

# TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

IN TWO PARTS • PART ONE

September • 1948

CALDWELL-CLEMENTS, INC.

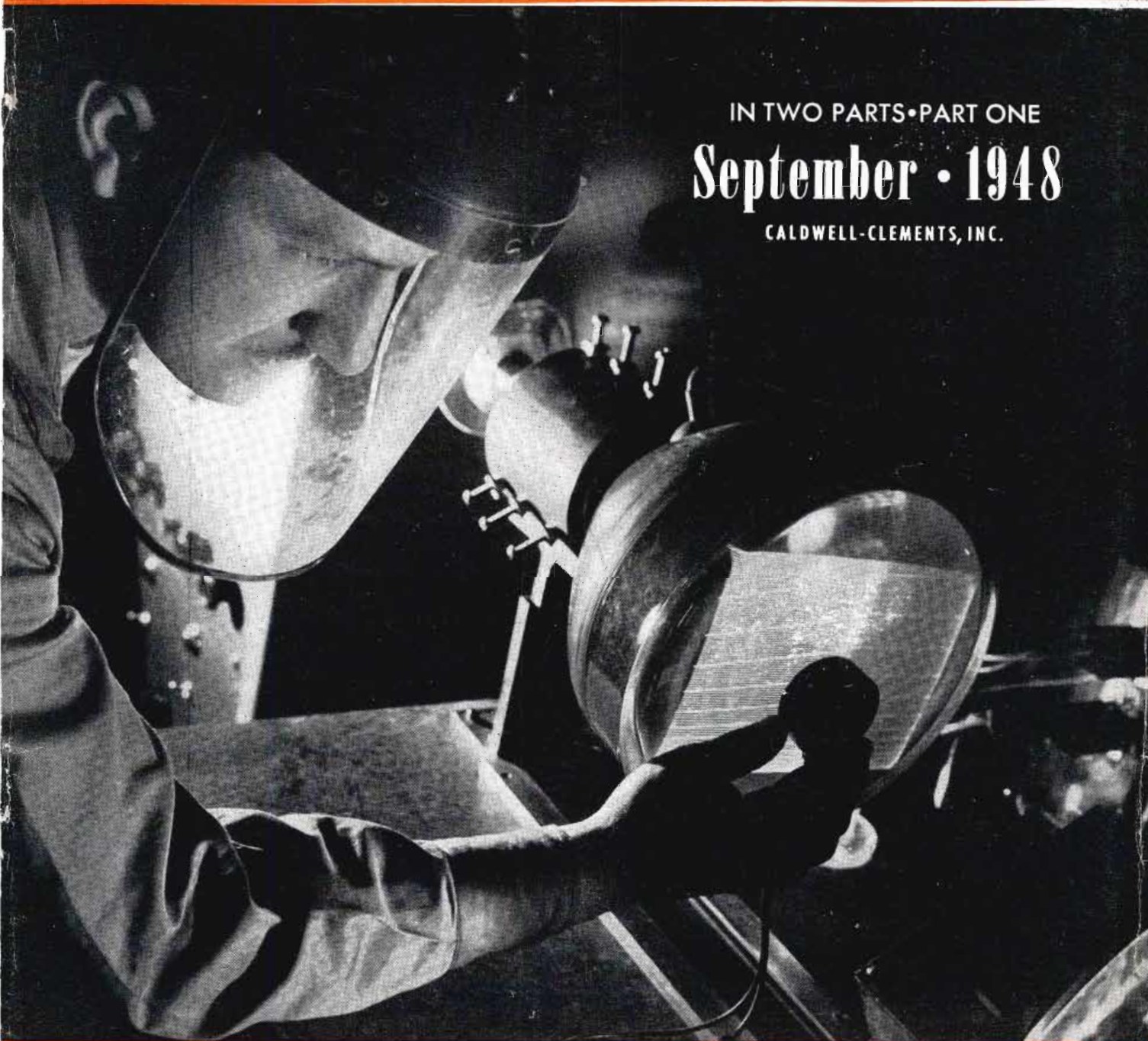


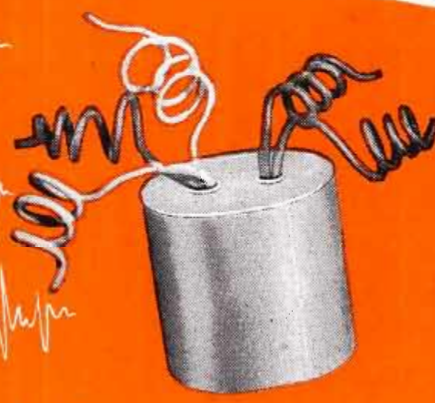
Photo: Measurement of light color values at Sylvania CR tube labs — See Page 1

**Report On World Radio Markets** Page 34

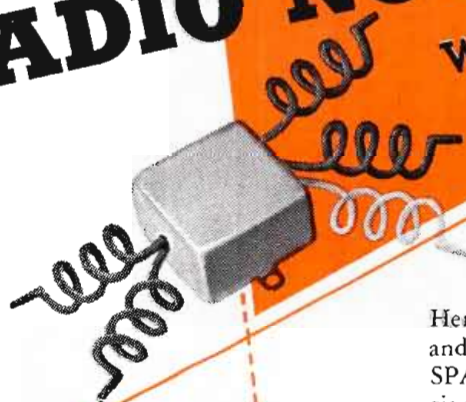
**Tele-Tech's TV Receiver Specifications** See Part 2

ENGINEERING TECHNICS — DESIGN • MANUFACTURING • OPERATION

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# RADIO NOISE-PROOFED WITH C-D QUIETONES



More and more, electrical appliance customers are asking – "Will it cause radio interference?" And in the answer to that question lies the secret for many more sales of your products.

Here at Cornell-Dubilier you'll find *your* answer – in a modern and complete laboratory, devoted to RADIO NOISE AND SPARK SUPPRESSION DEVICES – the industry's most experienced engineers – the thirty-eight-year C-D background, unequalled in the capacitor field. They're all at your disposal – NOW. Whether you want to Radio Noise-Proof equipment already in production – or if you're engineering a new product from the ground up – C-D Quietones will do the job efficiently and permanently. **YOUR INQUIRIES ARE INVITED.** Cornell-Dubilier Electric Corporation, Dept. J-8, South Plainfield, New Jersey. Other large plants in New Bedford, Worcester and Brookline, Mass., and Providence, R. I.

Make Your Products More Saleable with C-D Quietone Radio Noise Filters and Spark Suppressors



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WORLD'S LARGEST MANUFACTURER OF  
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# '48-'49 RECEIVER

IN TWO PARTS • PART TWO  
SEPTEMBER 1948

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Manufacturer's Name, Address and Model Number	Type	Size & Type of Pic Tube	Screen Size (Sp. In.)	List Price (Dollars) (*Includes Installation)	No. of TV Channels	AM-FM-SW Bands	Photo Record Pic
1	2	3	4	5	6	7	8
Admiral Corp., 3800 W. Cortland St., Chicago 47							
8C11	C	10BP4	55	499.95	13	AM, FM	Yes
30A14	C	10BP4	55	299.95	13		No
Air King Products Co., Inc., 170 53rd St., Brooklyn 32, N. Y. 1000	T	10BP4	52	369.00	13	No	No
Andrea Radio Corp., 27-01 Bridge Plaza N., L. I. C. 1, N. Y.							
CO-VJ12-2	C	12JP4		795.00	13	AM, FM	Yes
CO-VJ15	C	15AP4	123	1295.00	13	AM, FM	Yes
T-VK12	T	12JP4		499.00	13	AM, FM	No
Ansley Radio & Television, Inc., 41 St. Joes Ave., Trenton, N. J.							
Beacon	T		52	375.00	13	No	No
Bellevue	C		77	995.00	13	AM, FM	Yes
Salisbury	C		77	995.00	13	AM, FM	Yes
Somerset	C		77	995.00	13	AM, FM	Yes
Atlas Radio & Television, Inc., 26 Journal Square, Jersey City 6, N. J.							
100	T	7JP4	26	185.00	13	No	No
200	T	10BP4	52	335.00	13	No	No
Automatic Radio Mfg. Co., 122 Brookline Ave., Boston 15, Mass.							
T700	T	7JP4		150.00	12		
T1000	T	10BP4		369.00	13	No	
Bace Television Corp., Green & Leuning Sts., S. Hackensack, N. J.							
150	CO	15CP4	136	1250.00	13	Na	No
200	CO		220	1650.00	13	Na	No
Belmont Radio Corp., 5921 W. Dickens Ave., Chicago 39 18 DX21	T	7JP4	23		12	No	No
Bendix Radio, Division of Bendix Aviation Corp., Baltimore 4, Md.							
235M1	T	10BP4	52	349.95	12	No	No
325M8	C	10BP4	52	599.50	12	AM, FM	Yes
Colonial Television Corp., 780 E. 137 St., Bronx 54, N. Y.							
Add-A-Vision (Av 101)	T	10BP4	51.5	225.00†		No	No
5700	CO	5TP4	5050	1495.00	13	No	No
Cornell Television, Inc., 385 Flatbush Ave., Ext., Brooklyn 1, N. Y.							
1025	T	10BP4		289.00	13	Na	Na
1203	T	12JP4	80	495.00	13	AM, FM	Na
1212	C	12JP4	80	695.00	13	AM, FM	Yes
1225	T		80	375.00	13	No	No
1505	CO	15AP4	130	745.00	13	FM	No
1510	C	15AP4	130	895.00	13	AM, FM	Yes
1630	CO	15AP4			13		No
Cortley Television Co., 15 W. 27 St., New York, N. Y. 720-A	CO	5TP4	8640	1995.00†	13	No	
Crosley Div., AVCO Mfg. Corp., 1329 Arlington St., Cincinnati 25, Ohio							
348 CP	C	10FP4		795.00	13	AM, FM, SW	Yes
9-407M	T	12JP4	75	445.00	13	FM	No
9-408	T	10BP4	54	375.00	13	No	No
DeWald Radio Mfg. Corp., 35-15 37 Ave., Long Island City, N. Y.							
BT-100	T	10BP4	55	375.00	12	No	
BT-101	C	16AP4	142		12	No	
DuMont Laboratories Inc., Allen B., 2 Main Ave., Passaic, N. J.							
RA-101-B1 (Westminster)	C	20BP4	223	2495.00	13	AM, FM, SW	Yes
RA-101-B3 (Sherwood)	C	15AP4	121	1795.00	13	AM, FM, SW	Yes
RA-101-B8 (Custom)	CM	20BP4	223	1795.00	13	AM, FM, SW	No
RA-103-A2 (Savay)	C	12JP4	75	795.00	13	AM, FM	Yes
RA-103-A3 (Chatham)	T	12JP4	75	445.00	13	FM	No
RA-103-A4 (Sutton)	C	12JP4	75		13	FM	No
RA-105-A1 (Stratford)	T	15AP4	121		13	FM	No
RA-105-A2 (Westbury)	C	15AP4	121		13	FM	No
Duval Radio & Television Corp., 423 Grove St., Jersey City 2, N. J. 15C2	T	15AP4	122	695.00	13	FM	Na
Electro Technical Industries, 1432 N. Broad St., Philadelphia 21, Pa.							
10-A-Telekit	K	10BP4	52	99.50	12	No	No
7-A-Telekit	K	10HP4	52	59.50	12		
Emerson Radio & Phonograph Corp., 111 Eighth Ave., New York 11, N. Y.							
571	T	10BP4	52	269.50	13	No	No
585	C	10BP4	55	495.00	13	AM, FM	Yes
Espey Mfg. Co., 528 E. 72nd St., New York 21, N. Y. TV3K	K	3KP1		69.50	6	No	No
Fada Radio & Electric Co., 525 Main St., Belleville, N. J. 799	T	10BP4	54	375.00	13	No	No
Farnsworth Television & Radio Corp., 3700 E. Pontiac St., Fort Wayne 1, Ind.							
Capehart-501-P	C	12FP4	75	1395.00	13	AM, FM	Yes
Farnsworth-651-P	T	10FP4	52	395.00†	13	No	No



**PHILCO**

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TO THE

**TELEVISION INDUSTRY**

Winnworth—V-260	T	10FP4	52	375.00	8	No	No
Federal Television Corp., 210 E. 9th St., New York 3, N. Y.							
F-3012	T	12JP4		425.00	13	No	No
F-3015	CM	15AP4		795.00	13	No	No
PRO-3005	CO	5	11,520	2250.00	13	No	No
Freed Radio Corp., 200 Hudson St., New York 13, N. Y.							
200 TV	C	12LP4	74	795.00	12	AM, FM	Yes
201 TV	C	16	135	995.00	12	AM, FM	Yes
Garod Electronics Corp., 70 Washington St., Brooklyn 1, N. Y.							
900 TV	T	10BP4	54	375.00	13	AM, FM	No
1000 TV	T	12JP4	72			No	No
1200 TVP	C	12JP4	72			No	Yes
General Electric Co., Receiver Div., Electronics Park, Syracuse, N. Y.							
802-D	C	10FP4	52	725.00	13	AM, FM	Yes
810	T	10FP4	52	325.00	12	No	No
901	C	5TP4	432	2100.00	13	AM, FM, SW	Yes
910	CO	5TP4		1470.00	13	AM, FM, SW	Yes

Hollicrofters Co., The, 4401 W. 5th Ave., Chicago 24, Ill.							
T54	T	7JP4	23	169.50	13	No	No
T69	T	10BP4	52.5	279.50	12	No	No
Hoffman Radio Corp., 3761 S. Hill St., Los Angeles 7, Calif.							
CT-800	C	10BP4	52	425.00	13	No	No
CT-801	C	12JP4	79	475.00	13	No	No
Howard Radio Co., 1735 Belmont Ave., Chicago 13, Ill. 481-475 TV	C	10BP4	52	650.00	13	AM, FM, SW	Yes
Industrial Television, Inc., 359 Lexington Ave., Clifton, N. J.							
IT-11R	CO			1145.00	13	FM	No
IT-13R Essex-20	CO	20BP4	234	1570.00	13	FM	No
International Television Corp., 745 5th Ave., New York, N. Y.							
C-15	CO	15AP4			13	AM, FM	No
C-36	CO	5TP4	972		13	AM, FM	No
D-10	T	10BP4			13	No	No
D-12	T	12JP4			13	No	No
D-15	C	15AP4			13	AM, FM, SW	Yes
DP-24	C	5TP4	432		13	AM, FM, SW	Yes
S-7	T	7JP4			12	No	No
S-10	T	10BP4			12	No	No
Magnavox Co., The, Fort Wayne 4, Ind.							
CT214	T	10FP4	63		12	No	No
CT214	C	12KP4	82		12	No	No
Mars Television, Inc., 29-05 40th Rd., Long Island City, N. Y.							
1200 Custom	T	12JP4	80	499.00	13	No	No
1500 Custom	T	15AP4	130	695.00	13	No	No
Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.							
VF103	C	10BP4	54	495.00	12	AM, FM	Yes
VT71	T	7JP4	26	179.95	12	No	No
VT105	T	10BP4	54	279.95	12	No	No
YK106	C	10BP4	54	325.00	12	No	No
Multiple Television Mfg. Co., 987 Hegemon Ave., Brooklyn 8, N. Y.							
M1500	CO	15AP4	130	875.00	13	No	No
M2000	CO	20BP4	236	1595.00	13	No	No
National Co., Inc., 61 Sherman St., Malden 48, Mass. TV-7	T	7JP4		199.50	13	No	No
New England Television Co., 544 E. 6th St., New York 9, N. Y. Custom	C	15AP4	132	2000.00	13	AM, FM, SW	Yes
Nielsen Television Corp., Newtown Ave., Norwalk, Conn.							
1018-A	C	10BP4	65	449.00	13	No	No
1019-TRP	C	10BP4	65	595.00	13	AM, FM	Yes
Nobell Mfg. Co., 517 W. 47th St., New York 19, N. Y. 481	T	10BP4		375.00	12	No	No
Olympic Radio & Television, Inc., 3401-19 38th Ave., L. I. C., N. Y.							
922	T	10BP4	54	295.00	12	No	No
RTU-3 Duplicator	T	10BP4	52	245.00		No	No
Philco Corp., Trioga & C Sts., Philadelphia 34, Pa.							
700	T	7JP4		199.50	8	No	No
1001	T	10BP4	52	349.50	8	No	No
1075	C	10BP4	52	595.00	8	AM, FM	Yes
1240	C	12LP4	75	424.50	8	No	No
1275	C	12LP4	75	675.00	8	AM, FM	Yes
2500	C	TP400A	300	795.00	8	No	No
Pilot Radio Corp., 37-06 36th St., Long Island City 1, N. Y.							
TV-37	T	3KP4	6	99.50	12	No	No
TV-42	C	3NP4	192	795.00	12	No	No
Pioneer Television Co., Inc., 282 W. 25th St., New York, N. Y. 115	T	15AP4	128	795.00	13	FM	No
Radio Corp. of America, RCA Victor Div., Camden, N. J.							
8 PCS 41	C	5TP4	300	895.00	13	No	No
8 TS 30	T	10BP4	54	375.00	13	No	No
8 TV 41	C	10BP4	54	750.00	13	AM, FM, SW	Yes
648 PTK	C	5TP4	300	1195.00	13	AM, FM, SW	No
721 TCS	C	10BP4	54	369.50	13	No	No
721 TS	T	10BP4	54	325.00	13	No	No
730 TV1	C	10BP4	54	595.00	13	AM, FM	Yes
730 TV2	C	10BP4	54	675.00	13	AM, FM	Yes
Regal Electric Corp., 603 W. 130 St., New York, N. Y. 310	T	10BP4	54		12	FM	No
Remington Radio Corp., 80 Main St., White Plains, N. Y.							
80	C	12JP4	72	695.00	8	FM	No
130	C	15AP4	121	895.00	13	FM	No
"1950"	T	12JP4	72	495.00	13	FM	No
Remler Co., Ltd., 2101 Bryant St., San Francisco 10, Calif. 7150	C	10BP4	57		12	AM, FM, SW	Yes
Scott Radio Laboratories, 4541 Ravenswood Ave., Chicago 40, Ill. 6T11	T	3NP4	192	645.00	12	No	No
Sentinel Radio Corp., 2100 Dempster St., Evanston, Ill.							
402-CV	C	10BP4	52		12	No	No
405-TV	T	7JP4	26	189.95	12	No	No

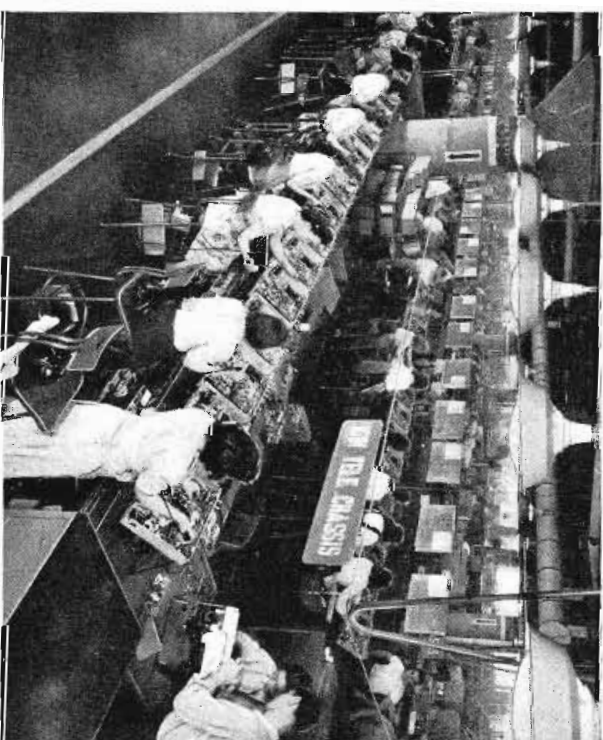
# Outstanding Advancements in Television Research a

## The Dividends of 20 Years of Philco Research!

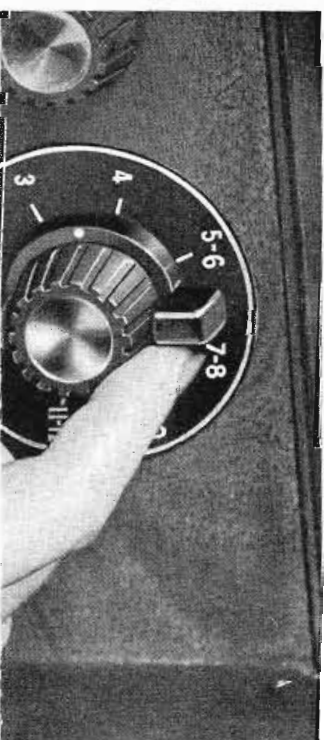
PHILCO brings to television exclusive features and outstanding engineering achievements . . . *the dividends of 20 years of research* . . . PLUS every feature of advanced design and quality construction to give you the finest television picture and sound yet developed . . . *at the lowest possible cost.*

Since 1928, the Philco laboratories have been pioneering in the science of television, gaining priceless experience and knowledge that is today embodied in every Philco receiver. Much of this Philco research has emphasized *brightness, clarity and detail* of the television picture, and standards which Philco engineers have developed and fostered through the years have become today the accepted standards of the industry.

*In addition,* Philco research has developed and perfected the easiest television tuning in the industry, revolutionary new screen and circuit characteristics, automatic level control to hold the intensity of the sound and picture constant and standard and a whole new series of ad-



**PHILCO, WORLD'S LARGEST** radio manufacturer: employs moving assembly lines and newest technological methods in producing an ever-increasing volume of *advanced design, quality* television receivers.



Shevers, Inc., Harold, 33 W. 46th St., New York 19, N. Y. ....930T	CM	10BP4	52	*	11	No	No
Sightmaster Corp., 385 North Ave., New Rochelle, N. Y.							
Americano	T	15JP4	120	995.00	13	AM, SW	
Sightmirror 10	T	12JP4	85	395.00	13	AM	
10 S-1	T	10BP4	52	375.00	13	AM	
12 S-1		12JP4		475.00	13	AM	
15 S-1	T	15JP4	130	595.00	13	AM	
Sonora Radio & Television Corp., 325 N. Hoyne Ave., Chicago 12 .....700A	T	10BP4	54	325.00	13	No	No
Sparks-Withington Co., The, Jackson, Michigan							
Sparton 4900TV	C	12LP4	72	694.95	12	AM, FM	Yes
Sparton 4940TV	C	10BP4	52	375.00	12	No	No
Starrett Television Mfg. Corp., 601 West 26 St., N. Y. C., N. Y.							
1510	C	15AP4	118	1575.00	13	AM, FM	Yes
800 Series	C	12JP4	78	795.00	13	AM, FM	Yes
300 Series	C	10BP4	52	325.00	13	No	No
Stewart Warner Corp., 1826 Diversey Parkway, Chicago 14, Ill.							
AVC-1	C	10FP4	61	375.00	12	No	No
AVC R-1	C	12KP4	82	650.00	12	AM	Yes
AVT-1	T	10BP4	61	325.00	12	No	No
Stromberg-Carlson Co., 100 Carlson Rd., Rochester 3, N. Y.							
TV 12H	T	12JP4	75	465.00	13	FM	No
TV 12L	C	12JP4	75	625.00†	13	FM	No
TV 12 M5M		12JP4	75	985.00†	13	AM, FM, SW	Yes
Tech-Moster Products Co., 123 Prince St., New York 12, N. Y.							
630TK	K	10BP4	54	375.00	13	No	No
Tele King Corp., 601 W. 26th St., New York 1, N. Y.							
	T	10BP4	60		12	No	No
BM100	T	15AP4	120	595.00	12	No	No
210W	T	10BP4	60	269.50	12	No	No
212	T	12JP4	75	395.00	12	No	No
310W	C	10BP4	60	299.50	12	No	No
Teleonic Corp. of America, 212 Concord St., Brooklyn, N. Y.							
661T-23-10	T	10		375.00	7	FM	No
661T-23-12	T	12		445.00	7	FM	No
Tele Tone Radio Corp., 540 W. 58th St., New York, N. Y.							
TV-149	T	7JP4		149.95	12	No	
TV-239	T	10BP4		239.95	12	No	
Television Assembly Co., 540 Bushwick Ave., Brooklyn 6, N. Y.							
F-101-C	K	10BP4	52	273.10*	13	FM	
F-101-S	K	10BP4	52	229.50*	13	No	
F-121-C	K	12JP4	75	303.10*	13	FM	
F-121-S	K		75	259.50*	13	No	
F-151-C	K	15AP4	120	393.10*	13	FM	
F-151-S	K	15AP4	120	345.50*	13	No	
P-520	K	5TP4	520	1299.00	13	FM	
Television Development Labs, Inc., 252 W. 64th St., New York 23 .....820A	T	10HP4	52	295.00	7	No	No
TELVision Laboratories, Inc., 542 N. Parkside Ave., Chicago 44, Ill.							
TR 7-1	T	7GP4	25	174.50	5		No
TR 10-1	T	10HP4	52	286.00	5	No	No
Televista Corp. of America, 114 E. 16th St., New York 3 .....MC-100	T	10BP4	115	550.00	13	No	No
Televue Corp. of America, 339 Laurel Ave., Lakewood, N. J.							
Dual 15	CO	15AP4	121	1095.00	13	FM	
Theatre	C	15AP4	130	1250.00	13	AM, FM	Yes
Tradio, Inc., 1001 First Ave., Asbury Park, N. J. ....Tradio-Vision No. 9	CO	5TP4	24192	1995.00	13	No	No
Transvision Inc., 460 North Ave., New Rochelle, N. Y.							
7BL	K	7EP4	50	185.00	12	FM	
10BL	K	10BP4	110	299.00	12	FM	
12" De Luxe	K	12JP4	75	299.00	12	FM	
12" Standard	K	12FP4	75	246.00	12	FM, SW	
U. S. Television Mfg. Corp., 3 W. 61st St., New York 23, N. Y.							
KRV-12836	C	12JP4		795.00	13	AM, FM	Yes
KRV-15836		15AP4	121	1495.00	13	AM, FM	Yes
T3X 4836	CO	5TP4	20,200	2495.00	12	No	No
T-525-PIC	CO	5TP4		1595.00		AM, FM, SW	
T-530	CO	5TP4	675	1795.00		AM, FM, SW	No
T-621	C	5TP4	355	1795.00		AM, FM, SW	Yes
T-10823	T		63	375.00	13	No	
T-12823	T	12JP4		445.00	13	No	
T-15823	T	15AP4	121	895.00	13	No	
Videodyne, Inc., 33 Jefferson St., Stamford, Conn.							
10FM	T	10FP4	58	399.50	12	FM	No
12FM	T	12JP4	72	499.50	12	FM	No
10TV	T	12JP4	58	369.50	12	FM	No
12TV	T	12JP4	72	469.50	12	FM	No
Westinghouse Electric Corp., 1354 Susquehanna Ave., Sunbury, Pa.							
H-181	C	10BP4	52	485.00	8	No	No
H-196	T	10			12	No	No

Companies not listed due to incomplete prices or data received after deadline are: John Meck Industries, Inc., Plymouth, Ind.; Uni-

C—Console CM—Custom  
CO—Commercial  
K—Kit T—Table  
CT—Continuous  
D—Direct View

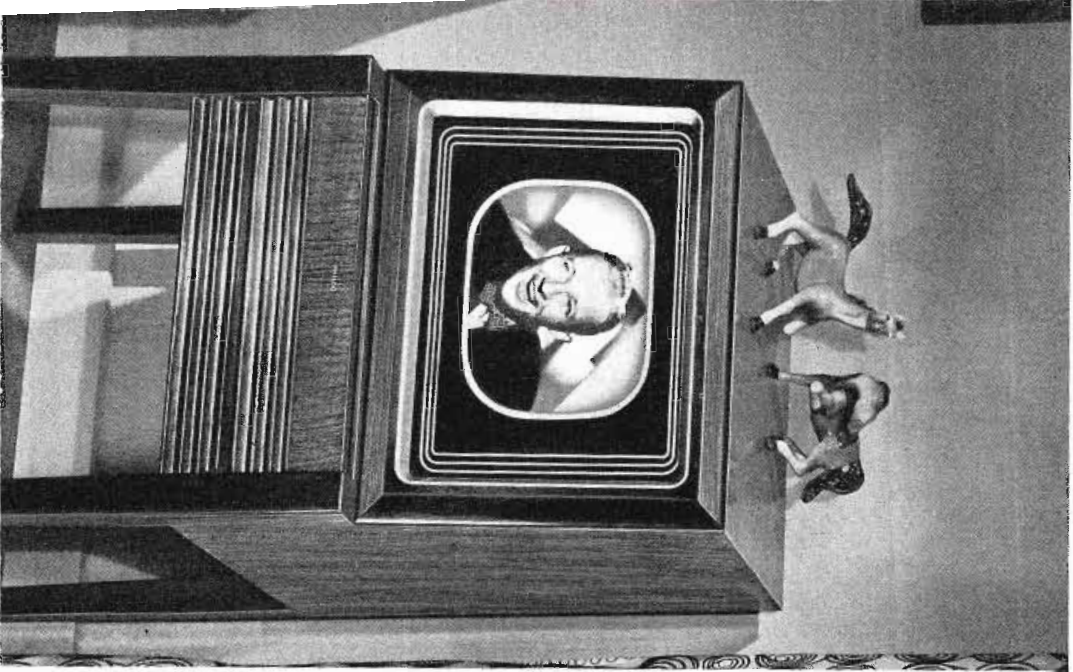
DI—Discriminator  
ED—Electrodynamic  
FB—Flyback  
IF—Intermediate Frequency  
M—Mirror reflected image

P—Projected image  
PB—Push-button  
PM—Permanent Magnet  
R—Ratio  
RF—Radio Frequency

RT—Rotary Tap  
SIF—Sound Intermediate Frequency  
TR—Transformer  
TS—Turret Switch  
VIF—Video Intermediate Frequency

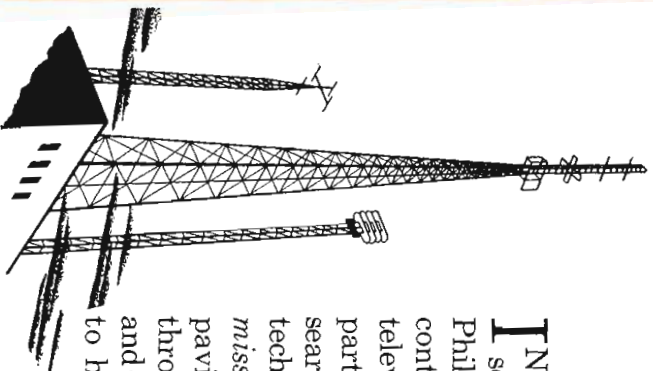
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2—Instal  
3—Instal  
4—Parts  
4a—Part

# nd Production . . .



## Philco Pioneers in TELEVISION NETWORKS

**I**N addition to pioneering research on television receivers, Philco has also made important contributions to the science of television transmission. A major part of this Philco television research has been devoted to the technique of *radio relay transmission* of television programs, paving the way for the networks through which television news and entertainment may be brought to homes from coast to coast.





# VISION SPECIFICATIONS

# TV

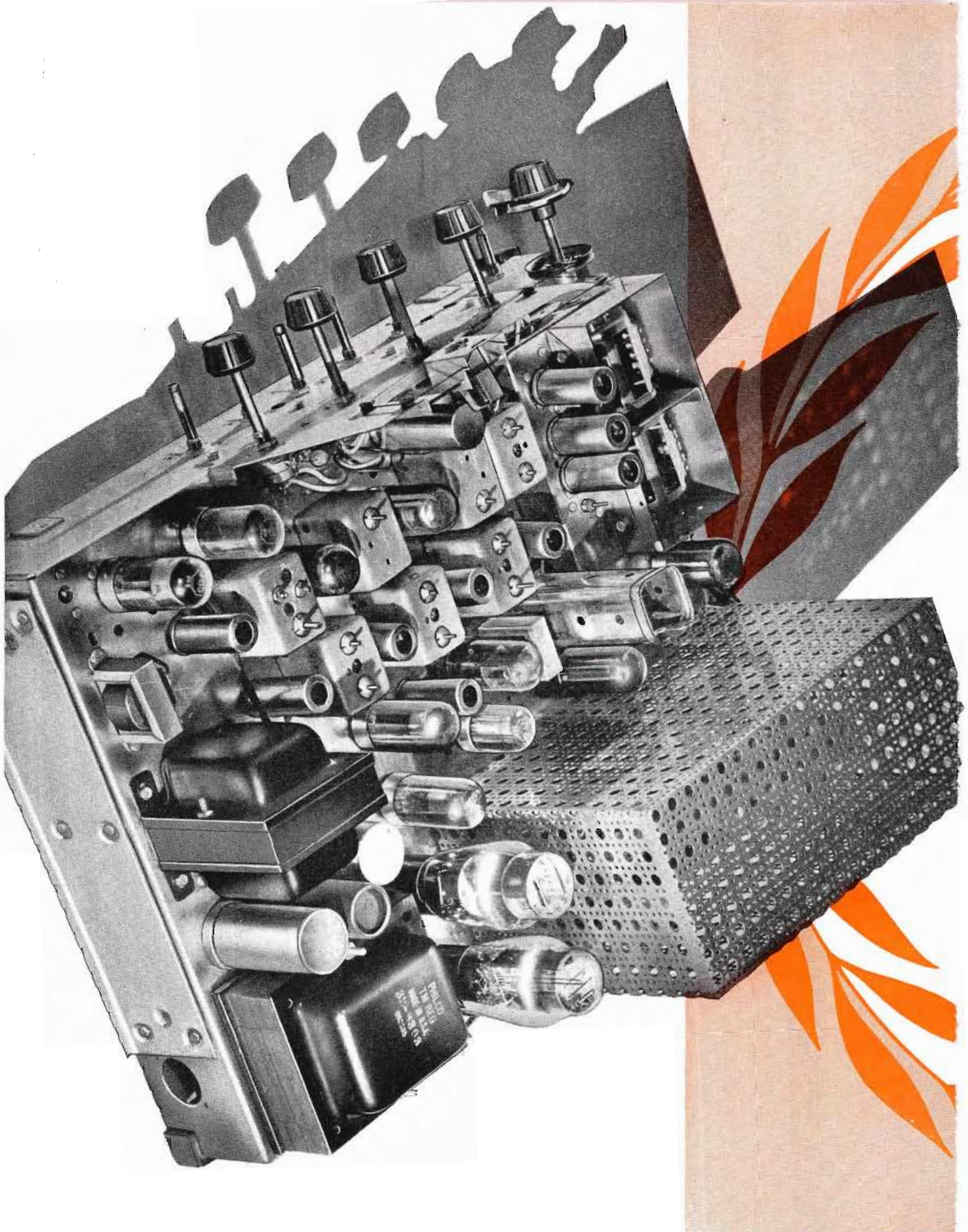
## TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

IN TWO PARTS • PART TWO  
SEPTEMBER 1948

New York 17, N. Y. • Publishers of Tele-Tech and Radio and Television Retailing

Year	Total Number Tubes	Number of Controls	Size & Type of Speaker (Inches)	Anode Voltage Used (KV)	Optical System	No. Tubes in RF and Mixer Stages	No. Tubes in Oscillator Stage	No. Tubes in Video IF Stages	No. Tubes in Audio IF Stages	No. Tubes in Detector & Audio Stages	No. Tubes in Sync. Separation Stages	No. Tubes in Vertical Deflection Stages	No. Tubes in Horizontal Deflection Stages	No. Tubes in Horizontal Vertical Scanning Power Supplies	Power Consumption (Watts)	Type Hi-Voltage Source	Type FM Detector	Scanning Oscillator Lock-In	Type RF Tuning	FM Image Wave Traps	Circuits Controlled by AGC	Installation Policy
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
9	8	10 PM	9	D											283	FB		Yes	RT	Yes	None	
9	8	6 PM	9	D		1	4		1						283	FB		Yes	RT	Yes	None	
10	7	5 ED	9	D	2	1	4	2	4	2	3	7	3		320	FB	DI	Yes	RT	Yes		4b
	8	10 ED		D	2	1	1	1	2	2	2	2	1		320	RF	R	Yes	TS	No	SIF	3, 4b, 5b, 7
	8	12 ED		D	2	1	1	1	2	2	2	2	1		320	RF	R	Yes	TS	No	SIF	
9	8	8 PM		D	2	1	1	2	2	1	2	2	2		280	FB	R	Yes	CT	No	SIF	
10	7	6 PM	9.3	D	2	1	4	3	3	4	3	5	4		320	FB	R	Yes	TS	Yes	RF	4a, 9a
11	6	12 PM	9.3	D	6	2	4	5	6	4	2	5	3		320	FB	R	Yes	TS	Yes	RF	
11	6	12 PM	9.3	D	6	2	4	5	6	4	2	5	3		320	FB	R	Yes	TS	Yes	RF	
11	6	12 PM	9.3	D	6	2	4	5	6	4	2	5	3		320	FB	R	Yes	TS	Yes	RF	
11	5	5 PM	2.3	D	2	1	3	1	3	1	1	2	2		200	TR		Yes	RT	Yes		4a, 5b
10	4	5 ED	9	D	2	1	4	2	3	2	2	4	3		350	FB	DI	Yes	RT	Yes		
12	6	5	5.5	D	2	1	3	1	2	1	1	4	2		105	RF	R		RT	No	RF-IF	4b
10	7	5	9	D	1	1	4	3	2	1	2	4	3		320	FB	DI	Yes	RT	Yes		
15	3		12	D	2	1	4	3	3	2	4	7	5		500	FB		Yes	RT	No	VIF	1, 4b, 5b
15	3				2	1	4	3	3	2	4	7	5		500	FB		Yes	RT	No	VIF	
18	5	4 PM		D	1	1	3			1	1	4	3		120	RF	DI		RT			
13	4	4x6	10	D	2	1	4	2	1	2	1	5	3		185	FB		Yes	PB	No	RF-IF	1, 4a, 5b
12	4	12	10	D	2	1	4	2	1	2	1	5	3		315	FB		Yes	PB	No	RF-IF	
11	2	6x4 ED	8.5	D						1	2	5	1		220	FB			RT	No		3, 4b, 5b
36	7	5	30	P	2	1	4	3	2	1	2	6	8		400	RF	DI	Yes	RT	Yes	None	
19	6	5 PM	9	D	2	1	3	1.5	1.5	1.5	1	5	2		220	FB		Yes	RT	Yes	VIF	1, 4b, 5b
13	7	8 PM	12	D	2	1	4	2	4	3	2	5	3		275	FB	DI	Yes	CT	No	VIF	
13	7	8 PM	12	D	2	1	4	3	3	3	2	5	3		275	FB	DI	Yes	CT	No	VIF	
19	6	5 PM	10	D	2	1	3	1.5	1.5	1	1	5	2		220	FB		Yes	RT	Yes	VIF	
29	5	8 PM	12	D	2	1	4	2	4	3	2	5	3		275	FB			CT	No	VIF	
13	7	8 PM	12	D	2	1	4	2	4	3	2	5	3		275	FB			CT	No	VIF	
10	6	5 PM	10	D	2	1	4	3	3	3	2	7	3		FB		Yes	RT	Yes	None		
17	7	5	27	P	2	1	5	3	3	3	2	5	6		325	RF		Yes	RT	Yes	None	1, 4b, 5a
26	9	10 PM	9.2	D		1	4	4	2	2	1	5	5		360	RF	DI	Yes		Yes		3, 9a
27	6	6 PM	8	D	2	1	3	2	3	3.5	1	5	3		290	FB	DI	Yes	CT	No	None	
30	4	5x7 PM	9	D	1	1	4	3	4	4.5	2	6.5	2		320	FB	DI	Yes	RT	Yes	None	
31	6	7 ED		D	2	1	5	3	3	3	2	7	3		225	FB			RT	Yes		3, 5c
31	6	12 ED		D	2	1	5	3	3	3	2	7	3		225	FB			RT	Yes		
39	10	15 PM	16	D	2	1	5	3	5	3	3	5	5		543	RF	DI	Yes	CT	No		3, 4b, 5, 9a
39	10	12 PM	16	D	2	1	5	3	5	3	3	4	5		543	RF	DI	Yes	CT	No		
39	10	12 PM	16	D	2	1	5	3	5	3	3	5	5		543	RF	DI	Yes	CT	No		
27	6	10 PM	8	D	2	1	3	2	3	3.5	1	5	3		290	FB	DI	Yes	CT	No	None	
27	6	6 PM	8	D	2	1	3	2	3	3.5	1	5	3		290	FB	DI	Yes	CT	No	None	
27	6	10 PM	8	D	2	1	3	2	3	3.5	1	5	3		290	FB	DI	Yes	CT	No	None	
34	7	6 PM	12	D	2	1	3	3	3	3.5	2.5	5	6		325	FB	DI	Yes	CT	No	V & SIF	
34	7	12 PM	12	D	2	1	3	3	3	3.5	2.5	5	6		325	FB	DI	Yes	CT	No	V & SIF	
	5	PM	13	D	2	1	4	3	3	7	2	4	3		390	FB		Yes	CT	Yes	None	
17	5	5	9	D	1	1	1	1	1	2	1	3	2		250	FB	DI	Yes	RT	No	None	4b
17	5	5	5.5	D	2	1	1	1	1	1	1	2	3		150	RF	DI	Yes	RT	No	None	
28	7	4x6 PM	9.5	D											290	FB		Yes	TS	Yes	RF-IF	3, 4, 6
36	4	12 PM	9	D											370	FB	DI	Yes	TS	Yes	RF-IF	
19	7	3		D	1	1	1	1	1	1	1		1		100				RT	No		4b
30	7	5x7 PM		D	2	1	5	3	3	3	2	8	2		320	FB	DI	Yes	RT	Yes		4b, 5b
33	8	12 PM	12	D	2	1	4	3	1	1	2	6.5	2		380	FB	DI	Yes	RT	Yes	IF	3, 5b, 7, 8
29	9	6x9 PM	8	D	2	1	3	3	2	1	2	2	2		300	FB	DI	Yes	RT	Yes	None	



