency of 21.9 to 26.4 MC, the image of channel 2 falls between 103.55 and 108.05 MC, in the FM transmitting range. In some localities these images are sources of interference to television receivers operating on Channel 2, unless the tuner unit gives adequate rejection to the signal. The same difficulty is encountered for the second harmonic of the oscillator plus the IF frequency for channels 2, 3, 4, and the second harmonic of the oscillator minus the IF for Channels 5 and 6; as all of these frequencies fall in the higher television bands for the IF frequency chosen.

While all of the interfering signal possibilities cannot be covered here, one that should be mentioned is the interference of one receiver with another. The oscillator radiation of one receiver may interfere with the operation of another receiver, and in such cases, the radiation of the second harmonic of the oscillator must be considered as well as the fundamental frequency since the second harmonic response may be stronger than the fundamental, as far as radiated voltage is concerned.

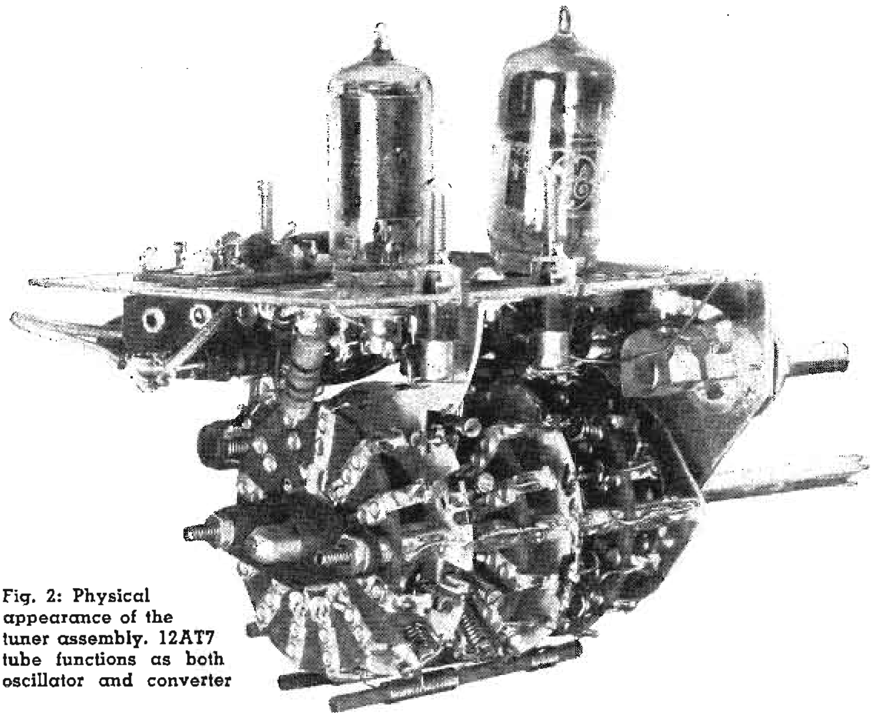


Fig. 2: Physical appearance of the tuner assembly. 12AT7 tube functions as both oscillator and converter

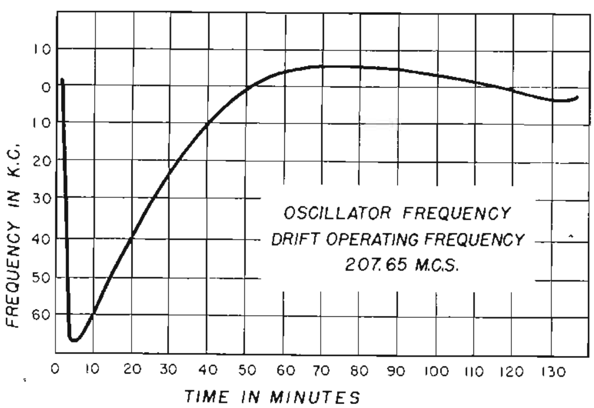
The band pass characteristic of the tuner unit is important because it affects the overall response of the receiver. It is usually desirable to make the response of the tuner unit flat over the frequencies covered by one television channel, but this is not necessary as combinations of RF and IF band pass can be staggered to give the overall performance necessary for good picture detail.

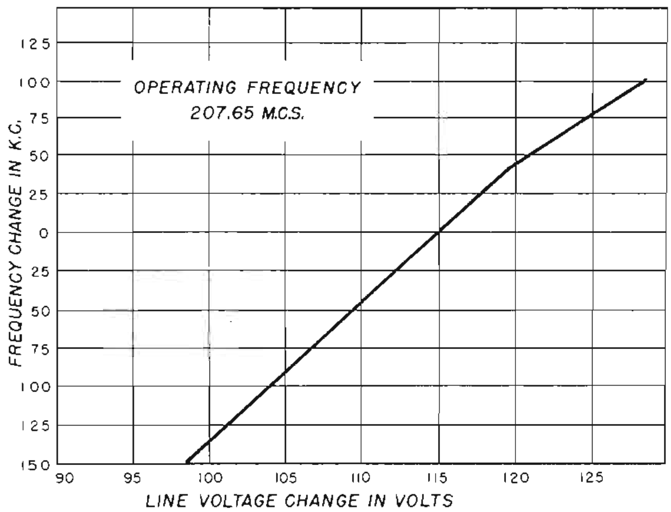
Other factors desirable in a good tuner unit, but having little effect on the quality of the picture obtained include a good stable oscillator, from the standpoint of both warm-up drift and line voltage fluctuations; it should be vastly aligned, and especially for tube changes the alignment should be minimized. Its physical size should be in proportion to other components of the set.

Fig. 1 shows the circuit layout of the tuner unit shown in Fig. 2. The input circuit contains a balancing transformer having a turns ratio of 1 to 1, and an interwinding electrostatic shield. The transformer gives a rejection of 24 DB or better to in-phase signals on all channels. It feeds the cathode of a 6AU6, triode connected, with the grid grounded. The input impedance of the circuit is controlled by the g_m of the tube and the g_m is adjusted for 300 ohms input impedance. The grounded-grid triode is a good low noise amplifier. More gain could be obtained by using a pentode but the

(Continued on page 54)

Fig. 3: (Left) Oscillator warm up drift with tuner on receiver chassis mounted in cabinet. Fig. 4: (Right) Oscillator frequency drift as a function of variations in line voltage





Elimination of Reflected Signal

"Echo suppression" circuit minimizes receiver's response to indirect signals

CERTAIN types of UHF and microwave equipment depend upon pulse width or spacing between pulses to convey information. Notable among this group are voice modulated pulse communications systems and transpondor beacons. The former, of course, includes systems utilizing pulse width modulation, pulse code modulation, and pulse separation, or paired pulse, modulation. The more recent transpondor beacons employ a pulse width discriminator in the receiver circuit which is intended to pass pulses of certain lengths. Each of these systems depends upon receiving a relatively undistorted replica of the original signal in order to reproduce the information transmitted. However, when such system factors as omni-directional antennas, reserve power, geographical location, and reflection coefficient are considered, the difficulties of achieving this performance can be appreciated.

Consider in more detail the simplest of these equipments, the transpondor beacon. The requirements for a land based beacon used for identifying a land position such as an airfield are: the intention is to reply to 2.0 microsecond interrogating signals and to ignore signals of lesser duration. These constitute the normal search signals of the associated radar and would receive no information even though the beacon replied. It is highly desirable that the search signals be rejected, since they would cause unnecessary traffic and ultimately might saturate the beacon by utilizing the entire transmitter capacity.

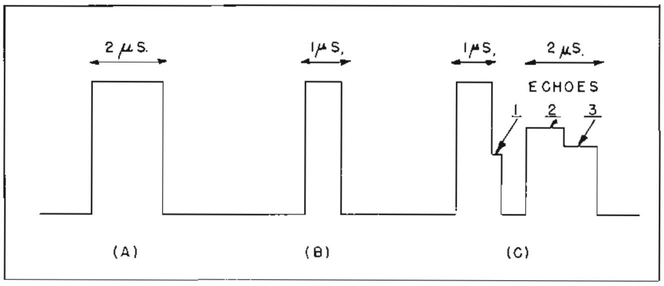
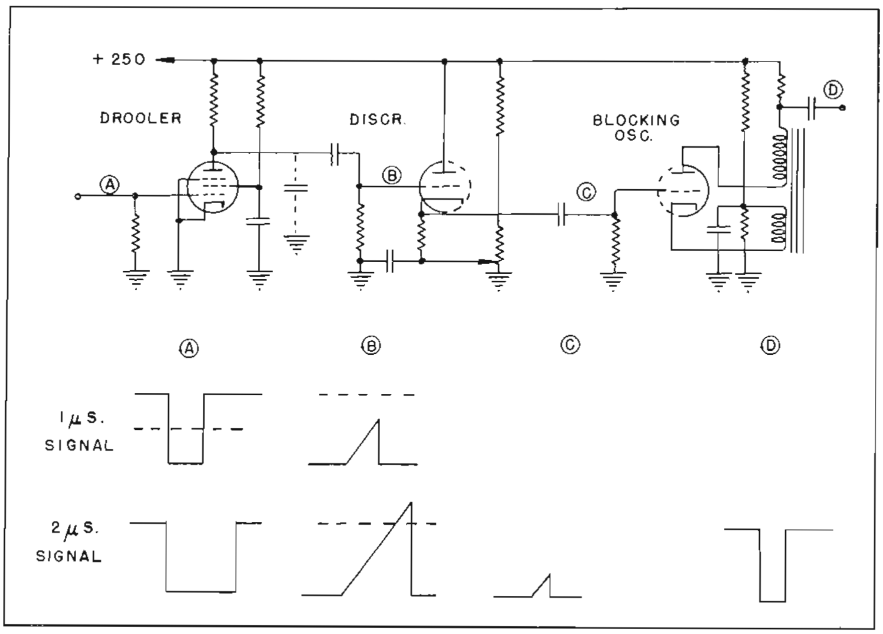


Fig. 1: (Left) Pulse width stretching due to multipath signals

Fig. 2: (Below) Pulse length discriminator circuit and wave forms in each stage



If a typical beacon installation is assumed, it must be accessible by a roadway, served by a power source, and be geographically near the position it identifies. These factors seldom permit the choice of a site entirely free from obstacles capable of producing reflections. The manner in which these reflected signals produce distortion and interference to beacon operation can best be understood by a brief look at a typical pulse length discriminator with and without the presence of reflections or echoes.

Fig. 1 shows an idealized version at (a) of a 2 microsecond interrogating signal, at (b) of a 1 microsecond search signal, and at (c) a combination of a 1 microsecond search signal with three echoes.

If the strength of the echoes exceeds the threshold sensitivity of the receiver, echoes 2 and 3 would combine to form approximately a 2 microsecond signal and cause a beacon reply.

Fig. 2 shows a simple pulse length discriminator circuit. Negative video output from the beacon receiver is used to drive the first tube to plate current cut-off. The magnitude of the signal and noise at this point largely determines the threshold signal level. A large load resistance is used in the plate circuit of the tube; together with the tube and stray capacitances it generates an exponentially rising voltage. Hence, the name "Drooler" is applied. By proper choice of circuit constants, the plate voltage rise is made a linear function of time with-

Effects in Pulsed Systems

By DAYLE O. COLLUP,
Naval Research Laboratory,
Washington 20, D. C.

in the limits in which we are interested. The positive going sawtooth wave is then fed to a fixed bias cathode follower, thence to a quiescent blocking oscillator. Bias on the cathode follower is so adjusted that the sawtooth generated by a 2 microsecond signal causes conduction, while signals of shorter duration do not. Two microsecond signals, therefore trigger the blocking oscillator which in turn causes the beacon transmitter to reply.

Recalling Fig. 1(c) it is obvious that echoes 2 and 3 can each drive the "Drooler" tube to cutoff and allow a sawtooth corresponding to a 2 microsecond signal to be generated. Substantiating evidence (Fig. 3) of this phenomenon was found by tests with a microwave beacon installed at Deer Island in Boston Harbor. This is a high point of land

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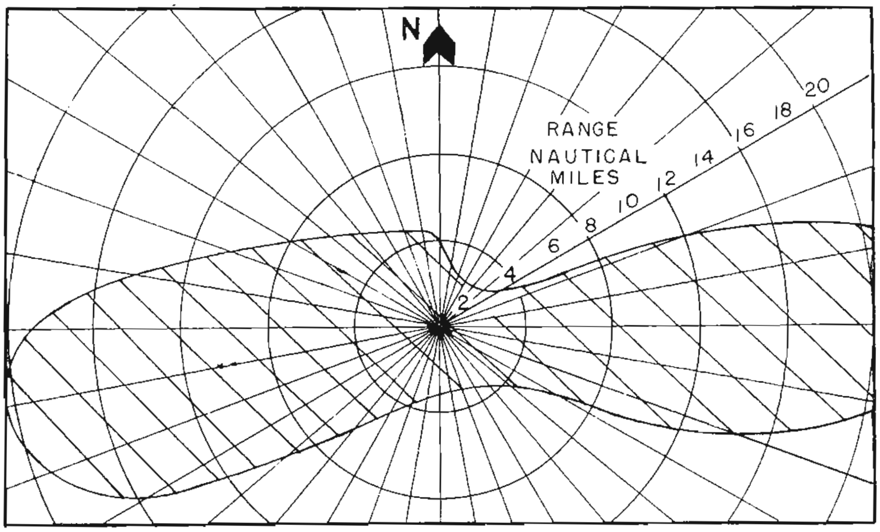


Fig. 3: Area of serious "stretching" in well chosen location (Deer Island—Boston Harbor)

Fig. 4: (Below) Multiple paths of interrogating signals from plane to Deer Island beacon

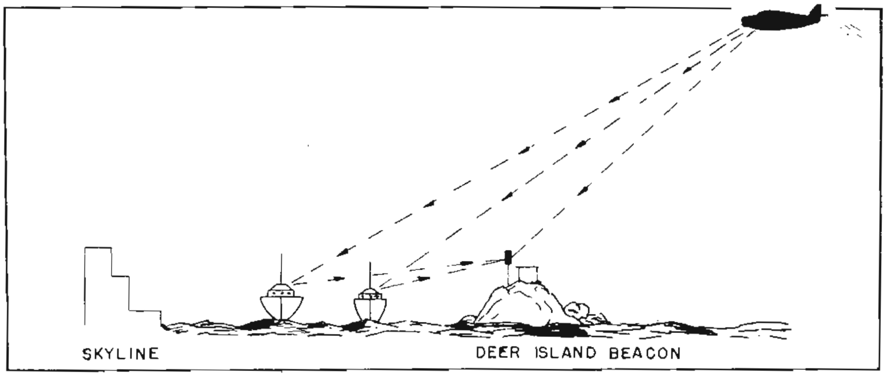
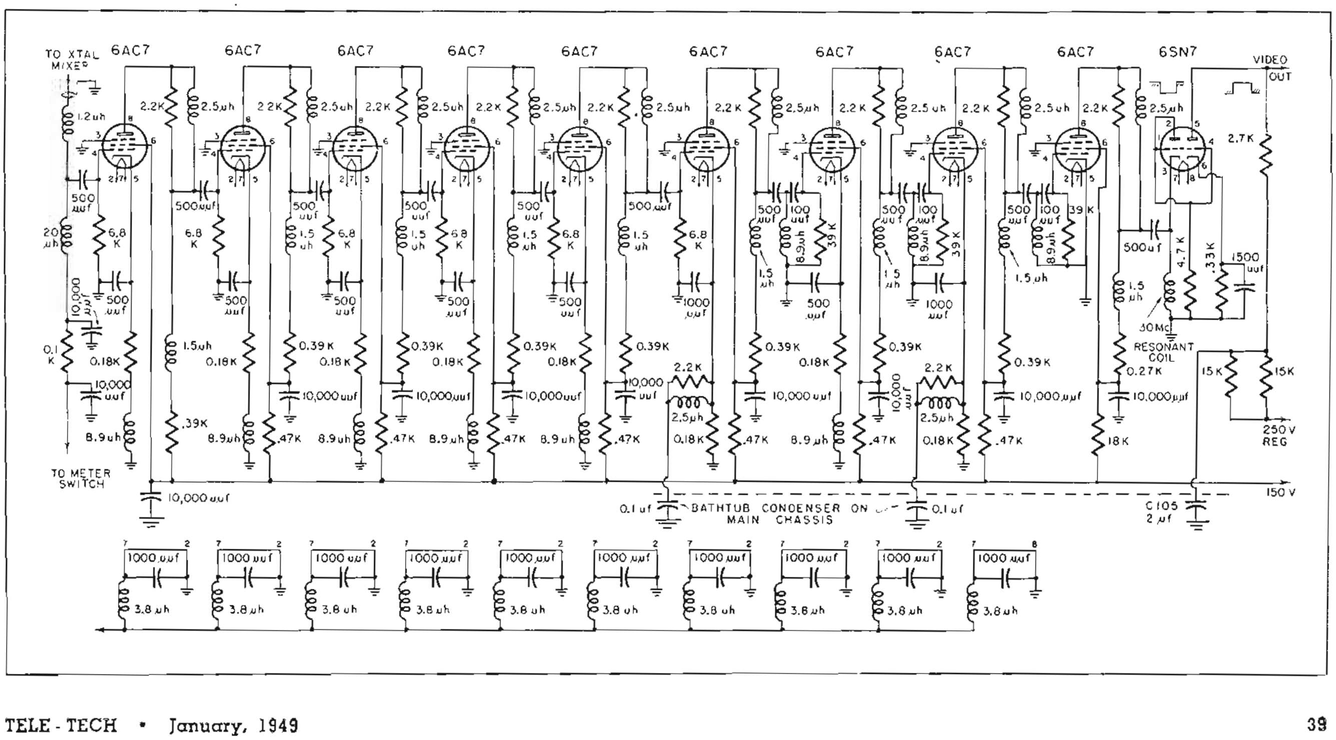


Fig. 5: (Below) Echo suppression IF amplifier in APN/CPN-6 Radar Transpondar Beacon



REFLECTED SIGNAL EFFECTS (Continued)

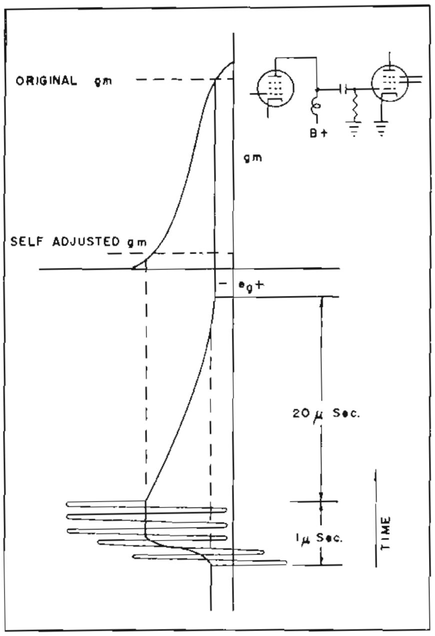


Fig. 6: Operation of basic amplitude limiter

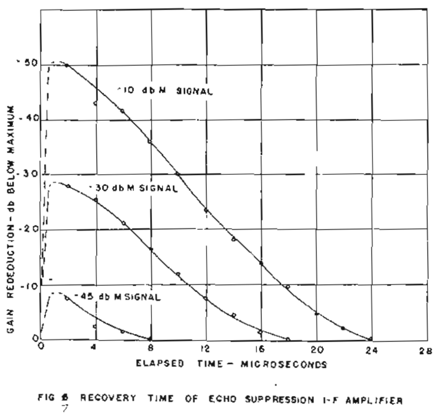


Fig. 7: IF amplifier using high-pass T filter

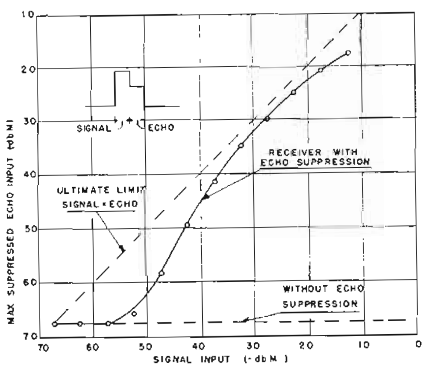


Fig. 8: Comparison of performance of conventional receiver and echo suppression receiver

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Fig. 9: Area within which serious stretching occurs in Naval Research Lab installation

extending into the water at the harbor entrance with relatively few obstructions. An airborne radar was made to challenge the beacon with a search signal of approximately 1 microsecond duration.

Fig. 3 shows a polar plot of the area within which "echo stretching", or echo combinations of the 1 microsecond signal from the plane, triggered the beacon steadily. Notice the pronounced east-west vulnerability. Since open sea was to the east and shipping and skyline to the west, the explanation must be made as in Fig. 4, where it can be seen that echoes from objects differing in range by only 500 feet could give the effect noted in Fig. 1(c).

Once the cause of this behavior is realized, certain fundamentals become apparent.

(1) The direct or line-of-sight signal reaches the receiver in the shortest time.

(2) The direct signal is always of greater amplitude than any reflected signal due to dispersion upon reflection.

(3) After a time representing a given path-length, dispersion and scattering of the reflected signals should reduce their magnitude below the threshold of the receiver.

Fortunately, each of these factors can be utilized in a circuit of simple proportions.

Since the amplitude of the signals conveys no information to the receiver circuit so long as it exceeds the threshold level, it appears that a circuit capable of preserving the amplitude relation between signal and echoes could provide additional information as pointed out in (2). Also, if the maximum amplitude of the output of this circuit just exceeded the threshold level at the discriminator, then echo signals, being of somewhat lesser amplitude, would not exceed the threshold level and could not trigger the beacon. One further requirement is that the circuit be capable of operating over an extremely wide range of signal inputs without manual adjustment. This, of course, is necessary because intermixed search signals may reach the beacon from airborne radars near at hand and from great distances.

All of these requirements are met by incorporating certain features of a basic amplitude limiting IF amplifier such as commonly used in FM receivers as is done in the circuit Fig. 5. Fig. 6 illustrates the operation of this type of limiter when time constants suitable for pulse operation are employed. Assume that this is the last stage of IF amplification and is operating with zero bias and reduced screen grid voltage. When a

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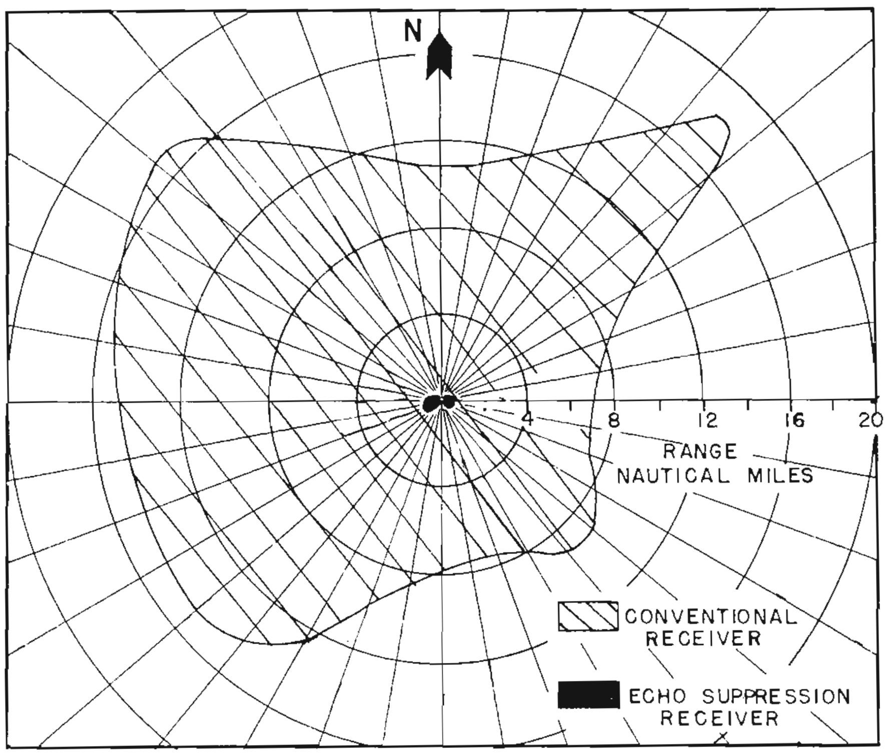


Latest Radio and Communications News Developments Summarized by Tele-Tech's Washington Bureau

WASHINGTON NEWS LETTER

TELEVISION ATTRACTS DEEP INTEREST OF HIGHEST OFFICIALDOM IN WASHINGTON—Television as the "miracle" industry of the nation is attracting the attention and deep interest of the highest officials of the government in Washington. While no direct disclosure of their discussions was revealed, it is known that FCC Chairman Wayne Coy gave President Truman a full description of the progress of television at their recent White House conference. Chairman Coy a week later gave definite hope of the FCC "thawing" its freeze on new video station applications by early spring. He commended the work of the industry's radio engineers in tackling the problem of tropospheric interference and publicly commended before the Television Broadcasters Association the technique of "polycasting" in UHF band TV, developed by RCA. Like the newly elected President Folsom of RCA who feels TV is ahead by two years of its rosiest postwar predictions, the FCC Chairman forecast that by the end of 1949 there will be at least 2,750,000 video receivers in the hands of the public or around triple the present number of sets.