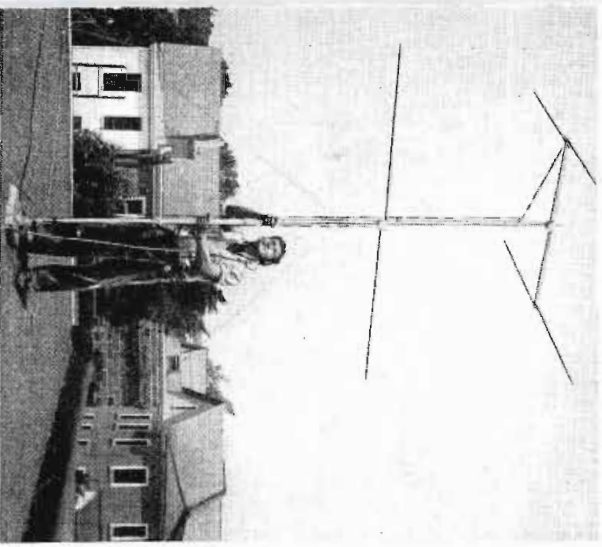
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26	8	6 PM	8	D	2	1	3	1	3	.5	1	2	2	260	FB	DI	Yes	TS	Yes	RF-IF	
30	6	10 PM	14	D										300	FB		Yes	RT	Yes	4b, 5c, 6, 7	
30	6	10 PM	14	D										350	FB		Yes	RT	Yes		
36	5	(2) 12 PM	42	P										400	RF		Yes	RT	Yes		
31	3	5 & 12	12	D	2	1	5	3	5	3	2			500	FB	DI	Yes		Yes	None	1
31	3	5 & 12	12	D	2	1	5	3	5	3	2			500	FB	DI	Yes		Yes	None	
27	10	6 PM	9	D	2	1	4	3	3	1	1	7	2	275	FB	DI	Yes	RT	Yes	VIF	3, 4b, 5a
27	10	6 PM	9	D	2	1	4	3	3	1	1	7	2	275	FB	DI	Yes	RT	Yes	VIF	
27	10	10 PM	9	D	2	1	4	3	3	1	1	7	2	275	FB	DI	Yes	RT	Yes	VIF	
25	7	12 PM	8.2	D	1	1	3	3	3	.5	1.5	7.5	3	225	FB	DI		RT	Yes	None	3, 4b, 5a
21	8	5 PM	9.3	D	1	1	3	2	2.5	1.5	2	5	3	225	FB	DI	Yes	RT	Yes	None	
42	6	(2) 10 PM	27	P	1	1	4	1	7.5	1	1.5	8.5	7	380	FB	DI	Yes	RT	Yes	None	
42	6	(2) 10 PM	27	P	1	1	4	2	7.5	1	1.5	8.5	7	380	FB	DI	Yes	RT	Yes	None	

22	7	5x7 PM	5	D	2	1	3	1	4	1	1	4	4	115	RF			PB	No	RF-IF	4b, 5a	
23	7	6 ED	9	D	2	1	3	2	4	1	2	6	2	225	FB		Yes	PB	No	RF-IF		
29	7	12	9	D	2	1	4	3	3	2.5	3	7.5	3	280	FB		Yes	RT	Yes		2	
29	7	12	9	D	2	1	4	3	3	2.5	3	7.5	3	280	FB		Yes	RT	Yes			
29	6		9	D	2	1	4	3	1	1	2	2	2		FB	R	Yes	TS	No		3, 4b	
34	5	12 PM	13.5	D	2	1	5	3	6	3	3	2	5	500	FB	DI	Yes	CT	No	SIF		
37	5	12 PM	17	D	2	1	5	3	3	2	2	3	4	350	FB	DI	Yes	CT	No	None		
32	4	10		D	2	1	6	4	5	4	2	4	3	265	FB	DI	Yes	RT	Yes	IF	1, 3, 4b	
44	4	(2) 12 ED		P	2	1	5	4	3	2	2	5	9	450	RF	DI	Yes	RT	Yes	IF		
32	4	8		D	2	1	6	4	5	2	2	2	3	265	FB	DI	Yes	RT	Yes	IF		
32	4	8		D	2	1	6	4	5	2	2	2	3	265	FB	DI	Yes	RT	Yes	IF		
32	4	10 & 12 ED		D	2	1	6	4	5	2	2	2	2	265	FB	DI	Yes	RT	Yes	IF		
44	4	12		P	2	1	5	2	5	2	2	5	9	450	RF	DI	Yes	RT	Yes	IF		
16	5	4x6	6.5	D			3	1	2	1	1	4	2	150	FB		Yes	RT	Yes	IF		
16	5	4x6		D			3	1	2	1	1	4	2	150	FB		Yes	RT	Yes	IF		
23	7			D	2	1	4	3	3	2	2	4	2	250	FB		Yes	RT		None		4b, 5, 5b
23	7			D	2	1	4	3	3	2	2	4	2	250	FB		Yes	RT		None		
30	4	6	10	D	2	1	4	3	2	3	2	9	3	320	FB		Yes	RT	Yes	None		
30	4	8	11	D	2	1	4	3	2	3	2	8	3	320	FB		Yes	RT	Yes	None		
25	6	10		D										300	FB	R	Yes	TS	No			
17	3	6 PM	6	D	1.5	.5	3	1	2	1	1	2.5	2	110	RF	R	Yes	RT	No	IF		
20	4	6		D										250	FB		Yes		No			
20	4	8		D										250	FB		Yes	TS	No			
30	7	PM	10	D	2	1	4	4	5	7	3	3	3	320	FB	R	Yes	RT	Yes	RF	4, 7	
31	7	PM	16.5	D	2	1	4	4	5	7	2	2	4	320	FB	R	Yes	RT	Yes	RF		
21	7		4.5	D	2	1	4	1	2	1	1	4	3	150	RF	R		RT	No	RF-IF		
35	5	12 PM	12	D	2	1	5	3	5	4	2	7	6	300	FB	DI	Yes	CT	Yes	VIF		
30	7	12 ED	9.3	D	2	1	4.5	3	3	2.5	2.5	7.5	3	320	FB		Yes	RT	Yes		1, 3, 5, 6	
38	7	12 ED	9.3	D	2	1	4.5	3	3	2.5	2.5	7.5	3	320	FB		Yes	RT	Yes			
30	4	4x6																CT	Yes			
22	7	4x6 PM	9	D	2	1	4	2	2	1	1	3	2	240	FB	DI	Yes	RT	Yes	None		
12	2	5 PM	9	D										200	FB							
25	5	6 PM	3	D	25										TR	R		TS	No	RF-IF	4, 9a	
27	5	6 PM	7.5	D	25										FB	R		TS	No	RF-IF		
31	10	10 PM	7.5	D	25										FB	R		TS	No	RF-IF		
25	6	5 PM		D	25										FB	R		TS	No	RF-IF		
32	10	10 PM		D	25										FB	R		TS	No	RF-IF		
29	5	10 PM		P	25										FB	R		TS	No	RF-IF		
21	5	4 ED	2.5	D	2	1	4	1	2	1	1	4	4	100	RF	R		CT	No	None		1
35	5	12 ED		M	2	1	4	3	4	3	3	6	6	700		R	Yes	CT	Yes	RF-IF		
6	(2) 6 PM			D	1	1	1	1	1	1	1	2	2	250	FB	DI	Yes	CT	No	None		
41	5	12 ED		P	2	1	4	3	6	5.5	2	11	4	530	FB	DI	Yes	RT	Yes	V & SIF	1, 4, 9a	
30	4	5x7 PM	9	D	1	1	4	3	4	4.5	2	6.5	2	320	FB	DI	Yes	RT	Yes	None		
41	6	12 ED	9	D	2	1	4	3	2	.5	2	6.5	2	430	FB	DI	Yes	RT	Yes			
48	9	12 ED		P	2	1	4	3	2	5.5	2	11	3	530	FB	DI	Yes	RT	Yes	SIF		
21	4	12 ED	8.5	D	2	1	3	2	3.5	2	1	4.5	1	220	FB	DI	Yes	RT	Yes	None		
21	4	4x6 ED	8.5	D	2	1	3	2	3.5	2	1	4.5	1	220	FB	DI	Yes	RT	Yes	None		
30	7	12 ED	8.5	D	2	1	3	2	2.5	2	1	4.5	1	345	FB	DI	Yes	RT	Yes			
30	7	12 ED	8.5	D	2	1	3	2	2.5	2	1	4.5	1	345	FB	DI	Yes	RT	Yes			
30	4	5x7 PM	9	D	1	1	4	3	4	4.5	2	6.5	2	320	FB	DI	Yes	RT	Yes	None		
26	7	8 PM	8	D	2	1	3	2	3	2	1	4	2	300	FB	R	Yes	CT	No			4b
26	7	8 PM	8	D	2	1	3	2	3	2	1	4	2	300	FB	R	Yes	CT	No			
25	6	8 PM	8	D	2	1	3	2	3	2	1	4	1	300	FB	R	Yes	CT	No			
27	7		9.2	D	1	1	4	3	1	2	1	2		320	FB		Yes	TS	Yes			
34	6		25	P	2	1	4	3	4	4	1	8	7	225			Yes	RT	No	VIF		
23	4	8 PM		D	2	1	4	1	3	2	1	6	2	220	FB	R	Yes	CT	No	RF-IF		
21	4	5 PM	5	D	2	1	4	1	3	1	1	4	2	150	RF	R	No	RT	No	RF-IF		

... convenience and security, and a whole array of other quality features to make television more enjoyable, more convenient, more useful!

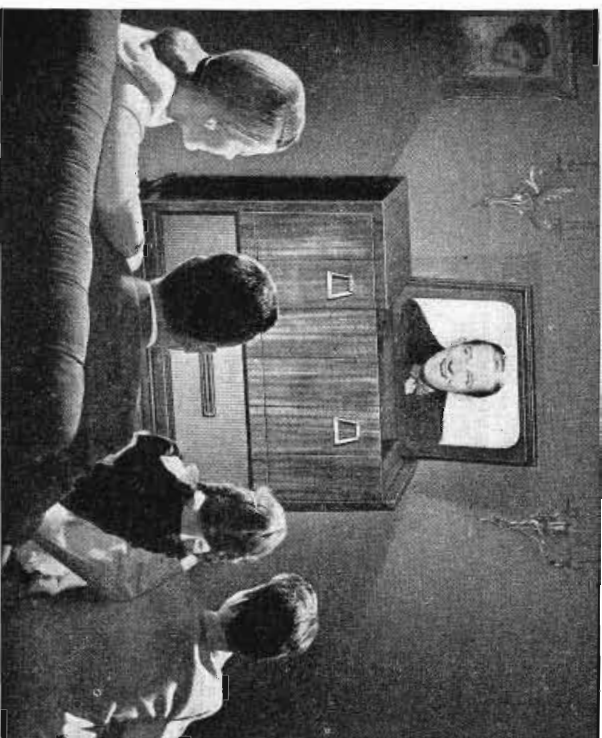
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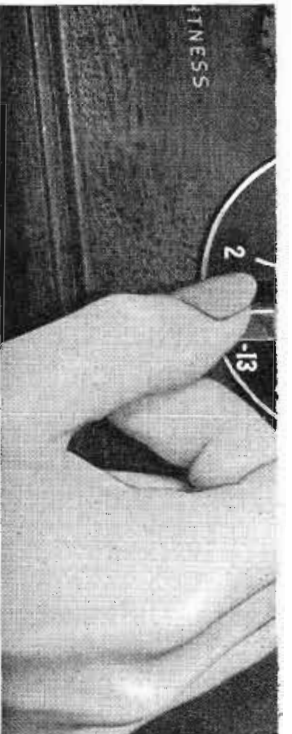
**ADVANCED DESIGN** Television Antennas . . . another dividend of Philco research . . . made of rust-proof aluminum and stainless steel . . . easy to install.



**PHILCO ENGINEERS**, in perfecting *Philco Projection Television*, explored the science of optics . . . creating a *front projection* system new to the industry.



**PHILCO MODEL 2500.** Schmidt optical system, new phosphor directional viewing screen, Keystone projection, and ingenious cabinet design produce 20 x 15-inch picture of exceptional brightness.



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**PHI** will the

30	4	5 ED		D	1	1	1	1	1	1	2	2	2	320	RF	R		CT	Yes			1
26	4	PM	10		2	1	3	2	3	3	2	7	3	300	FB	R	Yes	CT			1, 4a, 5b, 6	
24	4	9	9	M	2	1	1	1	1	1	1	3	1	250	FB	R	Yes	RT				
	5	6x9 PM	9	D	2	1	1	1	1	1	1	3	1	250	FB	R	Yes	RT				
	5	4x6 PM	9	D										250	FB	R	Yes	RT				
	5	4x6 PM	10	D	2	1	1	1	1	1	1	3	1	250	FB	R	Yes	RT				
26	7	PM	9	D	2	1	4	1	4	1	1	8	4	275	FB	R	Yes	RT	No	None		
28	5	10	10	M	2	1	4	2	3	3	2	6	3	265	RF	R	Yes	TS	Yes	RF-IF		
28	5	10	10	M	2	1	4	2	3	3	2	6	3	265	RF	R	Yes	TS	Yes	RF-IF		
42	8	12 ED	14	D										400	RF	DI	Yes	RT	Yes			
29	8	12 ED	9	D										325	FB	DI	Yes	RT	Yes			
21	5	5 PM	8.5	D										300	FB	DI	Yes	RT	Yes			
24	5	6x9 PM	9	D	1.5	.5	4	1	1	1	1	8	3	170	RF			CT	No	RF-IF	3, 4, 6	
24	5	12	9	D	1.5	.5	4	1	1	1	1	8	3	170	RF			CT	No	RF-IF		
24	5	5 PM	9	D	1.5	.5	4	1	1	1	1	8	3	170	RF			CT	No	RF-IF		
26	6	6 PM	9	D	2	1	3	1	3	2	1	3	3	300	FB	DI	Yes	CT	No	None	4b, 5	
26	6	12 PM	9	D	2	1	3	1	3	2	1	3	3	300	FB	DI	Yes	CT	No	None		
26	6	12 PM	9	D	2	1	3	1	1	2	1	3	3	380	FB	DI	Yes	CT	No	None		
30	4	ED	9	D	2	1	4	4	3	2.5	4	6.5	2	320	FB		Yes	RT	Yes	None	4b	
30	7	5 ED	9	D	2	1	4	3	3	3	2	8	3	320	FB		Yes	RT	Yes	None		
30	8	5 ED		D	2	1	5	3	1	2	2	2	2		FB	DI	Yes	RT	No	None	1, 3, 5b, 6	
23	8	8 PM		D	2	1	5	2	2	1	2	5	2	265	FB	DI		RT	No	RF-IF		
30	8	5 ED	9	D	2	1	5	3	2	2	2	8	2	225	FB	DI	Yes	RT	No	None		
23	8	8 PM		D	2	1	5	2	2	1	2	5	2	265	FB	DI		RT	No	RF-IF		
30	8	5 ED	9	D	2	1	5	3	2	2	2	8	2	225	FB	DI	Yes	RT	No	None		
23	4		10		2	1	4	1	4	2	1	5	2		FB		Yes		No		4a, 5c, 6	
23	4		10		2	1	4	1	4	2	1	5	2		FB		Yes	PB	No			
22	4	4 PM		D	2	2	3	1	4	1	1	4	3	100	RF	R	Yes	RT	No	RF-IF	4a, 8	
20	4	6x8		D	2	1	3	1	3	3	1	3	2	220	FB	R	Yes	CT	No	RF-IF		
30	5	12 PM		D	2	1	6	3	2	1	2	2	3	300	FB			CT	No		1, 5a	
30	5	12 PM		D	2	1	6	3	3	1	2	2	3	300	FB			RT	No			
30	5	12 PM		D	2	1	6	3	3	1	2	2	3	300	FB			CT	No			
30	5	12 PM		D	2	1	6	3	3	1	2	2	3	300	FB			RT	No			
30	5	12 PM		D	2	1	6	3	2	1	2	2	3	300	FB			CT	No			
30	5	12 PM		D	2	1	6	3	3	1	2	2	3	300	FB			RT	No			
36	6	12 PM	27	P	2	1	6	3	4	3	2	7	6		FB	DI	Yes	CT	No	IF	1, 4b, 5c	
21	7	PM	5	D	2	1	3	1	1	1	2	4	1	280	RF			RT	No			
21	6	5 PM	4.5	D	2	1	3	1	2	1	1		2	180	RF	DI	Yes	RT	Yes	IF	4b, 5c	
21	6	5 PM		D	2	1	3	1	2	1	1		2	180	RF	DI	Yes	RT	Yes	IF		
30	7	6 PM		D	2	1	4	3	2	3	2	9	2	320	FB	DI	Yes	RT	Yes		1, 3	
38	7	12	14	D	2	1	4	2	1	3	1	3	2	350	FB		Yes	CT	No	None	1	
46	7	(2) 12	14	D	2	1	4	2	1	3	1	3	2	350	FB		Yes	CT	No	None		
38	4	12 ED	27	P			3				8		8	450	FB		Yes	RT	Yes	None		
18	6	6 PM	2.2	D	2	1	3	1	2	1	1	4	2	250	TR	R		RT	Yes	None		
22	5	8 PM	9	D	2	1	3	2	1	1	1	7	2	275	FB	R		RT	Yes	None		
22	5	6x8	9	D	2	1	3	2	1	1	1	7	2	275	FB	R		RT	Yes	None		
22	4	6x8	9	D	2	1	3	2	1	1	1	7	2	275	FB	R		CT	Yes	None		
36	5	6&12 PM	10	D	2	1	4	3	3	2	1	3	2	300	FB	DI	Yes	RT			9	
36	5	6&12 PM	10	D	2	1	4	3	3	2	1	3	2	300	FB	DI	Yes	RT				
	8	12	27	P	2	1	4	2	2	3	2	7	9	400	RF	DI	Yes	RT	Yes	RF-IF		
32	6	12	27	P	2	1	3	3	2	3	2	7	8	450	RF	DI	Yes	RT	Yes			
32	6	12	27	P	2	1	3	3	2	3	2	7	8	450	RF	DI	Yes	RT	Yes			
32	6	12	27	P	2	1	3	3	2	3	2	6	8	450	RF	DI	Yes	RT	Yes			
23	4	5x7	10	D	2	1	4	3	3	2	1	3	2	250	FB	DI	Yes	RT				
23	4	5x7	10	D	2	1	4	3	3	2	1	3	2	250	FB	DI	Yes	RT				
23	4	6 PM	10	D	2	1	4	3	3	2	1	3	2	250	FB	DI	Yes	RT				
26	3	4x6		D	1	1	4	2	3	3	1	4	1	250	FB	DI	Yes	CT	No	None		
26	3	4x6		D	1	1	4	2	3	3	1	4	1	250	FB	DI	Yes	CT	No	None		
26	3	4x6		D	1	1	4	2	3	3	1	4	1	250	FB	DI	Yes	RT	No	None		
26	3	4x6		D	1	1	4	2	3	3	1	4	1	250	FB	DI	Yes	RT	No	None		
26	5	6 PM	7	D	2	1	3	2	3	2	4	5	3	275	FB	R	Yes	TS	No	RF-IF	3, 4, 6	
27	5	6 ED		D	2	1	5	2	2	2.5	2	6.5	3	260	FB	R	Yes	RT	No	RF-IF		

ersal Television Co., Brooklyn, N. Y.; Muntz Television, Packard-Bell Co., and Symphony Radio & Television Co., all of Las Angeles.

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led by manufacturer

led by authorized service company

and tubes guaranteed one year

s guaranteed one year

4b—Ports guaranteed 90 days

5—Pix tube guaranteed one year

5a—Pix tube guaranteed 90 days

5b—Pix tube guarantee prorated over one year

5c—Manufacturers guarantee on pix tube

6—Installation costs up to \$75.00

7—Installation costs more than \$75.00

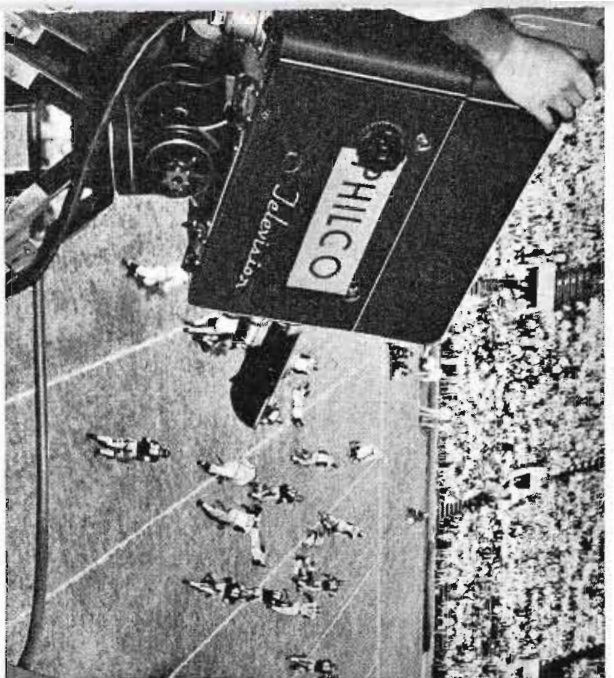
8—Console models only

9—Installation costs and guarantee periods vary

9a—Installation cost depends on models purchased



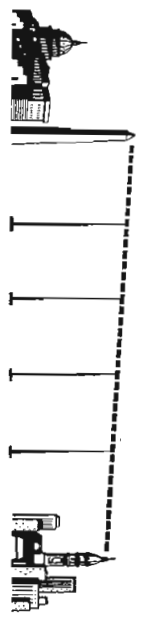
**PHILCO MODEL 1240.** New, advanced design television console; a 75 square-inch picture on 12-inch direct-view tube. Combines luxury of a console with the compactness of a table model!



**12, first commercially licensed television broadcast station in Philadelphia . . . second in U. S. . . . owned and operated by Philco. A table laboratory of experience for Philco Television engineers!**

### Philadelphia to New York

With the establishment of a radio relay station at Mt. Rose, N. J. carrying television programs from New York to Philadelphia, Philco inaugurated the first regularly scheduled television relay system capable of providing commercial service in the U. S. Today, this system brings many outstanding television programs to Philadelphia. Likewise, Philadelphia programs are being sent to New York . . . the first two-way television service in history.



### Washington to Philadelphia

The first television program ever broadcast from Washington, D. C. to Philadelphia was transmitted over a multiple-relay television network of six transmitters, developed by Philco. This historic broadcast, linking two major cities, was a demonstration of the scientific basis for network television and was heralded as the forerunner of nationwide television chains.

**PHILCO . . . Famous for Quality the World Over**

# TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

SEPTEMBER, 1948

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**NEW DESIGN FOR MEDIUM DEFINITION TV CAMERA SYSTEM** ..... Jesse B. Sherman 52  
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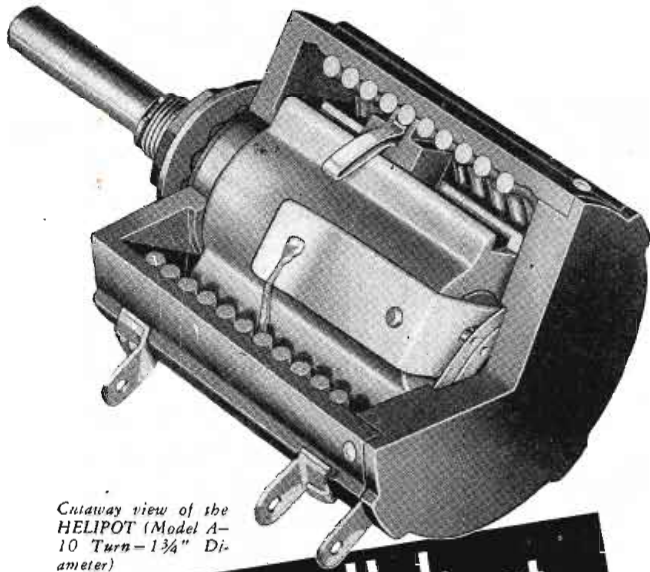
**TV RECEIVER SPECIFICATIONS** ..... Insert  
 A special section listing technical specifications of all television receivers; prepared by the editors of Tele-Tech

**COVER:** Measurement of light color values given by television picture tube screens is a regular quality-control procedure in the cathode-ray tube plant of Sylvania Electric Products, Inc., Emporium, Pa.

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Cutaway view of the HELIPOT (Model A-10 Turn-1 3/4" Diameter)

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(Trademark of the HELICAL POTentiometer)

**Provides many times greater resistance control in same panel space as conventional potentiometers!**

IF YOU are designing or manufacturing any type of precision electronic equipment be sure to investigate the greater convenience, utility, range and compactness that can be incorporated into your equipment by using the revolutionary HELIPOT for rheostat-potentiometer control applications... and by using the new DUODIAL turns-indicating knob described at right.

Briefly, here is the HELIPOT principle... whereas a conventional potentiometer consists of a single coil of resistance winding, the HELIPOT has a resistance element many times longer coiled helically into a case which requires no more panel space than the conventional unit. A simple, foolproof guide controls the slider contact so that it follows the helical path of the resistance winding from end to end as a single knob is rotated. Result... with no increase in panel space requirements, the HELIPOT gives you as much as 12 times\* the control surface. You get far greater accuracy, finer settings, increased range—with maximum compactness and operating simplicity!

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The HELIPOT is available in a complete range of types and sizes to meet a wide variety of control applications...

**MODEL A:** 5 watts, 10 turns, 46" slide wire length, 1 3/4" case dia., resistances 10 to 50,000 ohms, 3600° rotation.

**MODEL B:** 10 watts, 15 turns, 140" slide wire length, 3 1/4" case dia., resistances 50 to 200,000 ohms, 5400° rotation.

**MODEL C:** 3 watts, 3 turns, 13 1/2" slide wire length, 1 3/4" case dia., resistances 5 to 15,000 ohms, 1080° rotation.

**MODEL D:** 15 watts, 25 turns, 234" slide wire length, 3 1/4" case dia., resistances 100 to 300,000 ohms, 9000° rotation.

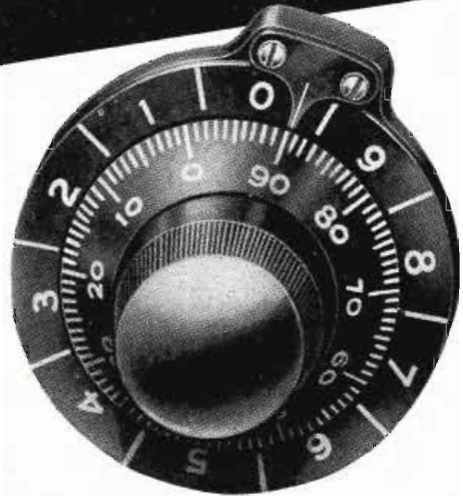
**MODEL E:** 20 watts, 40 turns, 373" slide wire length, 3 1/4" case dia., resistances 150 to 500,000 ohms, 14,400° rotation.

Also, the HELIPOT is available in various special designs... with double shaft extensions, in multiple assemblies, integral dual units, etc.

Let us study your potentiometer problems and suggest how the HELIPOT can be used—possibly is already being used by others in your industry—to increase the accuracy, convenience and simplicity of modern electronic equipment. No obligation, of course. Write today outlining your problem.

\*Data for Model A, 1 3/4" dia. Helipot. Other models give even greater control range in 3" case diameters.

## THE BECKMAN Duodial



The inner, or Primary dial of the DUODIAL shows exact angular position of shaft during each revolution. The outer, or Secondary dial shows number of complete revolutions made by the Primary dial.

**A multi-turn rotational-indicating knob dial for use with the HELIPOT and other multiple turn devices.**

THE DUODIAL is a unique advancement in knob dial design. It consists essentially of a primary knob dial geared to a concentric turns-indicating secondary dial—and the entire unit is so compact it requires only a 2" diameter panel space!

The DUODIAL is so designed that—as the primary dial rotates through each complete revolution—the secondary dial moves one division on its scale. Thus, the secondary dial counts the number of complete revolutions made by the primary dial. When used with the HELIPOT, the DUODIAL registers both the angular position of the slider contact on any given helix as well as the particular helix on which the slider is positioned.

Besides its use on the HELIPOT, the DUODIAL is readily adaptable to other helically wound devices as well as to many conventional gear-driven controls where extra dial length is desired without wasting panel space. It is compact, simple and rugged. It contains only two moving parts, both made entirely of metal. It cannot be damaged through jamming of the driven unit, or by forcing beyond any mechanical stop. It is not subject to error from backlash of internal gears.

### TWO SIZES—MANY RATIOS

The DUODIAL is now available in a 2" diameter model and soon will also be available in a new 4 3/4" diameter model for main control applications. Standard turns-ratios include 10:1, 15:1, 25:1 and 40:1 (ratio between primary and secondary dials). Other ratios can be provided on special order. The 10:1 ratio DUODIAL can be readily employed with devices operating fewer than 10 revolutions and is recommended for the 3-turn HELIPOT. In all types, the primary dial and shaft operate with a 1:1 ratio, and all types mount directly on a 1/4" round shaft.



Send for this  
**HELIPOT AND DUODIAL CATALOG!**

Contains complete data, construction details, etc., on the many sizes and types of HELIPOTS... and on the many unique features of the DUODIAL. Send for your free copy today!

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The design of these new power transformers assures maximum performance with minimum physical size and minimum temperature rise in accordance with RMA standards.

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Write direct for catalog illustrating, describing and listing the complete line, or contact your nearest radio parts jobber at once.

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 Primary 117 Volts, 50-60 Cycles

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PC-70	335-0-335	70	320	5 2	6.3CT 3	.....
PC-85	330-0-330	85	320	5 2	6.3CT 3	.....
PC-105	345-0-345	105	320	5 2	6.3CT 3.5	.....
PC-120	375-0-375	120	380	5 3	6.3CT 4	.....
PC-150	370-0-370	150	390	5 3	6.3CT 4	6.3CT 1
PC-200	385-0-385	200	390	5 3	6.3CT 4.5	6.3CT 1
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PR-105	445-0-445	105	325	5 2	6.3CT 3.5	.....
PR-120	500-0-500	120	400	5 3	6.3CT 4	.....
PR-150	505-0-505	150	400	5 3	6.3CT 4	6.3CT 1
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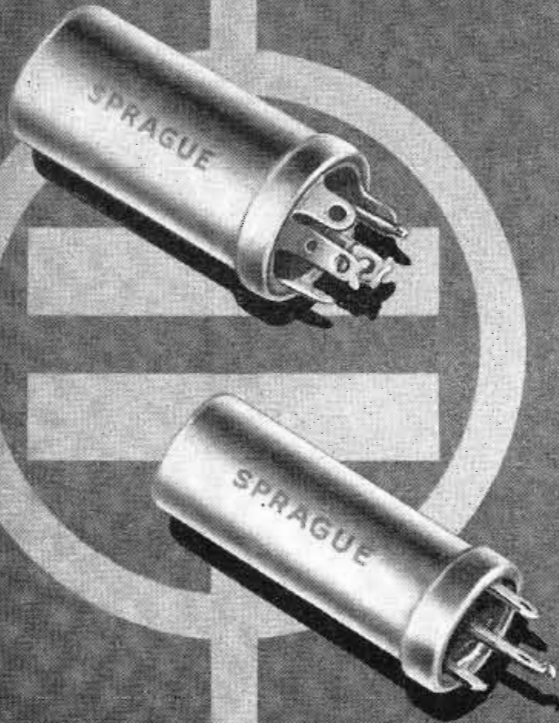
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# HAND-SIZE 50-OHM NICHROME\* RESISTOR SHRUGS OFF 35,000-WATT WALLOPS!

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.

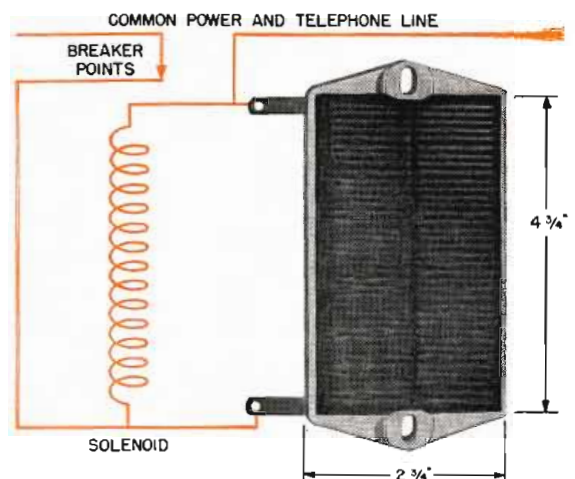
This is the story: Circuit breakers are installed in the power lines to protect them against "shorts" due to falling wires, etc. But the telephone carrier currents are blocked by the high impedance of the breaker solenoids. A low-impedance resistor is therefore used as a by-pass at each solenoid.

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.

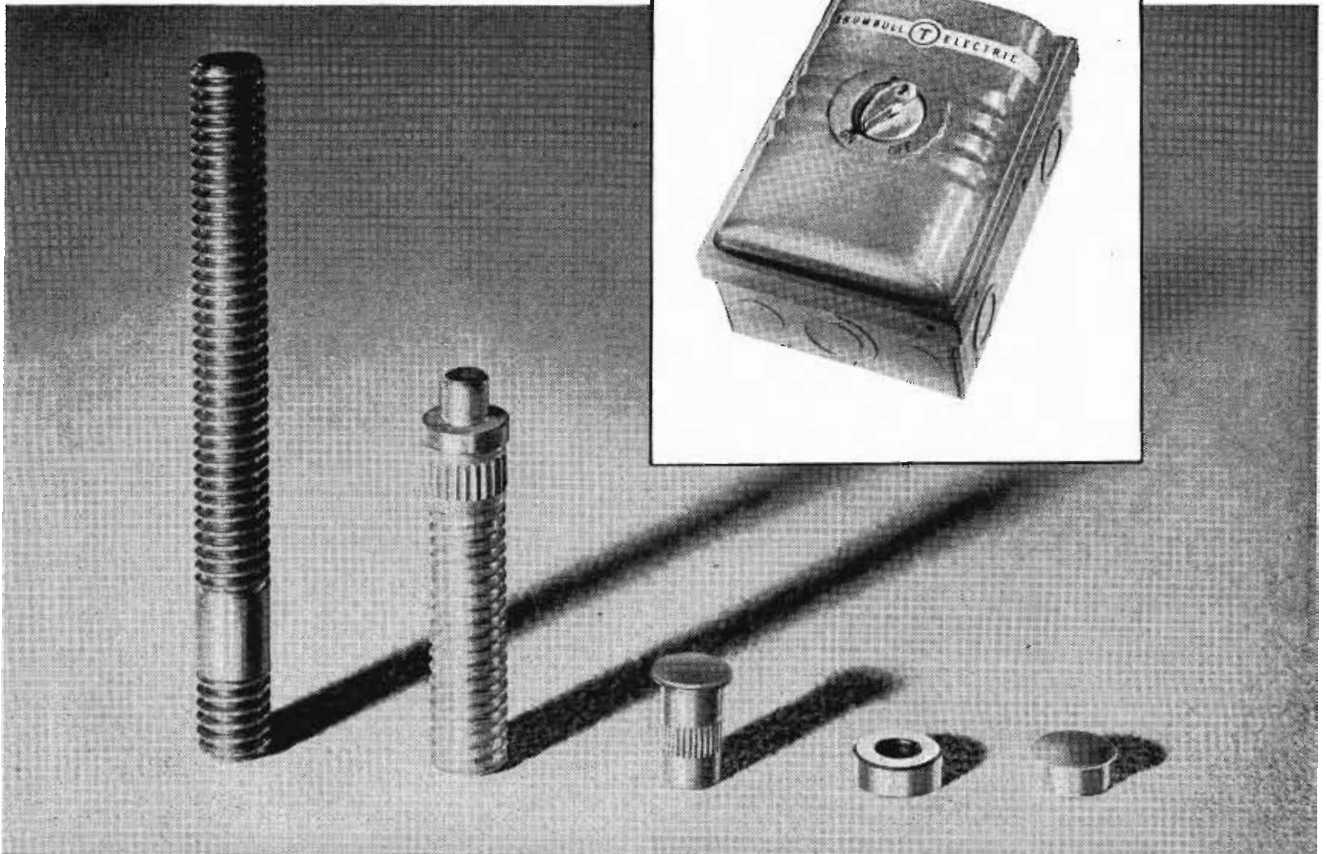


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Part #18107 and 18108, contacts for the Type D switch illustrated, were designed around this alloy. Trumbull states: "On both these parts we found we could make them in one operation instead of two. That is, due to the smooth free cutting of the metal, it was unnecessary to perform a facing operation . . . Our Screw machine foreman advises that, in his opinion, both these parts could be made four times as fast as out of ordinary electrolytic copper rod."

#3731, 60 amp. post stud.—5,760 pieces run in 19.6 hours with no machine down-time; 10,425 pieces of ordinary copper rod run in 66.6 hours with 11.8 hours machine down-time. In addition to the extra time required, three sets of dies were used for the regular rod. "The savings of the free-cutting material over ordinary copper were figured at \$1.81 per thousand, including in these costs both material and direct labor."

#16552, space washer. "Savings per thousand over electrolytic copper were 77¢. This figure included the material differ-

ence and direct labor. In addition, there was an 18% saving in machine down-time."

#K-60-1A, 70-200 amp. stud. "The use of Free-Cutting Copper Rod on this part very definitely increased production and practically voided machine down-time."

In a letter to Revere, Trumbull added: "In general, at least for most of the parts we have used, we find that there is at least a 25% saving in machine time of free-cutting over regular copper. In addition, the workers are enthusiastic about this material, particularly when running studs, because of the fact that it is no longer necessary for them to keep a constant close watch on the machine to see that the turnings do not become tangled up with the moving parts of the machine."

The Trumbull experience is being duplicated in other machine shops. If you have not tried this Revere Metal, we suggest you get in touch with your nearest Revere Sales Office.

# REVERE

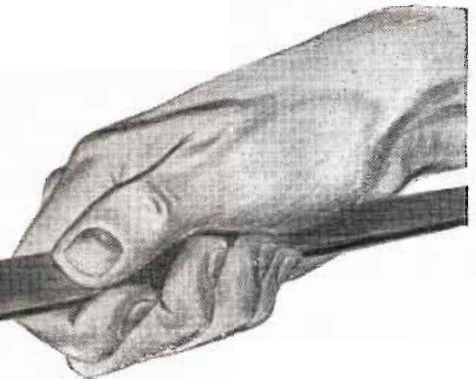
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Overlooking the rolling countryside at Princeton, N. J., the research laboratories of the Radio Corporation of America are built on land over which trails were blazed by American pioneers and across which Washington and his soldiers fought in the American Revolution. Today, on this historic site, scientists are conquering elements of nature so that the world continually may enjoy new benefits of electronics, AM and FM radio, and television.

Here, through discovery and invention, new products and new services are created for our national security and for the benefit of people everywhere.

The scientists and research men who work here are explorers of new frontiers in the invisible spectrum of

space. They blaze new trails, not only in radio broadcasting but also in radiotelegraphy, radar, and many other phases of radio-electronics, for the present and the future.

RCA scientists and engineers devote their efforts to the discovery of previously unknown principles and phenomena, to the revelation and expansion of knowledge, to the extension of man's horizons. They create and develop new and improved industrial processes and products, and provide new and expanded communication services.

The scientists of RCA believe that all additions to fundamental knowledge eventually will be worth while from the commercial as well as the scientific point of view. Therefore, RCA conducts basic research, the foundation upon which new industries are built and through which new services are made available to the public.

*When in Radio City, be sure to see the radio and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission.*



**RADIO CORPORATION OF AMERICA**



**RCA  
FM INSTRUMENTS**

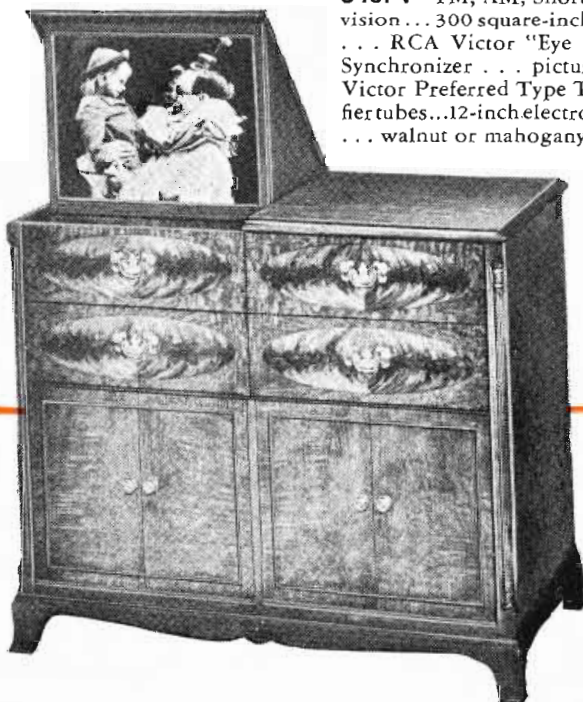


**730TV2**—FM, AM, Television and Victrola Phonograph . . . 52-square-inch picture . . . RCA Victor "Eye-Witness" Picture Synchronizer . . . picture tube, 26 RCA Victor Preferred Type Tubes plus 3 rectifier tubes . . . walnut, mahogany and blond finishes.

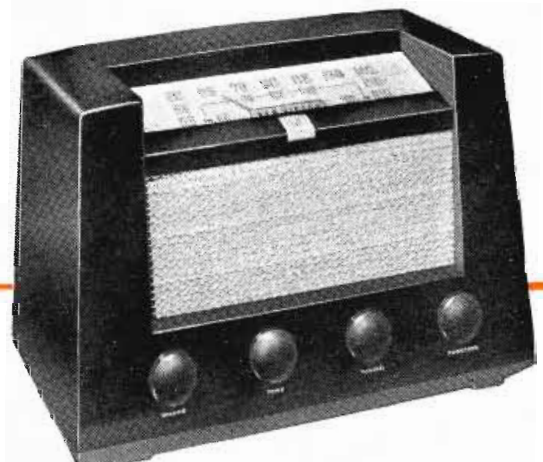


**8V151**—FM, AM, Short Wave and Victrola Phonograph. 14 RCA Victor Preferred Type Tubes plus 1 rectifier tube . . . 12-inch electro-dynamic speaker . . . "Crestwood" roll-out control unit . . . rich mahogany veneers.

There's an



**648PV**—FM, AM, Short Wave and Television . . . 300 square-inch television screen . . . RCA Victor "Eye Witness" Picture Synchronizer . . . picture tube, 40 RCA Victor Preferred Type Tubes plus 7 rectifier tubes . . . 12-inch electro-dynamicspeaker . . . walnut or mahogany finish.



**8R71**—FM and AM . . . Six RCA Victor Preferred Type Tubes plus one rectifier tube . . . powerful electro-dynamic speaker . . . maroon plastic case.





**8V112**—FM, AM, and Victrola Phonograph. 10 RCA Victor Preferred Type Tubes plus 1 rectifier tube . . . 12-inch electro-dynamic speaker . . . mahogany, walnut, or blond finish.



**711V3**—FM, AM, Short Wave and Victrola Phonograph. 10 RCA Victor Preferred Type Tubes plus 1 rectifier tube . . . 12-inch electro-dynamic speaker . . . roll-out record changer . . . mahogany cabinet.