MANY MONTHS BEFORE TV RATE VERDICT—FCC decision on the reasonableness of the rates charged by the Bell System and Western Union for intercity television relaying—of great importance to the ultimate development of nationwide network television—is not expected for many months. The Commission has just completed hearings on the knotty interconnection issue, occasioned by the Bell System's rule against connecting its TV relay links with those of Western Union and private broadcasters when telephone company channels are available. The FCC has said it will not start the rate hearings until the interconnection matter is settled. With the usual practice of attorneys' proposed findings, an FCC proposed report, oral argument, and final decision on interconnection, the expected lengthy rate hearings may not start for six months to a year.

CAA-RTCA DEMONSTRATIONS ON ALL WEATHER FLYING SHOW ELECTRONICS ONLY ANSWER—A much shorter period than the original timetable of 15 years for the completion of the all-weather electronic aviation navigation aid and traffic control system, proposed for the U. S. military and civilian aviation by the Radio Technical Commission for Aeronautics, now appears likely. This is the opinion of expert governmental, military and aviation industry observers who viewed the flight demonstrations conducted by the CAA at Indianapolis during the latter half of November until Dec. 2. CAA Administrator Delos W. Rentzel, former Aeronautical Radio President, highly commended the radio manufacturing industry and laboratories for their contributions and work and stressed the one answer to air safety was "electronics."

FCC ENGINEERING CONFERENCE ON TV AND FM STANDARDS MAY HASTEN VIDEO "THAW"—Many divergent views were presented to the FCC by the more than a score of radio engineers on tropospheric conditions and TV antenna-power standards and channel spacing at the recent three-day FCC informal engineering conferences on those subjects. Dr. A. F. Murray, TELE-TECH consulting editor who has a wide popularity and respect in governmental radio circles in Washington, is preparing a thorough technical report on the FCC conference. It is anticipated that as a result of the conference deliberations, including the emphatic RCA-NBC request for speedy action, and the seven-member engineering committee's studies, slated for completion by the end of 1948, there is a good chance for the formulation of TV and FM broadcasting engineering standards so that the FCC "freeze" on television station applications might be lifted with greater speed. The FCC staff hopes to complete proposed standards by the end of January.

TIN ALLOCATIONS SHORTAGE MAY BE OBSTACLE TO INCREASED TV SET PRODUCTION—Besides the shortage of cathode ray tubes, the governmental allocations of tin to the radio manufacturing industry now loom as a bad poential bottleneck in the stepping up of television receiver production next year. Tin is an important material in TV set components and for soldering. It is still one of the scarce supply metals allocated under the defense metal orders by the Commerce Department which has frozen the allocations this year, and probably in 1949, at the 1947 level. Even though the supply of tin has improved, the government agency has not increased the supply to the radio-electronics manufacturing industry but is transferring any excess in the current supply to the Munitions Board's strategic materials stockpile. The problem was serious enough to be taken up at the December meeting of the RMA board of directors.

MISCELLANY—FCC expected to issue final allocations for mobile and safety radio services early in new year. . . . Commission untouched in Hoover reorganization plan for government, but, if Budget Bureau keeps its funds at present level, may have to lop off 75 or so employees to meet recent governmental pay scale increases. . . . Congress is certain to increase pay of Commissioners from $10,000 to at least $15,000 a year.

TELE-TECH's NEWSCAST

Folsom Named RCA President

Frank M. Folsom, RCA executive vice president in charge of Victor Division, has been elected president of the Radio Corporation of America. Brigadier General David Sarnoff, former president, retains chairmanship of the board and continues as chief executive officer and chairman of RCA Communications, Inc.

Consulting Engineers Elect Officers of New Association

C. M. Jansky, well-known consulting radio engineer of Washington, has been elected president of the new Association of Federal Communications Consulting Engineers, whose purpose is to uphold "the honor and dignity of engineers before the FCC and to provide for the mutual improvement and social intercourse of the members."

Other officers are: Glenn D. Gillett, vice president; Andrew D. Ring, secretary; and George C. Davis, treasurer. Additional members of the executive committee are Frank G. Kear, James C. McNary, Joseph A. Chambers and John Creutz. The membership roll includes:

Stuart L. Bailey	Frank G. Kear
John H. Barron	Robert L. Kennedy
Clyde H. Bond	Worthington C. Lent
Lester H. Carr	George M. Lohnes
Joseph A. Chambers	Frank H. McIntosh
John Creutz	James C. McNary
Ronald H. Culver	Russell P. May
George C. Davis	E. C. Page
Everett L. Dillard	William E. Plummer
Millard M. Garrison	A. D. Ring
Glenn D. Gillett	James O. Weldon
Paul F. Godley	Herbert L. Wilson
C. M. Jansky, Jr.	Grant R. Wrathall

IRE Convention in March

A large proportion of a world-wide membership of 23,000 engineers and scientists is expected to attend the 1949 National Convention of The Institute of Radio Engineers which will be held from March 7 to 10 at the Hotel Commodore and Grand Central Palace in New York City.

At this time, under the theme of "Spotlighting the New", nearly 200 exhibits of the latest outstanding developments and products of post war research will be displayed. Featured among the exhibits will be a center devoted entirely to nuclear instrumentation. Social events will include a luncheon in honor of Stuart L. Bailey, IRE's incoming president, and a banquet welcoming 31 members elevated to the grade of Fellow because of their distinguished contributions to radio. Dr. Karl Spangenberg, Office of Naval Research and Stanford University, and one of the youngest scientists ever to be appointed Fellow of the Institute, will deliver an acceptance speech in their behalf.

Aside from social events and manufacturers exhibits, the Institute's program of technical sessions will include studies and discussions on the subjects of radio, Loran, radar, nuclear energy and all the other contributions made by radio engineers toward winning the last war. Television, the radio arts new big contribution toward modern living, will be thoroughly covered.

TELEVISION EQUIPMENT INSPECTED BY SIGNAL CORPS

Signal Corps officers and industry executives inspect television communications equipment following a luncheon of the Armed Forces Communications Association in Philadelphia. Left to right are: Leslie J. Woods, vice president of Philco; Major General Spencer B. Akin, chief signal officer of the U. S. Army; W. W. Watts, vice president of RCA Victor and president of the Philadelphia chapter; and Brigadier General Calvert H. Arnold, procurement chief

Coming Events

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

Jan. 19-21—Society of Plastics Engineers, Annual National Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa.

Jan. 22 — Television Receiver Symposium, New York Section of IRE, Engineering Society Bldg., New York, N. Y.

March 7-10—IRE Annual Convention, Hotel Commodore and Grand Central Palace, New York, N. Y.

April 8-13—National Association of Broadcasters, Annual Convention, Hotel Stevens, Chicago.

April 25-27—Fourth Annual Spring Meeting of IRE and RMA, Benjamin Franklin Hotel, Philadelphia, Pa.

New 16-in. TV Tube

Production of a 16-in. direct-view all-glass bulb for television receivers will begin early in 1949, according to an announcement by the Kimble division of the Owens-Illinois Glass Co. S. J. McGiveran, general manager of the plant, said that the new tube will present a televised picture more than two and a half times as large as the 10-in. bulb.

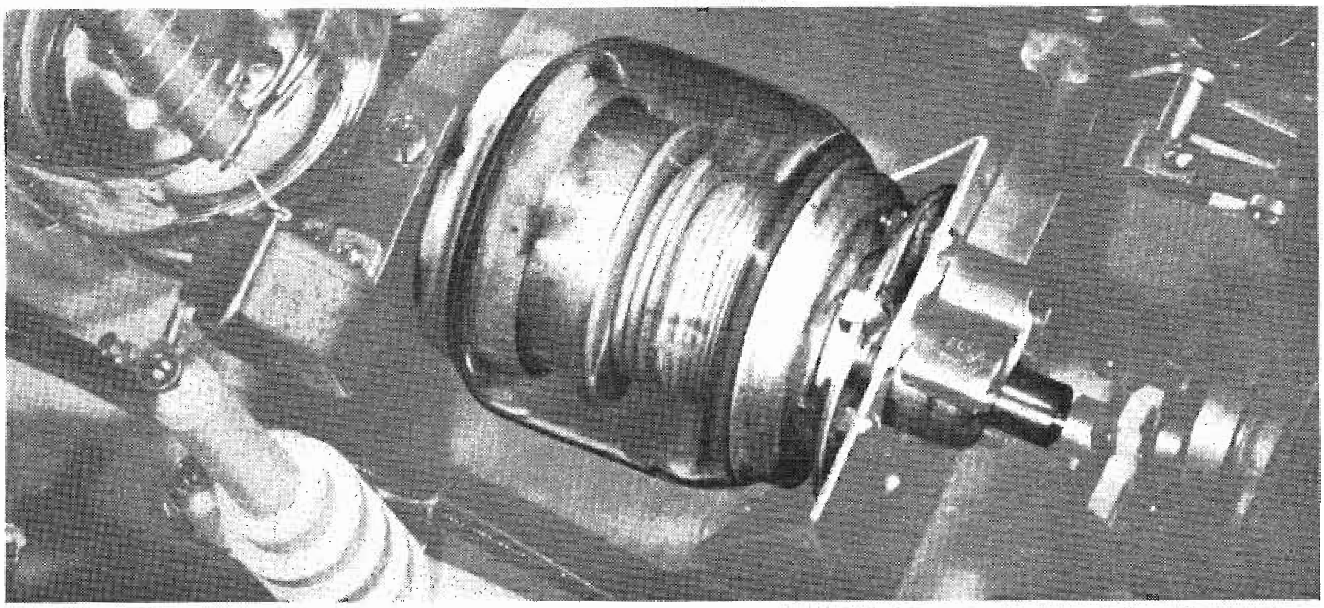
Muter Buys Jensen Co.

A joint statement by Leslie F. Muter, president of the Muter Co., and Thomas White, president of the Jensen Mfg. Co., both of Chicago, has been released saying that the Muter Co. has acquired all of the common stock of the Jensen Mfg. Co. Both principals said that no consolidation of operations was currently anticipated and no changes in management were contemplated.

It was further disclosed that White, president of Jensen, Hugh S. Knowles, vice-president and Ralph T. Sullivan, Jensen district sales manager, had acquired a substantial block of stock in the Muter Company. The new board of directors of Jensen Manufacturing Company will be, Thos. A. White, Leslie F. Muter, Hugh S. Knowles, Karl E. Rollefson and A. A. Dailey.

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

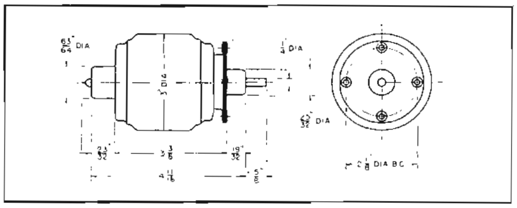
ESSENTIAL IN MODERN CIRCUITRY



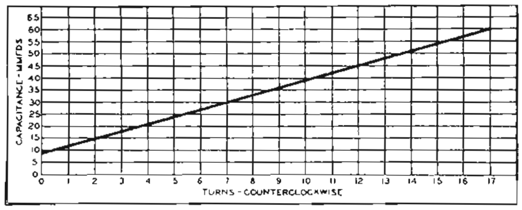
EIMAC VVC 60-20 in an ultra-compact 4-250A I KW Amplifier.

Consider the advantages . . . and Eimac Variable Vacuum Capacitors become the essential component in modern circuitry.

- Extremely compact size reduces equipment bulk. Type VVC 60-20 is less than one-sixth the size of air-dielectric capacitors with similar ratings.



- Structural rigidity eliminates electro-mechanical vibration.
- Low-torque tuning mechanism.
- Unaffected by dusty or humid atmospheres. Ideal for industrial application.
- Capacitance variation is linear with shaft rotation.



- Low temperature coefficient. Negligible change in capacitance due to temperature variance. (.004 mmfd. per degree cent.)

Eimac variable vacuum capacitors are immediately available. In addition to the type VVC 60-20 illustrated here, there are types VVC2 60-20 and VVC4 60-20.

GENERAL CHARACTERISTICS

	Capacity	R-F Peak Voltage	Maximum RMS Current
VVC 60-20	10-60 mmf.	20-KV	40 amp.
VVC2-60-20			
Parallel	20-120 mmf.	20-KV	80 amp.
Split-stator	5-30 mmf.	40-KV	40 amp.
VVC4-60-20			
Parallel	40-240 mmf.	20-KV	160 amp.
Split-stator	10-60 mmf.	40-KV	80 amp.

EITEL-McCULLOUGH, INC.

206 San Mateo Ave., San Bruno, California

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

NEWS . . .

Du Pont Machine to Sprague

The Sprague Electric Company, North Adams, Mass., through the Herlec Corporation, a wholly owned subsidiary, has, after extended negotiations with the Du Pont Company and the Signal Corps, acquired possession of an automatic machine for the production of vitreous enamel capacitors. This machine was under development for approximately five years by Du Pont and later by its subsidiary, the Remington Arms Co. It was completed during the war for the Signal Corps for the production of capacitors to take the place of mica units which were in short supply.