# RCA VICTOR FM instrument for everybody

**N**ow, everyone can enjoy the thrill of FM in the widest selection of RCA Victor instruments *ever*.

The great RCA Victor line has a full range of FM instruments . . . from the 8R71 table model AM-FM, to the superb 648PV AM-FM radio and TV receiver. All have the thrilling tone of the "Golden Throat" 3-way acoustical system.

Powerful RCA Victor advertising, in top-ranking national magazines, and over 163 NBC stations send people to their dealer for RCA Victor instruments with FM. Look for these hard-hitting advertisements in LIFE, COLLIER'S, SATURDAY EVENING POST and

LOOK. Listen to the RCA Victor Show "The Music America Loves Best" over your favorite NBC station every Sunday afternoon.

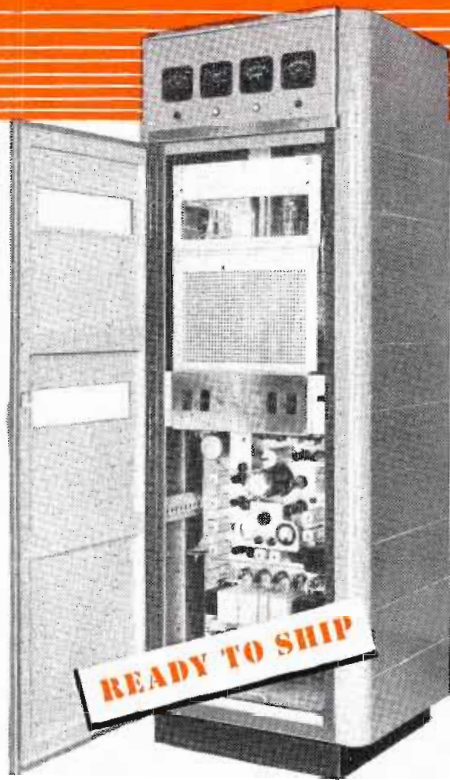
Every day more people learn about FM and want an RCA Victor FM instrument. RCA Victor dealers have the FM instruments everybody wants . . . instruments that offer FM through the famous "Golden Throat" tone system.

"Victrola"—T.M. Reg. U. S. Pat. Off.



# One Equipment Source for

**RCA  
FM BROADCAST  
EQUIPMENT**



## **RCA's 250-WATT FM TRANSMITTER**

Type BTF-250-A

Completely self-contained, this pace-setting 250-watt FM transmitter offers low-power stations the easy way to get on the air immediately with true FM quality. It includes RCA's "Direct FM" system using only 16 inexpensive tubes (about half the number used in many exciters)—with only 7 tubes in the r-f chain. All r-f circuits are single-ended. Multi-unit construction permits easy addition of higher power units later on. The BTF-250-A is the ideal standby for higher-power FM stations.

**READY TO SHIP**

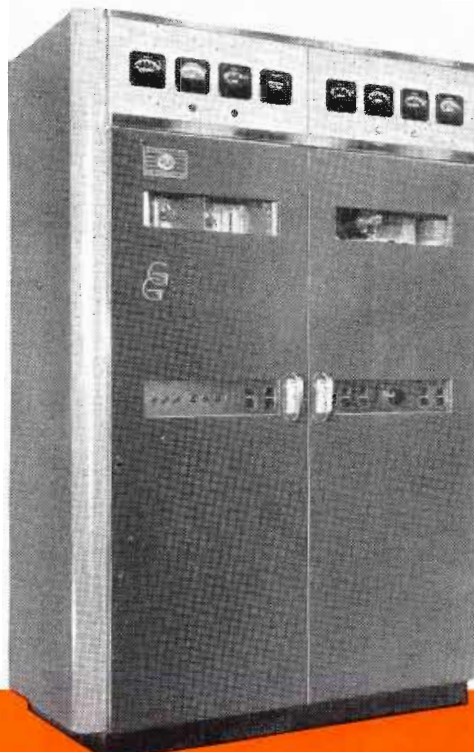
## **RCA's 3-KW FM TRANSMITTER**

Type BTF-3B

The BTF-3B is designed and built strictly for professional transmitter engineers who know transmitters. It uses only 36 tubes (15 regulator and voltage control tubes do not contribute to outages) and employs RCA's simple, straightforward "Direct FM" type exciter. The driver and final are "Grounded-Grid" for easy tuning and maximum stability. Shielded final tank circuit reduces housing radiation and r-f pick-up in nearby a-f circuits. Single-ended output provides greater stability and easier matching. Every component is easy to reach. Unit-type design makes for easy installation and simple modification to higher power. All air-cooled and self-contained. Can be tuned by inexperienced personnel in minutes.



**READY TO SHIP**



## **RCA's 1-KW FM TRANSMITTER**

Type BTF-1-C

Here is a self-contained 1-kw transmitter with a "Direct FM" exciter inherently capable of lower noise and distortion than any exciter yet developed. No fussy, complicated circuits. No trick tubes. Only 8 tubes in the r-f chain. Grounded-Grid circuits in the final amplifier provide greater stability than conventional amplifiers—require no neutralizing. The shielded tank circuit of the final amplifier provides near-perfect shielding. Output is single-ended for maximum stability. Unit-type design provides easy installation, flexibility, and simple modification for higher power. Type BTF-1-C is all air-cooled.



# Everything in the **FM** Station

# ...RCA

## IMMEDIATE DELIVERY FROM STOCK

• Continuing its active production of FM equipment, RCA today is manufacturing the most complete line of well-engineered FM station equipment in the industry—and is stocking it. Nothing in your station "specs" that RCA cannot supply. Nothing in the transmitter equipment line that RCA cannot ship promptly.

*Who are RCA's best references?*

The station men of the nation's leading FM stations. These are the men who like the practical engineering

that goes into each piece of RCA FM equipment. They like the completeness of the RCA FM line—with one manufacturing source for everything they need in the station. They like the undivided responsibility RCA assumes for its equipment. They like the prompt delivery RCA gives them on every item on the list.

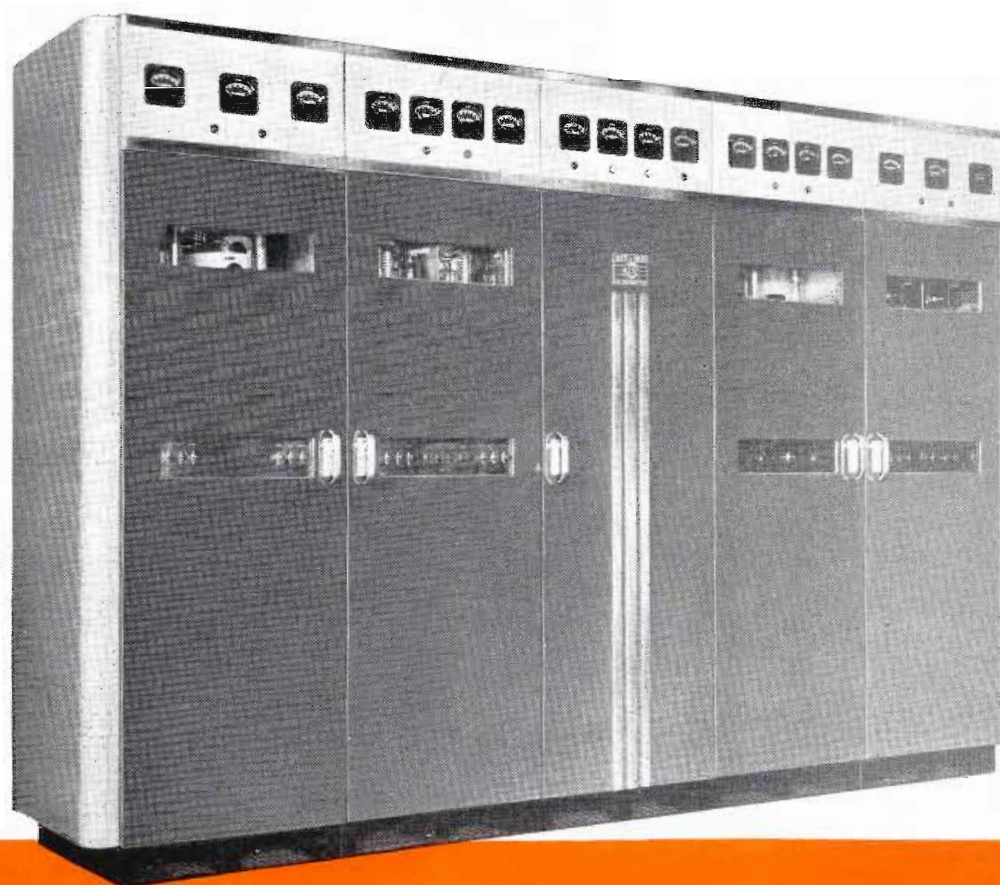
Call your RCA Broadcast Sales Engineer for information and help. He's an FM specialist. Or write Dept. 307, RCA Engineering Products, Camden, N. J.

### RCA's 10-KW FM TRANSMITTER

Type BTF-10B

Outstanding for its low running costs, this 10-kw FM transmitter takes only 22.5 kw to run it. Grounded-Grid circuits in both drivers and in the final permit the use of small power triodes (7C24's) in all three stages. RCA's "Direct FM" system is used, as in all RCA FM transmitters. All r-f stages are single-ended. High-power stages are motor-tuned. Carrier returns instantaneously after momentary power failure. Only 39 tubes, total, in the entire transmitter (only 23 of these are required for emergency operation). Only 14 different tube types to stock. All air-cooled, the entire transmitter is designed with just *one* high-voltage power supply. Possible savings in running costs of the BTF-10B—up to \$1500 a year!

**READY TO SHIP**



# ... FM Transmitters, FM Antennas



## RCA's 50-KW FM TRANSMITTER

**Type BTF-50A.** One of the easiest-handling high-power transmitters ever designed... and as reliable as a powerhouse. Grounded-Grid amplifiers and simplified single-end r-f circuits (class C) insure highly stable operation and easy tuning. Direct FM produces high-fidelity frequency modulation simply and directly (less than 1% output distortion 30-15,000 cps). Total tube complement, 42 tubes.

Of these, only 26 can seriously affect the carrier. *Number of different tube types, only 14. One high-voltage power supply for the entire transmitter.*

Type BTF-50A is built for true walk-in. Its unified front-panel design is functionally styled to fit any station layout—makes it economical to set up. Here is the 50-kw FM transmitter that is completely air-cooled—with two blowers operating independently to assure maximum program continuity.

READY TO SHIP



## RCA STUDIO CONSOLETTA

### Type 76-B5

Latest in the series of RCA Consolettes is the 76-B5. This type performs all the amplifying, monitoring, and control functions of most large and small stations—AM and FM. It has full facilities for simultaneous auditioning and broadcasting for practically any combination of studios, turntables, or remote lines.



# — Station Accessories



READY TO SHIP

**RCA's  
Duo-Cone Speaker  
Type LC-1A**

Expressly designed for monitoring FM programs and high-fidelity recordings, this revolutionary new two-cone speaker provides true FM response throughout the range 50 to 15,000 cps! It is free from resonant peaks, harmonics, and transient distortion at all usual volume levels. Cross-over response is remarkably smooth. Controlled "roll-off" is provided for 5 and 10 kc. *Room location of the LC-1A is non-critical.*

The RCA Duo-Cone Speaker is available in three bass-reflex cabinets; finished in two-tone gray, dark walnut, and light mahogany.

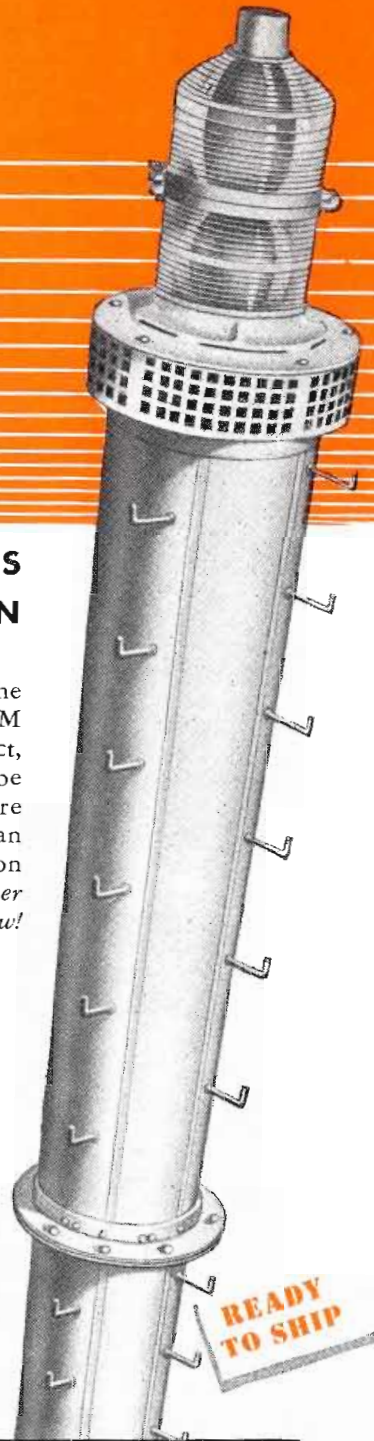
## RCA PYLON ANTENNAS FOR EVERY FM STATION

Today, RCA FM Pylons are by far the most popular radiators in the nation's FM broadcast stations. They are easy to erect, completely self-supporting, and can be mounted anywhere. RCA Pylons assure you maximum radiation. For example, an 8-section Pylon operated in conjunction with a 50-kw FM transmitter can *deliver an effective radiated power of over 600 kw!*



**RCA Isolation Unit  
Type BAF-4A**

For AM broadcasters who wish to install an RCA FM Pylon atop their present AM tower, and operate AM and FM simultaneously, this unique unit provides complete and efficient isolation of FM and AM signals. Mounts at the base of an insulated broadcast tower.



READY TO SHIP

### Data for RCA Pylon Antennas

**Standard Pylon.** This antenna is designed to meet the requirements of all FM Stations . . . handles up to 50 kw of power. The Standard combines maximum strength and rigidity with minimum weight.

**Heavy-Duty Pylon.** This is the only FM antenna designed to support the RCA Super-turnstile Television antenna. The Heavy-Duty Pylon is built for locations where winds of hurricane force prevail. It is designed to withstand wind velocities of more than 160 mph when used for FM service alone.

**Low-Power Pylon.** Here is the ideal low-cost antenna for interim operation and stand-by service. It has the same high gain as other two models, but is available only as a single-section antenna. The Low-Power Pylon handles up to 3 kw.

Type No.	Nominal Power Gain	Sections	Over-all Height (ft.)	Weight (lbs.)
BF-11A/B	1.5	1	13.5	350
BF-12A/B	3.0	2	27	700
BF-14A/B	6.0	4	54	2000
BF-18A/B	12.0	8	108	12497
<b>HEAVY-DUTY PYLONS</b>				
BF-12E/F	3.0	2	27	4322
BF-14C/D	6.0	4	54	10497
<b>LOW-POWER PYLONS</b>				
BF-21A/B	1.5	1	13.9	376

# RCA TUBES ...



## the standard of comparison in FM

• The RCA 7C24 and 5592 "metal header" tubes . . . used in the latest RCA FM transmitters . . . are striking examples of RCA's leadership in modern tube development. In addition to increased ruggedness and operating economy, these tubes require no neutralization, give stable wide-band operation, and provide superior shielding of elements when used in grounded-grid circuits.

RCA has a complete line of modern, more efficient power tubes for FM transmitters. For your convenience, these tubes are now available from your local RCA Tube Distributor or directly from RCA

• • •

For information on any RCA tube, write RCA, Commercial Engineering, Section IP-36, Harrison, N. J.

**THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA**

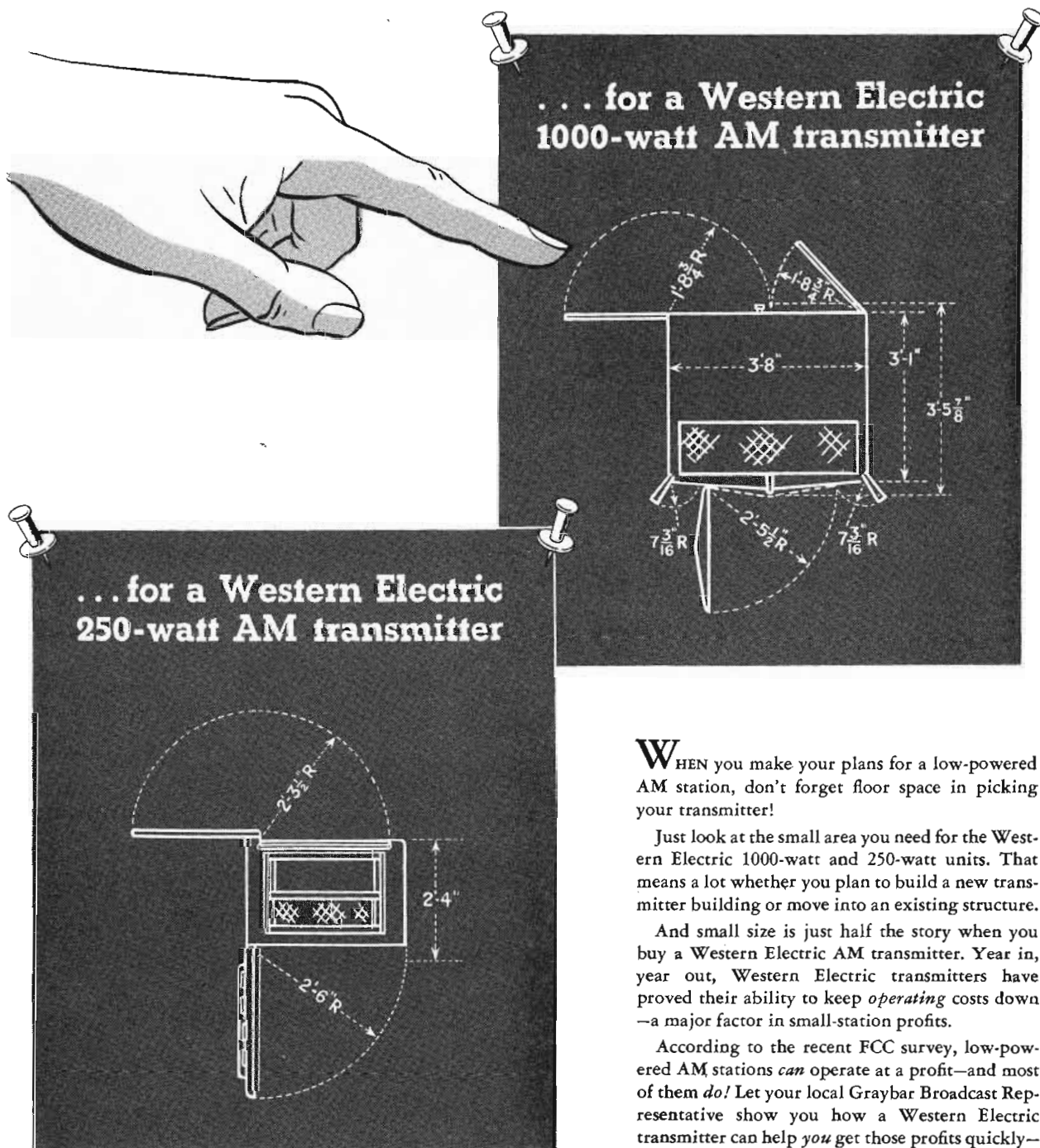


**TUBE DEPARTMENT**

**RADIO CORPORATION of AMERICA**

**HARRISON, N. J.**

# Only this much floor space...



**W**HEN you make your plans for a low-powered AM station, don't forget floor space in picking your transmitter!

Just look at the small area you need for the Western Electric 1000-watt and 250-watt units. That means a lot whether you plan to build a new transmitter building or move into an existing structure.

And small size is just half the story when you buy a Western Electric AM transmitter. Year in, year out, Western Electric transmitters have proved their ability to keep *operating* costs down—a major factor in small-station profits.

According to the recent FCC survey, low-powered AM stations *can* operate at a profit—and most of them *do!* Let your local Graybar Broadcast Representative show you how a Western Electric transmitter can help *you* get those profits quickly—through lower initial and operating costs. If you prefer, write direct to Graybar Electric Company, 420 Lexington Avenue, New York 17, N. Y.

— QUALITY COUNTS —



DISTRIBUTORS: IN THE U.S.A.—Graybar Electric Company. IN CANADA AND NEWFOUNDLAND—Northern Electric Company, Ltd.

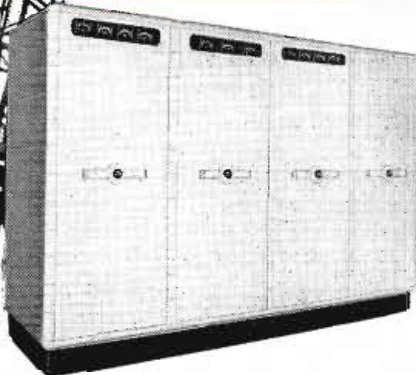
# Western Electric

# FEDERAL BROADCAST EQUIPMENT

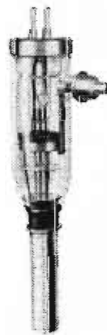
*... An Outstanding Line Offering  
Finest Performance and Real Economy*

**In standard AM and FM transmitters...TV transmitters for low or high band operation...square loop antenna...special new developments including Studio-to-Transmitter Links...Dummy Antenna...TV Monitors... High Power Transmitting and Rectifier Tubes.**

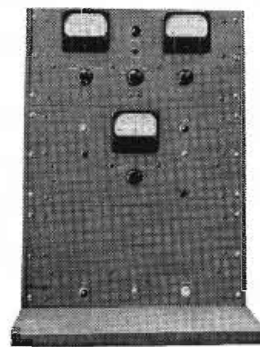
**Y**ou can count on Federal Broadcast Equipment—from a complete system to an individual installation. Federal Broadcast Equipment brings you the latest in engineering technique and practice... high quality of materials... precision craftsmanship of the highest order. There is real economy in both initial cost and operation. And you are assured of the finest performance, because Federal sees every job through. This Federal policy upholds a reputation established by more than 38 years of continuous achievement in the radio transmission field.



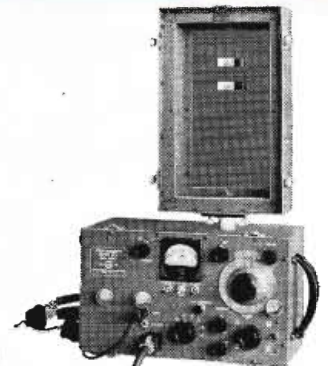
**FEDERAL'S FM 10 KW Transmitter**, officially approved by the FCC, has the exclusive "Frequematic" FM Modulator. It reduces distortion and noise well below RMA specifications, and stabilizes mean carrier frequency within 0.001 per cent of assigned value. This transmitter combines outstanding fidelity with economy, accessibility and highly dependable performance.



**FEDERAL'S Transmitting Tubes** provide long service. They stand up under severe operating conditions, and maintain original characteristics for life.



**FEDERAL'S TV Monitor** meets all FCC requirements. Designed for long service life, it accurately measures video carrier frequency, and monitors sound carrier and modulation.



**FEDERAL'S Field Intensity Meter** accurately measures signal intensity of AM broadcasting stations whether in the standard band of 530-1600 Kc—200 to 400 Kc—1600 to 3600 Kc—or 3600 to 7000 Kc. This 29-lb. unit is portable.

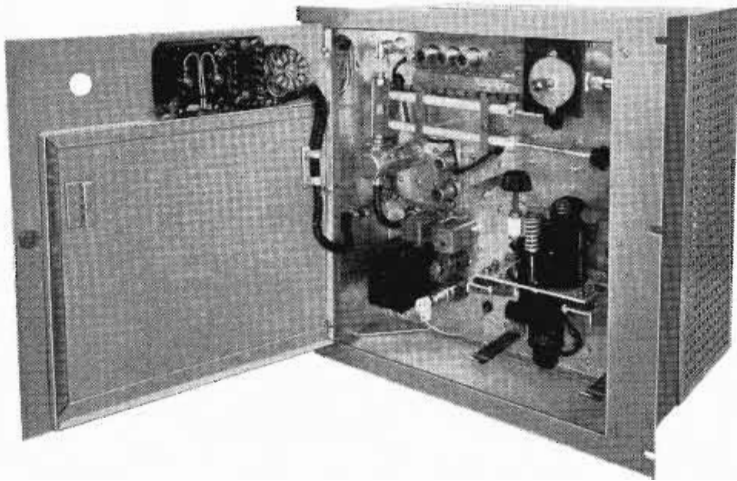
**HIGHEST GAIN IN THE FIELD WITH FEDERAL'S SQUARE LOOP ANTENNA.** In many installations from coast to coast, this design is producing an effective radiated power of as much as twelve times the Kilowatt rating of the FM transmitter. This means new power and new range for better and wider service. Federal's Square Loop Antenna also brings you simplicity of mechanical and electrical design... greater accessibility for maintenance... no operational tuning... maximum lightning protection... immediate delivery and ease of installation.



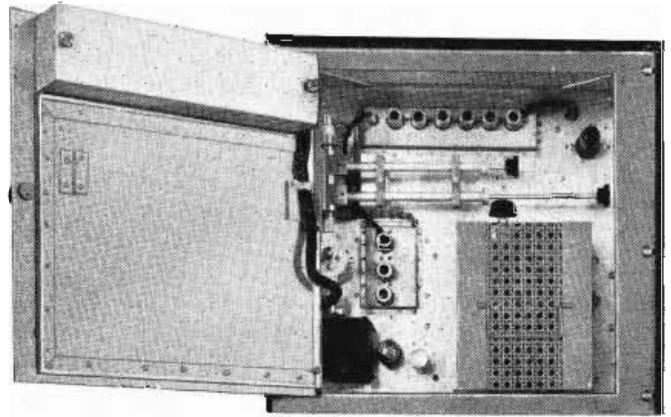
## Federal's Studio-to-Transmitter Link for High Fidelity Program Transmission

Here's the new Federal microwave system to eliminate S-T wire and cable circuits. Combining outstanding fidelity - distortion less than 1% over 50-15,000 cycles - low noise level, 65 db below 100% modulation - and a 35-mile "line of sight" range - this system complies with all applicable FCC regulations for good engineering practice. Link consists of a transmitter, receiver and two standard 6-foot parabolic reflectors (4- or 8-foot reflectors supplied on request).

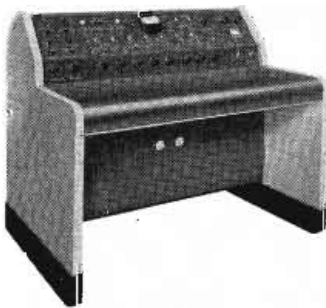
**ONE OF MANY NEW DEVELOPMENTS BY  
FEDERAL TELECOMMUNICATION LABORATORIES**



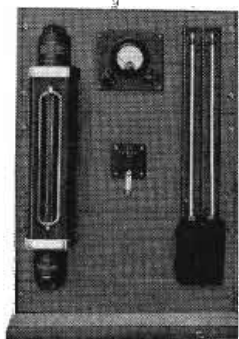
**TRANSMITTER** employs advanced-design direct frequency modulation and crystal-controlled klystron power oscillator. Complete monitoring facilities include frequency and power measurements, aural monitoring, and vacuum tube metering. Designed for mounting on standard 19" relay rack, it is only 35" high and 13" deep.



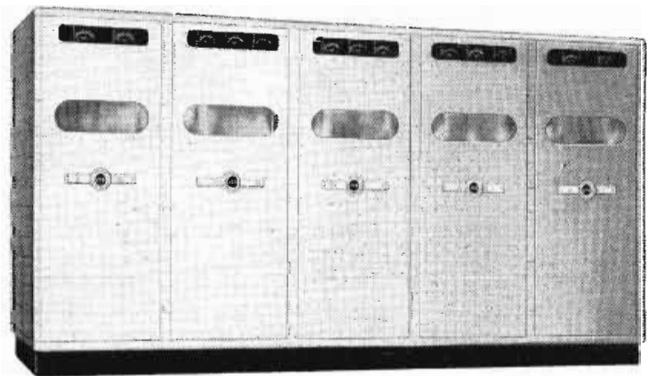
**RECEIVER** is a single superheterodyne which utilizes reflex-klystron local oscillator. It features pre-selection to reduce possibility of spurious interference. Relative stability is maintained within 0.01 per cent with automatic frequency control. Metering is provided for all vacuum tube circuits, carrier level, and crystal current. Same mounting and size as transmitter.



**FEDERAL'S De Luxe Studio Console** combines control of all facilities of an FM transmitter into one unit - a "nerve center" - convenient, foolproof, and handsome in appearance.



**FEDERAL'S All-Metal Dummy Antenna** meets the need of the Broadcasting Industry for testing of high power, VHF and microwave (FM and TV) transmitters. No conventional resistors and insulators. Compact, light, water-cooled - determines RF power accurately.



**FEDERAL'S Standard 5KW AM Broadcast Transmitter** assures high fidelity performance and maximum operating efficiency. Nominal output of 5KW can be transferred instantaneously to 1 KW. Every component is conservatively operated. Every circuit is engineered for maximum life of its elements. A new simplified power supply reduces maintenance to a minimum. Standard operating band.



# Federal Telephone and Radio Corporation

100 KINGSLAND ROAD, CLIFTON, NEW JERSEY

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

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

STAR PERFORMERS OF TOMORROW... MAKE THEIR DEBUT TODAY!

# DU MONT TELECASTING ACCESSORIES



R.F. WAVE-FORM MONITOR  
TYPE 5034-A



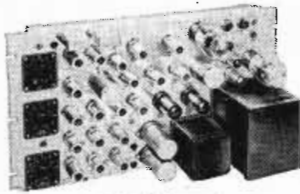
VISUAL FREQUENCY MONITOR  
TYPE 5102-A



AURAL FREQUENCY AND  
MODULATION MONITOR  
TYPE 5103-A



STATION MONITORING RECEIVER  
TYPE 5105-A



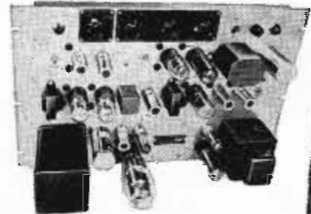
SYNC STRETCHER  
TYPE 5057-A



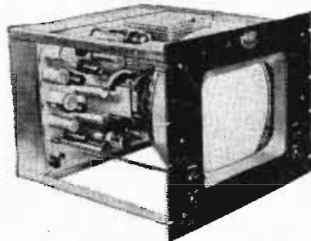
PICTURE DISTRIBUTION AMPLIFIER  
TYPE 5051-A



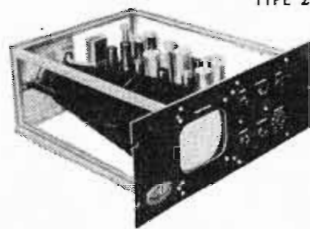
20-INCH PICTURE MONITOR  
TYPE 2116



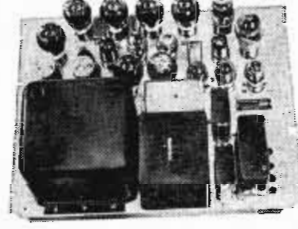
REMOTE SYNC PHASING UNIT  
TYPE 5056-A



12-INCH PICTURE MONITOR  
TYPE 5108



5-INCH WAVEFORM MONITOR  
TYPE 5109



LOW-VOLTAGE POWER SUPPLY  
TYPE 5019-A

Televesting is now strictly "professional." And in the grand tradition of the theatre, "The Show Must Go On!", regardless.

To that end, Du Mont provides, in addition to the basic studio and transmitting equipment, those final touches for smoothest television programming—waveform checking and monitoring,

off-the-air reception, sync stretching, picture monitoring, remote sync phasing, low-voltage power supply, and many other functions, in the form of accessory equipment.

Shown above are just a few of the many Du Mont aids to attaining "The First with the Finest in Television."

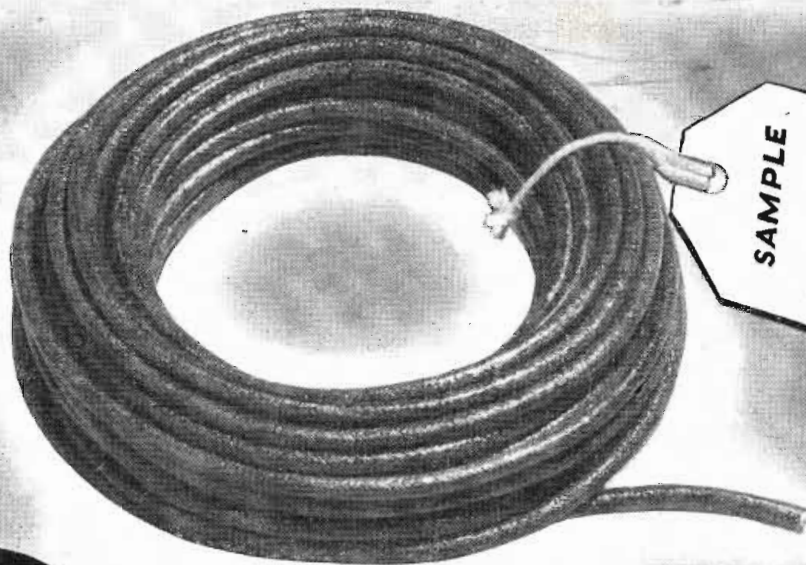
Write for descriptive literature.

© ALLEN B. DU MONT LABORATORIES, INC.

# DU MONT

*First with the Finest in Television*

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



**SAMPLE**  
**LENZ POWTRAN**  
 Submitted to  
 Coil Manufacturers



# powtran

FOR POWER TRANSFORMER LEADS

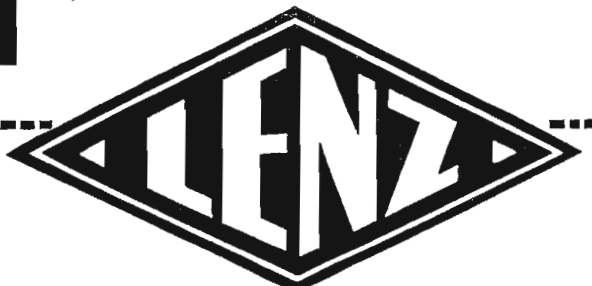
- ◆ Withstands coil impregnation temperatures without electrical or mechanical deterioration
- ◆ Textile Insulation rated at 90° operating temperature
- ◆ 4100 volts breakdown one foot immersed in Mercury
- ◆ Available in RMA Transformer Lead Color Code— Sizes 22 to 14
- ◆ Flame Resistant
- ◆ Easy Stripping

LENZ ELECTRIC MANUFACTURING CO.  
 1751 N. Western Ave., Chicago 47, Illinois  
 Please send me sample and specifications of POWTRAN.

Name.....Title.....  
 Company.....  
 Address.....  
 City..... State.....

**Mail This Coupon for FREE Sample and Specifications**

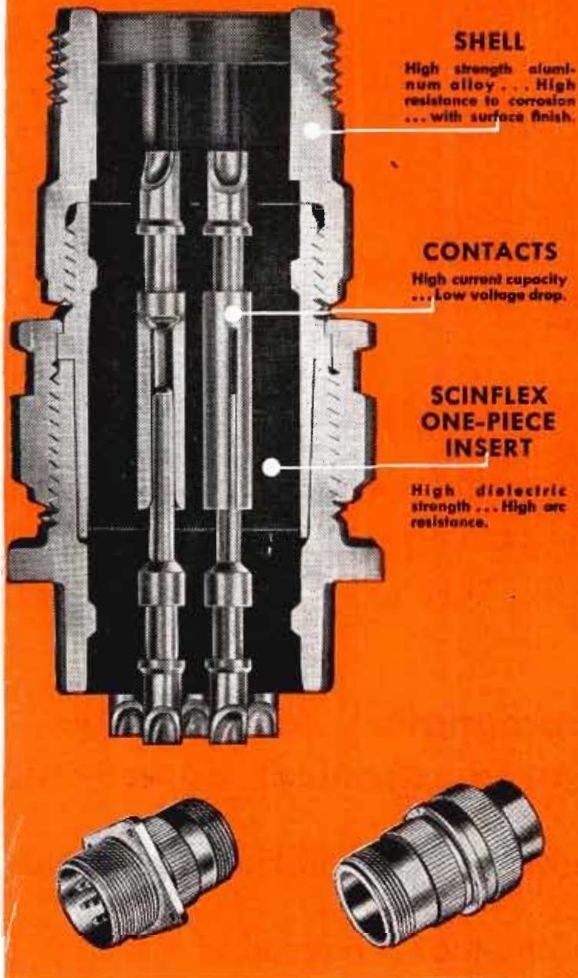
**in business since 1904**



LENZ ELECTRIC MANUFACTURING CO.

# BENDIX-SCINTILLA

the finest ELECTRICAL CONNECTORS  
money can build or buy!



## AND THE SECRET IS SCINFLEX!

Bendix-Scintilla\* Electrical Connectors are precision-built to render peak efficiency day-in and day-out even under difficult operating conditions. The use of "Scinflex" dielectric material, a new Bendix-Scintilla development of outstanding stability, makes them vibration-proof, moisture-proof, pressure-tight, and increases flashover and creepage distances. In temperature extremes, from  $-67^{\circ}\text{F.}$  to  $+300^{\circ}\text{F.}$ , performance is remarkable. Dielectric strength is never less than 300 volts per mil.

The contacts, made of the finest materials, carry maximum currents with the lowest voltage drop known to the industry. Bendix-Scintilla Connectors have fewer parts than any other connector on the market—an exclusive feature that means lower maintenance cost and better performance.

\*REG. U.S. PAT. OFF.

*Write our Sales Department for detailed information.*

- Moisture-proof, Pressure-tight • Radio Quiet • Single-piece Inserts
- Vibration-proof • Light Weight • High Arc Resistance • Easy Assembly and Disassembly • Less parts than any other Connector

*Available in all Standard A.N. Contact Configurations*



**TELEVISION RECEIVER SPECIFICATIONS** included as Part 2 of this issue is the industry's latest and most authoritative tabulation of receiver data on records. Never before compiled, it contains records of television receiver manufacturers now actually producing more than 185 different models. Average cost to the buyer is \$670.12 per set; average cost of a television set on the basis of sales is \$400. Average installation and antenna cost is \$65. With the 16-in. tube average sale price is expected to reach \$500 in 1949, thus marking television's entrance into the billion dollar class of industry. The specifications reveal many valuable statistics on receiver design, capacities, circuits, characteristics, etc., of vital interest to design and manufacturing engineers. Look for your copy in this issue.

**STORMS—STATIC—AND FM:** For radio static and atmospherics along the North Atlantic seaboard, the 1948 season has been the worst in many years. With AM channels riddled by nature's artillery fire and at times almost useless, listeners turned to FM for relief. Notable example was occasion of Republican convention speeches in Philadelphia. Unintelligible on AM because of a severe lightning storm, the addresses came through crystal-clear throughout the east for those equipped with quality FM receivers.

**BELL'S NEW YORK TO BOSTON RELAY** has proved so successful that the company is planning to install Buffalo-Chicago and Minneapolis-Chicago links shortly. Rumor has it that AT&T is concerned about the effect that microwave relays may have on its coaxial business of the future.

**ASSEMBLY-LABOR** economies of "printed circuits" and the like, may not prove so really important, declare production men, who point out that of all radio-factory costs, labor totals only 5% to 6%. In contrast, savings in cabinets and other large items can affect economies far greater than any possible labor-saving.

**STRATOVISION'S** success appears pretty well proved technically. In fact the TV range of an airplane at 25,000 ft. is so effective that to "clear" for one such TV strato-plane over Pittsburgh, 38 present allocated TV stations would be affected. And there lies the rub with FCC with whom Westinghouse has filed a request for a "clear" channel 8. S.G.

**RCA ENGINEERS**  
**SELECT CLARE...**

...A relay they could "install  
 and forget" ... for protection  
 of Electron Microscope

RCA's new Electron Microscopes present many advanced features in this remarkable scientific instrument. Designed for simplicity of operation, reliability and operator convenience, these instruments retain the high resolving power and useful magnification of earlier models with fewer mechanical components.

CLARE Relays were selected by RCA engineers as a protective device to prevent the high voltage from being connected with the electron tubes before the evacuation of the column is completed.

This application called for use of a relay designed for a long and reliable operating life . . . a relay that could be "installed and forgotten" . . . no further maintenance or attention required.

Selection of CLARE Relays by RCA engineers for this exacting service is typical of the increasing reliance placed in the ability of CLARE engineers to provide a CLARE Relay to meet specific job requirements. CLARE sales engineers are located in principal cities for your convenience. Whatever your relay problem, you will find them capable, experienced, and anxious to be of service.

Look up the nearest CLARE sales engineer in your classified telephone directory . . . or write: C. P. Clare & Company, 4719 West Sunnyside Avenue, Chicago 30, Illinois. In Canada: Canadian Line Materials Ltd., Toronto 13. Cable Address: CLARELAY.

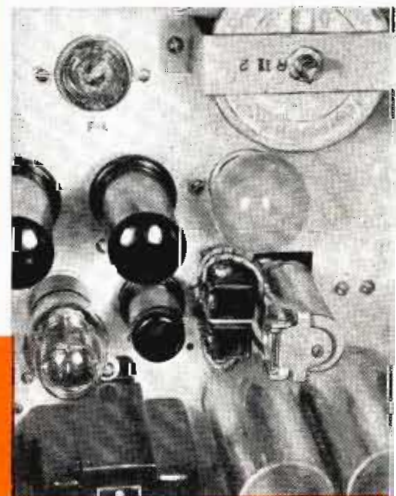
**CLARE**  
**RELAYS**

**First in the Industrial Field**



▲An example of Electron Microscope's magnification 46,500X of chrome iron by replica and shadowing. Used by courtesy of Dr. Wyckoff and Dr. Williams.

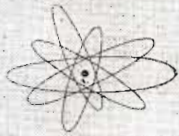
▲This RCA Electron Microscope makes it possible to examine and photograph metals, bacteria, fibres, tissues and other minute particles up to useful magnifications as high as 100,000 diameters.



Partial view of RCA Electron Microscope chassis, showing CLARE Type "CMS" d-c Relay. This relay makes it impossible to connect the high voltage to the vacuum tubes before the pressure is reduced to the required minimum. It is connected to the output of an auxiliary tube which prevents the passage of

sufficient current to the relay coil before this point is reached. When pressure is reduced to a safe level, the relay actuates two snap-action switches to place the microscope in operating condition.

**ELECTRONICS**



# Designers



*A panel instrument  
for every need*

These general-purpose panel instruments are particularly suitable for use in radio equipment and industrial applications where accuracy and quality are required and space is at a premium. Many of the instruments have been newly styled

for better readability and for the smooth, modern appearance that will help give your panels a well-engineered look.

Thermocouple-type instruments, for measurements of high-frequency alternating current in radio or other electronic circuits, are available. There is also a complete line of rectifier types (a-f), for measuring alternating current or voltage at high frequencies or where the source is not sufficient to operate conventional a-c instruments. Typical applications include television transmitters, radar wave meters, testing equipment for electronic circuits. For a full story of G-E instruments, send for Bulletin GEC-227.

**GENERAL**  **ELECTRIC**

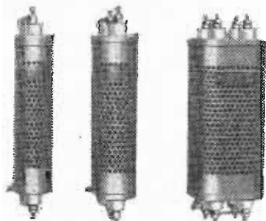
# Digest

## TIMELY HIGHLIGHTS ON G-E COMPONENTS



### CAGED FOR PROTECTION

Suitable for wall or panel mounting, these cage-type, enameled resistor units employ a strong, high-heat-resisting silicate-compound body which withstands sudden and extreme temperature changes without weakening or in any



way being injured. The resistance wire has a low temperature coefficient so that the resistance remains nearly constant as the temperature increases. Ample protection to the units is provided by the perforated metal case. Each unit is rated at 85 watts and is available in resistance values from 0.5 to 100,000 ohms; one to four units in a cage. For more complete information please contact your G-E representative.

### NEED A "LOW VA" VOLTAGE STABILIZER?

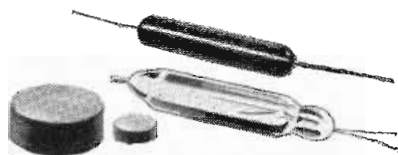
General Electric's latest additions to its line of automatic voltage stabilizers are three 115-volt, 60-cycle designs in 15-, 25-, and 50-va ratings. Check the low prices—you may now be able to utilize the advantages of an automatic voltage control for your application. The price consideration plus the low case height and small size will make these units especially applicable to radio chassis and other shallow-depth installations. Other features include totally insulated design, which is necessary where isolation is required between primary and secondary circuits, and universal lead



construction which makes these units adaptable to various wiring and mounting arrangements. If you have an application problem, contact your G-E representative, or check bulletin GEA-3634B.

### SOMETHING NEW IN CIRCUIT CONTROL DEVICES

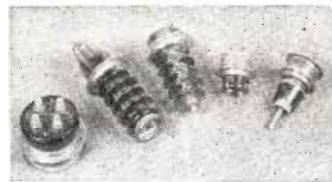
Simplify your circuit designs by replacing complicated and costly components with simple, economical G-E Thermistors. These electronic semiconductors are unique in that the resistance changes rapidly with slight variations in temperature—electrical resistance decreases as temperature rises, and increases as temperature falls. G-E Ther-



mistors give you these five advantages: flexible in application, small in size, available in various shapes, indefinitely stable, and they are economical. These new circuit devices are especially adaptable as sensitive elements in flow meters, liquid-level gages, time-delay relays, vacuum gages, switching devices, and modulating thermostatic circuits. Check coupon for technical report CDM-9.

### HERMETIC SEAL ELIMINATES MOISTURE PROBLEMS

The new cast-glass bushings with their sealed-in metal hardware can be readily welded, soldered, or brazed directly to the apparatus, thus eliminating gaskets and providing a better seal than ever before. The small, compact structure of the bushings often makes it possible to



reduce the overall size and weight of the electric apparatus. Bushings are practically unaffected by weathering, microorganisms, and thermal shock. Their great mechanical strength makes them well suited for use in airplanes, etc., where they are subject to continual vibration. Available in ratings up to 8.6 kv and for currents to 1200 amperes. Check bulletin GEA-5093.

### MORE SOLDERING WITH LESS POWER

G.E.'s midget soldering iron can do a big job for you with only one-fourth the wattage usually used. This handy 6-volt, 25-watt iron is only 8 inches long (with  $\frac{1}{8}$ " or  $\frac{1}{4}$ " tips) and weighs but  $1\frac{3}{4}$  ounces. It was especially designed for close-quarter, pin-point precision soldering. The "midget" offers you all these advantages: low-cost soldering; "fingertip" operation; quick, continuous heat; easy renewal; long life; low maintenance. The iron is a real aid in manufacturing radios, instruments, meters, electric appliances, and many other products requiring precision soldering. Irons and specially designed 115/6-volt transformers are available from stock. Check bulletin GES-3488.



GENERAL ELECTRIC COMPANY, Section B642-18  
Apparatus Department, Schenectady, N. Y.

Please send me the following bulletins:

- |   |   |
|---|---|
| <input type="checkbox"/> GEC-227 Instruments            | <input type="checkbox"/> GEA-5093 Cast-Glass Bushings |
| <input type="checkbox"/> GES-3488 Midget Soldering Iron | <input type="checkbox"/> CDM-9 Thermistors            |
| <input type="checkbox"/> GEA-3634B Voltage Stabilizer   |   |

Name .....

Company .....

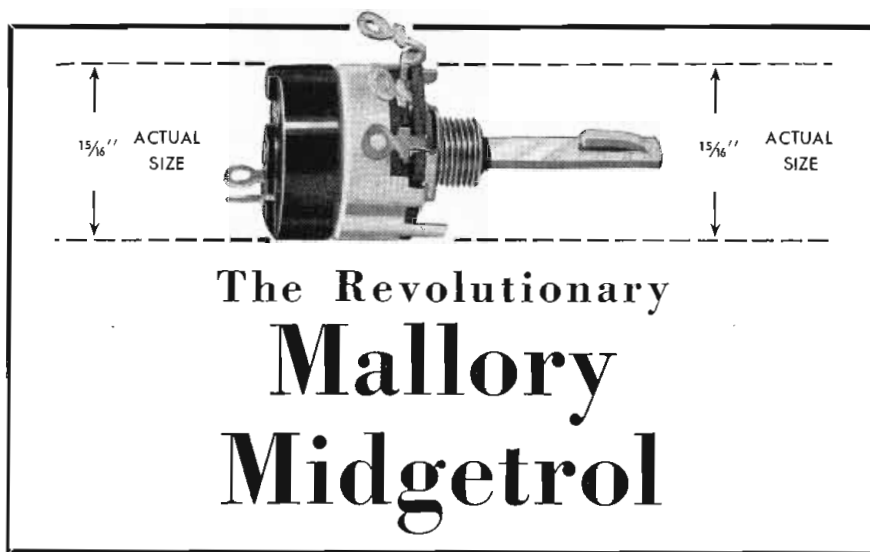
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City.....State.....

*Mallory Presents the First*

# ALL NEW

**Variable Resistor in Years!**



When we call this  $15/16''$  Mallory Midgetrol *new*, we mean entirely new inside and out—with new design and new features achieved by new production methods. It's the first really new control to appear in years.

## **EXTREMELY LOW NOISE LEVEL—STAYS QUIET, TOO**

Both mechanically and electrically, you'll find the new Mallory Midgetrol the quietest, smoothest control you ever handled—with greater uniformity and balanced contact pressure. The new carbon element, contact and 2-point, wobble-free shaft suspension combine to make it so. Better still, it stays quiet! Our tests and customers' laboratory tests prove that after tens of thousands of cycles, the Midgetrol still has an amazingly low noise level.

Behind the new Mallory Midgetrol are many years of Mallory experience and widely diversified manufacturing facilities in metallurgy and electronics. You can specify the Midgetrol with the utmost confidence. Write today for Technical Information Bulletin and Specification Sheets.

## **OTHER ALL NEW FEATURES . . .**

- *Higher standardization—faster delivery schedules—thanks to the Midgetrol's new design.*
- *You can bend or twist the terminals without breaking them.*
- *Terminals are farther away from the mounting surface . . . eliminates need for extra insulation.*
- *Has voltage characteristics that make it especially adaptable for television receivers as well as radio sets.*
- *Saves precious space—can be specified where a  $1\frac{1}{8}''$  diameter control ordinarily would be required.*
- *Lightness makes it ideal for portable radio applications.*
- *Flat shaft for standardization and uniformity in production—for adaptation to fit any type knob now in use.*
- *Specially designed switch for long, trouble-free life.*

**P. R. MALLORY & CO. Inc.**  
**MALLORY** CAPACITORS . . . CONTROLS . . . VIBRATORS . . .  
SWITCHES . . . RESISTORS . . . RECTIFIERS . . .  
VIBRAPACK\* POWER SUPPLIES . . . FILTERS  
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**APPROVED PRECISION PRODUCTS**

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





# ALPETH

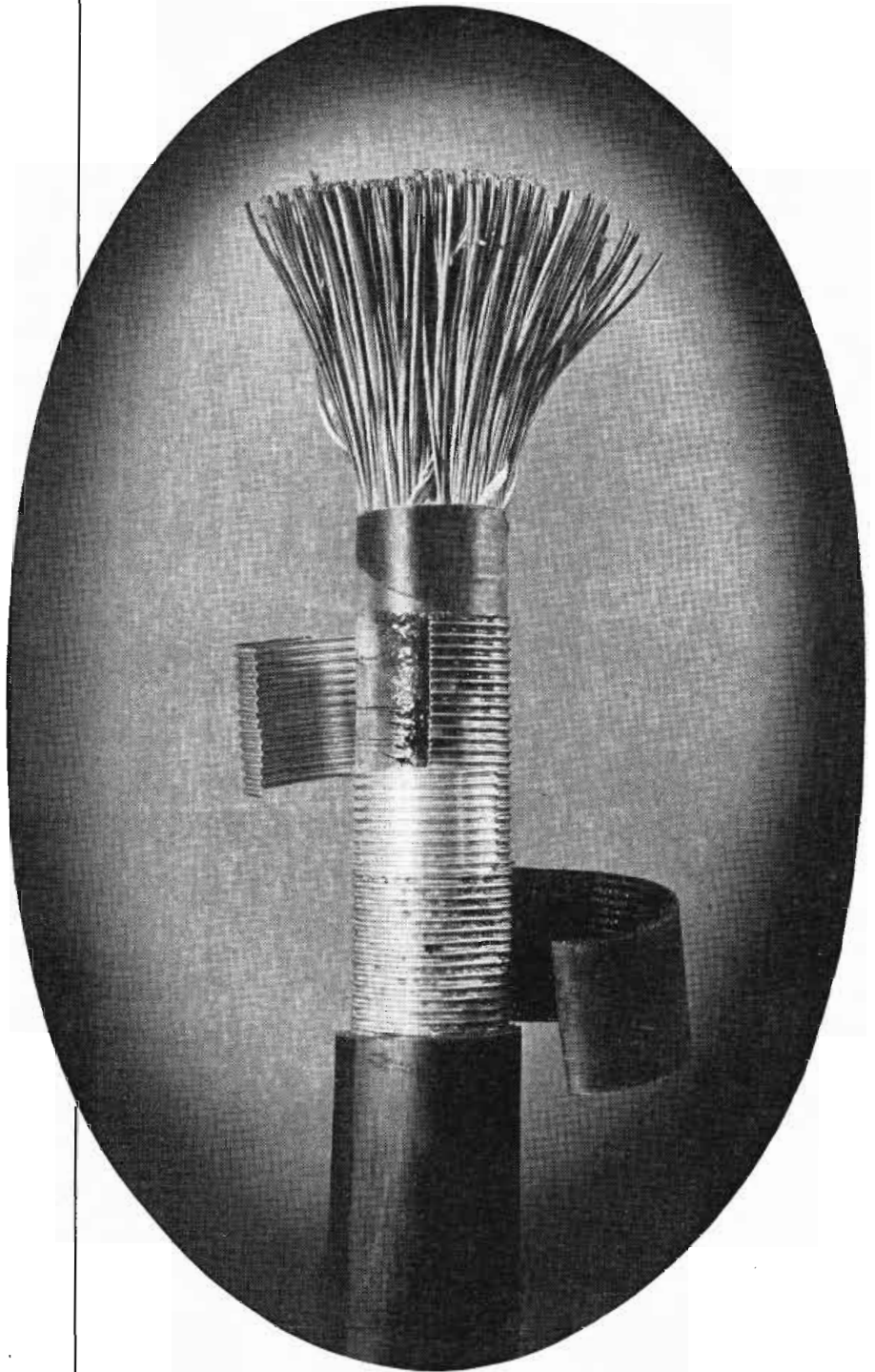
## NEW WORD ON TELEPHONE CABLES

Lead makes an excellent sheath for telephone cables—sixty years and thousands of miles in service have well proven that. But lead is useful in other ways—storage batteries and paint, to name only two. So the telephone industry shares the limited available supply with other claimants.

Before the war when there was no lead shortage, Bell Laboratories engineers sought to develop better and cheaper cable sheaths. An ideal sheath is strong, flexible, moisture-proof, durable and must meet specific electrical requirements. No single material had all those virtues, so thoughts turned to a composite sheath, each element of which should make a specific contribution to the whole.

Various materials and combinations were studied. Desirable combinations that satisfactorily met the laboratory tests were made up in experimental lengths, and spent the war years hung on pole lines and buried in the ground. After the war, with an unparalleled demand for cable and with lead in short supply, selection was made of a strong composite sheath of ALuminum and PolyETHylene. Now Western Electric is meeting a part of the Bell System's needs with "ALPETH" sheathed cable.

Meeting emergencies—whether they be storm, flood or shortage of materials—is a Bell System job in which the Laboratories are proud to take part.



## BELL TELEPHONE LABORATORIES



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

# NOW!

## .. LARGE PROJECTED PICTURE perfected by



# PROTELGRAM



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

### A VAST NEW MARKET OPPORTUNITY FOR MANUFACTURERS OF TELEVISION RECEIVERS

#### NOTE THESE 10 SIGNIFICANT FEATURES

- 1 Flat 16" x 12" non-reflecting picture provides fatigueless viewing from less than 5 feet up.
- 2 Wide-angle visibility - square corners.
- 3 True photographic black and white picture quality - no color distortion.
- 4 Compact unit - even fits table model cabinets.
- 5 Long-life, low-cost picture tube.
- 6 Standard chassis for 10" direct-viewing tube system can be easily adapted 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 power supply unit, making possible large-size home projection. More than ten years of exhaustive research led to the determination of the ideal system for reproducing a 525-line projected picture. The optical components were designed to produce perfected projection for a 16" x 12" image as 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.



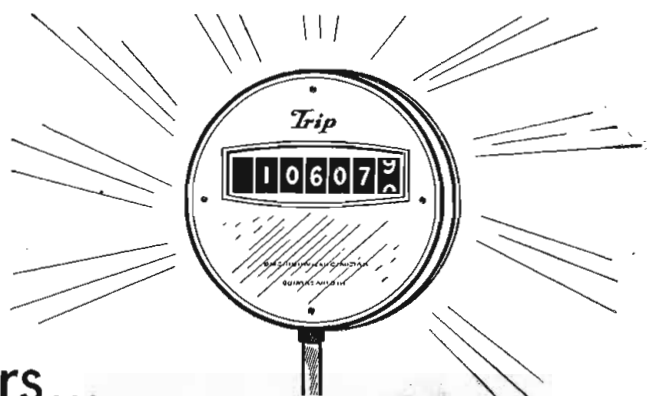
### PROTELGRAM IS PICTURE PERFECTION IN PROJECTION

## NORTH AMERICAN PHILIPS COMPANY, INC.

DEPT. TT-9 100 EAST 42nd STREET, NEW YORK 17, N. Y. ★ IN CANADA: PHILIPS INDUSTRIES LTD., 1203 PHILIPS SQUARE, MONTREAL

EXPORT REPRESENTATIVE: PHILIPS EXPORT CORPORATION, 100 EAST 42ND STREET, NEW YORK 17, N. Y.

If Recorders came  
with Mileage Meters...



Presto 6N would be ***MILES AHEAD***

Yes, day after day and year after year over 3,000 Presto 6N recorders are hard at work in broadcasting stations, recording studios, educational institutions and government agencies throughout the world.

6N recorders purchased ten years ago are performing as well today as when they were new. This outstanding record of the 6N recorder in action is proof again that Presto design is built for hard, continuous duty and Presto materials are the finest obtainable.

So when you're looking for a new recorder, remember: By actual test the best recorder for the most people is Old Faithful, the Presto 6N.



RECORDING CORPORATION, Paramus, New Jersey • Mailing Address: P. O. Box 500, Hackensack, N. J.

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

World's largest manufacturer of instantaneous sound recording equipment and discs

# NEW!...the Roto Ranger

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

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

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

**Simpson**  
INSTRUMENTS THAT STAY ACCURATE

SIMPSON ELECTRIC COMPANY  
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## Ranges

20,000 Ohms per Volt D.C., 1,000 Ohms per Volt A.C.  
Volts, A.C.: 2.5, 10, 50, 250, 1000, 5000  
Volts, D.C.: 2.5, 10, 50, 300, 1000, 5000  
Milliamperes, D.C.: 10, 100, 500  
Microamperes, D.C.: 100  
Amperes, D.C.: 10  
Output: 2.5, 10, 50, 250, 1000  
Ohms: 0-2000 (12 ohms center), 0-200,000 (1200 ohms center), 0-20 megohms (120,000 ohms center).  
Size: 12<sup>3</sup>/<sub>4</sub>" x 10<sup>1</sup>/<sub>8</sub>" x 5<sup>3</sup>/<sub>8</sub>"  
Weight: 8 lbs. 9 oz.  
Price, complete with test leads and 28-Page Operator's Manual..... \$69.85

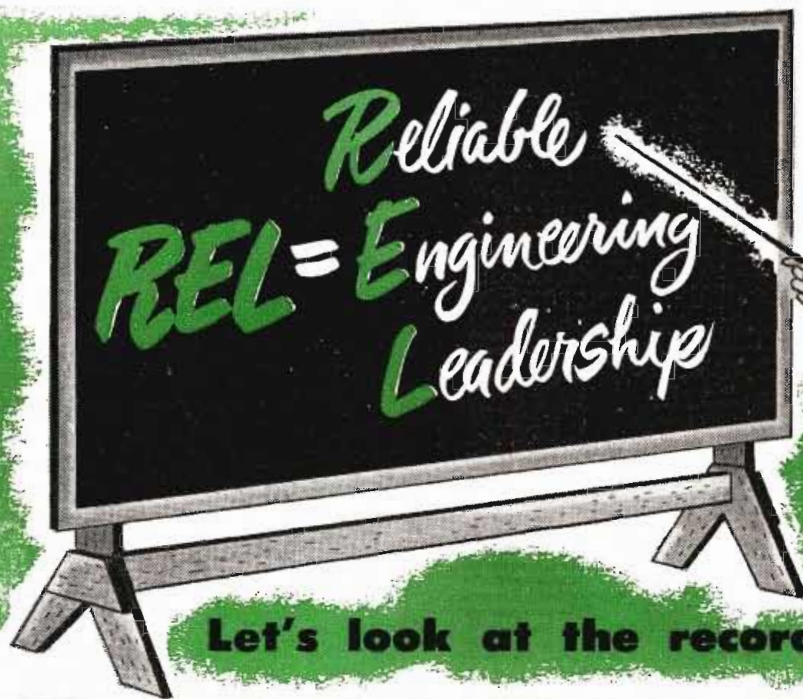
High voltage probe (25,000 volts) for TV, radar, x-ray and other high voltage tests, also available.

Ask your Jobber, or write for complete descriptive literature



A separate scale for every range—automatically!

Large 5 1/2" meter, with 18 separate, full length scales!



**Let's look at the record!**

**1935** **FIRST TO BUILD FM EQUIPMENT!**

REL manufactured the equipment used by Major Armstrong in the first public demonstrations of practical FM transmission.

**1939** **FIRST WITH COMMERCIAL FM!**

REL was the first manufacturer to produce and install commercial transmitter equipment for FM broadcasting.

**1939** **FIRST WITH AN FM RELAY!**

REL established the first studio to transmitter FM relay ever installed. This equipment is still functioning between Boston and Paxton, Mass., 43 miles airline over two ranges of hills.

**1940** **FIRST WITH 50 KW FM!**

REL engineered and built the first commercial FM transmitter rated at 50 KW output.

**1947** **FIRST WITH THE "QUADRILINE"!**

The "Quadriline" circuit structure, at one stroke, eliminated a host of expensive RF and mechanical construction problems at the 10 KW level.

**1947** **FIRST WITH AN FM NETWORK!**

REL transmitting and receiving equipment was used exclusively to establish the first FM-all-radio-linked network. This net covered a total distance of 445 miles with total radiated power of approximately 450 KW.

**1948** **FIRST WITH UHF STL!**

With the introduction of REL Model 694 STL equipment, the art and practice of FM broadcasting took another great stride forward free from the handicap of inadequate wire line facilities.

**1948** **FIRST WITH THE "SERRASOID" MODULATOR!**

Simultaneously with the introduction of high performance STL equipment REL announced the amazingly efficient and economical "Serrasoid Modulator."

**1948** **CONTINUOUS ENGINEERING LEADERSHIP!**

Another REL first is in the making. We can't release information now but you'll hear about it soon. Just remember the "80-80"—it's going to be big news for FM broadcasting.



**RADIO ENGINEERING LABS • INC**

35-54 36th STREET, LONG ISLAND CITY 1, N. Y.

# TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

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

**HOW SOON 475-910-MC TV?**—Prior to the Sept. 20 FCC hearing on this subject, there is speculation whether or not this band can be used within the next two years. In spite of the increased difficulty in covering a city with UHF, however, it is actually possible to have commercial operation within 1½ years, because field tests supplementing those already run could be finished by the end of 1948. Pressure on transmitting-tube engineers could produce suitable tubes, not as powerful as those used today, but giving sufficient output so that with extra high-gain transmitting antennas, cities having few skyscrapers can be covered.

If the range is limited, parabolic reflectors (less than 2 ft. in diameter) at receiving locations would yield gains of as much as 15 times that now obtained with single dipoles. Such antennas if rotatable at the receiver would also eliminate "ghosts". Manufacturers of TV transmitters could design such equipment before the end of 1949 if there was sufficient demand.

Most TV engineers believe about 35 channels are needed. With the present low bands added to this new band such a number could be attained.

**RESEARCH RUN RAMPANT**—One of the most far reaching research programs ever attempted, now proceeding under Government sponsorship, is responsible for the continued existence of dozens of war-born companies that never had to face the problem of competitive selling to the public. The plan is to run down every unusual effect ever discovered to see if it might fit in the defense picture somewhere. Doubtless many of the programs will lead to worthwhile solutions to problems of public interest.

But we view with misgivings the present trend toward requiring Uncle Sam's backing before anything is undertaken along this line. Government spending has

created a tax rate so high that private industry rarely can undertake the planned research it once did, without being subsidized. Programs of this sort are expensive in any case. But the present method of research operation seems to top all in this regard.

**EXPORTING TV XMITTERS AND SETS**—Already the RMA is laying plans to develop markets abroad for television transmitters and receivers, despite the hectic shortages at the moment existing inside U. S. A. In this new move some problems remain to be considered. In many foreign countries 50-cycle ac supply is going to require some redesigning of sets for export.

Great Britain also has her eye on TV exports, and if present BBC standards employing fewer than our 525 lines and also vertical polarization, are adopted in countries purchasing British equipment, certain U. S. modifications may be called for. At any rate now is the time to attempt worldwide standardization of TV specs.

**RADIO METHODS LEAD**—or are at the forefront in practically all military research programs. In any case of war emergency a situation will be created that so many technical workers will be required to build the projects already developed and "put on ice" for the time being, that much time will be lost training other thousands as to their operation and use. On the other hand one hears that any future war may be over in days or even hours!

All this indicates that a program for complete standardization of methods of construction of components and operating instructions must be put in effect now or the proposed technical advantages will never get a chance to be realized. Standardization might logically start with the minor accessories to the equipment, say cable types and terminal plugs, or similar items.

## TELEVISION RECEIVER SPECIFICATIONS . . . See Part 2

The first compilation of its kind in the history of the television industry, the television receiver specifications included as Part 2 in this issue is the industry's most complete and authentic tabulation of television receiver data on record. The specifications reveal many valuable statistics on receiver design, capacities, circuits, characteristics, etc. Look for your copy of the specifications chart in this issue.

# Report on the WORLD MARKET for RADIO

Prepared by STANLEY GERSTIN, Assistant Publisher, TELE-TECH

THE world market for radio and communication equipment exports from the United States is dwindling, but despite this fact an unusual opportunity lies ahead for advantageous capital investments for American industry. This is the opinion of Richards W. Cotton, engineer and industrialist and Anglo-American industries consultant.\*

The fact that foreign markets are closing down reflects the new role which radio products have assumed in national life. Considered a necessity for national defense, radio parts manufacturing is subject to the many restrictions placed upon priority metals by every foreign government. On the other hand, radio and communication equipment are classified as luxuries and as such are subject to the import regulations which give import priority to "essentials" such as food, clothing and certain industrial products.

An added obstacle to the development of export markets for radio products are the world monetary policies restricting the transfer of foreign capital to the United States in payment for goods accepted abroad. Limited foreign credit does not offer much relief since it is reserved for "essential" goods.

At the present time Great Britain is completely closed to American exports; the Argentine is also closed; Brazil, for instance, will not accept radios equipped with loudspeakers; Switzerland is completely open to American exports; the remaining markets of the world of interest to the radio industry are bound by restrictions of one kind or another which change weekly and which permit only limited imports.

At this time of writing, foreign import regulations of several countries will permit the United States to export to them limited quantities

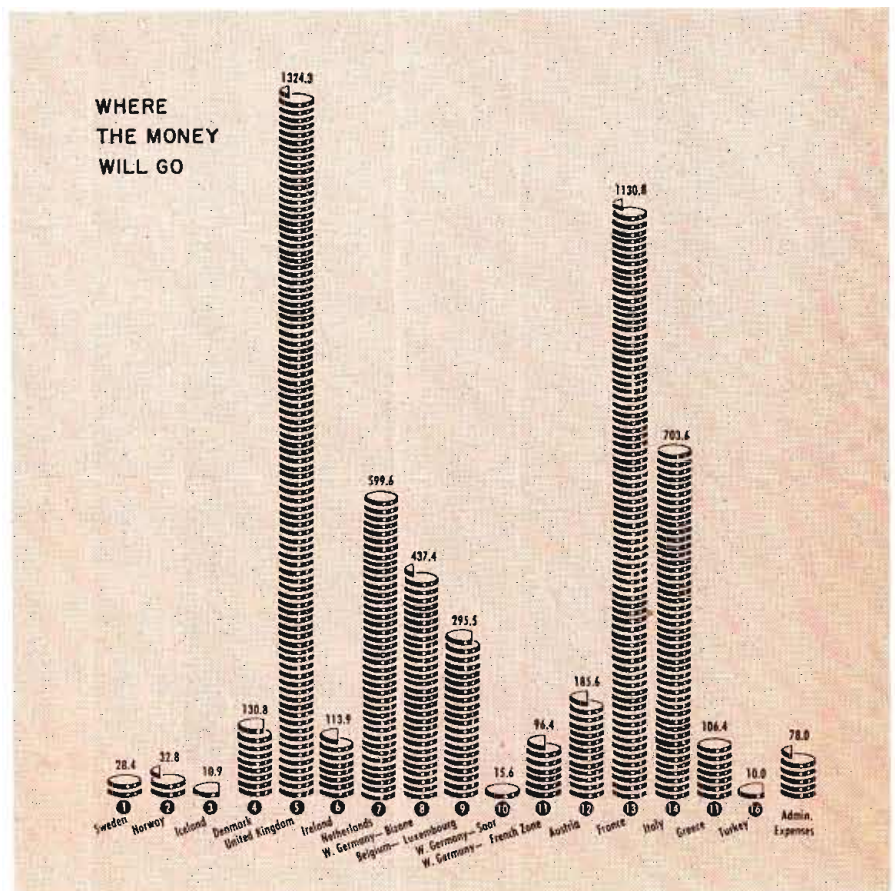
- American experts point to opportunities for venture capital abroad despite dwindling market overseas for export of radios and component parts.
- Marshall Plan insures dollar value of American investments in foreign manufacturing ventures but excludes radio products in aid plan.
- Opportunities abroad give radio industry something to think about.

of certain radio parts not now being made in those countries. Generally these exports are confined to radio components not in native production. Such imports serve to siphon off approximately eight percent of American output. Since this gener-

ally represents surplus from domestic stock piles, rather than specific production for foreign markets, it does not mean foreign trade in any real sense of the word for American radio manufacturers.

Despite these seemingly discour-

Allocation of funds for foreign aid is shown below. Chart prepared by Dun & Bradstreet, N. Y.



\*347 Madison Avenue, New York, N. Y.



# and COMMUNICATION Equipment

aging facts, the unusual opportunity which does exist for venture capital is in the construction and development of radio parts manufacturing within certain foreign countries. American investments can be made by providing know-how and by licensing patents in return for royal-

ties, or by engaging in actual manufacturing enterprises. Foreign countries generally welcome American investments, wholly owned or minority interests. In the opinion of experts experienced in foreign industrial activities, partial American ownership is recommended as the

safest and most profitable investment.

Radio manufacturing projects abroad are subject to the restrictions of government priorities on essential materials although materials not available domestically can be imported raw or as finished products, depending on regulations in force at the particular time in the particular country.

While the Marshall Plan does not provide a single dollar's worth of buying power to foreign countries for radio and communication equipment from this country, it does insure profits in dollars up to the value of the American investment for a period of 14 years at a cost to the investor of 1% per annum for this protection. Experience has shown it to be possible to realize complete return of the investment in much less time than the maximum 14 years of protective coverage by the United States Government.

In the opinion of world trade experts, there are a few stable countries where it would be advantageous to engage in foreign manufacturing of radio parts, and where the percent of return is more favorable than in the United States. Favorable markets are considered to be England (for export to other countries, such as Argentine), France, Italy, Sweden; South Africa; Australia; India and Indonesia; Mexico, Brazil and Argentine.

The greatest country of opportunity is considered to be India which is forcing domestic industrial development on a gigantic scale. This country has the natural wealth and raw products needed by the rest of the world in limitless quantities.

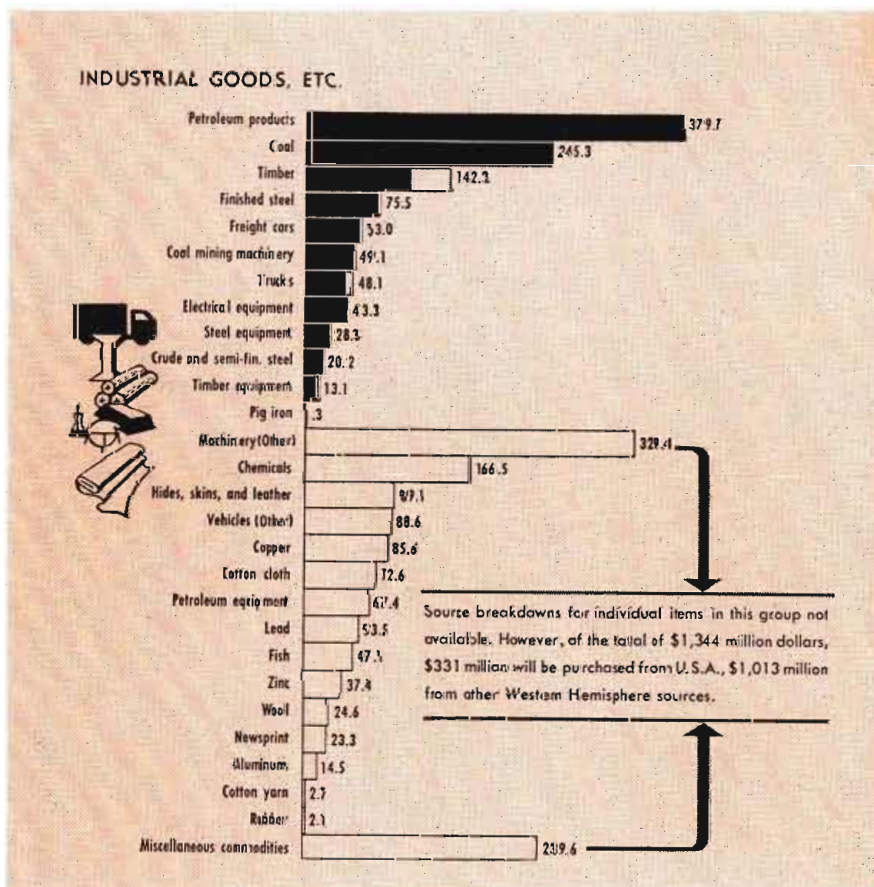
Although the general situation may appear somewhat confusing to American radio manufacturers curious about foreign markets for export or for foreign manufacturing ventures, the difficulties that exist serve to bring into sharp focus the nature of the opportunities abroad.

**Exports of U S. Radio Parts to Foreign Countries**  
(Typical list of component parts exported during April-May, 1948)

	Trans- mitting Tubes	Receiving Tubes	Capacitors For Radio Sets (Net)	Resistors For Radio Sets (Net)	Loud- speakers
Mexico	1,743	195,831	88,134	146,264	8,206
Brazil	1,048	302,637	245,017	346,237	60,099
Argentina	4,343	404,902	719,802	353,300	40,105
United Kingdom	593	4,004	none	6,250	none
Portugal	266	29,415	9,521	none	none
India	94	8,625	47,206	none	324

Compiled from U. S. Dept. of Commerce figures

Partial breakdown of industrial products (no radio) for foreign aid. ©Dun & Bradstreet



# Component Parts

## STANDARDIZATION

### What manufacturers say about need for uniformity of parts specifications

STANDARDIZATION of component parts is a goal towards which the industry has been striving for many years — this statement epitomizes the sentiment of an important group of the component parts manufacturers, and it reflects an interest on the part of the radio industry in reaching production efficiency through the use of standard specifications.

To the question of what has been achieved in the standardization of radio components, and what such standardization can mean in terms of production efficiency, lower manufacturing costs, uniform receiver performance and simplified maintenance, the editors of TELE-TECH present a round-up of comments from manufacturers who have responded to date to our inquiries.

for top radio executives to insist that engineering and commercial departments work with the proper committees of the Radio Manufacturers' Association to establish industry standards. If it is not done now, the next opportunity may be years away.

Here is an example of what can be accomplished. In one class of components, namely dry electrolytic condensers, there were more than 500 different types, ratings or sizes used as filters in the various radio sets made in a pre-war year. Chief engineers appear to agree that between 30 to 40 standard units will meet all filtering requirements in 95% of the chassis built.

Should something like 40 electrolytics be adopted as standard type filters, the manufacturers of these condensers can produce in larger quantities and in more fully mechanized departments, furnishing a more uniform product at lower cost. It is probable that metal encased units — with their longer life — can be made so economically that

### TIME TO SET INDUSTRY STANDARDS

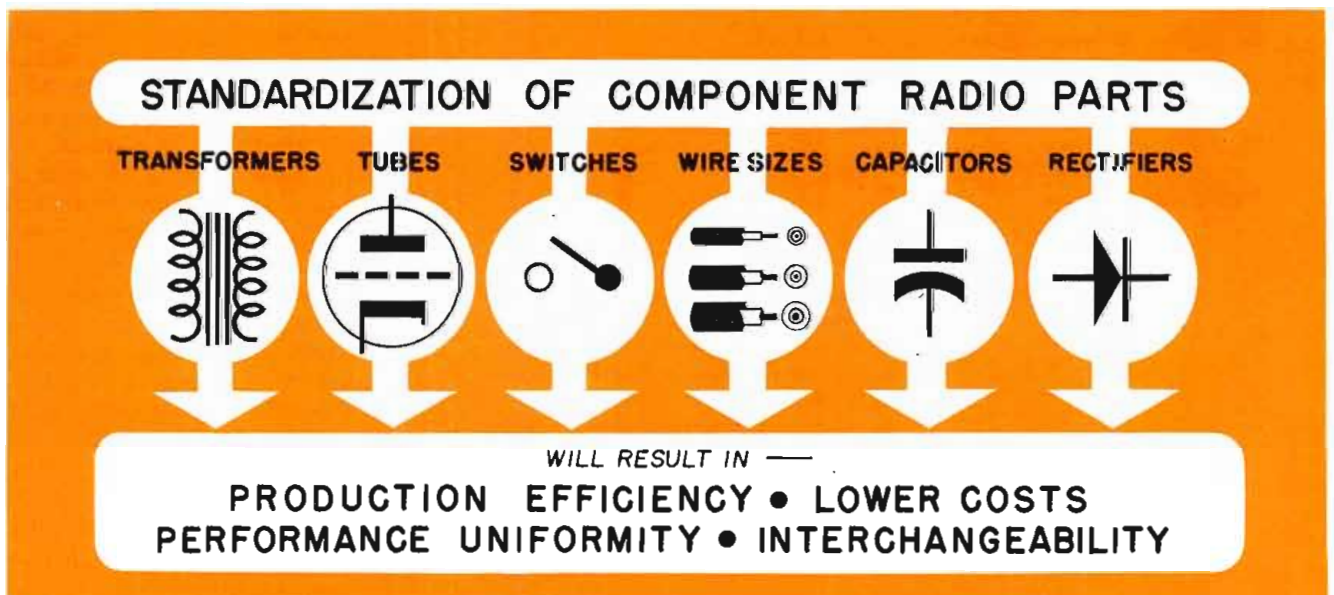
By *W. C. HARTER, Vice-President, Solar Mfg. Corp., North Bergen, N. J.*

Before the war, the variety of tubes, resistors, condensers, coils and hardware was limited only by the desires or fancies of hundreds of engineers and by the ability of parts makers to tool and tool and tool. Possibly this haphazard procedure was a necessary adjunct to pioneering and growth.

The automotive industry experi-

enced similar confusion in its early days, but with the advent of stability there also came standardization — of spark plugs, tire sizes, bumper heights, fan belts, sealed beam headlights, etc. Or maybe cooperative standardization helped to bring about industry stability.

Today—while postwar radio sets are still in the making—is the time



inferior cardboard enclosures can be eliminated as standards. Some production can be maintained in "off-season." Set manufacturers' and service department inventories can be kept lower than heretofore. The public obviously will benefit by cost reduction in both sets and service charges.

Although condensers are used as an example, similar benefits and economies will accrue to the industry and the public by elimination of unnecessary types of other components.

## STREAMLINE PRODUCTION; INCREASE EFFICIENCY

By P. M. DEELEY, Vice-President and Chief Engineer, Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Progress towards standardization of component parts seems to be somewhat stalemated at the present time. Years of effort have been put into attempts at standardization with relatively slow advance. While the RMA is steadily pushing standardization, the total effect of RMA's inroads on standardization cannot be considered of major significance in proportion to the overall problem.

The place to initiate standardization is with the radio set manufacturer. The greatest amount of progress, if any, can be made from his end. The receiver manufacturer demands an infinite variety of capacitors with different specifications which makes it almost impossible to achieve much in the way of standardization. We have in our files over 30,000 different specifications for electrolytic capacitors alone. This is due to receiver manufacturers' requirements for capacitors with minor differences in specifications and with his own name and parts numbers imprinted thereon. It appears at this time that the possibility of inducing receiver manufacturers to agree to a limited number of standardized capacitors to allow for interchangeability, as the automobile industry has done, seems remote at present.

Standardization efforts should stem from the user. Component manufacturers would gladly acquiesce to standards agreed upon. Any real progress in this direction would streamline production, increase efficiency and reduce component costs.

## RMA APPROVES 21 POSTWAR STANDARDS

REPORTS from the Radio Manufacturers Association issued in mid-June disclosed that 21 postwar engineering standards have been approved and recommended to the industry and that two score or more are under consideration. Most of the standards approved concern component parts and include electrical performance standards for TV transmitter channels and for AM transmitters, standards for audio facilities, disc home recorders, antenna-to-set transmission line for TV receivers, amplifiers, etc. A total of 154 tube-type designations have also been registered.

Following is a complete list of the 21 new standards:

Measurement of Direct Inter-electrode Capacitances . . . (*ET-109)	455 kc IF Transformer . . . . . (REC-114)
Electrical Performance Standards For Television Broadcast Transmitters Channels 1-13 (44 mc-216 mc) . . . . . (TR-104)	Disc Home Recording . . . . . (REC-105)
Amplifiers . . . . . (SE-101)	Color Coding . . . . . (REC-108)
Electrical Performance Standards For AM Broadcast Transmitters . . . . . (TR-101-A)	Intermediate Frequencies . . . . . (REC-109)
Audio Facilities For Radio Broadcasting Systems . . . . . (TR-105)	Antenna-To-Set Transmission Line For TV Receivers . . . . . (REC-110)
Dimensional Characteristics of Gaskets For Water-Cooled Transmitting Tubes . . . . . (*ET-104-A)	Chassis Pickup of Vehicular Receivers . . . . . (REC-111)
Designation System for Receiving Tubes . . . . . (*ET-110)	Tube-Type Designations . . . . . (*ET-108)
Vibrating Interrupters and Rectifiers For Auto Frequency 115 Cycles . . . . . (REC-113)	Class A Variable Air Capacitors . . . . . (REC-106)
	Ceramic Dielectric Capacitors . . . . . (REC-107)
	Dry Type Power Transformers for Radio Transmitters . . . . . (TR-102)
	Transmission Lines for FM Broadcast Transmitters (88-108 Mc/sec.) . . . . . (TR-103)
	Drive Pulleys . . . . . (REC-102-A)
	Recommended Standard for Export Receivers . . . . . (REC-112)

\*Formulated by JETEC and printed as Joint RMA-NEMA Standards

## QUANTITY OUTPUT TO REDUCE COSTS

By I. J. YOUNGBLOOD, Vice-President, Clarostat Mfg. Co., Inc., Brooklyn, N. Y.

We manufacture volume controls for over 120 radio set and sound equipment manufacturers. We run from one to eight controls with slightly different specifications at one time for each of these manufacturers. Over a period of one year, we run as many as 20 controls of different specifications for each of the larger manufacturers. The greatest variations are in the shaft and mounting bushing.

The shaft varies from  $\frac{1}{8}$  in. long with screw driver slot to 8 in. long with split knurled shaft, and many special requirements such as single flat, double flat, flat measuring .218 in. and flat measuring .156 in.

The bushing varies from the standard of the industry which is  $\frac{3}{8}$  in. diameter, 32 thread-per-inch,  $\frac{3}{8}$  in. long to  $\frac{1}{2}$  in. diameter, 24 thread-per-inch,  $2\frac{1}{2}$  in. long. Some bushings require a single or double flat for locating or locking. This is particularly true of automobile set controls.

The resistance element itself varies first in overall resistance value, second in tolerance, third in taper, fourth in hop off resistance of low-end and high-end, fifth in

location and value of taps, if taps are used, and sixth, some controls require a fixed minimum at either high or low end.