Film on TV Alignment

"Procedure of Television Alignment", the first film produced by Teck-Vision Productions, enables a technician familiar with television to align and check a TV set completely and accurately. Actual scope pictures showing the changes in alignment as each IF or trap is moved are presented. For information write to Jay H. Prager, 8363 West 3rd St., Los Angeles 36, Calif.

Brazing Resnatrons

High vacuum has now been applied to brazing of large components through the use of a high vacuum brazing furnace constructed by National Research Corporation, Cambridge, Mass., for use by Collins Radio Co., Cedar Rapids, Iowa.

In this furnace, brazing operations take place at pressures less than one micron (1/760,000th of normal atmospheric pressure). This almost total absence of air permits brazing to take place with virtually no oxidation. This furnace, the largest of its type, will be used by Collins for brazing large components of Resnatrons. The Resnatron is a large power tube designed for the generation of many kilowatts of continuous power at microwave frequencies. During the war this tube was used for jamming German night-fighter radar.

TV Symposium Program

The program of the TELEVISION SYMPOSIUM sponsored by the New York Section IRE to be held in the Engineering Society's Building, New York City on Saturday, January 22, 1949, includes two sessions starting at 10:00 AM and 2:00 PM.

D. D. Israel will be moderator of the morning session with three papers scheduled:

"Design Trends in Television Receivers" by Irving Lempert

"The Noise Figure of Television Receivers" by Frank Norton

"Television Tuner Analysis in Design Considerations" by Robert F. Romero

The afternoon session with Garrard Mountjoy as Moderator will contain three more papers:

"The Locked Oscillator in Television Reception" by Kurt Schlesinger

"Problems of Television Transmission and Reception" by F. J. Bingley

"A Rooter for Video Signals" by B. M. Oliver

Machlett Making Transmitter Tubes for Western Electric

Matchlett Laboratories, Inc., Springdale, Conn., has taken over the manufacture of the Western Electric Company's long established line of high-power tubes for AM and FM broadcast transmitters and allied applications. Under the agreement Machlett will manufacture the tubes for Western Electric in accordance with Bell Telephone Labs. designs, and obtain full use of the production techniques as developed by Western Electric. Tubes produced will carry the same performance guarantees that have prevailed in the past, and product distribution will continue to be made through the Graybar Electric Co.

The following tube types are now made by the Machlett Labs.:

212E	Air cooled triode, 275 watts
220C	Water cooled triode, 10 KW
220CA	Forced-air cooled triode, 5 KW
222A	Water cooled high vacuum rectifier
232B	Water cooled triode, 25 KW
232BA	Forced-air cooled triode
233A	Water cooled high vacuum rectifier
236A	Water cooled triode, 20 KW
240B	Water cooled triode, 10 KW
241B	Air cooled triode, 275 watts
251A	Air cooled triode, 1000 watts
255B	Mercury vapor rectifier
266B	Mercury vapor rectifier
266C	Mercury vapor rectifier
270A	Air cooled triode, 350 watts
279A	Air cooled triode, 1200 watts
298A and B	Water cooled triode, 100 KW
308B	Air cooled Triode, 250 watts
340A	Water cooled triode, 25 KW
341AA	Forced-air cooled triode, 5 KW
342A	Water Cooled triode, 25 KW
343A	Water cooled triode, 10 KW
343AA	Forced-air cooled triode, 5 KW
357B	Air cooled triode, vhf, 400 watts
363A	Air cooled pentode, vhf, 350 watts
379A	Air cooled triode, 1200 watts
5530	Forced-air cooled triode, uhf, 3 KW
5541	Forced-air cooled triode, uhf, 10 KW

New RCA Victor 45 RPM Reproducing System

Last month, at private exhibitions, a number of industry leaders were introduced to RCA Victor's new 45 RPM Vinylite record and its associated reproducing equipment. Engineers who have examined this equipment report the discs to be approximately seven inches in diameter with a two inch central hole from which the disc itself extends. Thus when stacked, the playing surfaces of the records do not come into contact so that there can be no injury through scratching. Also, this type of "doughnut" construction is said to greatly facilitate the operation of a simplified mechanical changer which can be manufactured at a cost of about one half that of present record changer types. High fidelity is claimed for the records that are microgroove recorded and which promise to cost less than either the 78 or 33 1/3 RPM types now in use.

A considerable difference of opinion exists over the launching of this "Madame X" reproducing system with some set manufacturers protesting that the use of still another speed will result in the utmost confusion at retail level and with others indicating that they will bring out equipment to play the "doughnut" discs on sets next spring. In the event new instruments incorporate facilities for all three systems, it is likely that some of the players will have two compartments, one to play both the conventional and the LP discs and the other for 45 RPM equipment. One large manufacturer asserts that if his firm does go along with the RCA Victor set-up, it will manufacture a single unit to play all of the three speeds in one compartment.

Reports also indicate that a single turntable speed changing mechanism is being considered to enable owners of 78 or 33 1/3 RPM players to adapt their equipments to the new system. This would be quite possible through the addition of a superimposed turntable with a planetary gearing link between its large central hole and the original center pin. Conversion, however, may also necessitate changes in pick-ups since needle pressures and stylus diameters will vary from system to system. Users of "Madame X" will also confront a new record storage problem and possibly experience record warpage troubles since the doughnut design appears to lend itself to "cold-flow dishing" effects.

In reviewing the available data on this new reproducing system, it appears that "Madame X" may eventually replace the conventional 78 RPM records and equipment because of reduced costs and because, even though the microgroove system of recording is employed, the design appears to have been aimed only at getting a playing time equivalent to present records. The latter point is important when it is realized that the vast majority of records sold last year were of the popular variety for use in home instruments and in juke boxes. It follows that the 33 1/3 RPM long playing record will still retain a place in home and in other services requiring fine quality from records that do not have to be changed every few minutes.

NEW NAMES AND ADDRESSES

James W. Dice, former assistant sales manager of Sperry Products, has announced the formation af a new sales and development organization to be known as J. W. Dice & Co. Headquarters are at Grand View-on-Hudson, N. Y.

* * *

Comdr. T. A. M. Craven has resigned as vice president in charge of engineering of the Cowles Broadcasting Co. and is joining George Lohnes and Roland Culver in the formation of a new firm of consulting engineers. Headquarters of Craven, Lohnes & Culver will be in the Munsey Building, Washington, D.C.

* * *

Teletronics Laboratory, Inc., Westbury, N. Y. has been formed to succeed the partnership, Teletronics Laboratory. Robert S. Marston, formerly of Kendall Mills and Sperry Gyroscope, is the new company's president; George F. Richards, formerly of Bell Telephone and Sperry Gyroscope, has been elected vice president. Manufacture of laboratory power supplies, klystron power supplies, bench model air cleaners for assembly of precision parts, and completely automatic microdrills is planned.

* * *

The Waveguide Mfg. & Equipment Co. Inc., has moved from 125 East 23rd St. to 190A Duane Street, New York, New York. The entire third floor at the new location has been leased by WMECO.

Wide-band Amplifiers? **Intensity Modulation?** **High Sensitivity?** **Amplitude Calibration?** **Low Price?**

JUST CHOOSE FROM THESE DU MONT *Oscillographs*

Here's an adequate selection of Du Mont instruments to meet any of the foregoing requirements:

If you require a **wide-band amplifier**, there's a choice of either Type 241 (5-inch) or Type 224-A (3-inch). An intensity-modulation amplifier is also featured by the Type 241. The deflection factor of Type 241 is 0.07 rms v/in.; that of Type 224-A, 0.1 rms v/in.

If you require **quantitative measurements**, the Type 264-A Voltage Calibrator is available. It works with any oscillograph. Once attached, it need not be disconnected for operation of the oscillograph.

If **portability** is your main requirement, there is the Type 164-E weighing only 22 lbs. Its frequency response is uniform within 20% from 5 cps to 100 kc.

For a **high-sensitivity** (0.01 rms v/in.) general-purpose instrument, the Type 208-B is recommended. Its frequency response is within 10% from 2 cps to 100 kc.

And as a very-low-priced **general purpose** 5-inch oscillograph, the Type 274-A is unsurpassed in its class. Its frequency response is within 10% from 20 cps to 50 kc; deflection factor is 0.2 rms v/in.

Regarding **price**, all these Du Mont oscillographs meet the demand for low price and high quality.

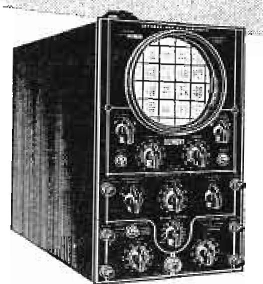
Write for detailed specifications describing all of these important Du Mont instruments.

20 CPS—2 MC
Type 241
$458

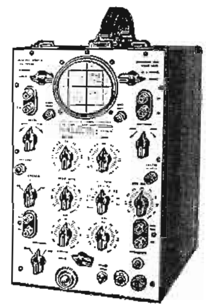
Voltage Calibrator
Type 264-A
$39.50

Portable-22 lbs.
Type 164-E
$127.20

General Purpose
Type 274-A
$136.50



Sensitive
0.01 RMS v/in.
Type 208-B
$285



Wide Range
20 CPS—2 MC
Type 224-A
$290

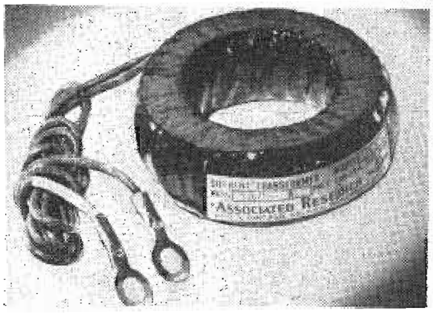
DUMONT *for Oscillography*

ALLEN B. DU MONT LABORATORIES, INC., PASSAIC, N. J.
CABLE ADDRESS: ALBEEDU, NEW YORK, N. Y., U. S. A.

New Parts For Designers

Current Transformers

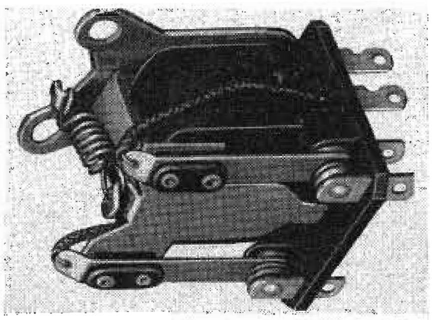
Current ranges of wattmeters, watthour meters, and other instruments requiring compensated transformers can be compensated for phase angle and ratio error with the new model 313 "Donut" type instrument current transformers. They are designed for five volt-amp. burden and are provided with two ft. secondary leads which may be connected



directly to the instrument, or through several switching arrangements where several transformers are to be used with one instrument. Ratios from 25/5 to 1000/5 amps. and multirange combinations with single primary and tapped secondaries are available.—**Associated Research, Inc., 231 S. Green St., Chicago 7, Ill.**

Miniature Magnetic Relays

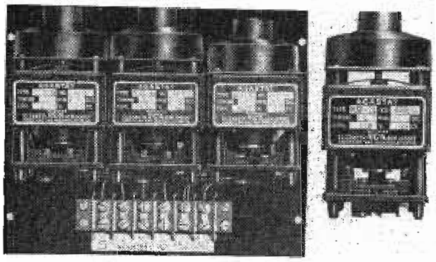
Bulletin 102 miniature magnetic relays have been designed for automatic and remote control circuit applications where space



is extremely limited. They have metal bases and solder type terminals, and measure 1⅛ x 1⅝ x 1-in. and are suitable for operation on 115 volts ac, 60 cycles, or 32 volts dc. Relays are supplied with DPDT silver contacts rated at 3 amps, 115 volts, 60 cycles maximum for non-inductive loads.—**Ward Leonard Electric Co., Mount Vernon, N. Y.**

Time Delay Relay

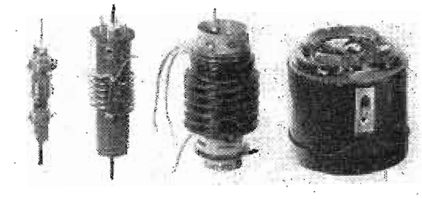
An initial time delay of one minute is provided by the new Agastat time delay relay and once its timing cycle is complete, should



a power failure occur, it switches off immediately. Restoration of power within one to 15 seconds re-establishes the circuit. If a power failure exceeds 15 seconds, a time delay proportional to the length of time of power failure takes place when the power is restored. A combination unit of two proportional and one standard Agastat facilitates a proportional time delay up to five or more minutes.—**Agastat Div., American Gas Accumulator Co., 1029 Newark Ave., Elizabeth 3, N. J.**

Deflection Yokes

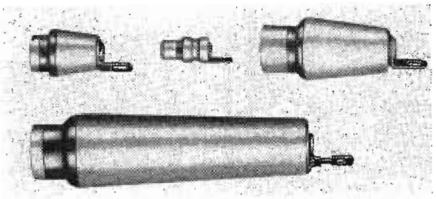
A new line of deflection yokes for 10 and 12-in. picture tubes has been designed with a deflection rating of 50°. Horizontal winding



is rated at 8.3 millihenries and 13.6 ohms. The vertical winding has an inductance rated at 50.33 millihenries at 66 ohms. Yokes meet all breakdown requirements for high voltage surges.—**The Joyner Corp., 462 N. Parkside Ave., Chicago 44, Ill.**

Steatite Terminals

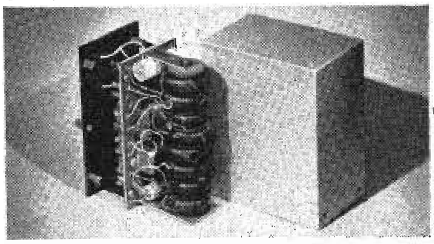
A diversified line of tinned steatite, sealed terminals are available for use on metal enclosures. A tinned surface, permanently



bonded to the steatite body permits rapid and easy soldering to the enclosure after insertion in a proper size hole. Leads are brought through an opening running axially through the bushing and are soldered to the tinned lug provided at the end of the bushing.—**General Ceramics & Steatite Corp., Keasbey, N. J.**

Toroidal Coils

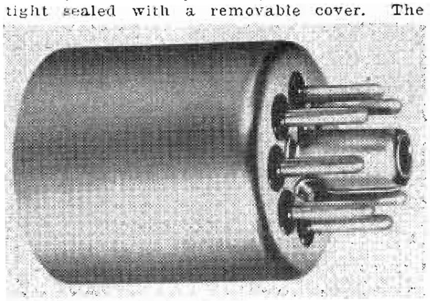
A new line of Toroidal coils are being produced, cased and uncased, impregnated and plain, tapped and untapped, with an induct-



ance range up to 15 henries and a Q as high as 300. They are available with two balanced windings or with a closely coupled secondary superimposed for impedance-matching applications. Cores of Permalloy or molded iron powder are used as required.—**Lenkurt Electric Co., 1109 County Rd., San Carlos, Calif.**

Hermetically Sealed Relays

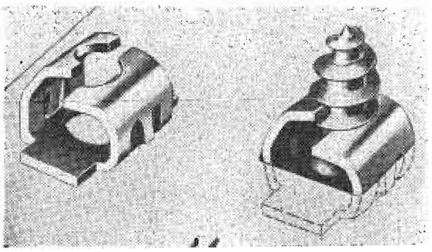
Any type or any size Advance relay can now be hermetically sealed, or can be dust-tight sealed with a removable cover. The



"Tiny Mite" relay (illustr.) is sealed in the octal plug type enclosure. Relays can also be vacuum sealed for special circuit requirements.—**Advance Electric Relay Co., Los Angeles, Calif.**

Panel Fastener

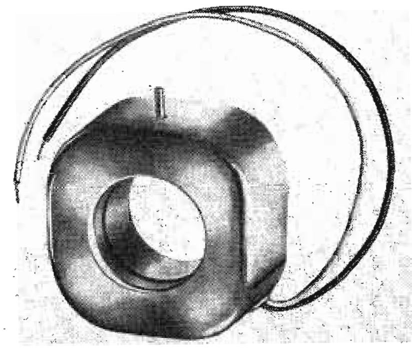
Anchoring nuts to panel in blind attachments is made quick and easy with the new spring steel "Snap Nut" which provides features similar to the complex, floating-type fasteners. No welding, riveting, clinching or special tools are necessary. The nut is simply pressed in to assembly position. It snaps into a 9/32 in. square hole in panels .037 in.



to .055 in. thick and is designed for easy entrance of screw, even in cases of extreme misalignment of panels.—**Prestole Corp., 3154 Bellevue Rd., Toledo 6, Ohio.**

Television Focus Coil

This new focus coil for television tubes is believed to be the first to use a paper-section coil winding, providing greatly increased in-

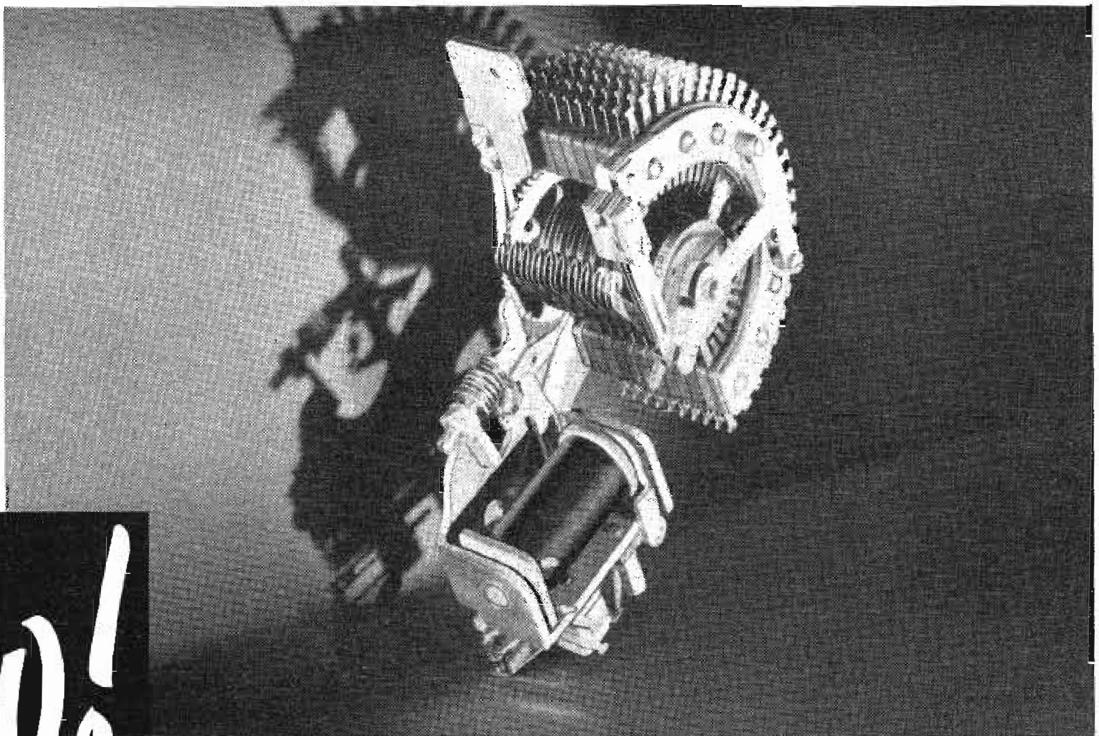


sulation and minimizing the chance of abrasion from repeated thermal changes. The entire coil is wax-impregnated for maximum dielectric strength. Housing is stress-relieved and its magnetic qualities are improved by heat treatment. Coils can be made to any specifications.—**Arthur Slepian & Co., 1600 Seaview Ave., Bridgeport 7, Conn.**

Miniature Resistors

A complete line of extremely small Carbofilm resistors has been designed for use in the manufacture of all types of miniature

electronic units. Available sizes range from ¼-1 watt, in value from 20 ohms to 5 megohms, with tolerances from ½-1%. Smallest resistor in the line measures 1/16-in. diameter over caps, ⅜-in. over-all length, with 1½-in. tinned copper leads.—**Wilkor Products, Inc., 3835 West 150th St., Cleveland 11, Ohio.**



new!

the Type 45 Rotary Switch

70 Steps a Second Speed
Up to 10 (or more) Bank Levels
Only 1 Field Adjustment

For *all* the features you want . . . in *any* remote-control application . . . look to Automatic Electric's Type 45 Rotary Switch!

SPEED . . . it's faster! It carries 10 wipers at 70 steps a second on 46 volts d.c. self-interrupted, or at 35 steps a second, externally interrupted.

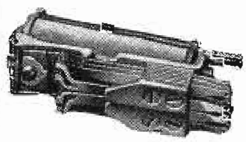
CAPACITY . . . it's greater! Ten or more 25-point bank levels can be accommodated on the same frame, and single ended wipers can be provided for 50-point operation.

ADJUSTMENT . . . it's simpler! A rare readjustment of the interrupter springs is all that's normally required.

OPERATION . . . it's smoother! With an even load on *all* contacts, the Type 45 runs without galloping; there's no chatter or bounce.

ADAPTABILITY . . . it's more useful! With more levels, faster speed and 25- or 50-point operation, it's suitable for a wider variety of control applications.

For complete information on this switch that's new and better, write for our new circular.



the Class "B" Relay

Here's a new relay, too, that can be used for ordinary relay service—opening, closing or switching circuits—and for extremely high-speed operation. Independently operating twin contacts assure perfect contact operation. Contact points are dome-shaped to maintain uniformly low contact resistance. They may be arranged in one or two pile-ups with a maximum of 16 contacts on 13 springs in each pile.

AUTOMATIC ELECTRIC

Distributors in U. S. and Possessions:
Automatic Electric Sales Corporation
1033 West Van Buren Street, Chicago 7, Illinois
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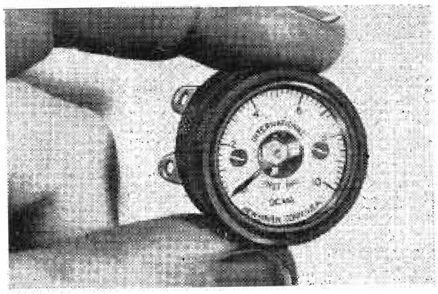
New Lab and Test Equipment

Midget Meter

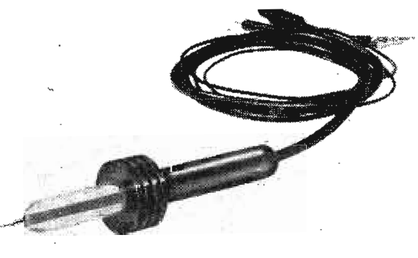
A scale arc of 270° on a new midget meter, one inch in diameter, provides a scale chord even longer than that obtainable on 3¼-in.



conventional meters. Accuracy of ±2% is claimed for the midget meter, which operates on the same general principles as the D'Arsonval moving coil types. It can be made watertight and is mounted by means of a threaded ring. This method of mounting makes drilling of mounting screw holes unnecessary and permits sealing the meter to the panel.—**International Instruments, Inc., 331 East Street, New Haven 11, Conn.**

TV Test Probes

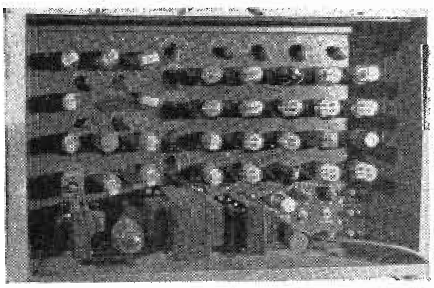
Direct measurement of live circuits up to 30,000 volts dc is afforded by the new series TV high voltage safety test probes. Extended



high dielectric anti-leakage paths and a multi-channeled guard barrier are two characteristics which contribute to the inherent functional safety of the instrument. The probe head is made of custom molded polystyrene and the internal components are constructed from specially machined and tooled lucite.—**Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.**

Video Signal Generator

A simple, compact composite video signal generator has been made available for TV receiver production line, camera chain and other uses where an output signal in strict



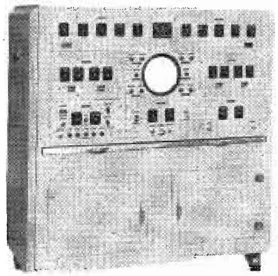
accordance with FCC standards is required. The unit provides both horizontal and vertical blanking pulses, horizontal and vertical synchronizing pulses, and exact equalizing pulses. With this alone, a receiver may be tested for horizontal and vertical synchronization, horizontal and vertical size and positioning of television raster. Correct placement may be made of electrostatically scanned picture tubes and of the deflection yoke, focus coil, and ion trap of magnetically scanned tubes. In addition, a pulse video modulating signal is provided which produces a grating pattern on the television raster. This is used to adjust either or both of the horizontal and vertical linearity controls common to many television receivers and the focus adjustment common to all receivers.

Heretofore, equipment required to provide the type of video signals available from the Composite Video Generator has been large and heavy with no thought of portability. The Composite Video Signal Generator provides exactly the same information yet is housed in a case no larger than the average traveling bag (weight approximately 50 pounds) so that field service is now a reality with this versatile instrument.