All of these variations occur on single controls without switch. Then, we have variations on dual controls, such as both controls operating on one shaft, each control operating separately on a concentric shaft arrangement; also, several switch combinations or arrangements.

Each of the above requirements must be properly priced and orders entered into the factory with complete specifications to insure controls meeting customers' requirements. There is no such thing as stocking parts except such parts as are used on all of the controls having the above variations. Therefore, few parts except molded housings, contact carriers, mounting nuts and terminals can be considered standard.

We realize that variations in the mechanical set up of the control are necessary to accommodate the many variations of chassis and cabinets prevailing in the radio set industry,

(Please turn to next page)

## COMPONENT PARTS STANDARDIZATION (Continued from preceding page)

and electrical variations are necessary to accommodate the many tube and circuit arrangements. In other words, the control must perform a specific function in a specific circuit and conform to mechanical shape and dimensions which will tie a specific chassis to a specific cabinet. In the past, a number of movements have been started to minimize the number of combinations of volume controls required. In each instance, the movement met with resistance due to the conditions outlined above.

We at Clarostat believe that it will always be necessary to make a number of control types and variations, but we also believe that the radio industry could, and should, continue to work at standardization, and we, along with other control manufacturers, will certainly appreciate any accomplishment in this direction.

Fixed resistors and other components mounted within the chassis whose functions are not as many and as complicated as those on volume controls can be used interchangeably in almost any chassis or cabinet arrangement. The problem here seems to be the production of smaller components for the small set.

The radio industry is fortunate in having so many component parts manufacturers who are willing to assume responsibility for development and production of the vital

parts of their products. It is almost as if the parts manufacturer considered himself a department of several set manufacturers. This is apparent when you consider that we have not frozen our designs so as to produce a large number of units at a minimum cost, but rather we have kept ourselves flexible in order to accommodate sudden and drastic changes.

Millions of dollars have been wasted in manpower and tools because of errors in judgment on the part of the set manufacturer. In many cases, the parts manufacturer has been left holding the bag. This can continue just as long as the ultimate customer is willing to pay the bill, and the parts manufacturer receives sufficient compensation to cover cost and make a little profit. The only way we can reduce prices is by reducing manufacturing and selling cost. One way to do this is to manufacture large quantities of identical units, or at least, units which are very similar.

If set manufacturers merely try to drive prices down, we believe that the situation similar to that in the automobile industry may develop, that is, the set manufacturers will eventually have to subsidize and take over component manufacturers in order to insure a suitable source of supply. We believe this would be more costly in the end than the maintenance of numerous independent sources.

tubular capacitors, particularly in the lower capacitance values since they were all the same size. Unfortunately, however, Company A's standards are not the same as Company B's standards, and each will have his own special types of units. These units are required by the specific circuit requirements of each company's receiver.

This condition is serious, but is not the most serious condition that exists in the capacitor industry today. The biggest problem which faces the capacitor manufacturer is the special marking required by each customer. As soon as any customer insists that the capacitors carry his specific part number or special type of marking, it has become a special capacitor inasmuch as it is no longer usable by any other manufacturer. This practice precludes the possibility of coordinating production and lumping all manufacturing of capacitors into a single line, but requires that each unit, regardless of whether capacitance, voltage rating, and tolerance are identical, be kept in its own line. It means that each order must be scheduled for the particular customer and his specific part number, and it is impossible to either stockpile these units or to manufacture a number of capacitors and then ship to the customers as they require them regardless of their special markings.

We have tried repeatedly to obtain permission from our customers to eliminate their part numbers, and seldom, if ever, have we been able to obtain permission to do so except during the period immediately following the war when the supply of capacitors was so short that our customers were willing to accept anything as long as they had capacitance that would withstand the voltage.

Now that the supply of capacitors exceeds the demand, each customer is doing everything possible to reduce his overall cost. If the use of a special capacitor or any other special component will reduce his overall cost, that component will be used regardless of the fact that it is special.

The situation is further complicated by the fact that the size of radio sets has been drastically reduced with the advent of miniature size tubes and other miniature components. Again each manufacturer has established his own sizes, his

(Continued on page 78)

## CUSTOMERS' MARKINGS; MARGINAL PRODUCERS

By LOUIS KAHN, Assistant Chief Engineer, Aerovox Corporation,  
New Bedford, Mass.

Standardization of components has been a goal toward which we have been striving for many, many years. During the war, as you know, an attempt was made by the Army and Navy to standardize on parts. We took an active part in the setting up of capacitor standards, and at the cessation of hostilities we immediately cooperated with the other members of the capacitor industry and the radio industry in setting up tentative RMA standards. I believe that today we are a long way from large-scale use of standardized components.

By this I do not mean that it is not wise or desirable to continue everyone's efforts along the lines of standardization. I should like to

point out, however, that there are certain practical difficulties which in my opinion will preclude extensive standardization, although I believe that some benefits may be obtained if the program is continued.

In the main, I believe that the larger radio manufacturers have standardized on capacitors as well as other components in their own organizations. A number of these have gone so far as to issue standard lists of components and are insisting that their design engineers use these in all new designs. Each individual company has reduced the number of components that they require to a minimum. Moreover, several companies have standardized on single voltage ratings of

# TV Circuits Cause Interference

**Radio reception marred by video and scanning circuits; RMA engineering report, issued by I. J. Kaar, Chairman, Committee on TV Receivers, recommends improved design**

CERTAIN forms of radio interference caused by television receivers through their video and scanning circuits have been studied with the object of eliminating this condition. In order that television not provoke an unfavorable public reputation, it is highly desirable that television receivers be designed to have reasonably low interference. Simple precautions in the design stage can often accomplish the desired result with a minimum expense. The following are suggestions towards this end.

The video spectrum normally covers the range of frequencies from 60 cps to some 4,500 kc per second. Since the range from 10 kc to 4,500 kc is coincident with those frequencies used in radio communication and radio broadcast, it is to be expected that wiring and components in the television receiver which carry video currents may possibly radiate or produce induction fields of sufficient strength to cause interference to other services employing radio frequencies in this spectrum.

Such interference has been observed. The interference in the broadcast band of 540 kc to 1,600 kc is of particular importance because receivers for this band may be located in an adjacent room in an adjoining apartment in the same building so that possibly only a few feet may separate the broadcast and the television receivers. The video interference usually sounds quite "mushy" and makes itself evident as a noisy background of variable intensity riding along with the broadcast program. The intensity may be so severe in some cases as almost to obliterate completely weak broadcast signals. In addition

to the "mush" there may be "birdies" or "tweets" caused by more or less steady frequency components in the video signal beating with the carrier frequencies of broadcast transmitters. While not of importance to broadcast receivers, a third type of interference may be found at 4,500 kc in a band used at airports and for some fixed and mobile services. This frequency is found in video circuits as a result of detection of the television sound carrier by the television picture second detector since the difference between the picture and sound carriers is 4,500 kc. This 4,500 kc signal will be frequency modulated by the television sound signal and may be readily identified and received by using slope detection in a standard AM receiver tunable to 4,500 kc.

That this form of interference may be serious was verified in one instance at least where the 4,500 kc signal interfered with airport operations at an airport located over a mile from the offending receiver. An examination of the receiver revealed that the installation was a "custom-built" one wherein the video frequency conductor from the last video amplifier to the cathode ray tube was over ten feet in length and unshielded. The situation was corrected by the use of suitable shielding.

In general, video interference can be reduced by observing the precaution in design of using short connecting wires shielded by running them in fairly close proximity to conductors at rf ground potential. A "brute force" method would be to enclose the whole receiver in a cabinet having a screen shield built completely covering its inner surface. Screening of course cannot be

put over the face of the picture tube so that some radiation occurs through the face of this tube. In an experimental receiver the residual interference was further reduced by employing a picture tube having a special conductive but translucent coating applied to its face and grounding the coating to the chassis.

The scanning systems employed in television receivers develop pulse-type and sawtooth-type waves having fairly steep decay characteristics (short-time decay). An analysis of the frequency spectrum reveals the presence of fairly strong harmonics of the line (horizontal) and field (vertical) frequencies. The harmonics of the field frequency, being harmonics of 60 cps, are ordinarily not bothersome at radio frequencies because the amplitude usually falls off inversely with the order of the harmonic. This is not true in the case of the horizontal frequency because the fundamental is 15,750 cps and is, therefore, itself a radio frequency. Harmonics of sufficient amplitude to cause interference to broadcast service have been observed. This type of interference makes itself evident in the form of "birdies" or "tweets" caused by the harmonics beating with the broadcast station carriers.

This type of interference is quite annoying and does not change in intensity with picture content, but may change in intensity if the size and linearity controls are adjusted or if a person walks up to a television receiver and changes the radiated field intensity by an antenna effect. A satisfactory cure for this type of interference has been found by the employment of grounded shielding. The components requiring shielding usually are:

1. The sweep yoke.
2. The high voltage rectifier system for the picture tube second anode if the h.v. supply is derived by the "kick" across the horizontal output transformer.
3. The horizontal sweep amplifier tube, and
4. The horizontal sweep damping tube, if employed.

Usually a single shield can enclose all of these components so that the shield may be made to serve two purposes, namely:

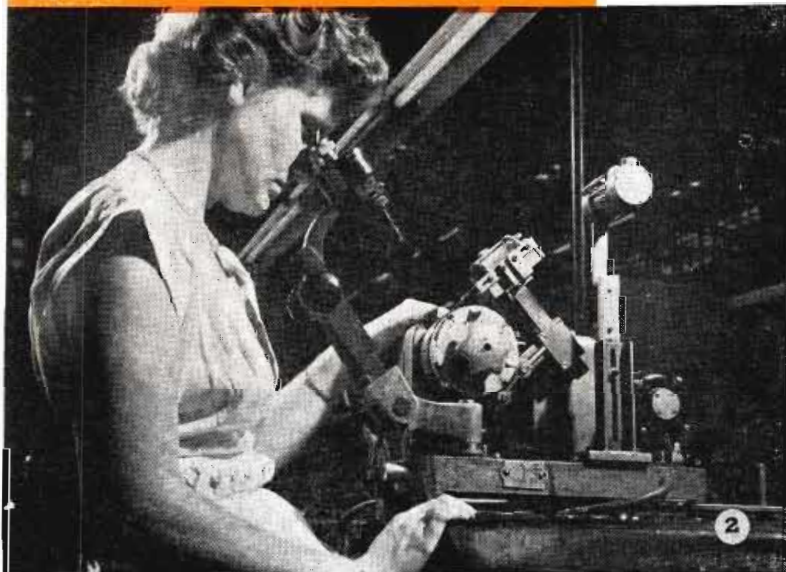
- a. To shield persons from coming into contact with high voltages as a safety measure, and
- b. To shield against radiating interference.

# *Speaker Production Technics*

**Quality control assured by organization of manufacturing and assembly operations in Western Electric Burlington, N. C., plant**

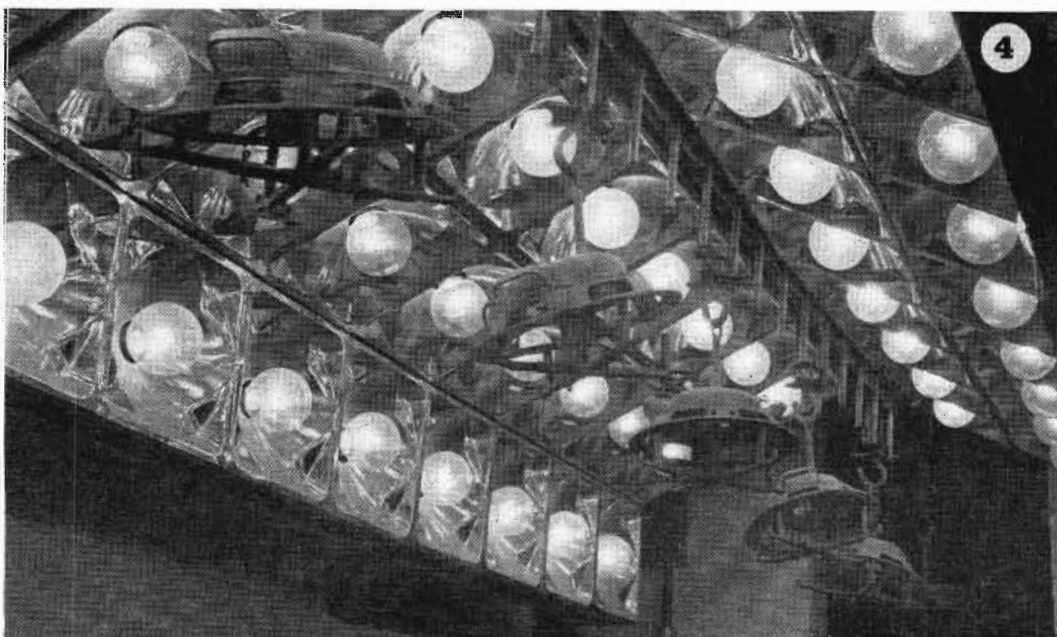


**Fig. 1:** Frame of Western Electric 756A loudspeaker is mounted in assembly jig at the company's Burlington, North Carolina, plant. Power tool is suspended by a spring mounting over the work area, expediting and facilitating the operation



**Fig. 2:** Voice coil quality is checked carefully before installation in the WE 756A loudspeaker. The operator examines the coil through a microscope during winding operation

**Fig. 3:** Completely assembled, these Western Electric speakers are shown coming off the production line at the Burlington plant. Every loudspeaker undergoes a careful final inspection before it is shipped from the plant



**Fig. 4:** After speaker frames have been sprayed with paint, they are carried on conveyor beneath infra-red heat lamps which bake the enamel and produce a durable finish



Fig. 5: Voice coil of Western Electric's 713 receiver, a component of the 757A loudspeaker, is attached to diaphragm at Burlington plant. As in winding of voice coil for the 756A, assembly is aided by use of high power microscope

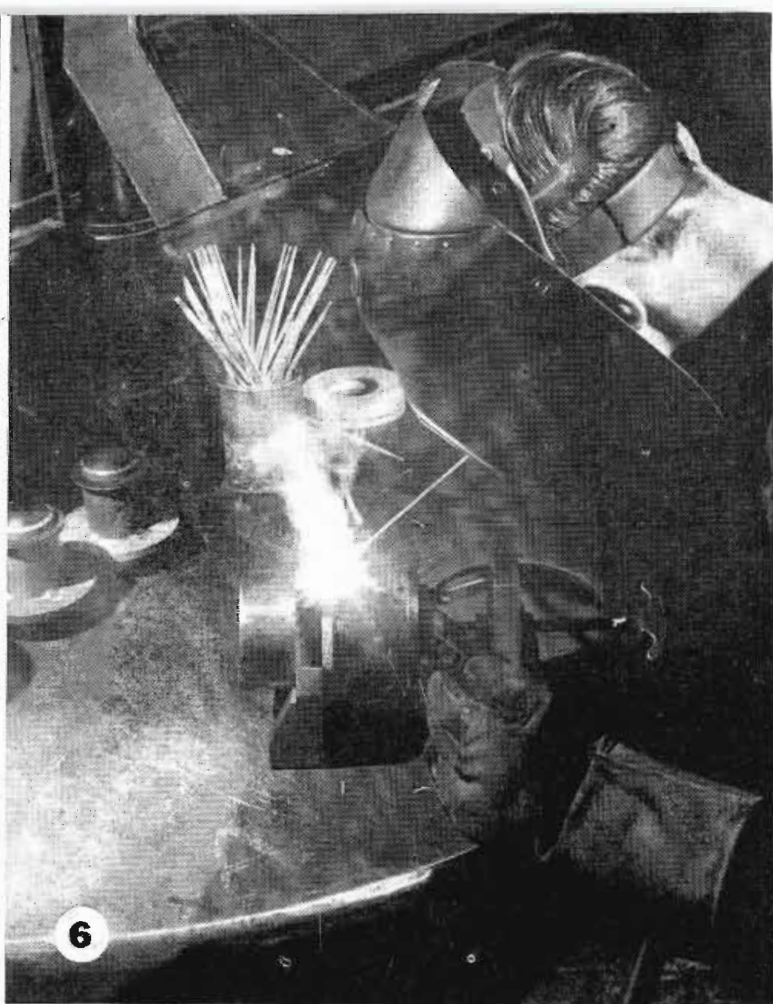


Fig. 6: Welding of the magnet assembly is one operation in the assembly of the 713C unit, a specially designed loudspeaker receiver. When coupled with Western Electric's 757A, its frequency range is 800 cycles to 15 kc

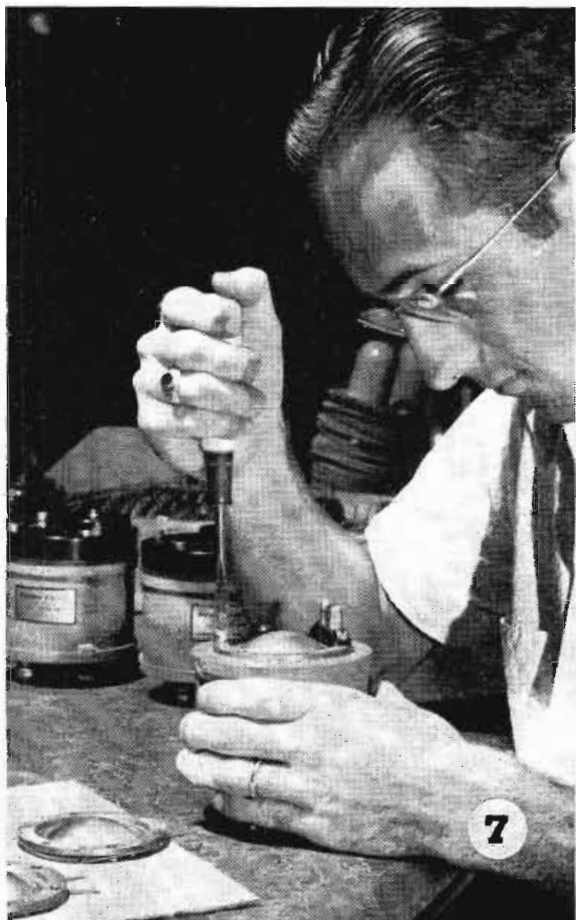
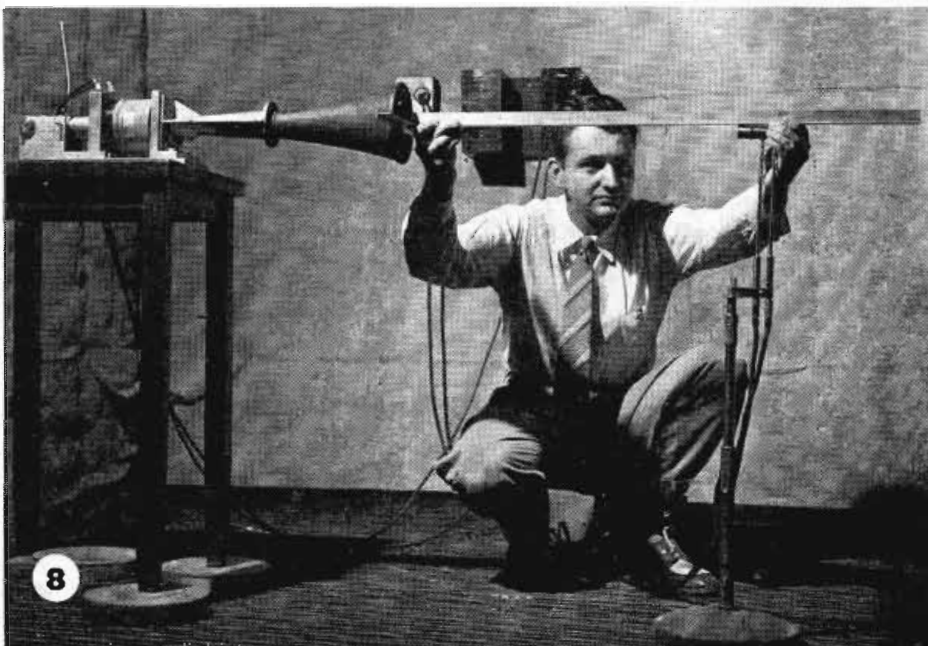


Fig. 7: Final assembly of Western Electric 713C receivers at the Burlington plant. These versatile units will be used as part of 757A loudspeaker installations

Fig. 8: Test of a 713C receiver under dynamic conditions. Test equipment must be positioned accurately in order to facilitate authentic and uniform results

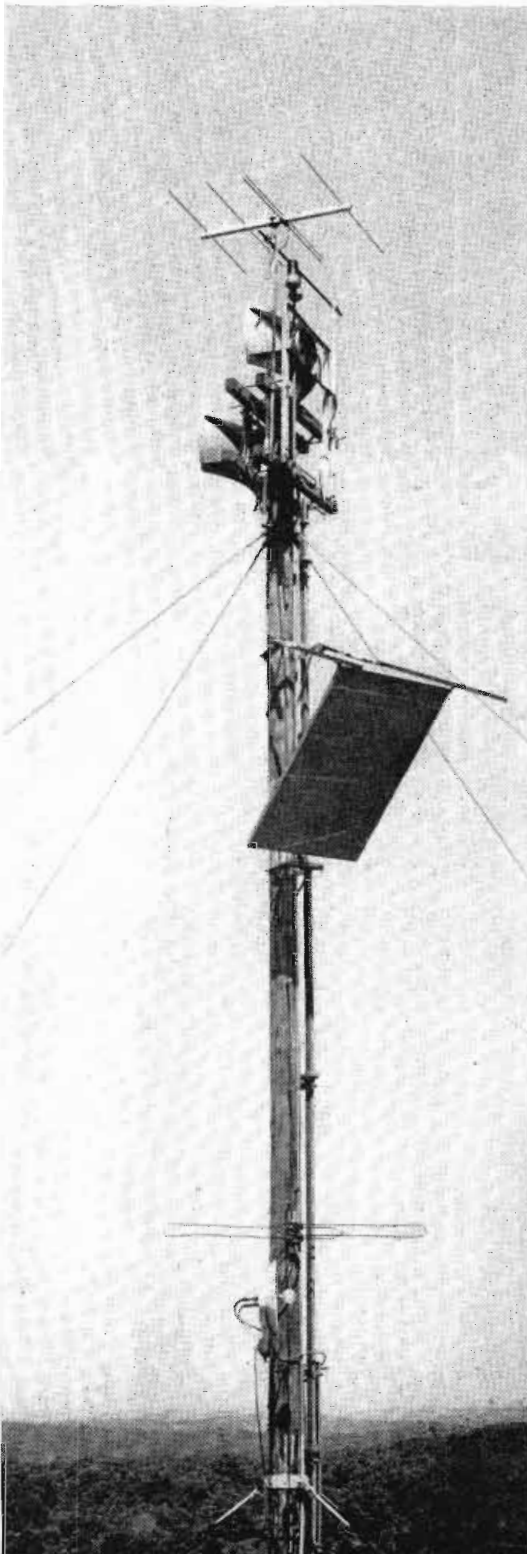


## RECEIVER ASSEMBLY AND TESTING

# Indirect Microwave Relay System

**Point to point passive repeater system using flat surface reflectors requiring no external power source facilitates relays over obstacles from remote pickup to transmitter**

By **ROBERT R. WAKEMAN**, Research Engineer, Allen B. DuMont Labs, Passaic, N. J.



**I**DEAL conditions for transmitting a signal by microwave from a remote point of pickup to the station transmitter seldom exist. The problem is usually one of trying to make the "shot" directly from the building in which the remote event is occurring or to "pipe" video to a more desirable transmitting area, or to use a double hop relay. The first results in an inferior picture due to poor propagation conditions; the second presents all sorts of cable problems; the third possibility is expensive and results in degradation of the picture due to additional equipment involved.

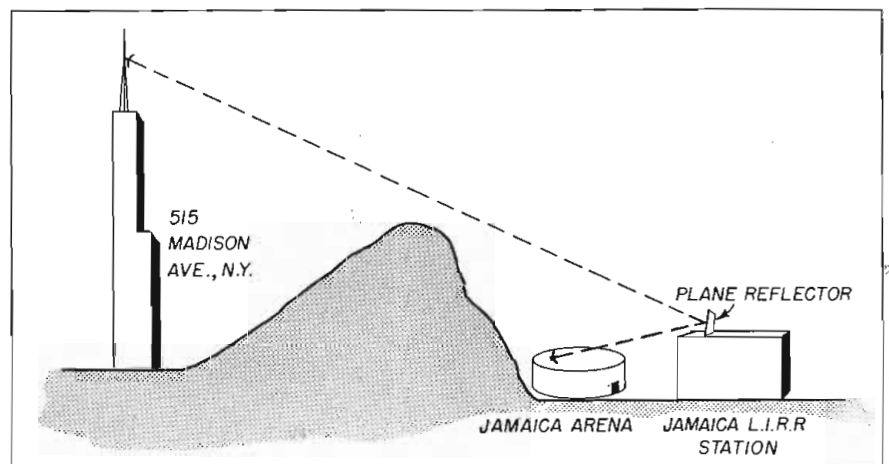
A satisfactory solution is to use a simple plane, or flat, reflector as a passive repeater (one requiring no external power source, but activated solely by the incoming signal) for point-to-point microwave relaying as illustrated in the several drawings and photograph.

While not a new idea, application of this relay method to television has been largely overlooked. One type of repeater which has been employed in microwave work consists of a pair of parabolic reflectors, identical to those used at

the microwave transmitter and receiver, but placed at the intermediate point. These are directed respectively toward the transmitter and receiver and coupled together with a section of waveguide. This system has been employed and found to work quite satisfactorily, the primary problem being the realization of a good impedance match between the two reflectors and the waveguide over the band of frequencies involved. A secondary problem arises from the condensation of moisture within the guide itself occasionally resulting in very high attenuation and selective absorption.

An extremely simple, yet highly effective passive repeater consists of a plane reflector. Here a single "mirror" is used at an elevated point to intercept the wave from the lower transmitting dish and redirect it to the receiving dish. Obviously, the mirror need not be any larger than the dishes. If it were, it would merely succeed in reflecting energy which would never strike the receiving antenna anyway. In other words, the only portion of the radiated energy which is effective is that which remains

Fig. 1: Photo shows reflector installation. Drawing shows relay to transmit over hilltop





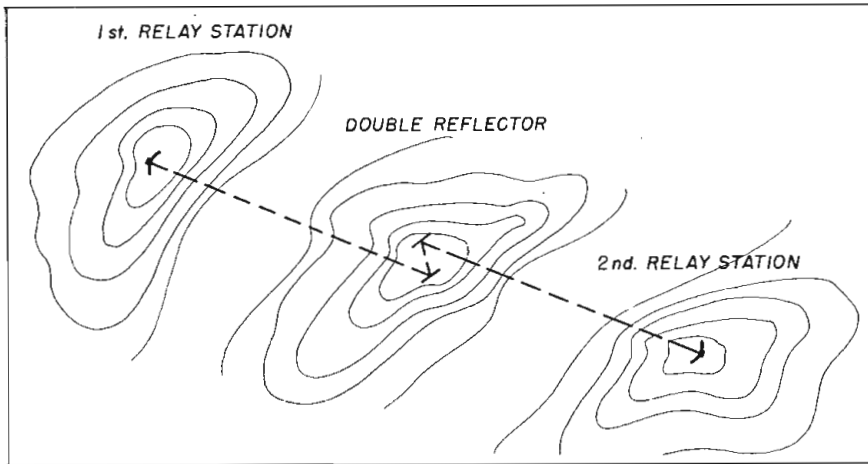


Fig. 2: Double reflectors are used between relay stations not exactly in line of sight

in a cylinder terminated by the two dishes. If the mirror is viewed along either of the radiation paths, it must, therefore, present a component of area (perpendicular to this path), at least as large as that of the dishes used, but nothing is gained by making it larger than this.

The conductivity of the mirror surface is not important at these frequencies where skin effect is so pronounced and reflection is essentially complete from any metallic surface. In general, the increased efficiency resulting from a silver-plated surface over that of a sheet of aluminum is negligible. Furthermore, the surface need not be optically smooth, since we are reflecting waves of the order of centimeters rather than millimicrons, and small scratches, imperfections and screw heads are of no consequence.

Although the smoothness of the surface is not at all critical, the

planeness is extremely so. Also, the deviation from a perfectly plane mirror results in the system's working better in one direction than the other. For example: if essentially parallel rays impinge upon the mirror surface which is convex to the extent that rays leaving the extremities form an angle of  $3^\circ$  with those leaving the center of the mirror, no serious attenuation will result, provided the mirror is located close to the receiving dish. However, the same mirror surface conditions may prove disastrous if several miles separate the mirror and receiver.

For most applications, a sheet of  $\frac{1}{8}$  in. aluminum properly reinforced with extruded aluminum angle will prove entirely satisfactory. A simple calculation will show that iron angle cannot be used with sheet aluminum as the thermal bimetallic effect will produce distortions in the surface far in excess of those permissible for dependable operation.

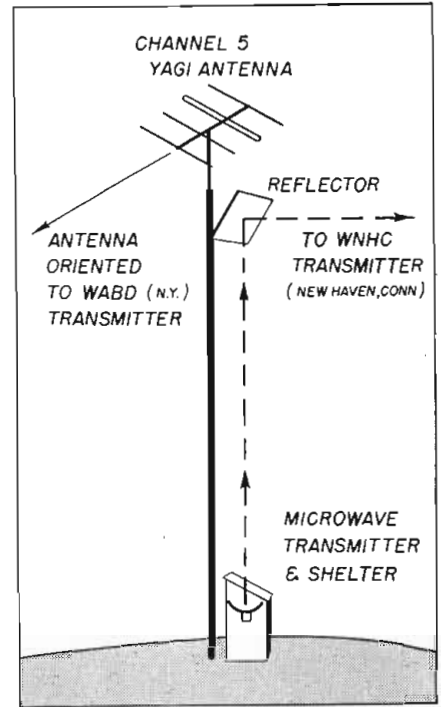


Fig. 4: Reflector permits installing relay transmitter on ground for easy servicing

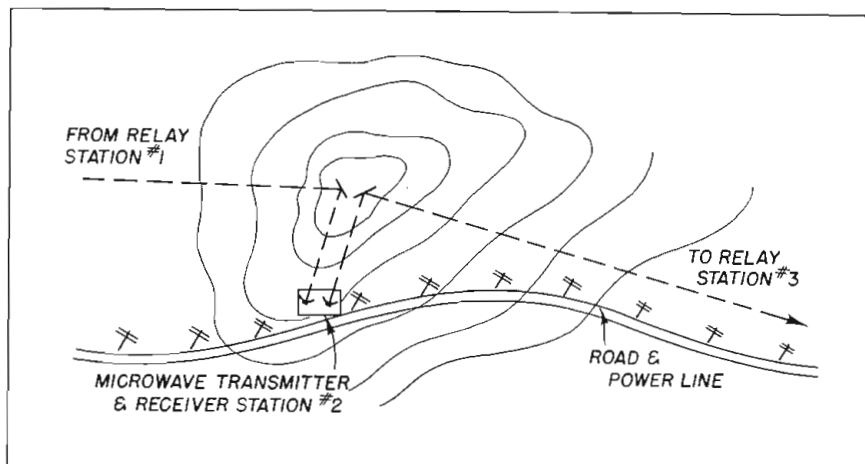
Over very long "reflector to receiver" paths it may be desirable to use a sheet of plate glass with its surface silvered like an optical mirror but so that the waves strike the silvered surface directly without having to pass through the glass. This is in the interest of providing a more perfect plane, rather than a smoother surface.

In cases where the transmitting and receiving sites subtend an angle approaching  $180^\circ$  at the intermediate point, the requirements that the mirror present a component of surface equal to the dish area along both paths results in an impractically large mirror. Fig. 2 illustrates such a condition and shows how two reasonably sized mirrors can be used instead of a single large one. Obviously the combined area of the two mirrors may be much less than that of a single one since the latter becomes infinite as the angle approaches  $180^\circ$ .

Because an absolutely clear propagation path (imperative at relay frequencies) is not required at television broadcast frequencies, it may be found that the broadcast transmitter itself is not located at the most desirable point for picking up remotes from all directions. Should a very tall building, commanding a clear view of a considerable distance in all directions exist within a few miles of the broadcast transmitter, it is possible to install a

(Continued on page 106)

Fig. 3: Passive repeaters on hilltop relay signal through booster station; obviate power lines



# Variable

By **RALPH G. STOKES**,

*Crystal Section,  
Naval Research Lab., Washington, D. C.*

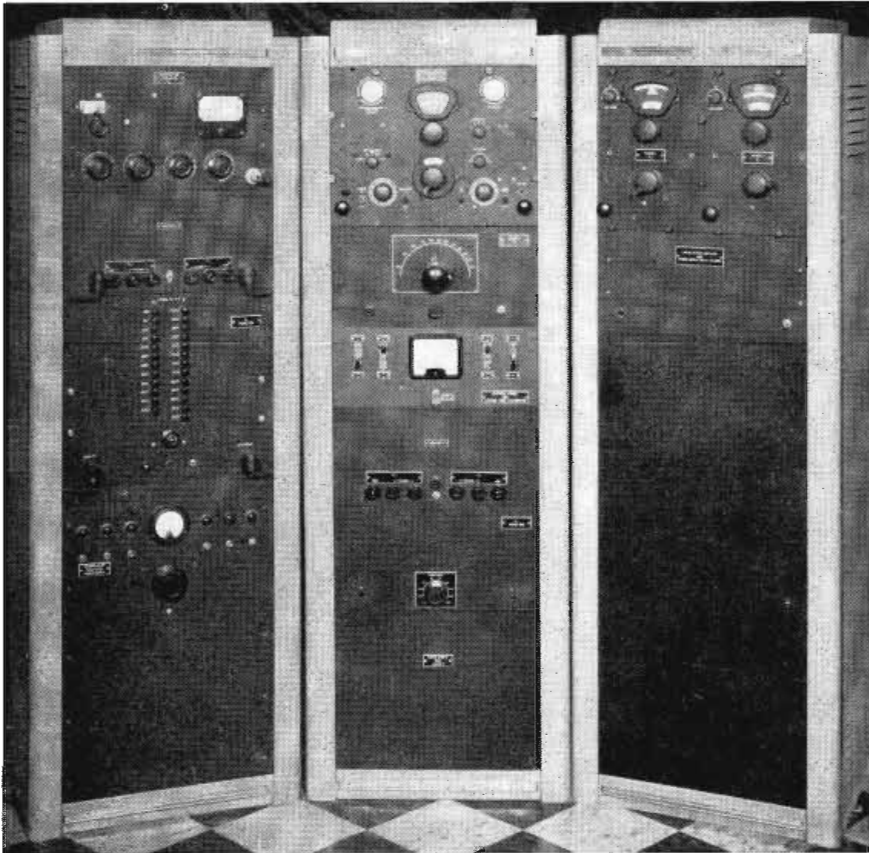


Fig. 1: Rack (left) has interpolation oscillator, first modulator, 40 kc to 1 mc generator, power supply. Center rack: filters Nos. 1 and 2, control panel, second modulator, 1-10 mc decade. Right rack: filters 3 and 4 and the output amplifier

**M**ANY problems in present day research require an accurate frequency source. Such problems include the accurate measurement of frequencies by the heterodyne method, calibrating secondary frequency standards, driving radio frequency bridges, measuring the resonant frequency of quartz crystals, and making ultrasonic diffraction measurements. The specific application of the equipment described is that of measuring the frequency characteristics of various types and sizes of piezoelectric crystals.

Because of the high "Q" of most of the crystals measured, the oscillator used in making the measurements must have extremely high stability and incremental precision. In addition it must have negligible distortion because it can be shown that the presence of harmonics and sideband components of any amplitude greater than 1% may result in erroneous evaluation of the frequency constants and elements of the crystal equivalent circuit. Furthermore, in order to accommodate

a wide variety of crystal sizes and to permit the measurement of harmonic modes, the equipment must cover the range from approximately 15 kc to 10 mc.

This article describes a signal generator which will fulfill all the above requirements. It covers the frequency range from 15 kc to 10 mc continuously variable, and is accurate to within one cycle of the primary standard of frequency. All spurious components, including sidebands, are down at least 40 db from the desired frequency. The output voltage is variable up to 3v. In a fairly constant temperature room the stability is better than 0.1 cycle/day in reference to the primary standard. The frequency can be varied in increments as small as 0.2 cycle.

Most modern research laboratories have on hand either a primary standard of frequency or a good secondary standard of frequency. Since statements concerning frequency accuracy and stability are usually made in reference to the type of standard that is avail-

able, it would be convenient to use one of the above mentioned devices directly as much as possible.

It is a fairly simple matter to produce a great number of frequencies with the accuracy of the primary standard by multiplication, division, addition, and subtraction of the primary standard frequency. However, the number of these combinations necessary to produce one-cycle steps is quite large and always leaves some combination of frequencies that is impossible to separate electrically, giving a "muddy" output waveform.

The use of an interpolation oscillator covering a narrow frequency range makes it possible to reduce the number of combinations necessary to a mere handful. By selecting a particular frequency range and restricting the range to a factor of two, it becomes possible to construct an interpolation oscillator with excellent characteristics. The final design makes use of 35 fixed frequencies derived from the primary standard and having the accuracy of the primary standard, along with an interpolation oscillator covering the frequency range from 20 kc to 40 kc. The equipment is included in three standard relay racks as shown in Fig. 1.

The manner in which these units are related is shown in the functional block diagram, Fig. 3. Simply stated, the frequencies from 15 kc to 1040 kc are obtained by mixing two frequencies and selecting either the sum or difference frequency with variable tuned filters, and the remaining portion of the desired range (1 mc to 10 mc) is obtained by adding another fixed frequency in the second modulator and again selecting the desired sideband with another set of variable filters. The output of the interpolation oscillator  $F_1$ , and the output of the 40 kc to one mc fixed frequency generator  $F_2$ , are mixed in the first modulator. The result of the modulation is selected and filtered by variable filters 1 or 2 to produce frequency  $F_3$ . This gives complete coverage

# Frequency Standard Signal Generator

**Designed for measuring piezoelectric crystal characteristics, equipment produces frequencies between 15 kc and 10 mc with accuracy to one cycle anywhere in range**

of the range from 15 kc to 1040 kc. Frequencies from 1040 kc to 10 mc are obtained simply by mixing  $F_3$  with some frequency out of the 1 mc to 10 mc decade  $F_1$ , in the second modulator and filtering with the variable filters 3 or 4.

When the second modulation occurs, the interpolation frequency is  $F_1 = F_2$  or  $F_3$ , and therefore the range from 15 kc to 10 mc is covered continuously. A single pair of output terminals can be connected to the output of either the first or the second modulation by means of a telephone type switch. An auxiliary cathode follower bank called the output amplifier is automatically switched in when the range from 1 mc to 10 mc is used.

Probably the most important unit of the equipment is the interpolation oscillator. Its purpose is to add or subtract any frequency between 20 kc to 40 kc to or from any one of the 25 fixed frequencies from 40 kc to 1 mc, in order to produce a continuously variable coverage; e. g.:

87,393 cycles = 120,000 cycles  
-32,607 cycles.

102,589 cycles = 80,000 cycles  
+22,589 cycles.

The requirements of an interpolation oscillator are stable fre-

quency, reproducible frequency and fine incremental control. In view of the above requirements, the frequency range usually selected for the oscillator is from 0.0 to 5,000 cycles. When such an oscillator is used, trouble is usually experienced in obtaining a "clean" output because of the close spacing of the sidebands. The range of 20 kc to 40 kc was decided upon after measuring the response characteristics of the first filters. This curve is shown in Fig. 2, and shows that the sideband response is down approximately 75 db when 20 kc is used to modulate 500 kc.

## Oscillated from Sound Unit

An oscillator covering this frequency range was available from a sound analyzing unit,<sup>1</sup> and proved to have amazing characteristics. Tests show that this oscillator has a stability, when in a fairly constant temperature room, almost equal to that of the primary standard of frequency. The frequency does not drift more than one cycle in reference to the primary standard over a period of weeks. The drift during the warmup period

L. H. Terpening, Inc., New York, N. Y.

does not exceed two cycles. The frequency can be reset to a predetermined value with an error not exceeding 0.1 cycle. One division of the main tuning dial is approximately 0.5 cycle, and does not exceed approximately 0.75 cycles anywhere in the band covered.

Fig. 4 shows the block diagram of this oscillator. It is of the two-stage, resistance-coupled type. An L-C circuit in the grid of the input stage is the frequency determining portion of the circuit. The range is covered in overlapping steps by changing both coil and capacitor, and the fine tuning is accomplished by means of a General Radio precision capacitor with an arbitrary calibration. The output voltage is well isolated from the oscillator tank and is kept substantially constant by changing the amount of feedback voltage when different coils and capacitors are selected. At present the oscillator is calibrated against the primary standard at 100-cycle intervals and a calibration chart is used.