Separate horizontal and vertical synchronization pulses are provided on a separate output terminal together with an input terminal suitable for utilizing video signals other than the pulse signals internally provided. The separate synchronizing signal output connection has been found extremely useful in synchronizing oscilloscopes when the oscilloscope is used for detailed examination of receiver video circuits.—**J and A Television & Manufacturing Co., 5066 Broadway, Chicago 40, Ill.**

Five Channel Oscilloscope

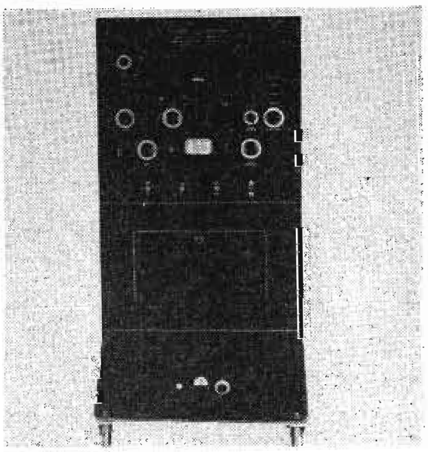
Simultaneous display of five independent waveforms, together with timing marks, is provided by model E5GVM five channel oscil-



loscope. The five amplifiers are grouped around the cathode ray tube and the timing signal generator and the sweep generator are located below the amplifiers in the cabinet. Power supplies are located in the rear and two doors at the bottom of the cabinet open into a storage space where the two preamplifiers and auxiliary equipment are kept. An exhaust blower in the back of the cabinet provides ventilation.—**Electronic Tube Corp., 1200 East Mermaid Lane, Philadelphia 18, Pa.**

TV Signal Generator

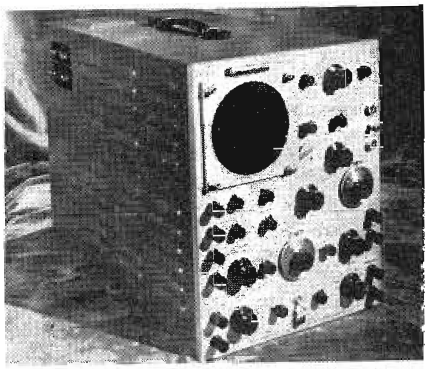
The first commercial wide-band, wide-range, TV standard signal generator has a master oscillator, buffer-amplifier and modulated power amplifier and has been designated



model 90. Output circuits are of the double-tuned, over-coupled, band-pass type, permitting modulation frequencies up to five mc. Excellent isolation is obtained between the final amplifier and oscillator through the use of a push-pull pentode buffer and harmonic operation. Carrier range is continuously variable from 20 to 250 mc in eight coil ranges. Continuous monitoring is provided by a built-in oscilloscope which displays the output of a keyed dc potentiometer superimposed on the video for accurate determination of modulation levels.—**Measurements Corporation, Boonton, New Jersey**

Oscilloscope

Type 512 cathode ray oscilloscope is a portable precision laboratory instrument which is designed to permit observation of signals from



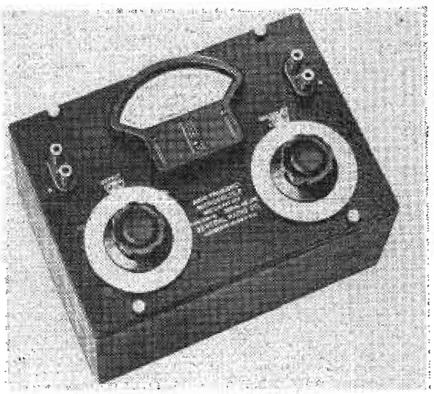
three mc down to dc with a maximum sensitivity of 7½ millivolts per centimeter. Vertical sensitivity may be varied continuously with a low impedance potentiometer and an eight-position selector switch. Each position of the selector switch provides an approximate gain of three and the potentiometer gives continuous control between each step. The CR tube face is covered by a plastic edge-lighted graticule which has scribed reference lines marked off in centimeters. These lines appear in a color complementary to that of the color filter used to improve the trace contrast under high ambient light conditions.—**Tektronix, Inc., 1516 S. E. Seventh Ave., Portland 14, Ore.**

Modulation Monitor Receiver

Measurement and study of the modulation envelope of the video-modulated carrier waves of television broadcast signals on any one of the 13 commercial channels is provided by the 1323 modulation monitor receiver. The modulation envelope of the received signal, together with a line representing the zero-carrier level, is displayed on the screen of a cathode-ray tube. This unit is useful for monitoring the television signals produced by factory or laboratory signal generators as well as those from broadcast transmitters. Means are provided for measuring the depth of modulation of any portion of such signals, particularly the synchronizing and blanking signals of the composite television signal.—**Hazeltine Electronics Corp., 58-25 Little Neck Parkway, Little Neck, N. Y.**

Audio-Frequency Microvolter

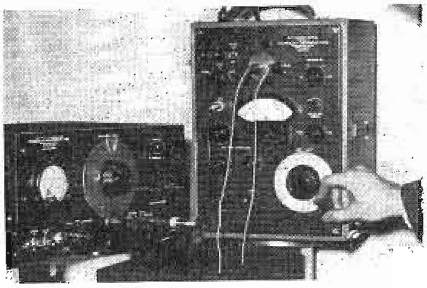
Redesign of the 546 audio-frequency microvolter has improved its sensitivity, frequency response, and distortion characteristics and has standardized its impedance level at 600



ohms. Consisting essentially of a sensitive voltmeter and a precise attenuator, this microvolter converts any audio oscillator to a standard signal generator, capable of such measurements as gain or loss, frequency response, overload level, and hum level on amplifiers, lines and other networks. The output voltage range is 0.1 microvolt to 1.0 volt, open circuit for an input of 2.2 volts across 600 ohms.—**General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.**

Phase Angle Meter

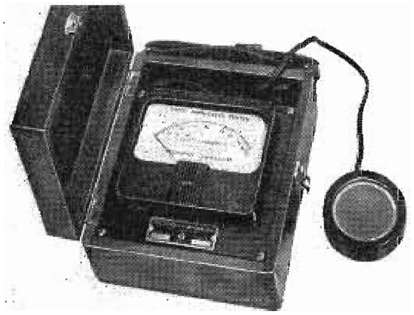
Direct readings of impedance and phase angle at radio frequencies are provided by the recently developed RF Z-Angle Meter (right),



an instrument which affords speedy, efficient, and accurate measurements of complex electronic circuits. It has found wide acceptance for measuring at audio frequencies, the impedance and phase angle of loud speakers, transformers, transmission lines and complex networks without the need of extensive mathematical calculations.—**Technology Instrument Corp., 1058 Main St., Waltham 54, Mass.**

Video Brightness Tester

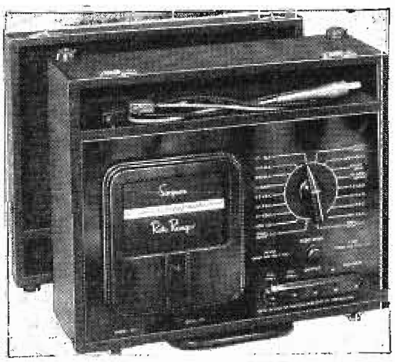
Brightness of television picture tubes may be measured with Photovolt model 205, a photoelectric instrument for checking light output as well as the uniformity of light dis-



tribution. When the photocell is held to the face of the tube, the instrument indicates the brightness directly in ft.-lamberts. Range extends to 100 ft.-lamberts and the four-in. scale is expanded for accurate measurement of low brightness values. Rugged and self contained, the model 205 requires no batteries or external power connections. The self generating photocell is provided with a light filter which furnishes brightness values in terms of visual perception.—**Photovolt Corp., 95 Madison Ave., New York 16, N. Y.**

Volt-Ohm-Milliammeter

Actually the equivalent of 25 individual instruments, model 221 Roto-Ranger eliminates the confusion of numerous scales and multiplying factors common to ordinary multi-

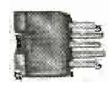


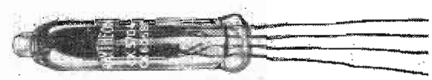
range testers. As the selector switch is moved to the range desired, the proper scale for the meter range is brought into place behind the meter window. Each scale is large and full-sized, as it would be for a separate instrument. The 221 will easily measure automatic frequency control diode balancing circuits, grid currents of oscillator and power tubes, bias of power detectors, automatic volume control diode currents, rectified rf current, and high-mu triode plate voltage—**Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.**

New Tubes and Communications Components

Subminiature Diode

A new subminiature diode, the CK5704/CK606BX, has characteristics similar to those of one half of a 6AL5 and its resonant fre-

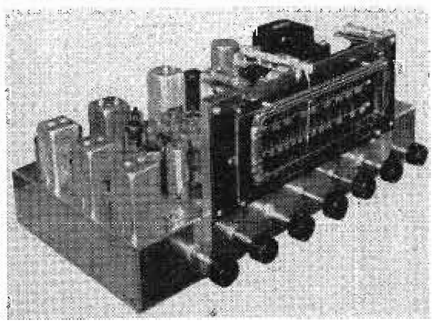




quency is over 1200 mc. It has a 6.3 volt 150 ma heater and is well adapted for applications up to a few hundred mc where extremely small size is important. One recent application has been in the small, easily handled rf probe for a vacuum tube voltmeter.—**Raytheon Mfg. Co., 60 East 42nd St., New York 17, N. Y.**

FM-AM Tuner

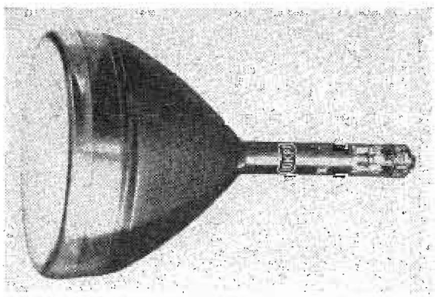
Two tuners, independent except for audio amplifier, have been mounted on a single chassis and designated RJ-20 FM-AM tuner. The FM section uses the Armstrong system



with dual limiters for best quieting and a standard de-emphasis circuit removes high frequency pre-emphasis applied at the transmitter. The AM section employs a superheterodyne circuit with a tuned rf stage. The IF transformers are variable in bandwidth from eight to 18 mc. Audio signals from either channel are fed through two cascaded triode audio amplifiers which are located on either side of a frequency selective type treble-bass control system.—**Browning Laboratories, Inc., 750 Main Street, Winchester, Mass.**

Oscillograph Tube

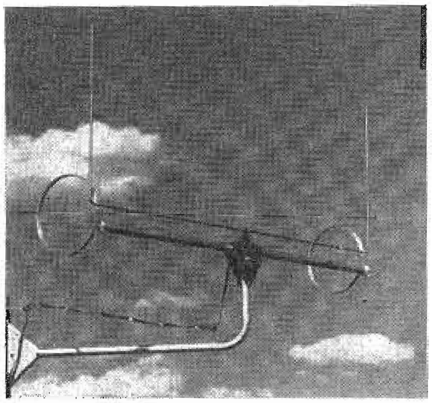
A 10-in., direct-view cathode ray tube of the magnetic-deflection and magnetic-focus type has been designed for radar indicator



service and general oscillographic applications where a temporary record of electrical phenomena is desired. Known as the 10KP7, it has a long persistence, cascade (two-layer) screen which exhibits greenish-yellow phosphorescence. This phosphorescence persists for several minutes under conditions of adequate excitation and low ambient light. Electron gun provides high effective resolution even when the tube is operated with high beam current as in pulse-modulated service. Face plate is almost flat, providing a large useful screen surface in relation to bulb diameter which facilitates the use of an external, transparent, calibrated scale.—Tube Dept., Radio Corporation of America, Harrison, N. J.

TV-FM Antenna

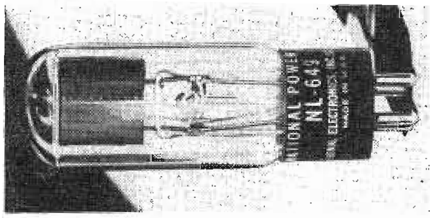
Model 500 TV and FM antenna has been designed for locations where roof installations cannot be made. Easily installed, it matches



all sets with 300 ohm input and affords full coverage of TV and FM bands. Net weight is 2½ lbs. It features a low standing wave ratio and comes complete with all mounting hardware and 35 ft. of 300 ohm line.—Tricraft Products Co., 1535 N. Ashland Ave., Chicago, Ill.

Mercury Vapor Rectifier

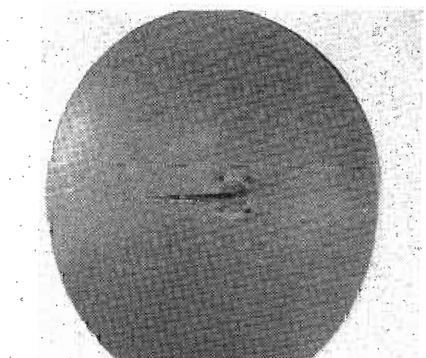
Designed for "back-rectifier" applications in conjunction with a thyratron tube, the NL-649 is a compact, quick-heating two-amp.



mercury vapor rectifier tube which has a peak inverse voltage rating of 900 volts. Other ratings are: filament voltage, 2.5; filament amps., 7; dc amp output, 2; peak current output, 10 amps. The NL-649 is a single-ended tube, thus eliminating the necessity for a seperate plate connection clip.—National Electronics, Inc., Batavia Ave., Geneva, Ill.