The other directly connected input to the first modulator is the output of the 40 kc-to-1 mc generator. Since the interpolation oscillator covers the range from 20 kc (Please turn to next page)

Fig. 2: Selectivity response curve of filter No. 1

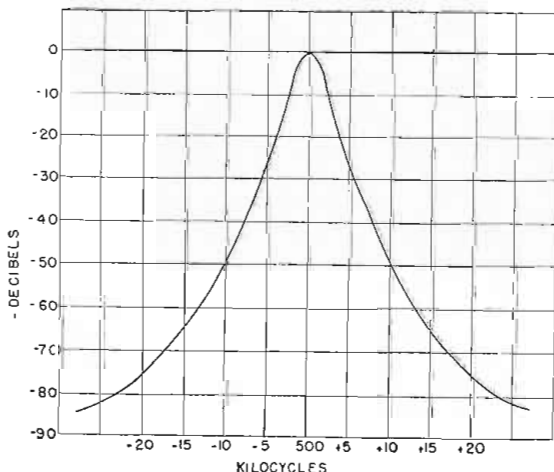
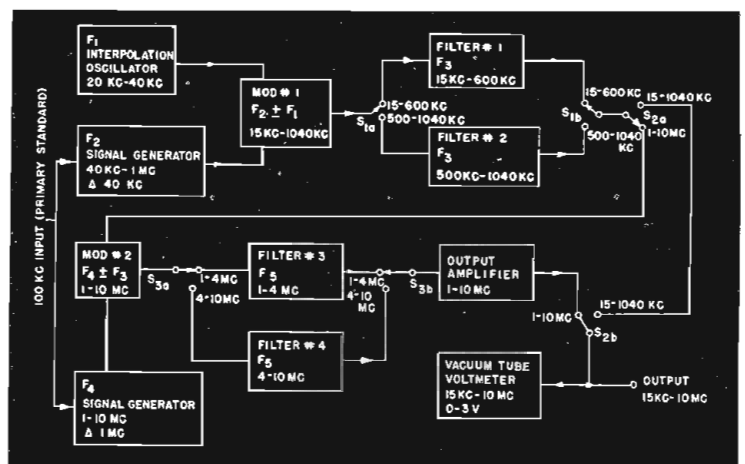


Fig. 3: Functional block diagram of variable frequency standard signal generator



# VARIABLE FREQUENCY STANDARDS (Continued)

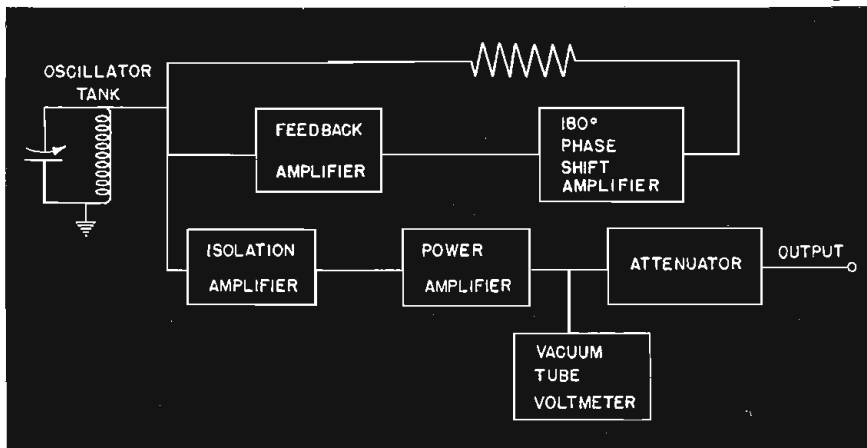


Fig. 4: L-C combinations determine the frequency ranges of the interpolation oscillator

to 40 kc, the frequencies with which it is mixed to produce a continuously variable range from 15 kc to 40 kc must be in 40 kc steps.\* The lowest frequency step of the generator is 40 kc and the highest is 1.0 mc. Push buttons allow instant selection of any of the 25 discreet frequencies; e. g., 40 kc, 80 kc, 120 kc, 1 mc. This unit contains no free-running or locked oscillators. The 25 frequencies are produced by multiplying, dividing, adding and subtracting frequencies derived

\*This generator was designed and constructed by S. J. Haefer and R. H. Smith at the U. S. Navy Underwater Sound Laboratory, New London, Conn. (See A Std. Freq. Gen., TELE-TECH, Apr. 1947, pp. 58-59.)

from the 100 kc primary standard. Reference to Fig. 5 will show the method of obtaining the various frequencies.

The two modulator units are identical. Fig. 6 shows the block diagram of the modulators. They are of the double-balanced or ring type. With the load connected as shown, both the carrier and modulating frequencies are cancelled and the two predominant frequencies present in the output are the upper and lower sidebands. The absence of the carrier makes sideband separation adequate with the filters employed.

The load circuit for the modula-

tor is incorporated in the variable filters. To prevent damage to the tubes when switching filters, a resistor remains connected between plate and screen of the modulator tubes at all times. The output of the first modulator goes to either of the variable filters 1 or 2 depending upon the frequency range of the filters.

## Variable Filters

There are four variable filters altogether, although only two are used at any one time. Filters 1 and 2 are used with the first modulator. Filter 1 covers the range from 15 kc to 600 kc and is used when the desired output frequency from the first modulator lies within this range. Filter 2 covers the range from 500 kc to 1040 kc and is used when the desired output frequency from the first modulator falls within that range. A telephone-type switch connects either of these two filters to the output of the first modulator from the front panel. These two filters, along with the three units just described, are the only ones necessary to use for the output range of 15 kc to 1040 kc.

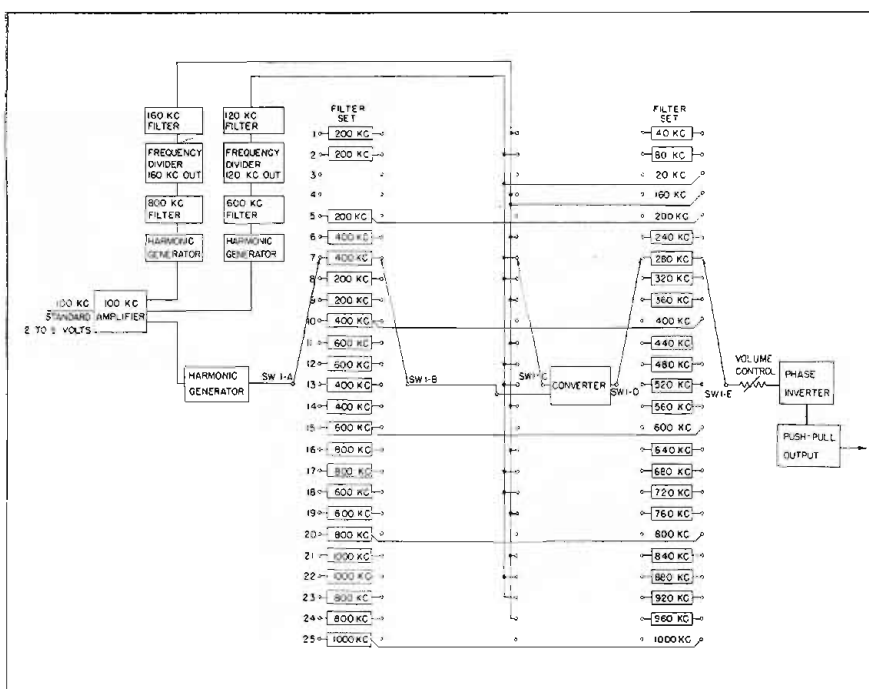
Variable filters 3 and 4 are used in the same fashion with the second modulator in order to extend the output frequency range to 10 mc. Filter 3 covers the range from 1 mc to 4 mc and filter 4 covers the range from 4 mc to 10 mc.

These filters are simply modified receivers. Receivers were selected to have the necessary gain, nicely calibrated dials, and excellent shielding. The low frequency filter 1 was a four-stage tuned radio frequency receiver, and therefore it was necessary to change only the detector into an output cathode follower. This filter covered from 15 kc to 600 kc which was inadequate. To extend the range to the 1040 kc necessary, an additional filter was constructed. The two high-frequency filters 3 and 4 utilize the rf portion only of two standard Navy superheterodyne receivers.

When the rf portions of the two receivers were placed side by side, they were of a size convenient to slip into a standard rack. The local oscillator in each section was converted into an output cathode follower. The only awkward part of the conversion was the dc isolation of the input inductance to ground. The block diagram of the filters is not shown because of their simplicity. The input coil is shown dotted in the modulator diagram, Fig. 6.

The purpose of the 1 mc to 10

Fig. 5: Push-buttons provide for 25 output frequencies from the 40 kc to 1 mc oscillator



mc decade, Fig. 7, is to extend the range of the variable frequency standard above 1040 kc. In order to accomplish the extension without encountering the problem of too many sidebands, a second modulator is used. The previously obtained variable range from 15 kc to 1040 kc is combined with any one of 10 frequencies from the decade, in the second modulator, and filtered in the manner as previously described, e.g.:

$$9.765824 \text{ mc} - 9 \text{ mc} + 765.824 \text{ kc}$$

$$3.207549 \text{ mc} - 4 \text{ mc} - 792.451 \text{ kc}$$

It is apparent that it is not necessary for the modulating frequency  $F_2$  (the result of the first modulation) to approach the carrier (1-10 mc)  $F_1$  any closer than 500 kc and, therefore, sidebands are easily separated in the variable filters 3 and 4. The decade is driven by the 100 kc primary standard, and the 10th harmonic of the 100 kc is filtered, amplified, and again distorted to produce the frequencies 7 mc, 2 mc, 3 mc to 10 mc which are filtered by fixed tuned filters and selected by means of a ten position rotary switch on the front panel. The output voltage of the various frequencies are kept substantially constant by means of voltage dividers. An output cathode follower is used as an isolating medium.

### Output Amplifier

The output amplifier is a bank of cathode followers connected in parallel. The purpose of this unit is to reduce the output impedance to a sufficiently low value in order to permit the use of an output connecting cable several feet in length without reducing the output voltage available, and to eliminate the effect of the cable capacity upon the crystal being measured. The output impedance of this amplifier is approximately 37 ohms. Actually, there are two cathode followers used on the band from 1 mc to 10 mc. These cathode followers are cascaded, one being in the variable filter, and the second is the output bank of 10 tubes.

The control panel contains the output vacuum tube voltmeter, the output terminals, and four telephone-type, low-capacity switches. One switch is used as a main power switch in conjunction with a mercury relay, the other three are used to select filters and output frequency range.

The output vacuum tube voltmeter is a bridge-type dc amplifier

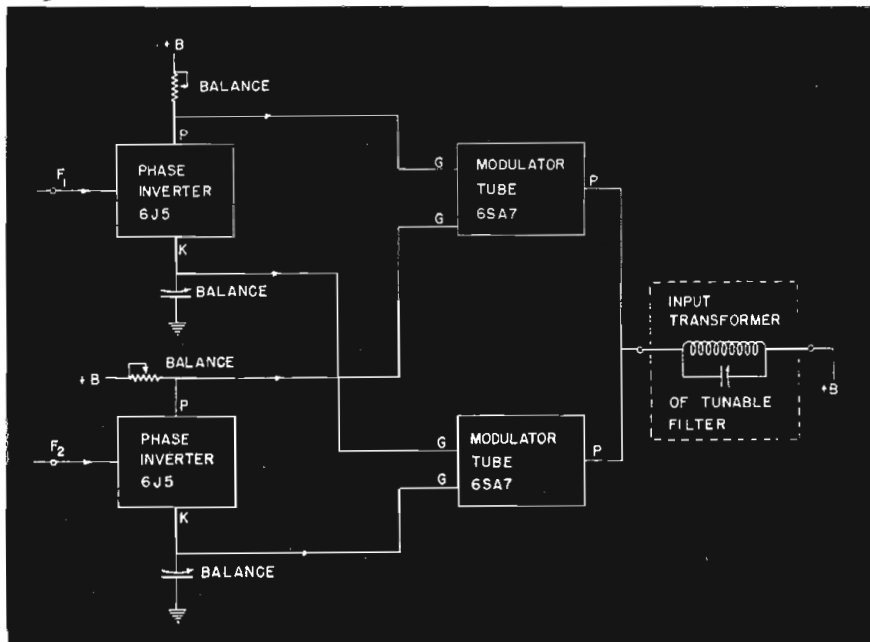


Fig. 6: Diagram showing the modulator units with the filter (dotted box) input coil

with a diode rectifier. The frequency response is flat to at least 10 mc. This voltmeter remains connected to the output terminals at all times and indicates the voltage available directly at the output terminals. It is also used as an indicator when tuning the filters.

Setting the equipment to a specific frequency is not difficult if a few details are kept in mind.

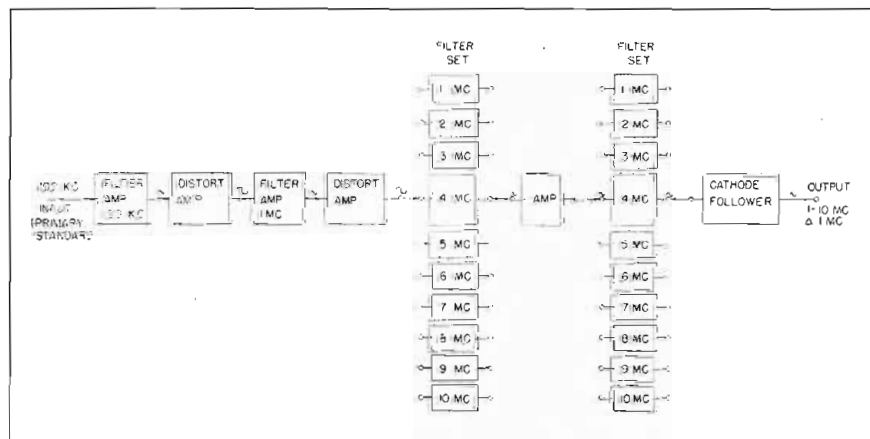
1. Three units are adjusted for output frequencies up to 1040 kc: the interpolation oscillator, the 40 kc to 1 mc push-button unit, and filter 1 or 2.
2. Five units are adjusted for output frequencies from 1 mc to 10 mc: the units mentioned in (1) above plus the 1-10 mc decade and filter 3 or 4.
3. The preliminary step of deciding what combination of frequencies to use in order to produce the desired output frequency must be undertaken.
4. It is easier to work from the output filter back toward the interpolation oscillator when setting up a frequency.

The reliability of this equipment has been thoroughly proved. It has been used over a period of 8 months and, as yet, has not given any trouble at all, particularly from sidebands. Actually the frequency of 10,000,001 cycles can be obtained to an accuracy of 0.1 cycle in relation to the driving standard. Even at this frequency there is no spurious component in the output, including sidebands, that exceeds 1%.

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Fig. 7: A 1 to 10 mc decade extends range of variable frequency standard above 1040 kc



# World's Largest Airport

**10 receivers, 5 transmitters, and mobile radios facilitate smooth functioning of N. Y. International airport (Idlewild)**

**R**ADIO performs dual functions at Idlewild, the International Airport in New York City, which is being built on filled-in, marshy tidelands in a five-year \$160,000,000 construction program. Operators in the airport's control tower not only direct the landings and take-offs of aircraft but also act as radio "traffic cops" for the numerous jeeps, bulldozers and tractors which overrun the field.

To provide the utmost safety, the Port of New York Authority, which operates the field, has equipped several dozen key vehicles with mobile VHF stations, and the drivers of these cars are required to obtain clearance from the control tower before crossing runways, entering or leaving certain areas, etc. They also act as shepherds for other vehicles not radio equipped. Addi-

*(Continued on page 108)*

Main receivers and all transmitters are on ground floor of Idlewild Control Tower

VHF equipment in this Port of New York Authority car assigned to Idlewild operates on 121.9 mc. Control unit with microphone is mounted under dashboard

Transmitter-receiver installation in rear. A thin co-ax cable leads roof-top antenna



# Under Radio Control

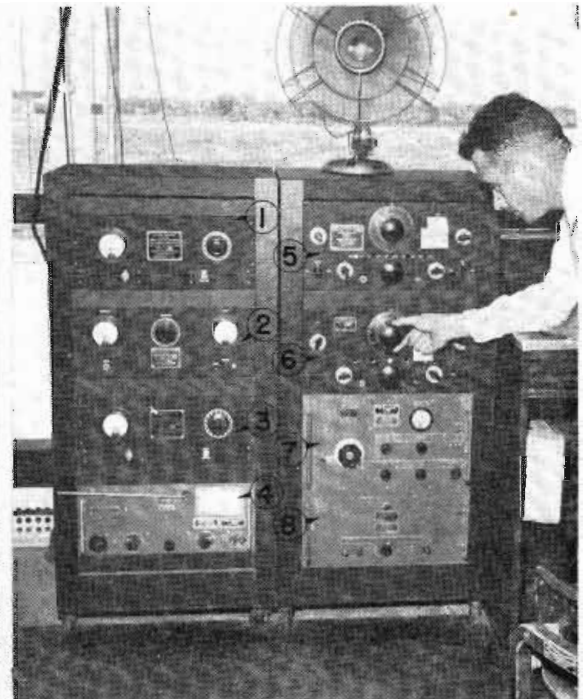
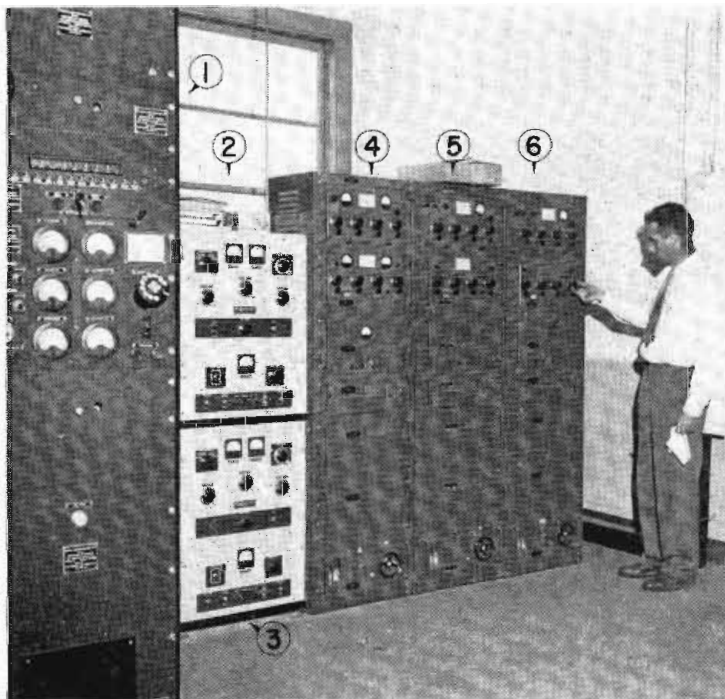
By **ROBERT HERTZBERG**,  
Contributing Editor, **TELE-TECH**



Inside of Control tower, Mrs. Christina Murray, CAA Air Traffic Controller gives landing instructions to approaching aircraft

Radio room under control tower. Equipment includes: (1) monitor rack for instrument landing system; (2, 3) duplicate transmitters on 239 kc; (4, 5, 6) VHF transmitters; (4) on 118.1 mc, (5) on 119.1 mc, (6) standby on 119.1

Equipment in tower: (1) limiting amplifier in mike circuit; (2) output amplifier; (3) same as (1); (4) frequency meter; (5,6) communications receivers; (7,8) BC-639-A VHF receiver



# Crystal Calibrator for

**Instrument features dual-channel, multiple crystal-controlled output frequencies for close tolerance alignment work; particularly suitable for television testing**

THE instrument described in this article was designed specifically for use in television alignment work but is also useful in commercial communications and FM. Known, fixed frequencies held within close tolerances are indispensable in designing this type of equipment. While crystal-controlled outputs are highly desirable, most available equipment is not flexible enough for original design work. It was to supply the need for crystal control plus flexibility that this unit was designed.

By using two output channels and 15 crystals, it is practical to produce a selection of output frequencies in both the IF and rf ranges which is limited only by the number of crystals available. For example, the particular unit illustrated was set up as shown at right.

The dual channel feature permits simultaneous low and high-frequency operation. The low-frequency channel provides IF frequencies while the high frequency range can be used for adjustment of signal and receiver oscillator circuits.

The particular crystals used in

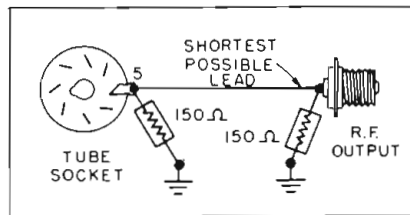


Diagram shows wiring connections for minimizing the effective cathode lead length

the original model are accurate to 150 cycles per megacycle in the temperature range between zero

CHANNEL No. 1		CHANNEL No. 2	
Cry. Osc. Freq. (mc)	Output Freq. (mc)	Cry. Osc. Freq. (mc)	Output Freq. 10×Cry. (mc)
8.250	8.25	4.525	45.25
6.375	12.75	5.125	51.25
7.750	23.25	6.125	61.25
5.555	27.75	6.725	67.25
Extra	Extra	7.300	73.00
		7.900	79.00
		7.925	79.25
		8.900	89.00
		9.500	95.00
		10.700	107.00

and 70°F. The unit was calibrated at an ambient temperature of 70°F. and has maintained excellent accuracy over a long period of time.

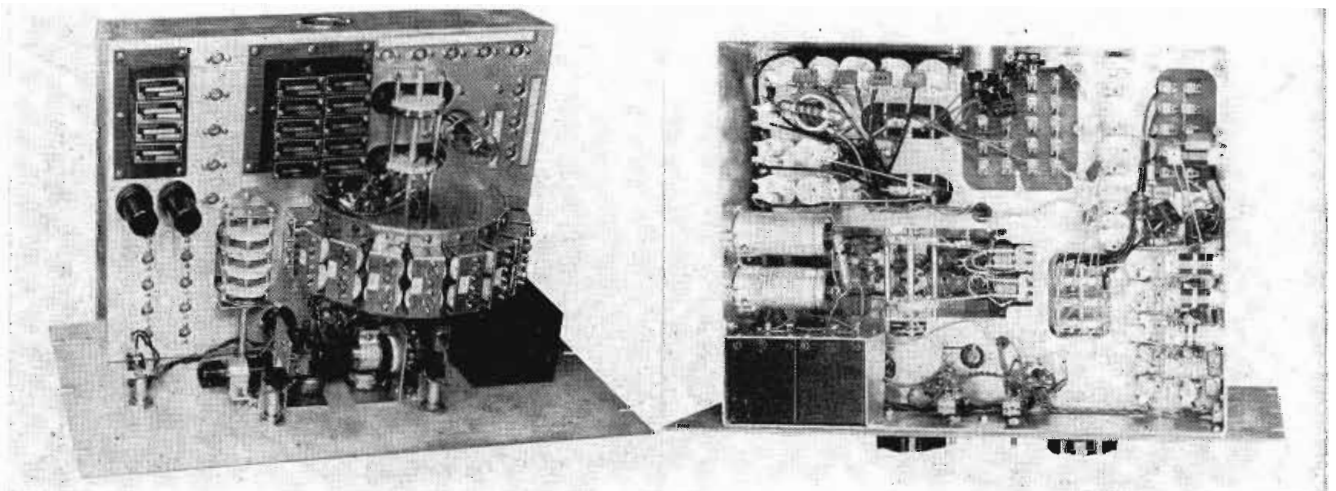
The two outputs appear across 75-ohm loads. Across this load, the low frequency channel provides maximum voltages of 2-3 volts rms while the high frequency section supplies between .35 and .50 volts rms at the output terminals.

Assembly is conventional except for the high-frequency multiplier transformers. These components are mounted on a semi-turret surrounding the selector switch. This construction permits short leads with resultant improved stability.

The calibrator is built on an aluminum chassis with a welded cabinet of the same material and is designed for rack mounting.

Channel No. 1 covers the lower frequency band. The circuit comprises a standard crystal oscillator employing a type 6J5 triode with a five-position crystal-selector switch in its grid. The type 6J5 plate feeds a type 6SK7 pentode multiplier which has a five-position selector switch in its plate. This second

Top (left) and bottom (right) views of chassis and control panel as ssembly illustrate component layout and wiring of crystal calibrator

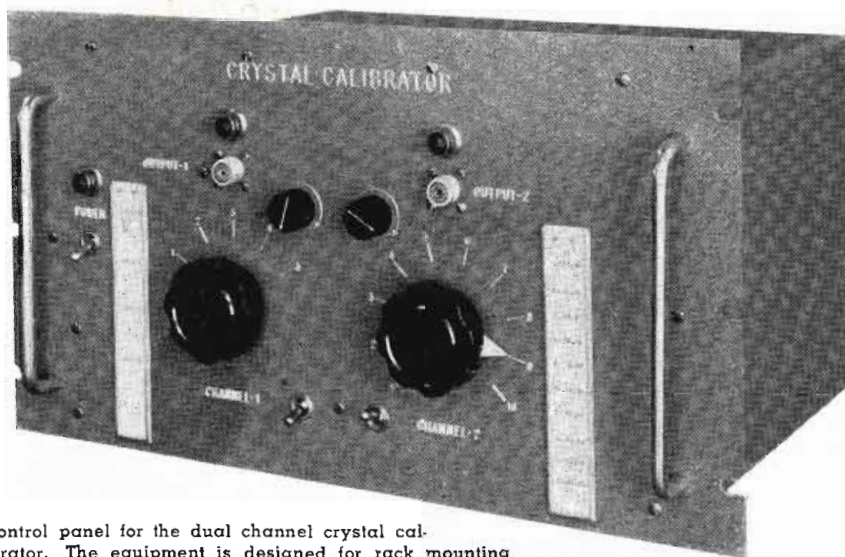




# HF and VHF

By JAMES F. GORDON,

Research Engineer,  
Bendix Radio Division, Baltimore



Control panel for the dual channel crystal calibrator. The equipment is designed for rack mounting

switch section is ganged with the oscillator switch. It selects one of the five pre-tuned rf transformers, and can be tuned to either the oscillator fundamental or a harmonic to provide the desired output frequency. The secondary winding of the multiplier transformer is fed to a type 6J5 buffer amplifier whose plate is coupled to a type 6AG7 tube connected as a follower. The 50  $\mu\text{f}$  coupling capacitor to the output tube grid feeds into a 5000-ohm potentiometer which functions as the attenuator. The attenuator is located adjacent to the channel No. 1 selector switch on the front panel.

Channel No. 2 is fundamentally the same as channel No. 1. However, the multiplier stage required a type 954 tube to maintain satisfactory performance. Similarly, a type 954 tube was used in the buffer-amplifier stage instead of the type 6J5. The output stage and attenuator are essentially the same as channel No. 1.

An indicator light is mounted above each output terminal to show when the channel is operative. Toggle switches near the lower

center section of the front panel are used to turn the heaters of either channel on or off. The main power switch and its indicator light are on the left.

The crystals are of the plug-in type and are accessible from the rear. Frequency charts are mounted behind plexi-glass covers on the front panel. The covers are removable so that the charts may be changed when desired.

## Design Considerations

Where grid and plate components are not specially isolated, both low and high-frequency multipliers have a tendency to oscillate at their anode frequencies. To prevent such undesired oscillation, small rf chokes are used in series with the multiplier grids.

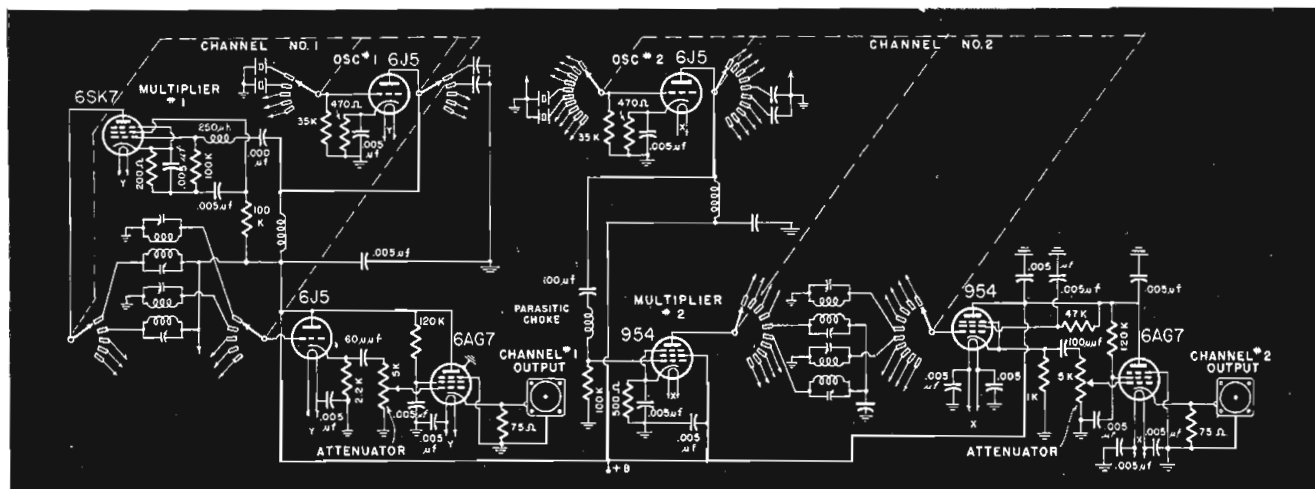
The attenuators were located be-

tween the buffer plates and the output grids to prevent reaction on the tuned circuits of the multipliers. The follower output tubes were mounted horizontally to permit very short leads. Their metal shells are grounded to the chassis panel with heavy ground straps. This arrangement permits output attenuation ratios of 100 to 1.

Both the output tubes and their buffer-amplifiers are operated class A, to insure good waveform at the output terminals. Output circuit resonance is kept well above the highest output operating frequencies to prevent any possible interaction which might affect operation. This was accomplished by using short leads between the cathodes of the type 6AG7's and the output terminals, and by employing a low

(Continued on page 103)

A partial schematic of the crystal calibrator. Equipment illustrated required no maintenance or recalibration in over a year's operation



# New Design for Medium Definition TV Camera System

**Equipment consists of special control panel unit and iconoscope with motor-powered focusing; suitable for experimental, lab use**

By **JESSE B. SHERMAN**, Professor, E. E. Dept., Cooper Union, New York City

**T**HE new type 5527 iconoscope discussed in this article opens some interesting possibilities in low-cost medium definition television. It permits experimenters, industrial engineers, radio dealers, schools and laboratories to set up a local camera capable of serving a number of applications in their respective fields. This tube affords 250-line resolution, about twice

that of its pre-war version, the type 1847.<sup>1,2</sup>

The outfit comprises two units. One consists of the camera, containing the iconoscope, scanning output amplifiers, video pre-amplifier, blanking amplifier, and optical

focusing means. The other unit contains a 7-in. JP4 kinescope, the necessary video amplifiers, scanning and pulse circuits, power supplies, and a 2-in. oscilloscope.

The vertical scanning oscillator operates at 60 cps. For flexibility in demonstration, the horizontal oscillator can be run from three to 16 kc and can operate either non-interlaced or in 2/1, 3/1, or 4/1 interlace. The video amplifiers are intended to operate 2.5 mc, permitting non-interlaced operation at 250 lines.

Views of the camera are illustrated. (Please turn to page 54)

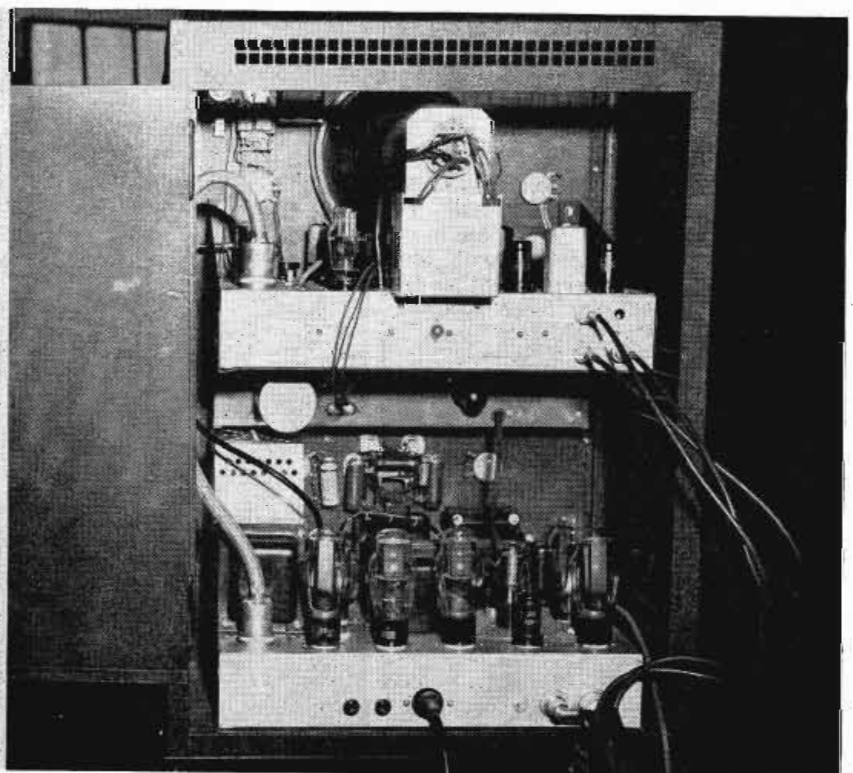
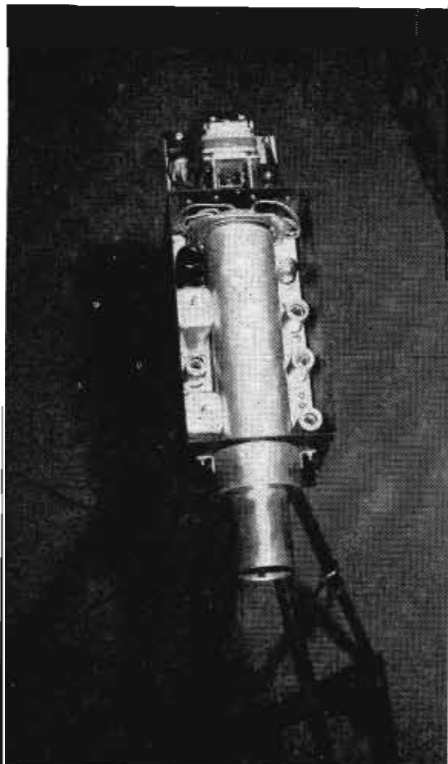
## Notes On Diagrams

- Capacitances are in microfarads unless otherwise indicated
- Capital letter omega equals megohms
- K equals kilohms
- P indicates panel control

<sup>1</sup>J. B. Sherman, "A new electronic television transmitting system for the amateur," QST, Vol. 24, pp. 30-36; May, 1940.  
<sup>2</sup>J. B. Sherman, "A simple television demonstration system," Proc. I.R.E., Vol. 30, No. 1, pp. 8-15; January, 1942.

Fig. 1: Top view of iconoscope camera unit

Fig. 2: Kinescope and chassis for pulse generating, oscilloscope, power supply circuits



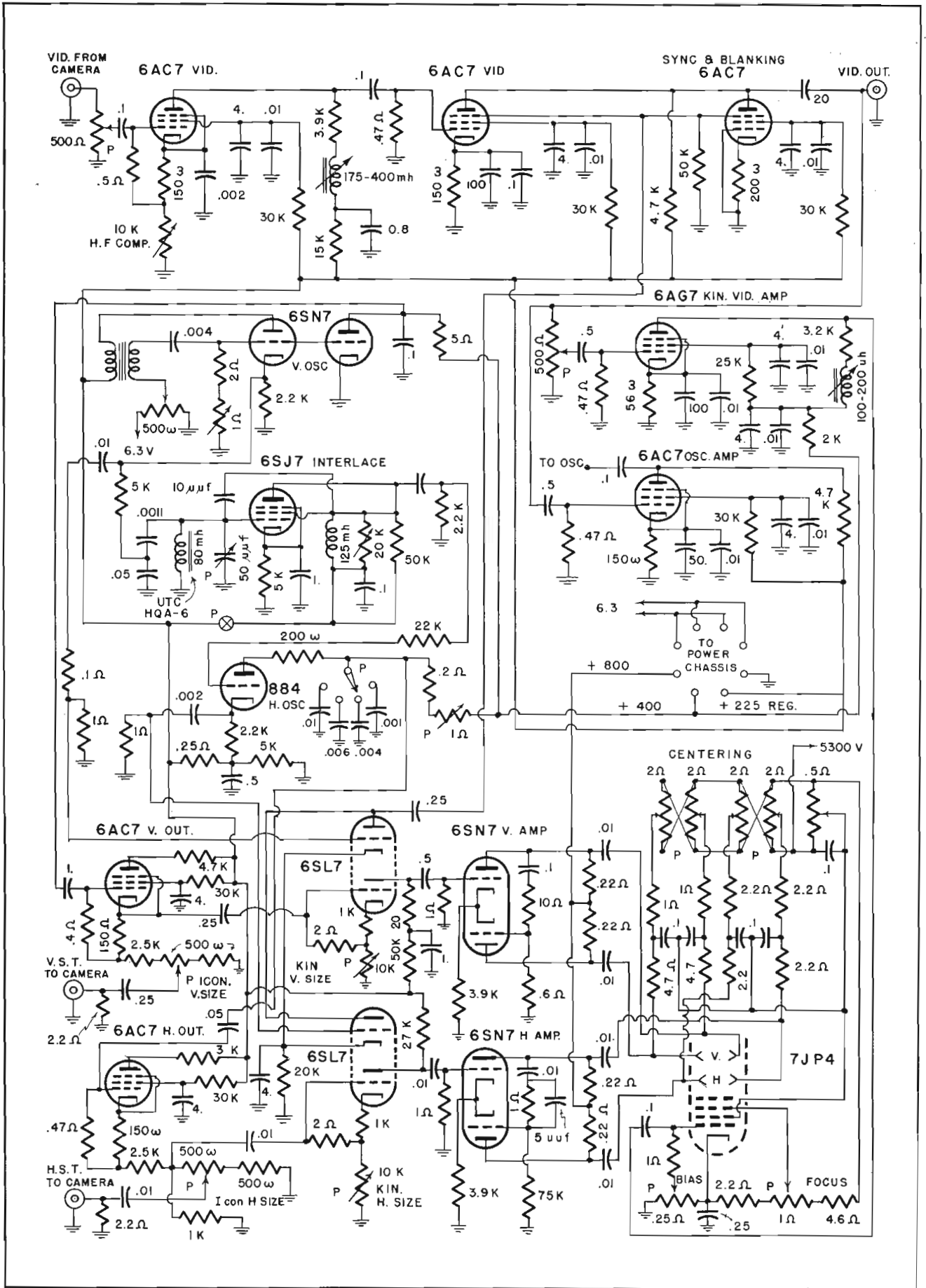


Fig. 3: Main chassis schematic showing deflection, interlacing and iconoscope control circuits to the 7JP4 kinescope

# MEDIUM DEFINITION CAMERA SYSTEM (Continued)

trated. The lens has a focal length of 2 in., f/1.9, and is focused by means of a small reversible motor with clutch to prevent over-travel. The lens is driven on a screw at about .03 in. per second. The motor is controlled from the main panel by means of a micro-switch arrangement actuated through a key movement. Micro-switches in the motor enclosure prevent over-running the lens in either direction. The camera measures 5x6x9 in., plus the motor enclosure at the rear and the lens housing into which the iconoscope extends.

The circuit diagram of the camera is shown in Fig. 5. The deflection amplifiers are supplied from the cables at a level of about three volts. A vertical blanking signal is derived from the scanning voltage by differentiation and shaping. No horizontal blanking is used. The video pre-amplifier employs two stages plus a cathode-coupled output stage.

The main cabinet is shown in Figs. 2 and 6. The top chassis contains the 7-in. kinescope, scanning and pulse circuits, and video amplifier. The center chassis holds a 2-in. oscilloscope, and the bottom chassis contains the power supply equipment.

The circuit diagram of the main chassis is shown in Fig. 3. Vertical scanning is obtained from a blocking oscillator, which also supplies blanking and synchronizing signals. An extremely simple method of obtaining interlace is used. This has been described previously<sup>3</sup>; it consists in applying an impulse at frame frequency to a tuned circuit resonant at twice the horizontal frequency; this will produce a 2/1 interlace when the horizontal oscillator is synchronized from the derived high frequency, providing an odd num-

ber of double-frequency cycles occurring between successive frame pulses. The train of damped oscillations produced by shocking the tuned circuit is prevented from going to extinction by using a coil with Q of the order of 100 and reducing the decrement further with a moderate amount of regeneration. Clipping circuits can then be used to make the derived high frequency of uniform amplitude, but for the present purpose this is not done. The resistance across the feedback choke is adjusted so that the final amplitude is about a quarter or a third of the initial amplitude, and horizontal locking is then adequate for the present purpose. The resonant circuit is tuned to about 15 kc, so that sequential scanning at 250 lines is obtained when the horizontal oscillator runs at the same frequency, and 2/1, 3/1, or 4/1 interlace occurs when the horizontal oscillator is run at half, third, and quarter frequencies. The peculiar visual phenomena accompanying high-order interlace are readily shown with this simple arrangement, the stability of which is adequate

<sup>3</sup>J. B. Sherman, "Horizontal synchronizing pulses from vertical pulses by means of impulse excitation," Proc. I.R.E., Vol. 28, No. 9, pp. 406-409; September, 1940.