Parabolic Antennas

A new series of parabolic high gain antennas for use in the 920 to 960 mc FM relay band have been designed with dish dia-



meters of two, four, and six ft. Field gains of these models over a half wave dipole are 10, 15, and 20 db respectively. Input impedance of the antennas is a nominal 51.5 ohms and ⅞-in. air dielectric cable is recommended as a feed line. Maximum voltage standing wave ratio over the band is 1.4.—Andrew Corp., 363 East 75th St., Chicago 19, Ill.

Television Trends

(*Continued from page 24*)

construction of yokes and their mounting on these wide angle, relatively short tubes if adequate focusing over the whole screen is to be attained. This problem also extends to the design of the tube's electron guns. Also the public is soon dissatisfied with receivers whose clarity and focus change each time the DC component of the signal changes. There are a number of sets produced now where this occurs, generally requiring refocusing each time a new camera is switched in.

Some engineering attention is being given to the development of circuits which simplify the adjustments of the brilliance and contrast knobs. These are inter-dependent controls on most sets and the right settings are not usually attained in the home.

In this regard at least one manufacturer has incorporated an automatic contrast control circuit in present models. This circuit holds the black level on the picture tube at a brilliance desired level set by a "picture control" knob by the user.

There are many interesting developments in circuits and components under way that will have an important bearing on designs in future years. In general, 1949 will be marked with a great expansion of television and general cheapening of receiver costs, by reduction of stages with fewer, and in many cases better components.

CIVILIAN WALKIE-TALKIE

The first portable radio transceivers to be produced for public use are now being turned out by Citizens Radio Corp. Tiny headphones and batteries (not shown) are carried in separate case. Unit uses Sylvania subminiature tubes, weighs 11 ounces and operates on 465 MC with 3 watt input

PERSONNEL

A. H. Brolly, veteran television engineer, has left WBKB, Chicago, to become chief engineer of the Television Associates, Inc., 190 North State St., Chicago, engineering and manufacturing organization of which **Captain W. C. Eddy** is president.

Edward Dervishian has been appointed chief electronics engineer of N. R. K. Mfg. & Engineering Co., Chicago, by **F. C. Griffiths**, President. Dervishian has been associated with American Television Laboratories for eight years prior to his recent appointment and was personal assistant to Dr. Lee deForest for two years.

Earl E. Eldredge has been appointed chief engineer of the Press Wireless Mfg. Co., Hicksville, L. I. He was formerly affiliated with Erco Radio Laboratory, Mackay Radio & Telegraph Co. and General Electric. Press Wireless produces communications equipment

Dr. Allen V. Astin has been named chief of the Electronics Division, National Bureau of Standards, to succeed the late Harry Diamond. Dr. Astin, who has served as assistant chief of the Electronics Division and prior to that in the same capacity with the Ordnance Development Division, has had wide experience in the fields of precision electrical measurements and liquid dielectrics.

F. P. Barnes has been appointed sales manager of broadcast equipment for GE's transmitter division, Electronics Park, Syracuse, N. Y. He joined General Electric in 1937 and was named assistant to the manager of sales (transmitter division) in August, 1948.

Dr. Harold A. Zahl, formerly chief of the engineering staff, has been appointed director of research of the Signal Corps Engineering Laboratories at Fort Monmouth, N. J. He is a holder of the Legion of Merit for contributions in the fields of radar and vacuum tubes.

G. F. Callahan has been named division engineer, cathode-ray tubes in the General Electric tube divisions. He will supervise all design and application engineering and standardizing activities relating to cathode-ray tube designs.

Dawson J. Burns was elected chairman of the executive committee of the Ward Leonard Electric Co. after tending his resignation as president before meeting of the board of directors. **Arthur A. Berard,** executive vice president and general manager of the company since 1944, was elected president and general manager.

FRONT END FOR TELEVISION RECEIVERS

(*Continued from page 37*)

signal to noise ratio would suffer.

The cathode of the amplifier is tuned to reduce the effect of the input capacitance of the circuit by the use of only two coils. There are two reasons for this; first the impedance of the circuit is only 300 ohms, which gives a broad tuned circuit; and second, there is some capacitance feed back between plate and cathode, due to wiring and tube, which feeds back a signal in phase and effectively cancels out some of the input capacitance. While this tends to increase the resonant frequency the effect can be taken into consideration in setting up the tuned circuit.

A double tuned, over-coupled transformer is used for all channels except Channel 2 which employs a triple-tuned transformer. The latter has a tuned circuit to couple energy from the RF plate to the converter grid winding for improving image rejection to a value better than 70 DB. This is adequate to eliminate interference from most signals appearing on the image of Channel 2.

For simplicity of design and to reduce cost, six of the higher television channels were combined into three switch positions. This means that the band pass characteristic for those three switch positions are such that they will pass two channels of television signals. The oscillator rimmer has sufficient range on these positions to cover both channels.

On the high frequency channels of the switch, the ground plate in the band switch used to connect the RF plate and converter grid coils to ground is constructed so that it furnishes the coupling for the coils, making it unnecessary to adjust coupling, and allowing the coils to be placed in any plane desired for tuning. The coils for these positions of the switch are tuned by using a brass screw. They are self supporting, being wound with No. 20 Formex wire on a small diameter. The tuning screw has threads that conform to the inside of the coil and gives a wide tuning range for the coil. Actually the adjustment is great enough so that the same coil can be used in all four positions of the band switch, and results in reduced manufacturing costs since only one part needs to be handled.

Trimmers, placed directly across the tuned circuits, permit realignment. Thus one alignment covers all channels when tubes are changed. The oscillator is a modified Colpitts oscillator, coupled to the converter by capacity coupling, thereby eliminating the need for adjusting oscillator excitation.

A triode converter is used to minimize the noise generated by the tuner unit, because it has a low equivalent noise resistance, which aids in improving the signal to noise ratio of the receiver.

The RF gain for the amplifier includes the conversion gain of the converter and was measured using the load to the converter that is presented by the converter plate transformer, table below. The gain of the amplifier is not great, but the signal to noise ratio of the unit is good, which is the important factor.

RF Gain for Amplifier

Channel Number	RF Gain	Signal to Noise db from Ultimate	Oscillator Radiation
2	8.4	8.2	8.5 Mil. V.
3	6.75	8.2	5.5 Mil. V.
4	5.6	9.1	6.0 Mil. V.
5	6.5	11.0	10.9 Mil. V.
6	6.45	12.0	12.7 Mil. V.
7	5.8	13.9	3.9 Mil. V.
8	4.4	16.3	28.4 Mil. V.
9	4.4	16.3	43.2 Mil. V.
10	4.3	15.1	60.0 Mil. V.
11	4.3	15.1	51.5 Mil. V.
12	3.5	16.3	47.5 Mil. V.
13	3.5	16.3	41.6 Mil. V.

The signal to noise measurements were made by using a pulse generator that pulse modulates a standard signal generator. The output of the generator was adjusted until the pulse signal was equal to the noise of the set. Ultimate noise for the set was calculated, using the proper input impedance to the set and the effective band width. A ratio of the input signal from the generator to the ultimate noise figure was taken in DB to obtain data in the signal to noise column.

The oscillator radiation measurements were taken by using a field strength meter connected directly to the antenna input terminals of the tuner unit. The field strength meter was calibrated for each reading by a standard signal generator. It is really oscillator volts appearing at the antenna terminal since it does not take into account any radiation from the receiver chassis.

In a triode converter the excitation which is provided by the oscillator should be above 10 microamps, so that approximately 3 volts of oscillator voltage is necessary on the grid of the converter for good operation. It is difficult to reduce this voltage to a low value of only one tube to isolate it from the antenna terminals. At the higher frequencies, it becomes more of a problem as the small feed back capacities in the switch and tube sockets have lower reactance than at low frequencies, allowing more oscillator voltage to appear in the antenna terminals. If expensive shielding and insulation of the band switch wafers are employed these figures can be reduced to some extent.

Table below shows the rejection to some interfering signals that may be encountered in operating a television receiver. Although these figures are below the requirements necessary for good operation in all localities, they are higher than that accomplished by the majority of tuner units used in television sets on the market today. The attenuation is great enough to give good operation in most localities.

Rejection to Interfering Signals

Channel Number	Type of Interference	Frequency (Megacycles)	Attenuation (Decibels)
2	Image response	106	71.4
	2nd Harmonic of Osc. + IF	188.8	65.5
3	2nd Harmonic of Osc. + IF	200.85	69.1
4	Image Response	128	46
	2nd Harmonic of Osc. + IF	212.85	65
5	2nd Harmonic of Osc. — IF	181.65	44
6	2nd Harmonic of Osc. — IF	193.65	434
11	Image Response	249	27.9

Figs. 3 and 4 show the operating characteristics of the oscillator. The drift of the oscillator is minimized by using a mica-filled hard rubber socket, and using a hard rubber rotor, and a high grade of textolite in the stator of the band switch. The oscillator warm up drift was made with the tuner chassis mounted in the receiver which was located in its cabinet. This accounts for the long period of stabilization of the oscillator since it requires some time to reach a constant temperature in the cabinet.

Fig. 4 shows the stability of the oscillator with line voltage change. The stability is good since a change of 25 volts will only change the oscillator frequency 215 KC.

Brunetti Joins Stanford

Dr. Cledo Brunetti, former chief of the engineering electronics section in the U. S. Bureau of Standards, has joined the staff of the Stanford Research Institute. During the war, he played a major part in the development of the radar-guided bomb and the radio-proximity fuse.

Oscillator Power Variation

(*Continued from page 32*)

duced to 1/3 by capacity-loading the oscillator. For the purpose of this article the amount of reduction in pulling is not the important point. Rather, this example is intended to draw attention to a certain trend which results from such reduction. This is that the experimental curve for the capacity loaded oscillator rises almost linearly with τ instead of the almost exponential rise of the theoretical curve and the pulling values for the non-capacity loaded oscillator. Thus, in the instance of the capacity-loaded oscillator, if the coupling is increased from 70% to 100%, the pulling goes up only 65% whereas in the uncompensated case the pulling rises 330%. This is important in instances where the oscillator is deliberately undercoupled but where the action of a standing wave of proper phase would be to increase the effective coupling to optimum or beyond. In such a case the pulling in an uncompensated oscillator could be expected to increase sharply. Admittedly, the simple linear theory of the foregoing pages fails to explain or predict the effects of capacity compensation.

The study of pulling in the overcoupled case is pursued by plotting

$$f(K) = \frac{2}{1 - K}(1 + \sqrt{K}) - 1.$$

See Fig. 13. Multiplying this by values of $f(\beta)$ from Fig. 11 results in a plot of $(4Q_u)\Delta f_o/f_o = f(\beta) \cdot f(K)$ shown in Fig. 14. It is evident that the pulling increases with the degree of overcoupling but not as rapidly as predicted by the theory. It is probable that for overcoupling the oscillator feedback which was not taken into account in this article plays a more important role than in the undercoupled case.

The preceding variations show clearly that the frequency pulling and power variation are independent of the kind but dependent on the amount of coupling and on the voltage standing wave ratio (VSWR).

Further, they show that once a figure for pulling and for VSWR have been decided upon that the percentage of critical coupling is at once determined and thereby the power output from the oscillator. It follows that if more power is desired, the frequency stability of the oscillator must be improved.

The author is indebted to Mr. James Ferry, formerly at Naval Research Laboratory, for suggestions concerning the foregoing theory.