Fig. 4: Camera unit with cable connections

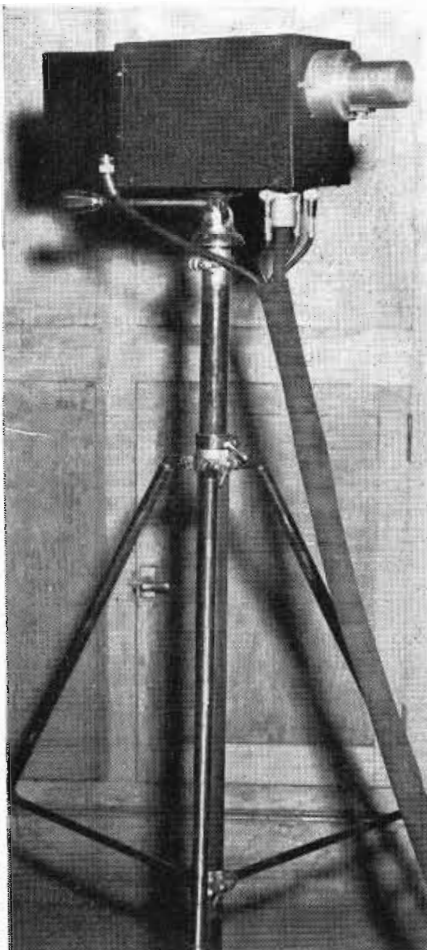
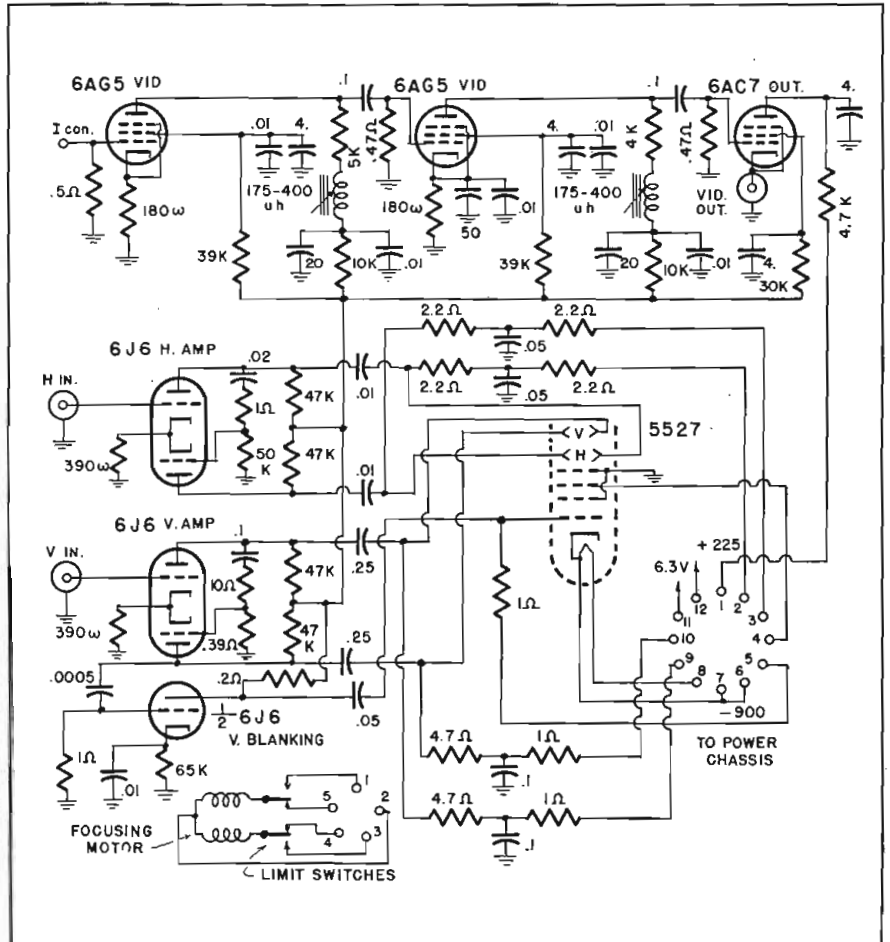
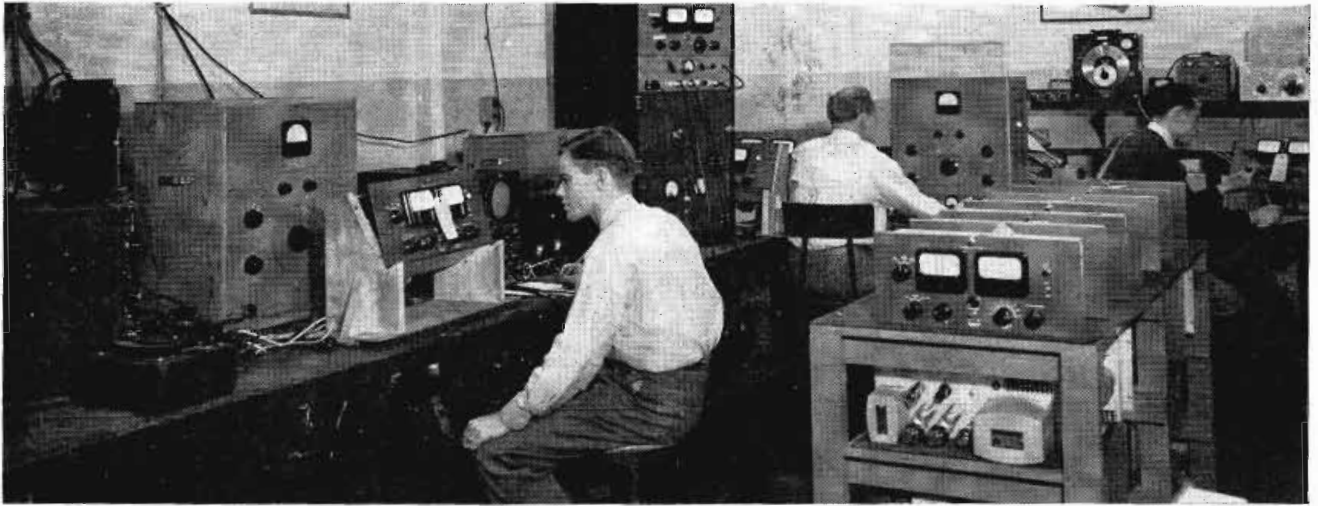


Fig. 5: Circuit diagram of iconoscope connections to video and deflection amplifiers







A special crystal-controlled FM signal generator is used to check indicator units, part of the new GE 4BZ1A1 broadcast station monitor

# FM Monitor Design Speeds Output

**Indicator and electronically controlled power supply comprise the two major units in simplified design; new assembly technic facilitates production, aids test operations**

By **EDWARD F. TRAVIS**, *General Engineering and Consulting Lab., General Electric Co., Schenectady, N. Y.*

**H**IGHLY specialized electronic equipment ordinarily built by hand on a single unit basis is now being manufactured in the GE laboratory on a production line basis at a substantial saving in cost. This has been accomplished in the production of FM monitors through the adoption of unusual monitor design and production technics. The most important function of the FM monitor is the continuous indication of the carrier of center frequency of FM broadcast stations in the frequency range of 88 to 108 mc. The indicator is calibrated in cycles per second and will indicate a maximum of  $\pm 3000$  cps variation of the station frequency. The precision and accuracy of this indication is guaranteed by two temperature regulated crystals.

One operates at 5.4 mc for basic calibration of the monitor; i.e., mixer stage, IF limiter stage, discriminator and zero setting of the center frequency instrument. The second crystal provides a local "oscillator frequency" through the frequency multiplier chain, and mixes with the station frequency to provide a 5.4 mc IF signal. Variation of the IF signal from 5.4 mc produces a dc voltage out of the

discriminator that causes the deflection of the center frequency instrument.

The next important function of the FM monitor is the continuous indication of the degree of modulation or carrier swing with modulation. This indicator is calibrated in percent and the scale marked in steps of 10% from 0 to 100 with the scale extending to 130% in larger steps. The 100% point indicates a carrier swing of  $\pm 75$  kc, the limit set by the Federal Communication Commission for maximum modulation of an FM station. Either the positive or negative polarity of modulation can be coupled to the modulation amplifier, rectifier, and dc amplifier for indication on the percent modulation instrument.

To indicate peaks of over modulation, a front panel flasher and a relay to operate a remote alarm or an over-modulation counter are provided. Both of these devices are operated by a gas-filled triode. The operating point of this tube can be

set by a front panel control for any level of modulation from 50 to 120%.

A 2-volt, 600-ohm impedance audio output is provided for continuous monitoring of the audio quality. This audio output circuit follows a standard de-emphasis circuit. The noise level on this audio output is 70 db below the 100% modulation level with a maximum of 0.5% distortion limit.

A second audio output at a level of 20 volts is provided for "proof of performance test" on the transmitter. This output has of necessity a high impedance and the 20 volt level is provided in order to operate the standard commercial instruments used in this type of test. This audio output circuit has a noise level 75 db below the 100% modulation point and a maximum distortion limit of 0.25%.

The monitor was designed to consist physically of two units: an indicator unit and an electronically regulated power supply unit. Breaking down the monitor in this

way immediately increased the possible number of workers that could be put on the job and thereby cut the production time. The fact that each unit now has fewer parts and circuits, reduces the number of operations required of each worker and permits standardizing on the motions involved. At the same time, testing problems have been reduced because each unit can be tested separately and only the difficulties pertinent to the separate units would have to be considered at one time.

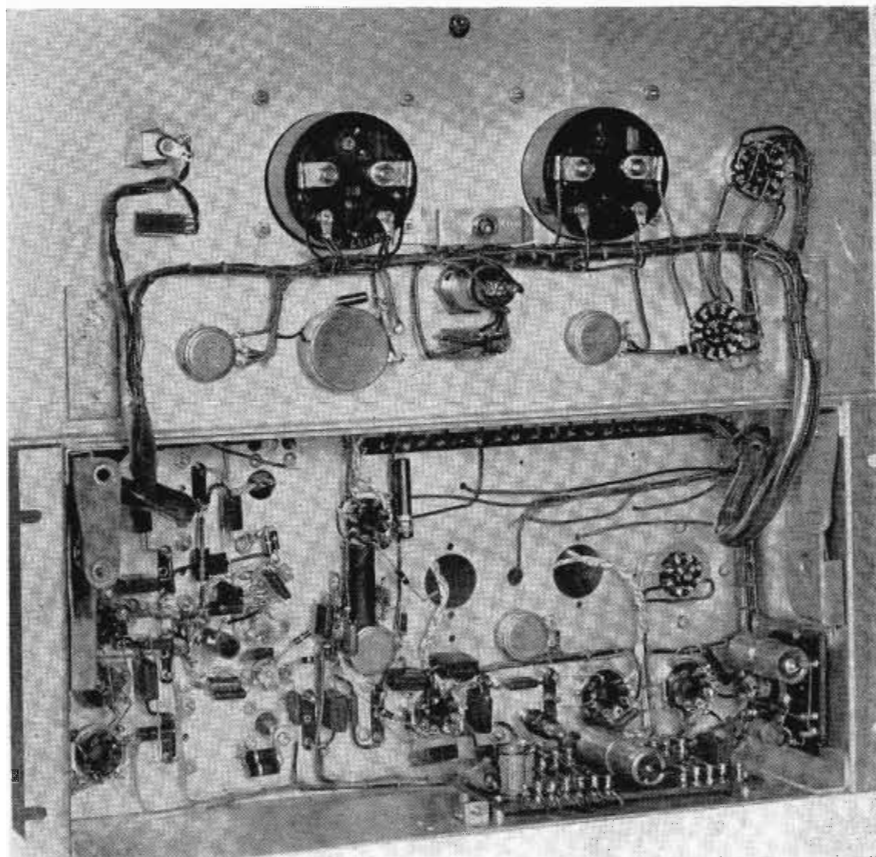
The power supply has been so designed that all the small components, resistors and capacitors, are assembled on one component board and only two wiring harnesses are required. The heavy components, i.e., choke and transformer are assembled on the chassis last to avoid unnecessary handling. In this way, it is possible to utilize five workers in the assembly and wiring with each worker having only a few operations to perform.

One operator assembles the resistors and capacitors on the component board and solders all connections including the wires that connect to other parts of the supply. Another operator places the completed board in a jig and makes up the largest of the two wiring harnesses; a third makes the small harnesses; a fourth assembles the two harnesses in the chassis and solders the connections to the terminal board; a fifth assembles and wires in the filter capacitors, choke and transformer in the order named. It is estimated that the man-hours required to produce the power supply by this method have been reduced by one-half. The same methods and procedure are applied to the indicator unit.

Due to the high frequencies involved in many of the circuits, it is necessary to wire many of the components direct from tube pins, transformer terminals, etc. Also rigid bus-bar wiring is required in certain places to maintain constancy of circuit performance.

Likewise, testing of the two units comprising the monitor has been broken down into a series of operations following the same reasoning that was used in breaking down the assembly procedure; namely, the use of as many operators as possible with each having only a small portion of the unit to test. Test stations have been arranged to permit flow from one to the next with a minimum of handling.

The test of the indicator unit is done in 14 steps, each requiring specialized measuring equipment



Indicator unit with front panel lifted to show interior wiring and layout of components

and trained personnel. The more important of these tests are:

- a. Audio amplifier and de-emphasis characteristics.
- b. Calibration of percentage modulation instrument and modulation amplifier.
- c. Tuning of frequency multiplier.
- d. Tuning of IF amplifier.
- e. Tuning and calibration of discriminator.

f. Calibration of center frequency instrument.

g. Calibration of the indicator for rf input and IF level and discriminator level.

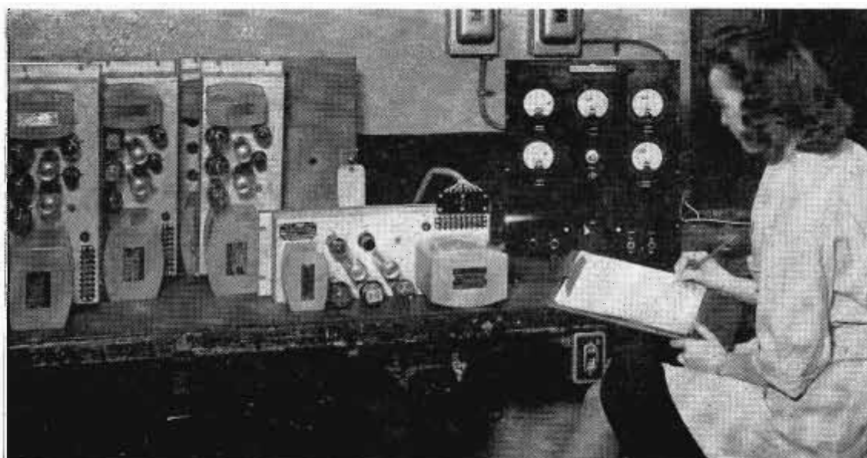
h. Calibration of the over-modulation flasher and alarm circuits.

i. Calibration and adjustment of the crystal oscillator circuits against primary frequency standards.

j. Final over-all calibration at operating frequency.

(Continued on page 76)

Power supply units feeding dummy loads are production tested in less than 15 minutes



## TV Station Cost Study

Charles A. Batson, NAB information director, recently presented results of a three month survey on the cost of television station installations. Equipment and installation costs for a metropolitan station average \$355,000. A community station costs approximately \$95,000 less. A breakdown follows:

Remote Equipment	
Dual camera chain (2 cameras, sync generator, master monitor and switching system) .....	\$35,000
Audio equipment .....	1,500
Microwave relay .....	10,000
Mobile unit (with power control, reels for cable, etc.) .....	10,000
Additional control room equipment .....	3,500
Margin of safety .....	5,000
	<b>\$65,000</b>
Control	
Sync generator .....	\$3,500
Audio equipment .....	2,000
Flying spot camera .....	2,500
Miscellaneous .....	1,000
Margin of safety .....	1,000
	<b>\$10,000</b>
Studio	
Dual studio camera chain .....	\$30,000
Two studio camera dollies .....	4,000
Studio lighting .....	3,000
Master mixing facilities .....	5,000
Master monitor .....	2,500
Distributing amplifiers, power supply units, equipment racks, panels .....	5,000
Audio facilities (incl. boom) .....	3,000
Building development .....	10,000
Installation of equipment .....	2,500
Miscellaneous .....	2,500
Margin of safety .....	7,500
	<b>\$75,000</b>
Film	
Single film camera chain .....	\$10,000
2 16-mm projectors, 1 slide projector .....	7,000
Preview and rewinding .....	1,000
Additional audio facilities .....	2,000
Video mixing facilities, etc. .....	5,000
Equipment installation .....	1,000
Projection room construction .....	1,000
Margin of safety .....	3,000
	<b>\$30,000</b>
TRANSMITTING PLANT	
Community Station	
Transmitter .....	\$30,000
Transmitter input and monitoring equipment .....	7,500
Antenna system .....	6,000
Tower (extremely variable) .....	7,500
Equip. installation .....	3,500
Transmitter building .....	10,000
Transmitter site, incl. development .....	3,000
Miscellaneous .....	2,500
Margin of safety .....	10,000
	<b>\$80,000</b>
Metropolitan Station	
Transmitter .....	\$82,500
Transmitter input and monitoring equipment .....	7,500
Antenna system (less \$1,000 for lower channels) .....	12,500
Tower (extremely variable) .....	17,500
Equip. installation .....	10,000
Transmitter building .....	20,000
Transmitter site, incl. development .....	5,000
Miscellaneous .....	7,500
Margin of safety .....	17,500
	<b>\$175,000</b>
Studio Transmitter Relay	
Equipment .....	\$10,000
Installation .....	1,000
	<b>\$11,000</b>

## WJZ-TV on Air

WJZ-TV, key station of ABC's television network, went on the air August 10 on channel 7, transmitting from the Hotel Pierre, Fifth Ave. and 61st St., N. Y. C. Frank Marx, ABC vice-president in charge of engineering, pointed out that only 41 days elapsed from the time negotiations were completed for the transmitter site and the time that the first test pattern was on the air. The station's studio, measuring 100 x 200 ft., is claimed to be the largest in the country.



Philco television receiver mounted on jeep provided Philadelphia residents with convention highlights. Left to right: Mrs. D. C. Hay, G. B. Larson, Phillip Willkie, Louis Stevens

## WCAU-TV Mobile Television

THROUGH the cooperative efforts of the Philco Corporation, WCAU-TV, and the Keystone Automobile Club, Philadelphia residents were privileged to witness the proceedings of the recent national conventions on mobile television screens.

An especially converted Philco model 1001 television receiver was mounted on top of each of three radio-telephone, road patrol jeeps belonging to the automobile club. The Philadelphia Evening Bulletin and Station WCAU announced the location of each of the jeeps daily.

The required conversion for the Philco receivers consisted mainly of power supply rearrangement. Three 120 ampere-hour storage batteries were mounted in back of each jeep. One battery supplied filament voltage (total drain 14.4 amps at 6 volts dc) to all tubes. The other batteries were used to energize two Mallory-type VP-555 Vibrapacks which converted six volts dc to 340 volts dc at 140 ma. Hot cathode rectifiers were replaced with 0Z4 cold cathode types and the installation of separate knife-type switches in the battery leads enabled operators to apply filament power to the receivers before the plate power was applied. The use of 0Z4 rectifiers makes separate application of filament and plate power mandatory. The connecting leads between the storage batteries and their loads was made of heavy braid to minimize any voltage drop in those portions of the circuit.

The antenna for the receivers consisted of a single 1/2 wave-length dipole (cut to length for station to be received) without reflector. A 70-ohm coaxial transmission line was used to minimize ignition interference effects from other passing vehicles. The dipole was supported by a two-section mast mounted on the back of the jeep. Each mast section was six feet in length with the top section tapered so that it could

be slid into the lower section. A bolt was screwed into the lower section about five inches from the top to prevent the two sections from binding and thus making it possible to orient the antenna by turning the top mast. When driving along highways where bridges or low hanging trees were encountered the top mast section and the antenna were detached and strapped to the top of the jeep. At times, it was also found as 30 miles an hour. Standard J.A.N. ignition suppression was used in the jeeps to minimize electrical disturbance from the engines.

## TV Timetable Revision

A spot check of television stations scheduled to go on the air this year, as reported in Tele-Tech's TV Timetable for 1948 published in May, indicates revised dates for some stations. Of 18 stations slated to go on the air in Nov.-Dec., reports show that six will go on the air as originally scheduled, three will go on earlier and five will go on later. An actual check shows:

Station	City	Original Date	New Date
WBRC-TV	Birmingham, Ala.	Dec., 1948	June, 1949
KGO-TV	San Francisco, Calif.	Dec., 1948	On Schedule
KRON-TV	San Francisco, Calif.	Dec., 1948	Early 1949
WWHB	Indianapolis, Ind.	Dec., 1948	On Schedule
WTVO	Detroit, Mich.	Nov., 1948	On Schedule
WXYZ-TV	Detroit, Mich.	Nov., 1948	Oct. 1, 1948
WTCN-TV	Minneapolis, Minn.	Nov., 1948	On Schedule
WOW-TV	Omaha, Nebr.	Dec., 1948	Spring, 1949
WLWC	Columbus, Ohio	Dec., 1948	On Schedule
WLWD	Dayton, Ohio	Dec., 1948	On Schedule
WNBK	Cleveland, Ohio	Dec., 1948	Oct. 16, 1948
WMCT	Memphis, Tenn.	Dec., 1948	Nov. 1, 1948
WDTE	Erie, Pa.	Nov., 1948	Dec. 15, 1948
WJAC-TV	Johnstown, Pa.	Nov., 1948	Fall, 1949



# FMA Convention

Engineering program set for Sept. 27-29 Chicago meet

THE second annual convention of the FM Association will be held Sept. 27, 28 and 29 at the Sheraton Hotel, Chicago.

Heading the list of speakers who will discuss frequency modulation and its various applications and advantages in broadcasting and communications, are Dr. E. H. Armstrong, inventor of FM circuits and the only life member of FMA, and Hon. Wayne Coy, chairman of the Federal Communications Commission.

The convention agenda is designed to cover all aspects of FM broadcasting—programming, engineering, sales, networks, promotion, special events, etc. plus facsimile.

Facsimile speakers will be John V. L. Hogan, president of Radio Inventions, Inc., New York, and Capt. W. G. H. Finch, president of Finch Telecommunications. It is planned to devote a half-day's session to facsimile.

At the opening general session, Dr. Armstrong will talk on FM's advancement, and Chairman Coy will discuss government relationships and assignments for the new art. Other speakers who have accepted are: Col. R. H. Ranger, president of Rangertone, Inc., Newark, N. J., who will discuss the use of magnetic-tape recorders for FM networks; Bond Geddes, executive vice-president, Radio Manufacturers Assn., who will discuss the receiving-set picture; Frank Freiman, vice-president, Magnavox Co., Fort Wayne, Ind., who will discuss suppressing surface noises on recordings; Kenneth Godfrey, senior executive in charge of media operations, American Association of Advertising Agencies, on "What the Agency Expects of FM"; Mortimer H. Fogel, New York dealer, on what the retailer and FM broadcaster can do to stimulate interest in FM; Hulbert Taft, Jr., Cincinnati, president of Transit Radio, Inc., on Transit Radio; The Rev. R. F. Grady, S. J., founder and former director of WFUV, Fordham U. noncommercial educational station, on "The University and FM Broadcasting".

Exhibitors at the FM convention will include: Raytheon Manufacturing Co., Federal Telephone & Radio Corp., Stewart-Warner Corp., Radio

Corporation of America, Westinghouse Electric Co., Rangertone, Inc., Radio Engineering Laboratories, and Collins Radio Corporation, in addition to various program services.

Present officers of FMA are Everett L. Dillard, president; William E. Ware, vice-president, and Thomas F. McNulty, treasurer. L. H. Marks serves as general attorney and C. M. Jansky, Jr., as engineering counsel.

To name directors to replace those whose terms are expiring, President Dillard has appointed the following nominating committee:

Matthew H. Bonebrake, vice-president and general manager, KOCY-FM Oklahoma City, chairman; Gaines Kelley, general manager, WFMY Greensboro, N. C.; Ben Strouse, vice-president and general manager, WWDC-FM Washington, D. C.; Robert M. Beer, co-owner, WATG Ashland, Ohio; Thomas B. Tighe, manager WJBK Asbury Park, N. J., and Charles D. Lutz, general manager, KYFM San Antonio.

There will be five candidates to run for three-year terms to succeed



1948 President of FM Association  
E. L. Dillard, general manager of FM stations  
WASH. Wash., and KOZY, Kansas City, Mo.

## FMA Convention Committees

**AGENDA:** C. M. Jansky, Jr., Jansky & Bailey, Washington, D. C., chairman; Gaines Kelley, WFMY, Greensboro, N. C.; Fred Weber, WDSU-FM, New Orleans, La.; James H. Moore, WSLS-FM, Roanoke, Va.

**RECEPTION:** Frank A. Gunther, vice-president, Radio Engineering Laboratories, New York; William J. Halligan, president, The Hallicrafters, Chicago; Thomas F. McNulty, WMCP, Baltimore; Ray E. Dady, KWK-FM, St. Louis; Ben Strouse, WWDC-FM, Washington; Matthew H. Bonebrake, KOCY-FM, Oklahoma City; Howard Lane, Marshall Field Enterprises, Chicago.

**REGISTRATIONS AND MEMBERSHIP:** Harold Essex, WSJS-FM, Winston-Salem, N.C.; William E. Ware, KFMX, Council Bluffs, Ia.; E. J. Hodel, WCFC, Beckley, W. Va.; Charles D. Lutz, KYFM, San Antonio, Tex.; George L. Sutherland, WAMS-FM, Wilmington, Del.

**EXHIBITS:** Sam Insull, Jr., Stewart-Warner Corp., Chicago; Stanley H. Manson, Stromberg-Carlson Co., Rochester, N. Y.; Thad Holt, WAFM, Birmingham, Ala.; Milton B. Sleeper, FM and Television, Great Barrington, Mass.; Raymond F. Kohn, WFMZ, Allentown, Pa.

**ENTERTAINMENT:** Edward A. Wheeler, WEAW-FM, Evanston, Ill., Chairman; Bert Low, Associated Program Service, New York, C. O. Langlois, Lang-Worth Feature Programs, Inc., New York; A. J. Kendrick, World Broadcasting System, New York; Milton Blink, Standard Radio Transcription services, Inc., Chicago; Walter Davidson, Capitol Records, Hollywood, Calif.

**PUBLICITY:** Paul W. Reed, WFAH, Alliance, Ohio, Chairman; Thomas B. Tighe, WJBK, Asbury Park, N. J.; Dan E. Jayne, WELL-FM, Battle Creek, Mich.; John K. West, RCA Victor Division, Camden, N. J.; Stanley Glaser, Crosley Division, Avco Mfg. Corp., Cincinnati; O. H. Brown, Eitel-McCullough, Inc., San Bruno, Calif.; Roy Jordan, General Electric Co., Syracuse, N. Y.; Jerry Stone, WDNB-FM, Daytona Beach, Fla.; Leonard Higgins, KTNB, Tacoma, Wash.; Robert E. L. Moore, Transradio Press Service, New York; Fred W. Fischer, Westinghouse Electric Corp., Baltimore.

five whose terms expire with the convention. The sixth will fill the unexpired term of W. R. David, resigned. Mr. David had been selected for a three-year term as a representative of General Electric, but he retired to become a vice-president of WPTR, Albany, N. Y. His successor will serve until the next annual convention in September, 1949.

Directors whose terms expire with the coming convention are:

Marion Claire, WGNB Chicago; Frank A. Gunther, Radio Engineering Laboratories, Long Island City, N. Y.; Raymond F. Kohn, WFMZ Allentown, Pa.; M. S. Novik, Unity Broadcasting Corp., New York, and Stanley W. Ray, Jr., WRCM New Orleans.

Holdover members of the FMA board are: Everett L. Dillard, WASH Washington and KOZY Kansas City; Roy Hofheinz, KOPY Houston, C. M. Jansky, Jr., Jansky & Bailey, Washington, and Thomas F. McNulty, WMCP Baltimore, all with another year to serve.

E. J. Hodel, WCFC Beckley, W. Va., E. Z. Jones, WBBB-FM Burlington, N. C., Ben Strouse, WWDC-FM Washington; David G. Taft, WCTS Cincinnati, and William E. Ware, KFMX Council Bluffs, Iowa, all of whom have two years more to serve.

For the best FM station promotion the past year the FM Association, in cooperation with Radio Engineering Laboratories, New York, will present an REL professional FM receiver, the award to be made at the closing luncheon of the FMA's Second Annual Convention, Sept. 29.



## NEWS LETTER

**TELEVISION PROBLEMS ARE NO. 1 TASK OF FCC**—Television problems were the foremost matters for consideration by the FCC as it entered the fall months. The proceedings and oral argument on the assignment of channels to the various cities of the nation were completed in mid-August and an early decision was promised by FCC Chairman Wayne Coy. Next, the television industry faces, starting Sept. 20, the all-important Commission hearings on the proposals to use the 475-890 mc band.

That the "upstairs" region of the spectrum will be flooded with all types of video uses already has been presaged and it will not just be by telecasters, but by educators, farmers, et al. FCC Chairman Wayne Coy has urged a group of leading university and secondary school educators to present their claims for television channels for non-commercial educational purposes at the September hearings, while the U. S. Department of Agriculture is studying methods to use video to inform farmers on developments in agricultural and home economics research.

**MOBILE ALLOCATIONS SUBJECT OF LONG HEARING** — A month-long series of hearings is in prospect before the FCC on the allocations proposed for the various mobile radiotelephone services, probably during October.

Several segments of the general mobile radio services, particularly the telephone companies and the railroads, vigorously criticized the FCC proposed allocations — the railroads assailed the Commission for taking away one-third of their original 60 channels and the telephone companies felt the FCC did not give adequate consideration to the needs of the public users of their service.

A number of the mobile services now constitute "big business" in the expenditures for radio equipment. The Bell System has been spending many millions of dollars, while the power-gas-water utilities have spent about \$50 million to date, as has the petroleum industry. The taxicab industry, which has shown phenomenal growth, has so far spent over \$30 million.

**MANUFACTURERS COOPERATING WITH ARMED FORCES**—In the objective of miniaturizing radio-electronic apparatus for the armed services, a goal established by the Army Signal Corps, all major manufacturers have been cooperating fully with the Signal Corps and other communications-electronics procurement and research branches of the national military establishment. Secretary of the Army Royall, after a recent inspection of the Signal Corps center at Fort Monmouth, highly lauded the "notable progress" of the

Signal Corps Laboratories in the "miniaturization, integration and standardization" of communications-radio-electronic equipment.

Maj. Gen. S. B. Akin, Chief Signal Officer of the Army, has been greatly impressed with the potentialities of the latest major development of the Bell Telephone Laboratories — the Transistor — and ordered immediate military tests because it offers possibilities of revolutionary changes in Army communications equipment through its saving in battery and tube weight. (See technical story in August Tele-Tech.)

Because the military procurement machinery will be at full speed by the end of this month, the mobilization-liaison committee of the Radio Manufacturers Association has been engaging in important conferences with the Munitions Board, Navy, Army, Air Force and National Security Resources Board in an effort to establish a fully-coordinated plan of mobilization. Just as happened before in Washington, the mobilization blueprinting has been fraught with sparring between different agencies who wish to get their ideas to the forefront.

**MANUFACTURERS SEEK CONFERENCE ON CARRIER HARMONICS**—The FCC has been asked to stage an engineering conference between the leading technical experts of the radio manufacturing industry as represented by the Radio Manufacturers Association's engineering committee and the Commission engineering staff on the proposed definitions on spurious responses and direct harmonics and subharmonics of the carrier frequency as offered in the projected rules and regulations for general mobile services.

The RMA transmitter subcommittee for mobile radio, which is headed by Link Radio Corp.'s chief engineer Frederick T. Budelman, stated to the FCC that for mobile radio services it was felt the direct harmonics and subharmonics of the carrier frequency should be excepted from the general radio engineering rules, although the industry agreed all interference should be corrected in individual cases. In this way the great majority of mobile radio services would be saved an unnecessary rise in transmitter installation cost.

Radio manufacturers also asked the FCC not to put into effect its proposal for eliminating experimental channels in the 44-50 and 152-162 mc bands as such frequency space was necessary for field testing of equipment for continued improvement. One manufacturer also protested vigorously the lack of provision of space in the 152-162 mc band for remote pickup broadcast service (AM, FM and TV) as working a severe hardship on manufacturers and broadcasters.

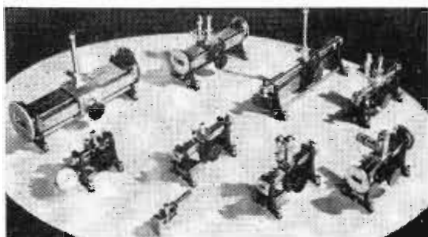
*National Press Building*

*ROLAND C. DAVIES  
Washington Editor*

# New Lab and Test Equipment

## Impedance Meters

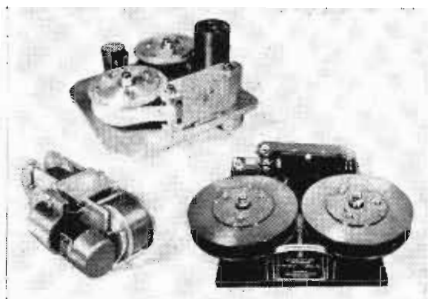
Standing wave ratios and node positions as well as relative power, attenuation, and wavelength in the line are measured by a new



series of nine precision impedance meters. All standard sizes of waveguides from 3 x 1 1/2 in. to 0.360 to 0.220 in. and rigid coaxial lines of 1/2 and 3/4 in. can be measured with the new line. Accuracy and repeatability of measurements is 2%. Probe position can be calculated to 0.1 mm on vernier scale instruments and to 0.01 mm on dial and micrometer instruments.—Industrial Dept., Sperry Gyroscopic Co., Great Neck, N. Y.

## Data Recorders

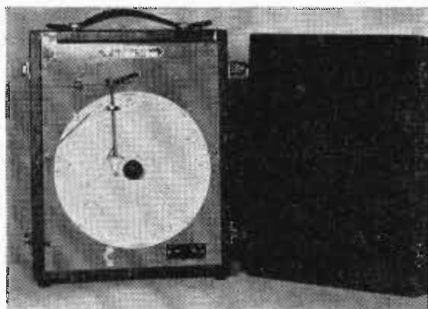
Designed for building into vehicles, aircraft, guided missiles or other mobile equipment, types MR-2, MR-3, and MR-6 data recorders



(upper left, lower left, and lower right, respectively in the accompanying illustration) use magnetic tape to store variable or transient data under conditions of severe shock acceleration for later re-running and analysis. All three have multi-information channels and in addition include a time base channel for speed and error compensation purposes.—Cook Research Laboratories, 1457 Diverser Parkway, Chicago 14, Ill.

## DC Recorder

Measurement of microcurrents and voltages are facilitated with a portable, direct current recorder which has a minimum full scale range of 0 to 0.1 ma and a maximum range of 0 to 12 amps. Sensitivity is one part in 1000. The recorder is supplied with eight coils and each is adjustable over a range of 11.5 to one. The circular 24-hour chart is driven by a conventional synchronous motor



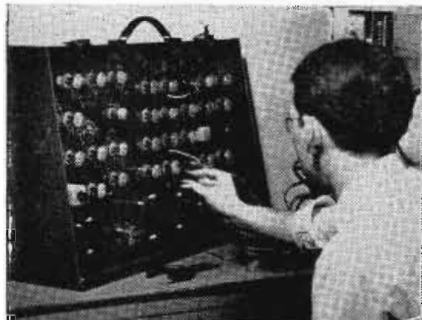
which consumes approximately five watts. Bearing friction and friction between the pen and chart are virtually eliminated.—Wallace & Tiernan Products, Inc., Belleville 9, N. J.

## Servishop

The equivalent of 6 service instruments, (tube tester, multimeter, FM signal generator, AM signal generator, audio oscillator, and condenser tester) is housed in a convenient carrying case with dimensions of 5 x 13 x 9 1/2 in. Model 8073 Servishop operates on 50 to 60 cycle lines 105 to 135 volts and its tube tester, in addition to incorporating all the features of model 322, tests all the new miniature tubes.—Radio City Products Co., Inc., 152 W. 25th St., New York 1, N. Y.

## Video Generator

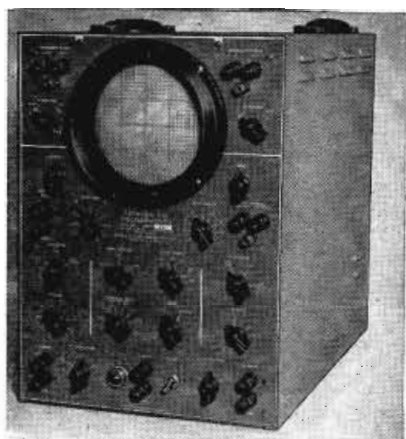
A video signal equivalent in all respects to the signal transmitted by a standard television broadcast station is provided by the



Composite Video Generator, facilitating a complete analysis of sync separation, sweep and video circuits. A choice of positive or negative output makes the generator adaptable to any television receiver. In addition, horizontal and vertical blanking pulses are provided for synchronizing a monoscope or camera as well as a jack through which an external video signal can be applied to the unit. Power input is 175 watts, 117 volts, 60 cycles. Measurements of the 45-lb. portable unit are 7 x 16 1/2 x 24 1/2 in.—Belmont Radio Corp., 5921 West Dickens Ave., Chicago 39, Ill.

## Oscillograph

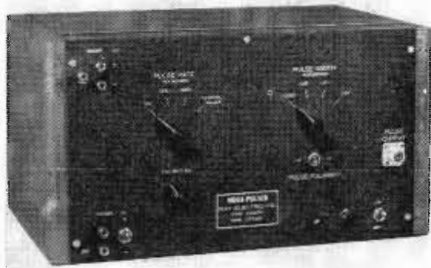
Signals may be applied to the vertical deflection plates on model 250 cathode-ray oscillograph through the high gain, capacity-coupled amplifier, the medium gain, directly coupled amplifier, or by direct connection to



the deflection plates. The choice of three connections is made with a switch on the front panel. Signals are applied to the horizontal deflection plates through a similar channel selecting switch. On driven sweep, automatic beam-blanking circuits intensify the spot only during the go-time. Hence, photographs of high-speed transients on driven sweep may be made with the shutter of the camera open before and after the occurrence of the transient. The recurrent range of the linear time base is 1 cps to 150 kc per sec., and the duration of the driven sweep is continuously variable from 1 sec. to 20 micro-sec.—Allen B. DuMont Laboratories, Inc., 1000 Main Ave., Clifton, N. J.

## Pulse Generator

A pulse which more than covers the present video frequency range is provided by the Mega-Pulser, an ultra-short pulse generator. Pulse widths of 0.025, 0.05, 0.1 and 0.25



microseconds are generated and it may be triggered from an internally or externally provided pulse. Output pulse is delayed approximately 0.25 microseconds to permit observation on an oscilloscope. Operation is from 117 volts, 60 cycles.—Ray Electric Co., Pine Brook, N. J.

## Beat Frequency Oscillator

Identical in over-all size and in frequency range with the 913-C, the new 1304-A beat-frequency oscillator has greater accuracy,



better stability and lower distortion. Frequency output ranges from 20 cycles to 20 kc with an accuracy of  $\pm(1\% + 0.5 \text{ cycle})$  after the dial zero has been set in terms of the ac line frequency. Output impedance is 600 ohms, balanced or unbalanced. Normal maximum output is 0.2 watts with total distortion of less than 0.25% over most of the range. Frequency drift from a cold start is less than seven cycles in the first hour, and is essentially completed after two hours. Power supply is 105 to 125 (or 210 to 250) volts, 50 to 60 cycles. Total power consumption is 100 watts.—General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

## Frequency and Modulation Monitor

Handling up to four frequencies anywhere between 25 mc and 170 mc, the FD-12 frequency and modulation monitor checks frequency deviation and percentage of modulation and is accurate to .0015%. Thermally controlled crystals are employed for those frequencies above 50 mc. IF and discriminator are calibrated and centered by means of a local oscillator. Direct reading of modulation up to 20 kc on positive or negative peaks and the peak-flasher to show over-modulation can be set at any value from 5 to 20

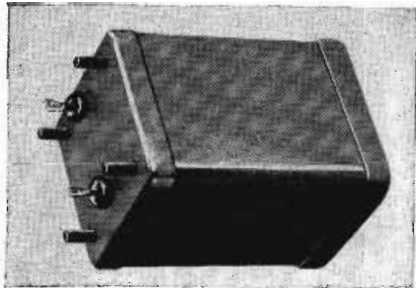


kc for either positive or negative peaks. Measuring sensitivity is 500 microvolts or less across the antenna terminals.—Doolittle Radio, Inc., 7421 S. Loomis Blvd., Chicago 36, Ill.

# New Parts For Designers

## Capacitors

Unicon Mykaplast capacitors are available in hermetic or wax-sealed assemblies and in single or multiple units with ratings as high



as 5 $\mu$  at 25 kv. Dielectric hysteresis is claimed to be only one tenth that of similar mica dielectric units. They are especially suitable for low frequency power oscillators, timing circuits, computing equipment.—United Condenser Corporation, 422 East 138th St., New York 54, N. Y.

## Power Supply

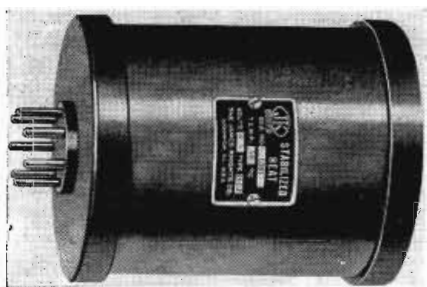
Designed as a source of dc power at high voltage and low current, the series 710 electronically regulated power supplies have a



continuously adjustable regulated output voltage over a range of less than 600 volts to more than 1500 volts. Models 710-2 and 710-3 are supplied respectively with 2 or 3 independently adjustable outputs. In these models a single high voltage rectifier, source of reference voltage, and meter are used, cutting costs and space without sacrificing performance.—Furst Electronics, 800 W. North Ave., Chicago 22, Ill.

## Crystal Heating Unit

The JKO-7 stabilized crystal heat unit accommodates crystals from 80 to 10,000 kc and is recommended for broadcast and fre-



quency standard applications. Operating temperature is 50° C  $\pm$ 1°; other temperatures on special order. The unit may be mounted in any position and crystals are electrostatically shielded.—James Knight Co., Sandwich, Ill.

## TV Transformer Cores

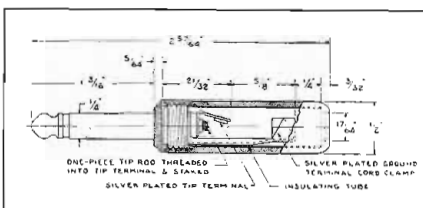
Two standard types of horizontal deflection and flyback transformer cores molded from iron powders for television applications assure uniform operating results while permitting easier assembly at a worthwhile cost saving. Type 10034, a large rectangular unit with a sliding hub, may be used with any television tube which employs magnetic deflection. A smaller spool type, the 10748, is recommended where space is at a premium and where tubes are no larger than 10 in.—Electronic Components Div., Stackpole Carbon Co., St. Marys, Pa.

## Flexible Waveguide

A convoluted, bellows-type, electroplated, flexible waveguide has been built to have an electrical impedance matching that of a rigid waveguide. As a flexible joint it facilitates alignment and is available in largest waveguide size needed by the industry down to 1 cm length. Airtron, Inc., 650 Bloomingdale Rd., Pleasant Plains, Staten Island, N. Y.

## Phone Plug

Featuring a unique dual-purpose sleeve which can be clamped over the metal braid of shielded wire cables, the Little-Plug is especially suited for use in recorders, radio, public address systems and communication and test equipment. A one-piece tip rod threads into the tip terminal and is staked to insure tightness, eliminating probability of tip disassembling during use. High grade in-



ulation is used throughout. Available in red or black tenite handles or bright nickel plated handles for shielding. All exterior metal parts are nickel plated. The Little-Plug will fit 1/4-in. diameter jacks. Body and handle have an outside diameter of 1/2-in.—Switchcraft, Inc., 1328 N. Halstead St., Chicago 22, Ill.

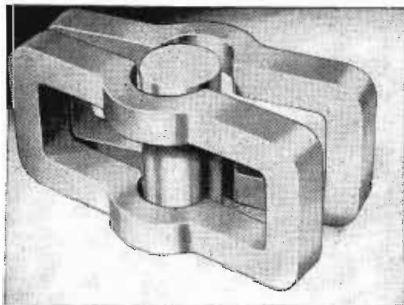
## Inorganic Insulation

Properties of thinness and electrical insulating strength never before attained in a flexible, inorganic, asbestos sheet have been achieved with Quinterra, an entirely new type of electrical insulation. Quinterra looks like paper, having no holes or interstices like the woven or open structures of cambrics and glass cloth. Sheets of Quinterra can be brought to bright red heat in a Bunsen burner flame without igniting or melting. Even at 800° C it retains a dielectric in the order of 100 VPM.—John-Manville, 22 East 40th St., New York 16, N. Y.

## Powdered Iron Transformers

A low-loss energy-recovery system requiring no additional electrical energy yet providing large increases in deflection capability is produced by a two-piece frame and center slug assembly for television receiver deflection transformers. Depending upon molding pressures ranging from 15 tons to upwards of 60 tons per sq. in., the degree of dc saturation and again the peak amplitude of ac flux density, effective ac permeabilities of 40 to 230 are available in these powdered iron assemblies.