BULLETINS

Miniature Castings

Manufacturers who are interested in mass producing small parts of intricate shape to close tolerances may obtain a copy of a new booklet entitled "New Horizons With Micro-castings" from the Austenal Laboratories, Inc., 224 E. 39th St., New York 16, N. Y. Fully illustrated, the booklet lists parts suitable for quantity production by this technic as well as range and type of alloy. (Mention T-T)

Synthetic Elastic Compositions

Properties and use of "Fairprene" synthetic elastic compositions are pointed out in a 12-page manual recently issued by the Fabrics Division, E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware. Copies may be obtained by writing to division headquarters at Fairfield, Conn. (Mention T-T)

Radio Links

FTL-10-A and FTL-11-A are bulletins describing the 23 Channel Pulse-Time multiplex radio link and the frequency modulation UHF radio link respectively. Both are available from Federal Telecommunication Laboratories, Inc., 67 Broad St., New York 4, N. Y. Material is also available on the television broadcast transmitter monitor (FTL-12-A), the frequency modulation UHF broadband link (FTL-13-A) and the all metal dummy antenna for FM broadcast transmitters (FTL-15-A). (Mention T-T)

Vibration Control

The Vibrashock Division of Robinson Aviation, Inc., Teterboro, N. J., has published a brochure describing the vibrashock line of scientific vibration controls. Complete mounting systems for standard and special applications are included. (Mention T-T)

Sound Products

Microphones, amplifiers, speakers, program control and distribution facilities are covered in the new sound products catalog (No. 218-P) issued by RCA. Copies may be obtained by written request to the Sound Products Section, Engineering Products Dept., Radio Corporation of America, Camden, N. J. (Mention T-T)

Miniature Electron Tubes

The complete RCA line of miniature electron tubes are catalogued in folder MNT-30B, covering 80 types and superseding the MNT-30A. Tubes are listed numerically and alphabetically with thumbnail descriptions and metal and GT equivalents of each tube opposite the listings. (Mention T-T)

High Frequency Resistors

Complete specifications and characteristics for type MP high-frequency resistors are given in a four-page technical bulletin, published by International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa. (Mention T-T)

Public Address Manual

The first industry-wide public address manual by Rider, containing the products of 147 PA equipment manufacturers, now is available. Write to John F. Rider Publisher, Inc., 404 Fourth Ave., New York 16, N. Y. for details. (Mention T-T)

Quartz Crystal Units

A new catalog covering their complete line of quartz crystal units has been released by Reeves-Hoffman Corp., 321 Cherry St., Carlisle, Pa. The new bulletin (RHC-X) features a small universal crystal holder with a frequency coverage from 50 kc to 100 mc. (Mention T-T)

Tape Recorder

How the Ampex magnetic tape recorder is being used by the Bing Crosby show is described in a color brochure released by the Audio and Video Products Corp., 681 Fifth Ave., New York 22, N. Y. Noise-free splices may be made with scissors and "Scotch" cellulose tape. (Mention T-T)

COLLINEAR COAXIAL ARRAY FOR 152 MC

(*Continued from page* 35)

nitude as well as in phase. In a collinear array in which only one end element is directly driven, the current magnitude in successively coupled dipoles drops noticeably. While no convenient and accurate method was available to measure this effect, it was demonstrated by the simple expedient of noting the progressive dimming of a neon bulb touched first at the voltage anti-nodes of the driven dipole and later at the voltage anti-nodes of the successively coupled dipoles. The effect is of little importance in this particular design.

With tuning adjustments completed, the input impedance of the antenna was measured with a 50 ohm slotted line and a General Radio Crystal Galvanometer. The slotted line, two meters long, interposed the transmitter and a twenty foot length of 50 ohm coaxial cable feeding the array. By the displacement of the voltage minima with the antenna terminals first short circuited and secondly open, and by the standing wave ratio measured as 2 to 1, the driving point impedance of the antenna was shown to be approximately 100 ohms and slightly inductive. For a quarter-wave matching transformer the matching section impedance (Z_m) being equal to the geometric mean of the feed line impedance (Z_c) and the load impedance (Z_l), it was estimated that a length of 72 ohm line slightly shorter than one quarter wavelength would produce a close match to the 50 ohm solid dielectric feed line. Consequently, a 12-in. length of 72 ohm solid dielectric cable was carefully spliced between the 50 ohm line and the antenna input terminals.

Subsequent measurement with the slotted line apparatus confirmed that the termination was almost resistive with a standing wave ratio of 1.2 to 1. No further attempt was made to improve this adequate match.

This collinear coaxial array should operate successfully over the newly proposed Taxicab Land Station frequencies of 152.15, 152.21, 152.27 and 152.33 mc without change in dimensions. The adjustable features of the array may be dispensed with in the event that the listed dimensions are carefully followed. It is to be appreciated that an antenna power gain of 3 db is equivalent to doubling the transmitter output power. The antenna described has been in use for an extended period at Land Station K2XAC of the Mobile Radio Service in Niagara Falls, N. Y. with results measurably superior to the original ½ wave coaxial antenna.

Synchronizing TV Carriers

(*Continued from page* 29)

in the TV carrier frequency as there is in the sidebands, beats between carriers produce much more visible interference. All interested parties agree more field tests are desirable. The method is not limited to synchronizing only two stations.

It is fortunate that the successful tests of this principle were made in time for consideration by the FCC, now investigating revision of its rules in order to reduce tropospheric interference. It should be tried at once in the Detroit-Cleveland area to reduce the troublesome interference experienced there. It may be the factor which will decide FCC on keeping the present 150 mile spacing between co-channel stations and thus hasten the end of the present "freeze" of TV assignments.

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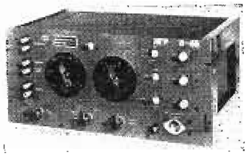

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Reflected Signal Effects

(*Continued from page 40*)

pulsed signal is received, grid rectification causes the effective grid bias to increase rapidly to a value proportional to the amplitude of the signal. Thus the output of the amplifier is limited. Since the build-up time of the grid bias is a function of the coupling capacitor and the grid-cathode resistance, and the recovery or decay time is a function of the same capacitor and the grid leak resistance, these times can be independently controlled. This feature permits us to provide for the third fundamental, allowance, for echo dispersion.

If each preceding IF amplifier stage is provided with a similar time constant, an increasing signal strength merely drives more stages into the grid conduction region and the gain of the receiver is proportionately reduced. In practice, video components of the grid bias curve may become troublesome if a low intermediate frequency is used, particularly when the interstage coupling is of large bandwith. Normally, however, these two conditions are not found simultaneously in an optimum design. It is possible, of course, to use a high-pass T filter section between stages to provide adequate attenuation of the video components when necessary.

Fig. 7 shows the performance of a particular amplifier incorporating this circuit. Gain reduction, in db below maximum, is plotted as the ordinate, while elapsed time in microseconds is the abscissa. The effect of three signal amplitudes is shown. Note the greater recovery time with greater signal strength, allowing more time for dispersion of echoes. The choice of time constants shown was experimentally found to be optimum for suppressing the greatest number of echoes consistent with a minimum period of reduced sensitivity.

Obviously, 2 microsecond interrogating signals of small amplitude arriving during the period of reduced sensitivity following a strong 1 microsecond search signal will not receive a reply from the beacon transmitter. However, since the airborne radars are not synchronized, this condition will not prevail for more than a small time interval, and when we consider that both radar antennas are scanning, the situation does not appear to be serious. The conventional receiver, of course, would quite probably have allowed the strong search signal to trigger

(*Continued on page 64*)

TELE-TECH

Advertisers January 1949

REFLECTED SIGNAL EFFECTS

(*Continued from page 62*)

the beacon and would, therefore, disable the equipment for a period of approximately 150 microseconds while the identifying code was transmitted. The latter situation can easily become more wasteful of duty cycle than the former.

Briefly, this amplifier uses series-shunt compensation to achieve a band-pass from 8 to 48 MC. The parallel resonant elements in the cathode circuits of the first five stages begin to cause degeneration below 8 MC, and the compensating elements in the plate circuits of all stages keep the response uniform to 48 MC. A stage gain of 9.5 MC is obtained with an overall gain of 76 db in the first 8 stages. The ninth stage is operated at zero bias and reduced plate and screen voltage, just as in the conventional type limiter. The T filter sections, for eliminating video components of the rapid grid bias adjustments, will be recognized in the interstage coupling of the latter stages of the amplifier. This amplifier illustrates how the echo-suppression feature can be added with little complication and with no appreciable sacrifice of gain or bandwidth.

A laboratory evaluation of a circuit of this type provided the data for Fig. 8. The dashed diagonal line is the locus of equal signal and echo magnitude. This represents the ultimate limit in the capabilities of the "echo-suppression" circuit. The horizontal dashed line shows that a conventional receiver fails to perform properly when the echo signal exceeds the threshold level, in this case −67 dbm. The time sequence of both signals is shown on the figure. The experimental curve shows how close the suppressing feature approached the ultimate limit in a particular beacon receiver.

Operational tests of this circuit, when installed in a microwave transpondor beacon, were performed at the Naval Research Laboratory. This is a particularly choice location for the generation of echoes, due to the many buildings, towers, etc. in the immediate vicinity. Two beacons were operated simultaneously, one conventional and the other containing the "echo-suppression" circuit. By using an airborne radar to challenge the two beacons with a search or 1 microsecond signal, the data for Fig. 9 were obtained. The large cross-hatched area is that in which the conventional beacon was interrogated; the solid area is that in which the modified beacon was interrogated.

ANNUAL INDEX OF TECHNICAL BOOKS—REVIEWED IN 1948

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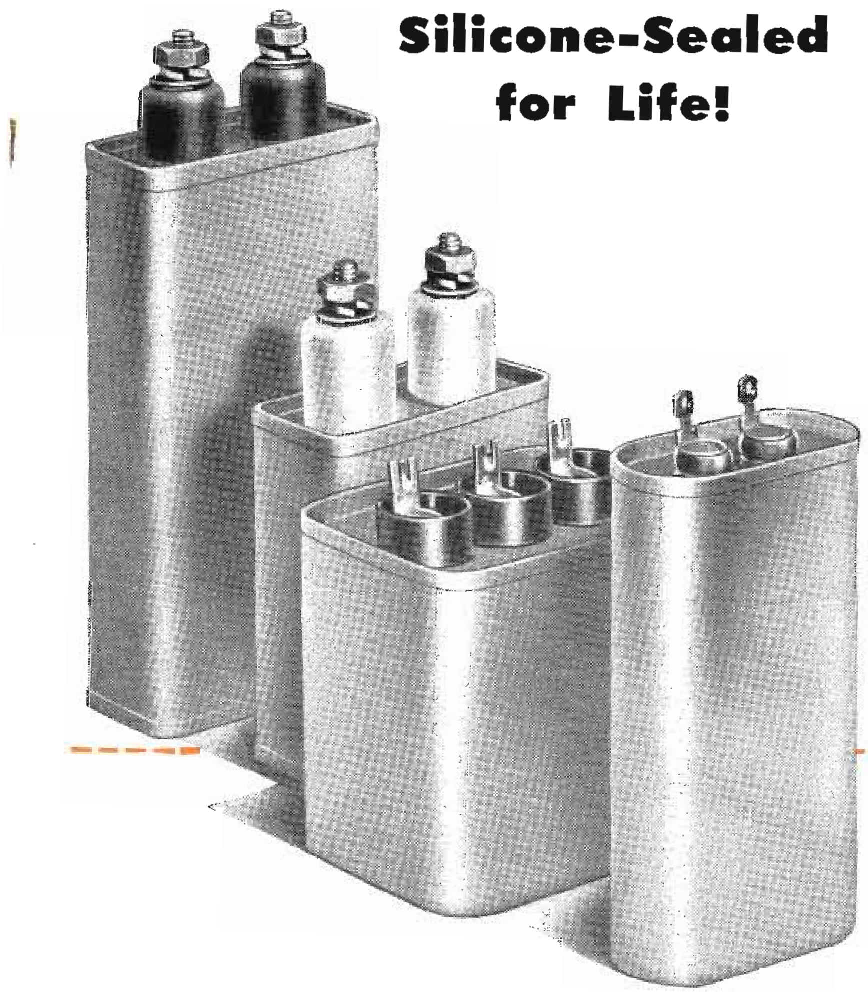
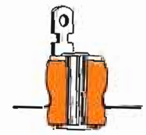


Silicone—the amazing new synthetic—made headlines when General Electric brought it out during the war. It's news again today—for G.E. has now made Silicone bushings and gaskets a *standard feature* of all its specialty capacitors up through 5000 volts.

This means that your new G-E capacitor is sealed positively, permanently—for maximum life. For Silicone seals by compression alone, without the use of contaminating adhesives. It will never shrink, loosen or pull away—it remains elastic at any operating temperature a capacitor will ever meet. Moreover, it is impervious to oils, alkalies and acids, and its dielectric strength is permanently high.

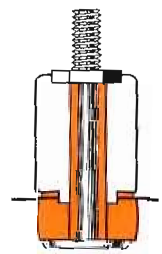
This exclusive G-E feature—with the use of highest grade materials, with strictest quality control and individual testing—make General Electric capacitors finer and more dependable than ever before. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Silicone bushings used with capacitors 660-v a-c, or 1500-v d-c and lower.

Silicone bushings and plastic cups used with capacitors 660-v a-c, or 1500-v d-c and lower.

Silicone gaskets and plastic stand-offs used with capacitors rated 2000-v d-c and lower.



Silicone gaskets and porcelain stand-offs used with capacitors rated 2500-v to 5000-v d-c.

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- Electronic equipment
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- Flash photography
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- Television
- Dust precipitators
- Radio interference suppression
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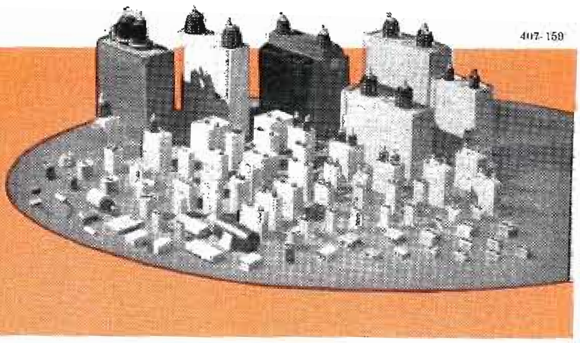
AND MANY OTHER APPLICATIONS



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