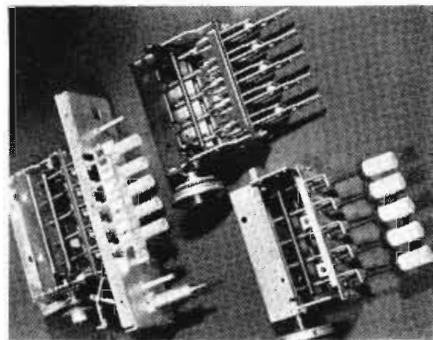
The necessity for dissipating large amounts of energy from the transformer and deflecting yoke structures is eliminated by the stepped-up efficiency. In addition, the molded core



structures produce negligible hum noise in comparison with laminated core structures, according to the manufacturer.—Henry L. Crowley Co., Inc., 1 Central Ave., West Orange, N. J.

## Precision Tuners

Precision tuning assemblies calling for very close tolerances required for dependable settings with minimum frequency shift at any



point within the AM broadcast band in automobile radio receivers are available. Service provided includes tooling for production, metal stamping, plating, fabrication and over-all assembly of component products built to customer specification.—Sylvania Electric Products, Inc., Emporium, Pa.

## HV Multiplier Leads

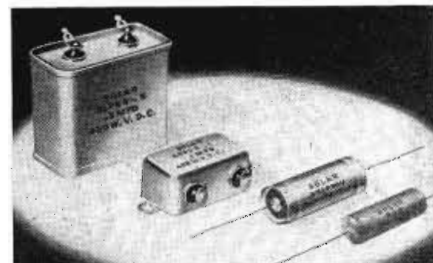
Any low voltage multimeter can be converted into a high voltage instrument simply by attaching a pair of Reiner high voltage



multiplier leads to the unit. Special high-voltage type resistors are built into the prod handles so that practically the entire voltage drop takes place before the wire lead of the cord is reached. Only the lowest range such as 2.5-3-5-10-12-15 is used depending upon the scale of the instrument. Multiplier accuracy is maintained within 2%. Alligator clip terminal is supplied for solid grip at the point of measurement.—Reiner Electronics Co., Inc., 152 W. 25th St., New York 1, N. Y.

## Polystyrene Capacitors

The ability to store charges for a long time and then discharge instantly and completely is a characteristic of a new line of



polystyrene-film dielectric capacitors. They are unexcelled for applications where extremely high insulation resistance, large capacitance with high "Q" or extremely low dielectric absorption are required. Typical applications include timing and integrating circuit capacitors, rf padding capacitors, and coupling capacitors in high-gain amplifiers.—Solar Mfg. Co., 1445 Hudson Blvd., North Bergen, N. J.

## Multiple Section Capacitor

Case construction of four completely shielded sections makes the MC-9A63 capacitor especially useful in applications where circuits must be isolated. Rated 4 X .02 mfd., 500 volts dc, the MC-9A63 has been designed to JAN-C-25 performance characteristic E and has exceptionally small base dimensions for a four-terminal capacitor.—Cornell-Dubilier Electric Corp., South Plainfield, N. J.



## MEASURE HIGH VACUUM ACCURATELY, EASILY, ECONOMICALLY, WITH DPA-37 our newest Ionization Gauge Control Circuit

The DPA-37 is DPI's newest Ionization Gauge Control Circuit. It measures all the pressures commonly met in high-vacuum diffusion pump work. And it incorporates all the desirable features you would look for. For example:

**DPA-37 is sensitive**—Using the highly sensitive VG-1A Ionization Gauge Tube, DPA-37 measures from .0025 mm to .0000005 mm of Hg in four ranges by means of a specially designed amplifier circuit. The zero setting may be checked instantly without interrupting normal operations.

**DPA-37 is easy to operate**—There are a minimum of steps necessary for taking a pressure reading. Just two dial adjustments—and the pressure is

obtained by multiplying the dial reading by the scale factor. No calibration charts needed.

**DPA-37 is easy to maintain**—All circuit tubes and nearly all other parts are standard radio type for simple, inexpensive maintenance. Less-than-normal loads on component parts assure long life for the circuit.

**DPA-37 is economical**—Lower fila-

ment current (only 2 MA) and a built-in automatic overload relay result in maximum life for the VG-1A Ionization Gauge by protecting it from the most abrupt surges of pressure.

The price for the DPA-37 panel mounted is \$350. The cabinet mounted model illustrated is \$365. DPA-37 gives you more per dollar—costs less in the long run. For a more complete description of its features, wire—

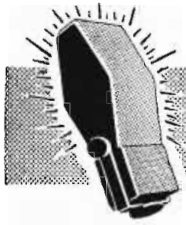
Vacuum Equipment Division  
**DISTILLATION PRODUCTS, INC.**

777 RIDGE ROAD WEST • ROCHESTER 13, N. Y.

570 Lexington Avenue, New York 22, New York  
135 South LaSalle Street, Chicago 3, Illinois

Manufacturers of Molecular Stills and High-Vacuum Equipment; Distillers of Oil-Soluble Vitamins and Other Concentrates for Science and Industry





# TELE-TECH's NEWSCAST

## FCC Proposes New Rules For Citizens Radio Service

New Citizens Radio Service Rules governing the use of individual radio transmitter-receivers for personal and private communication have been proposed by the FCC. Existing rules concerning technical requirements were made effective on December 1, 1947.

Two classes of citizens stations are proposed. Class A stations (operating on 460-470 mc band) would be required to meet more rigid technical requirements than class B stations (operating on 465 mc only). A maximum input power of 50 watts is provided for class A stations, a maximum of 10 is assigned to class B.

Licenses would have to be citizens and at least 18 years old. Stations could be used either at fixed locations, or as mobile units on vehicles, aircraft or boats. Station call signal would probably be the registered serial number appearing on the station license.

Pending the adoption of final rules by the commission, no licenses will be issued in the Citizens Radio Service except on an experimental basis. Interested parties may submit comments or briefs to the commission on or before Oct. 1, 1948, after which date a hearing may be scheduled.

## NAB Appoints New Engineering Committee

Appointees to the Engineering Executive Committee of the National Association of Broadcasters to serve during 1948-49 are: A. James Ebel, WMBD, Peoria, Ill., chairman; O. W. Towner, WHAS, Louisville, Ky.; E. K. Jett, WMAR, Baltimore, Md.; Oscar C. Hirsch, KFVS, Cape Girardeau, Mo.; J. R. Poppele, WOR, New York; K. W. Pyle, KFBI, Wichita, Kans.; John H. DeWitt, WSM, Nashville, Tenn. *Board Liaison:* T. A. M. Craven, WOL, Wash., D. C.; G. Richard Shafto, WIS, Columbia, S. C. *Network Advisory:* William B. Lodge, CBS, New York; Frank Marx, ABC, New York; Earl Johnson, MBS, New York; O. B. Hanson, NBC, New York. *Non-Voting Associate Members:* George Adair, Radio Engineering Consultants; Paul deMars, Raymond M. Wilmotte, Inc.; Dixie McKey, Dixie B. McKey and Associates, all of Wash., D. C.

## RCA Tube Plant Expansion

An additional 40,000 sq. ft. of space will facilitate an increase in the production of cathode ray television picture tubes at RCA's Lancaster tube plant. Work is already underway on the new building which is expected to be completed by midsummer. The increased floor space will make way for additional automatic machinery which turns out better than one CR tube a minute.

## TELEVISION-RADIO PRODUCTION BOX SCORE

(RMA Members)

Receiver Production	Jan.	Feb.	March	April	May	June	July	1948 Totals	Postwar Totals
Television	30,001	35,889	52,137	46,339	50,117	64,353	56,089	334,925	460,032
Consoles	13,261	10,295	15,304	12,536	12,535	11,256	10,234	72,886	138,218
Table M.	16,740	25,594	37,833	33,803	37,642	47,588	42,193	241,393	314,799
AM & FM	1,339,256	1,379,605	1,633,435	1,182,473	1,096,780	1,049,517	1,235,799	8,916,685	39,916,865
AM-FM	136,015	140,629	161,185	90,635	76,435	90,414	74,988	770,801	2,076,301

## Chairmen Appointed in Parts Division

Two new sections have been created and 21 section chairmen have been appointed in the RMA Parts Division by A. D. Plamondon, Jr., division chairman and president of the Indiana Steel Products Co., of Chicago. The new groups are for tube parts manufacturers and ceramic capacitor producers. Following are the section chairmen and some of the alternate chairmen who will serve for the current 1948-49 fiscal year:

**Coil:** Edwin I. Guthman, Edwin I. Guthman & Co., Chicago.

**Ceramic Capacitor:** K. E. Rollefson, The Muter Co., Chicago, chairman; and W. H. Fryling, Erie Resistor Corp., Erie, Pa., alternate chairman.

**Fixed Capacitor:** W. Myron Owen, Aerovox Corp., New Bedford, Mass.

**Fixed Resistor:** D. S. W. Kelly, Allen-Bradley Co., Milwaukee, Wisc., chairman; and H. A. Williams, Stackpole Carbon Co., St. Marys, Pa., alternate chairman.

**Instrument & Test Equipment:** R. L. Triplett, Triplett Electrical Instrument Co., Bluffton, Ohio.

**Insulations:** John W. Appgar, Irvington Varnish & Insulator Co., Irvington, N. J.

**Metal Stampings & Metal Specialties:** Marvin M. Lane, Croname, Inc., Chicago, Chairman; and Jay H. Johnson, John Volkert Metal Stampings Inc., Brooklyn, N. Y., alternate chairman.

**Phonograph Cartridges & Pickups & Microphones:** S. N. Shure, Shure Brothers, Inc., Chicago, chairman; and H. G. Kobick, Webster Electric Co., Racine, Wisc., alternate chairman.

**Plastics and Molded Parts:** John J. Bachner, Chicago Molded Products Corp., Chicago.

**Record Changers & Phono-Motor Assemblies:** R. E. Laux, General Instrument Corp., Elizabeth, N. J., chairman; and A. W. Fritzsche, The General Industries Co., Elyria, Ohio, alternate chairman.

**Socket:** Lester W. Tarr, Cinch Manufacturing Corp., Chicago.

**Speaker:** Laurence A. King, The Rola Co., Cleveland, Ohio.

**Speaker Parts:** Wm. H. Welsh, Wm. H. Welsh Co., Chicago.

**Special Products:** W. R. MacLeod, King Laboratories, Inc., Syracuse, N. Y.

**Switch:** W. S. Parsons, Centralab (Div. of Globe-Union Inc.), Milwaukee, Wisc.

**Transformer:** L. S. Racine, Chicago Transfamer Div., Chicago, chairman; and James M. Blackledge, Standard Transformer Corp., Chicago, alternate chairman.

**Tube Parts:** S. L. Gabel, Superior Tube Co., Narristown, Pa.

**Variable Condenser:** Russell E. Cramer, Radio Condenser Co., Camden, N. J.

**Variable Resistor:** W. A. Nicely, Chicago Telephone Supply Co., Elkhart, Ind.

**Wire:** R. G. Zender, Lenz, Electric Mfg. Co., Chicago.

**Wire Wound Resistor & Rheostat:** Ray S. Laird, Ohmite Manufacturing Co., Chicago.

## Ignition Suppressors For TV Interference

Automobile ignitions causing television receiver interference can be minimized or corrected if motor car manufacturers equip their autos with proper suppressors on spark plugs and distributors, according to a recent report by the RMA engineering department. The tests demonstrated that automobile ignition systems must not exceed 35 microvolts per meter if they are not to interfere with normal television reception.

## JTAC Query on 475-890 Band

The Joint Technical Advisory Committee is seeking information which will aid the FCC in its Sept. 20th hearing on commercial use of the 475-890 mc band for television. Answers to the following questions are being solicited:

1. What is the present state of development of equipment in the band 470-890 mc, in regard to (a) transmitters, tubes, and components; (b) receivers and components; (c) antennas, transmission lines and related equipment for transmission and reception?

2. How much experimental work has been undertaken in television systems in this band, with respect to field operation (transmitter hours operated, number and distribution of receivers, and propagation tests) and laboratory work (development of receivers, transmitters and tubes)?

3. What consideration has been given to the costs of television systems for this band, particularly to the reduction of receiver costs, and the transfer of cost burdens to the transmitter?

4. What areas of service might be expected in this band, based on the following assumptions: (a) a particular system, using one of the following typical bandwidths: 6 mc, 13 mc, 20 mc; (b) radiated power, available now and expected to be available, say, 10 years in the future; (c) receiver sensitivity; (d) at each of the following typical frequencies: 475 mc, 600 mc, and 890 mc?

5. What co-channel and adjacent-channel separations would be appropriate under the assumptions made in item 4, above?

6. How many channels would be available in the band 475-890 mc on the assumptions of Item 4, above, and how might they be allocated among the 140 metropolitan districts of the U. S.?

Replies should be sent to the secretary of the JTAC, L. G. Cumming, Institute of Radio Engineers, 1 East 79th St., New York 21, N. Y.



RCA WR-39A Television Calibrator    RCA WR-59A Television Sweep Generator    RCA WO-58A Television Oscilloscope

# THE RCA TV TRIO...

for Production and Laboratory use

## a complete set-up for the precision alignment of television receivers

• The new RCA Television Calibrator, Sweep Generator, and Cathode Ray Oscilloscope are high-precision instruments incorporating design features which reflect the wide experience of RCA engineers in television. The RCA TV Trio provides a complete set-up for testing and aligning television receivers in the laboratory or in production and quality-check positions.

RCA Television Calibrator WR-39A has two crystal oscillators for establishing the calibrator frequency. The marker oscillator operates on fundamental frequencies in all bands, and provides markers at all TV frequencies. An easy-reading scale enables

quick crystal-harmonic identification, and a built-in speaker is provided for zero-beat indication.

RCA Television Sweep Generator WR-59A covers all broadcast television channels, TV- and FM-if bands. All ranges employ fundamental signals, are pre-set, and can be quickly selected by means of a band switch. Sweeps are provided for both 10.7-Mc. and 25.75-Mc. if bands, and for video channels to 10 Mc. Amplitude variation is less than 1 db. The piston attenuator has a maximum ratio of 20,000/1.

RCA Oscilloscope WO-58A has a flat response from 5 cycles to 2 Mc., with less than 2 per cent tilt and overshoot, and rise time of less than 0.15 microsecond. It displays all TV sync. signals accurately, and is easily calibrated for use as a peak-to-peak voltmeter. A phase-shift control is provided.

For complete technical data on the RCA Television Trio, see your RCA Test Equipment Distributor, or write RCA, Commercial Engineering, Section IY63, Harrison, N. J.

Available from your RCA Test Equipment Distributor.



**RADIO CORPORATION of AMERICA**

**TEST AND MEASURING EQUIPMENT**

**HARRISON, N. J.**

# NEWS . . .

## Beacon-Aided Radar Charts Flight Paths of Rockets

Beacon-aided radar has proved to be a most satisfactory method for measuring flight paths of experimental rockets at White Sands Proving Grounds according to a recent statement by C. E. Mattox, Signal Corps Engineering Laboratories, Fort Monmouth, N. J. The beacon-aided radar, which incorporates a transponder in the nose or body of the rocket, has the advantage over doppler and theolite methods of instrumentation because it gives ballistic data immediately to the firing agencies. Optical and doppler systems of guided missile tracking often require weeks to compute the direction and altitude versus ground range.

## NEDA Chapters Elect Officers

Three chapters of the National Electronic Distributors Assn. elected officers at July meetings. The Nebraska-Iowa chapter meeting in Des Moines elected E. H. Nestander as president; Crandall Lassaux, vice president; L. F. Leuck, secretary-treasurer. In the San Francisco conclave of the Golden Gate chapter, C. C. Brown was named director; A. T. Styles, president; Bob McHale, secretary. The Louisiana-Mississippi chapter re-elected their presiding officers. They were L. L. Hale, director-president; Alfons Schadler, vice president; Ted Schneider, secretary-treasurer.

## CONVENTIONS & MEETINGS

- Sept. 6-7—**Mathematical Association of America**, Madison, Wisconsin.
- Sept. 13-14—**Television Lighting Conference**, General Electric Co., Nela Park, Cleveland, Ohio.
- Sept. 13-17—**1948 American Instrument Fair**, Instrument Society of America, Convention Hall, Philadelphia, Pa.
- Sept. 13-17—**American Association for Advancement of Science**, Washington, D. C.
- Sept. 18-26—**First National Television and Electrical Show**, Chicago Coliseum.
- Sept. 27-29—**FM Association**, Sheraton Hotel, Chicago.
- Sept. 27-Oct. 1—**Third National Plastics Exposition**, Grand Central Palace, New York.
- Sept. 29-Oct. 2—**IRE West Coast Convention**, Los Angeles.
- Sept. 30-Oct. 2—**Fourth Annual Pacific Electronics Exhibit**, West Coast Mfgs. Assoc., Biltmore Hotel, Los Angeles.
- Oct. 18-22—**American Institute of Electrical Engineers**, Fall Meeting, Hotel Schroeder, Milwaukee, Wis.
- Oct. 18-21—**Associated Police Communication Officers**, Annual Meeting, Houston, Texas.
- Nov. 4-6—**National Electronics Conference**, Annual Technical Forum, Edgewater Beach Hotel, Chicago.
- Nov. 8-10—**IRE and RMA Engineering Dept.**, Rochester Fall Meeting, Sheraton Hotel, Rochester, N. Y.
- Nov. 29-Dec. 1—**Conference on Electronic Instrumentation in Nucleonics and Medicine**, Engineering Society Bldg., 29 W. 39th St., N. Y., N. Y.

## RCA's UHF Television

Approval by the FCC for RCA to operate an experimental television station in Washington, D. C., will enable that company to determine the suitability of frequencies above 500 mc for television, according to Dr. C. B. Joliffe, executive vice president in charge of RCA Laboratories. The new experimental station has been installed at the Wardman Park Hotel in Washington, location of NBC's commercial TV outlet, WNBW. Simultaneous operation of the two stations on 67 mc and 510 mc will enable engineers to compare the service possibilities of uhf with the lower-band commercial frequencies.

If the uhf experiments prove successful, a simple and inexpensive adapter could be installed on present television sets which would facilitate reception on the higher frequencies as well as on the present television wave band.

## Stratovision at FCC

A temporary setback was suffered by Westinghouse at recent FCC local channel allocation hearings when the company sought a stratovision allocation of channel eight at Pittsburgh, with no other channel eight authorization within a 200-mile radius of the city. A decision to rule out some of the Westinghouse testimony came after FCC General Counsel Benedict P. Cottone protested that the company's added request to delete allocations of adjacent channels had not been proffered within sufficient time to allow affected parties time to prepare replies.

## "Picture Frame" Screen on Belmont TV Set

A viewing screen 13½ x 18 in. in an ornamental frame which can be hung on the wall like a portrait will be placed on the market by Belmont Radio Corp., Chicago. The main body of the receiver, including tuning knobs, will be housed in a chairside cabinet with controls on top. Extra viewing screens may be placed in other rooms and wired to the set.

## GE Forms New Division

A new division, called the Industrial and Transmitting Tube Division, has been formed within the Tube Division of the General Electric Co.'s Electronics Dept. This new division will consolidate all sales, design engineering and manufacturing activities. George W. Henyan, assistant to the vice president, has been named manager; K. C. DeWalt and E. F. Peterson have been appointed assistant managers; G. W. Pike is manager of engineering, Tube Divisions.

## Armstrong Sues RCA

Dr. Edwin H. Armstrong has filed suit against RCA and NBC charging infringement of five of his basic patents. He is also challenging RCA's licensing practices with manufacturers of radio transmitters, receivers and other equipment. RCA is preparing a denial of the charges, according to that company's officials.

## NAB Requests Hearing

An informal hearing by the FCC on the proposed reallocation of frequencies has been requested by the National Association of Broadcasters to discuss the NAB's opposition to deletion of present 152-162 mc channels and their support of 26 and 450-460 mc channels for remote pickup broadcast stations. The request was made in a statement of the NAB position which said that frequencies assigned for remote pickup "have never been adequate in quantity or quality to serve the public interest from day to day, to say nothing of meeting distress and emergency needs."

## Monmouth IRE Election

At the recent meeting of the Monmouth County (New Jersey) Subsection of the IRE, new officers were elected. Lloyd Hunt, Bell Telephone Laboratories, Holmdel, N. J.; S. E. Petrillo, Signal Corps Engineering Laboratories; George Reynolds, Jr., Electronics Associates, Long Branch, N. J., were elected chairman, vice-chairman, and secretary, respectively, for the 1948-1949 season.

## RCA Introduces TV Projector

Commercial equipment designed specifically for presentation of television programs to large audiences is being produced in quantity by RCA and initial distribution has begun in areas served by the television networks. Pictures ranging from three by four ft. to seven by nine ft. are produced by the TLS-86 which employs a Schmidt-type reflective optical projection system.

## NEW NAMES AND ADDRESSES

Harold E. Kennedy has resigned as vice-president of the Phillips Control Corp., Joliet, Ill., in order to open his own sales-engineering office at 509 Fifth Ave., New York 16, N. Y. He will handle electronic and television equipment.

International Television Corp. has completed negotiations for purchase of the facilities, equipment and furnishings of the Minerva Radio Corp., 238 Williams St., New York, N. Y.

Formation of Hayes-Parnell Production, Inc., 600 Sunset Blvd., Hollywood, has been announced. The new company will produce television receivers and films. Chairman and vice-president is Parnell S. Billings, former president of Belmont Radio Corp.

Premier Crystal Laboratories has moved to 79 Seventh Ave., New York, N. Y. Bernard C. Progeron is sales manager.

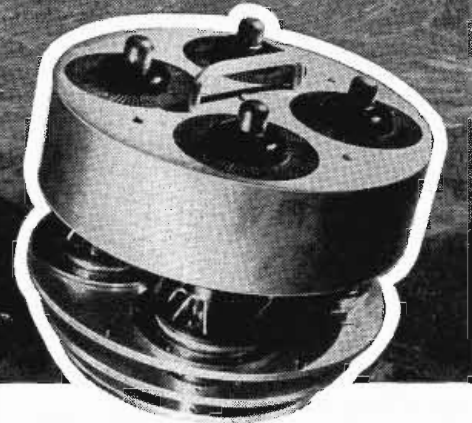
The Television Receiver Sales Division of Allen B. DuMont Laboratories, Inc., has moved to new and enlarged quarters at 515 Madison Ave., New York. The division which was formerly located in a section of the second floor now occupies the entire 41st floor of the building.



# PROVEN 50 Kw, 100-Mc. FM BROADCAST

Follow the Leaders to

**Eimac**  
TUBES  
The Power for FM



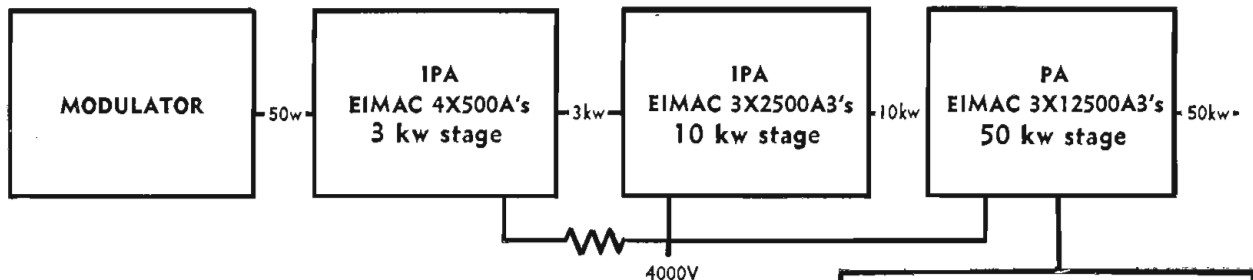
THESE ARE IMPORTANT FACTORS of sound high-power FM operation . . . proven important in over one year of operation by station KSBP, Mt. Diablo, California, 100.5-Mc., channel 263, effective radiated power 250,000 watts.

- 1) Overall power consumption is under 90 kw.
- 2) Equipment is of compact design.
- 3) Power tubes have highly efficient thoriated tungsten filaments.
- 4) Tube servicing is possible without special tools, equipment, and training.
- 5) Vacuum tube components are capable of supplying sufficient output without being run at maximum ratings.
- 6) 50 kw. final is driven directly by the 10 kw. stage.
- 7) Air cooled. 3, 10, and 50 kw. stages only require the output of a single blower driven by a 1 h. p. motor.

And they are made possible because of one component . . . the Eimac multiunit triode, type 3X12500A3. A pair of these tubes (as grounded grid amplifiers) are capable of providing over 50 kw. of useful output power with but 10 kw. watts of drive. The lineup of KSBP equipment and operational data, below, further illustrates advantages inherent to equipment designed around the 3X12500A3.

Analyze the vacuum-tube components in the equipment you consider . . . be sure their design presents the highest advantage to you. The Eimac sales department will gladly furnish names of equipment manufacturers and engineers using Eimac tubes. Phone, write or wire direct.

## HERE'S THE KSBP LINE-UP



**OVERALL EFFICIENCY:** input from 50 watts to 50KW - - - - - 65%  
**OVERALL POWER CONSUMPTION** - 85KW  
**TOTAL FLOOR SPACE USED BY EQUIPMENT** - - - - - 22 sq. ft.  
**TUBE REPLACEMENT COST**

4X500A \$97.50, 3X2500A3 \$180.00, 3X12500A3 \$875.00\*

\*\$115 credit for return of radiator and mechanical assembly in good condition. \$35.00 credit for return of crate in good condition.

### OPERATING CONDITIONS (Two Tubes)

D-C Plate Voltage - - - - 4000 volts  
D-C Plate Current - - - - 14.4 amperes  
D-C Grid Voltage - - - - -620 volts  
D-C Grid Current - - - - - 1.9 amperes  
Driving Power (Approx.) - - 12 kilowatts  
Plate Dissipation (total) - - 15.4 kilowatts  
Plate Power Input - - - - 57.6 kilowatts  
Useful Power Output - - - - 54.4 kilowatts<sup>1</sup>  
Apparent Efficiency - - - - 94 per cent

<sup>1</sup>Actual power delivered to water-cooled load. Amplifier output estimated to be 3 kw higher, due to resistance and radiation losses between amplifier and load.

**EITEL-McCULLOUGH, INC.**  
201 San Mateo Avenue, San Bruno, California

**MULTI UNIT DESIGN IS ANOTHER EIMAC FIRST**

# Survey of World Wide Reading

**A review of foreign scientific and engineering journals**

## Propagation of Attenuated TE-Wave in Cut-Off Frequency Region

*A. Kaech, Brown, Boveri & Cie, Baden, Switzerland (Helvetica Physica Acta, Basel, Switzerland, 1947 pp. 341-356).*

Propagation of  $TE_{om}$ -waves in rectangular wave guides are studied at the cut-off frequency and in the surrounding frequency region; the losses in the walls of the guide are taken into account.

It is shown that the distortion of the wave introduced by the losses in the guide walls will result in a slight curvature of the wave front which would otherwise be a plane wave front. An exact computation of the field components pertaining to this configuration is not attempted. However, the field distortion is so small that it may be considered linear as a first approximation. Further, the high conductivity of the metal walls and the high operating frequency, result in an extremely narrow penetrating depth of the wave into the walls of the guide because of the skin effect. The small penetration depth permits considerable simplification of the mathematical treatment.

Fig. 1 illustrates the field compo-

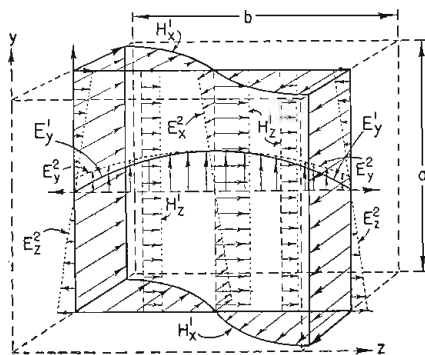


Fig. 1: Diagram of TE-Wave field components

nents  $E_y^1$ ,  $H_x^1$ , and  $H_z^1$  of the original  $TE_{01}$ -wave, present in a perfectly conducted guide, while  $E_x^2$ ,  $E_z^2$ , and  $E_y^2$  are the secondary field components, indicated by dotted lines, introduced by the finite resistance of the guide walls. The secondary wave is essentially a TM-wave which may be considered to be superimposed on the original TE-wave which is of much larger magnitude.

## Design of Wave-Guide Filters

*W. L. Fritchard (Journal of Applied Physics, 1947, pp. 862-872).*

The band-pass wave-guide filters considered consist of a series of rectangular cavities connected by quarter wavelength guide sections and coupled by connecting apertures. Formulas for resonant frequency, loaded Q, and insertion loss in the pass band are derived for a single stage. The general theory of n stages is developed and a specific design procedure based on the derived formulae and on the curves presented in the paper is suggested. The effect of finite thickness inductive apertures is studied.

## Two-Station Diversity Police Radio

*(Wireless World, London, England, December, 1947, pp. 457-458).*

The installation planned for the Hertfordshire county police, employing diversity transmission with amplitude modulation, is described. The scheme employs two 100-watt UHF transmitters, one located at Barkway in the northeast corner of the county, and the other at Leverstock Green, in the south-east corner. Both these stations are remotely controlled by a 10-watt transmitter operating on 150 mc located at the

county police headquarters at Hatfield. This transmitter feeds a half-wave horizontal antenna mounted at the top of a 100-foot steel tower. Leverstock Green and Barkway operate on two carrier frequencies of the order of 80 mc, the frequency separation being about 10 kc.

The patrol car transmitter supplies 10 watts at a frequency of the order of 100 mc. A vertical roof antenna is used, and both, transmitter and receiver, are crystal controlled. The receiver is of the superheterodyne type.

## Magnetron Frequencies

*G. H. Metson (Wireless Engineer, London, England, December, 1947, pp. 352-356).*

The wavelength of oscillations generated by split-anode magnetrons feeding into a Lecher-wire system is experimentally investigated. For B-mode oscillations (magnetic field smaller than the critical field), the generated oscillating frequency is independent of the electric parameters but depends on the tube geometry and the electrical length of the Lecher-wire system.

By adding the electric length of the Lecher wire system to the equivalent electric length of the magnetron — found from its electrostatic capacitance — the resonant frequency of the combined magnetron-Lecher system can be computed. The experiments with three different tubes operating under various conditions indicate that this resonant frequency will be generated. The wavelength  $\lambda$  will then be given by the formula:

$$4\pi l/\lambda = \pi n - 2 \tan^{-1} \omega CZ_0$$

where  $l$  is the actual length of the Lecher system and  $Z_0$  its characteristic impedance.  $C$  is the electrostatic capacitance of the magnetron plates and is an odd integer.

## Design of Single-Layer Coils

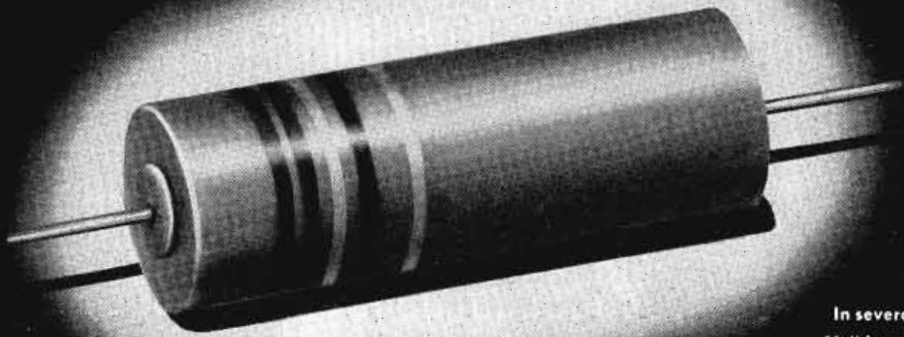
*A. I. Forbes Simpson (Electronic Engineering, London, England, November, 1947, pp. 353-360).*

A series of design charts are presented to facilitate the selection of a former, the wire diameter, and the number of turns for small single-layer coils used, for instance, in a tuned plate load. Standard size formers and wire dimensions are considered and optimum quality factor may be established.

# The Star Performer—

in assemblies that must stand the gaff... day-in-and-day-out... for months and years to come:

## DURANITE THE SUPERIOR CAPACITOR



In several sizes. This size 1½" long by ½" diameter.



#### TELEVISION

Minimizes costly service calls. Shows greater profit on usual maintenance deals.

#### MILITARY

Roughest handling without failure. Withstands climatic conditions without flinching.

#### AUTO RADIO

Unaffected by temperatures from sub-zero to 212° F. Nothing to melt. Humidity-proof.

#### SOUND SYSTEMS

No "noise" troubles due to moisture penetration and electrical leakage. Dependable.

#### INSTRUMENTS

No shelf deterioration. Can be stocked well ahead of use, yet remain "fresh" and reliable.

#### BROADCASTING

Greatest freedom from component-breakdown troubles and "off-the-air" spells.

#### HOME RADIO

Smaller than usual paper capacitors. Contribute to more compact chassis. Build good will.

#### AIRCRAFT

Withstand wide temperature ranges, varying air pressures, vibration, shock.

● Component-breakdown insurance. That's precisely why assemblies that must stand up—regardless of humidity, heat, cold, mechanical or electrical abuse—are featuring Duranite capacitors.

Duranite means *different*. Not just another plastic tubular. Not just an improvement over previous paper tubulars. Duranite stands for an *entirely new* concept

of the capacitor art—new impregnant, Aerolene, doing the work of both wax and oil; new casing material, Duranite, providing rock-hard, non-varying, impervious sealing throughout; new processing methods insuring quality with economy. You will never know how dependable radio-electronic components can be until you have tried Duranite capacitors.

● Write on your business letterhead for samples. Detailed literature on request. Let us quote on your requirements.



### FOR RADIO-ELECTRONIC AND INDUSTRIAL APPLICATIONS

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*Want the MOST EFFICIENT TRANSMISSION LINE for Your Station?*



WTAD-FM did. That's why they selected Andrew 6 1/8" coaxial transmission line. In spite of the 800 ft. long run, including a 750 ft. run up the tower, the overall efficiency is 90%!

Not only is this 6 1/8" line the most efficient standard RMA line used in broadcasting, but it offers the additional advantage of very high power handling capacity. It will handle up to 166,000 watts at 100 MC with unity standing wave ratio, allowing a wide margin for future power expansion.

Fabricated by Andrew in twenty foot lengths with connector flanges brazed to the ends, sections can be easily bolted together with only a couple of small wrenches. Flanges are fitted with gaskets so that a completely solderless, gas-tight installation results.

Still another advantage to buying Andrew equipment is that Andrew engineers are available to properly install it. NO OTHER TRANSMISSION LINE MANUFACTURER OFFERS YOU THIS COMPLETE INSTALLATION SERVICE!

Here's what Mr. Leo W. Born, Technical Director of WTAD-FM, writes about Andrew installation service:—

*"You will be interested to know that the installation of the Andrew coaxial line made by your organization has been giving us trouble-free performance of high efficiency in the daily operation of WTAD-FM.*

*Knowing the great difficulties involved in the installation of such a large line on a 750 foot tower over a period of such inclement weather conditions, I feel that the excellent operation of the line is indeed a tribute to the men of your company who were on the job. Such performance is not accidental and we congratulate you on a tough job well done."*

This again emphasizes Andrew's unique qualifications:—Unsurpassed equipment and complete engineering service.

**WANT THE MOST EFFICIENT ANTENNA EQUIPMENT FOR YOUR STATION? WANT EXPERIENCED ENGINEERS TO INSTALL IT? WRITE ANDREW TODAY!**

The 750 ft. high tower of WTAD-FM, Quincy, Illinois — one of America's finest FM Stations—showing 6 1/8" copper coaxial transmission line manufactured and installed by Andrew.

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CORPORATION

TRANSMISSION LINES  
ANTENNA EQUIPMENT

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## Diverse Adaptor

When connected to two antennas, the DM-430 diverse adaptor automatically selects the better antenna for receiving the desired sig-



nal which passes through one stage of broad-band amplification and then to antenna terminals of any standard receiver. All connections are made to barrier-strip terminals mounted on top of the chassis. The DM-430 operates on 200 to 300 volts at 15 ma and a filament supply of 613 volts ac at 1.5 amps. Chassis is 7 x 7 x 2 in. Special fixed-frequency models are available for police, taxi, and commercial communications services.—Declimeter, Inc., 1428 Market St., Denver 2, Colorado.

## Ground Plane Antenna

Four ground plane radials at a 28° drop angle have been incorporated in the isoplan antenna for exact matching of the cable at the mid band. An isolation array of 4 horizontal radials beneath the ground plane reduces unwanted mast radiations that normally waste 15% to 25% of the signal on the stratosphere. The isolation array brings the signal down to earth for a stronger, longer range signal and reduces noise pick up to a minimum. — Motorola Inc., 4545 Augusta Blvd., Chicago 51, Ill.

## TV Antenna

As simple to open as an umbrella, the Quik-Rig antenna can be made ready for operation in less than 30 seconds. In its disassembled state, the antenna forms a complete, compact unit free of all loose elements and hardware. The dipoles and reflectors, which are neatly folded up against the side of the crossarm, are simply swung out into position and tightened in place with wing nuts.—J. F. D. Mfg. Co., Inc., 4117 Fort Hamilton Parkway, Brooklyn 19, N. Y.

## FM Transmitter and Receiver

The PJZ-1 FM portable transmitter operates on a single frequency in the 30-44 mc band and is equipped with a 1/4-wave detachable telescopic antenna. Power output of the transmitter is 1/2 watt. Receiver sensitivity is 1 1/2 microvolts for 20 db silencing and selectivity is 85 db down at 100 kc and 40 db down at 40 kc. Power is supplied by two 2-volt storage cells in parallel which give approximately six hours of service between charges. High voltage supply is obtained from a vibrator. The unit is supplied complete in one case weighing nine lbs.—Doolittle Radio, Inc., 7421 S. Loomis Blvd., Chicago 36, Ill.



# Components

## Frequency Shift Exciter

The existing crystal or master oscillator in any transmitter may be replaced by the 250-T crystal controlled frequency shift exciter which is designed to key a radio telegraph transmitter by the frequency shift method. Keying input to the exciter may be a teletype machine or high speed tape transmitter. A front panel switch facilitates instant selection of 3 crystal controlled operating frequencies, each preset to its individual carrier frequency.—Erco Radio Laboratories, Inc., Garden City, N. Y.

## Aircraft Transceiver

A light plane radio transceiver, known as the "One-Sixteen," provides the private plane with all essential radio communication and



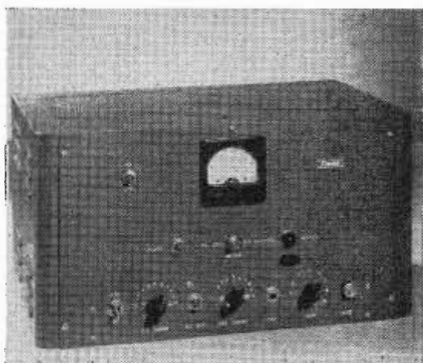
navigation facilities in a single compact package. Weighing only nine pounds and fitting conveniently into the instrument panel, the new unit provides the following services: tower communications, four course ranges, marker beacons, standard broadcast frequencies, loop direction finding, six vhf transmitting channels, and a cabin intercommunication system.—RCA Victor Div., Radio Corp. of America, Camden, N. J.

## TV Amplifier

The Tele-Booster, a specially designed rf amplifier with self-contained power supply, will boost weak television signals to a point where good reception is possible. Compact, simple to install and operate, this amplifier is connected in series with the receiving antenna; no other connection to the television set is necessary. When the amplifier is turned off the antenna is connected directly to the television received and thus has no effect upon normal signals which require no boosting. Physical dimensions of the unit are 3 x 5 x 6 in.—Vision Research Laboratories, 87-50 Lefferts Blvd., Richmond Hill, N. Y.

## Amateur Transmitter

The Telvar amateur transmitter (model T60-2) is a compact unit which incorporates a regenerative oscillator circuit, operating with the output at the crystal frequency on



all bands except 10, 11, and 15 meters. For operation on these bands the plate of the oscillator is tuned to the second harmonic of the crystal; the regenerative oscillator circuit provides ample driving power. Two 6L6G's operate as push-push doublers in the final rf amplifier.—Audar, Inc., Argos, Indiana.



# Uniformity

The days of "file and fit" went out when volume methods came in. The modern assembly line in large production plants is in itself so dramatically arresting a spectacle that the "feeder lines", of which there are hundreds in every volume industry, are lost sight of. Just as mighty rivers exist only because of the less majestic tributaries, so the production line is dependent upon sources of supply so unvarying in flow and quality, that every part is ready and right to "fall into place" with mechanical precision and constant supply. Our production line has been standardized to a degree of uniformity attainable only through long-time development of machines, controls and skilled workmen.

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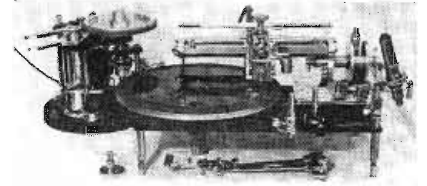
# GENERAL ELECTRIC

166-GE

# Sound

## Precision Recorder For Microgrooving

Designed to accommodate the recent trend toward the use of microgroove records, this newly designed, bench type, precision disc recorder cuts 190-272 lines per in. on one range setting, and 85-106 lines per in. on



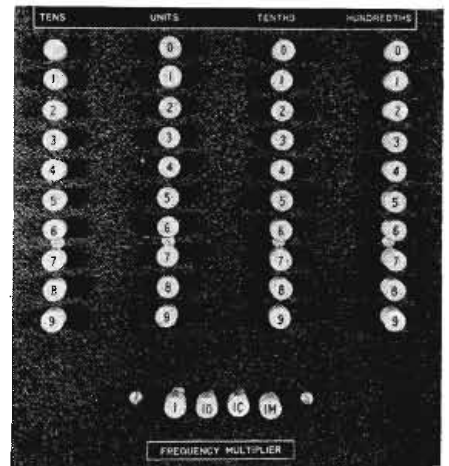
another. Unlike most disc recorder designs, the 1/12 HP, single phase, sync drive motor has been mounted on the left side of the main assembly to minimize rumble effects. Belt drives for both the 15 1/2-in. turntable and the leadscrew serve to further reduce undesirable mechanical noises. The equipment records outside-in and inside-out at 33 1/3 or 78 rpm, and the spiraling mechanism included also operates in both directions. Suction equipment is available but not included. Other features of the equipment are: reed armature type cutter, provision for automatic cutter lift, and ability to cut record stampers completely without removal from the turntable.—Fred Van Eps Laboratories, Plainfield, N. J., RD-2.

## Audio Amplifier

Model 8430 high-fidelity amplifier delivers 30 watts output at less than 4% harmonic distortion (47 watts peak) with a frequency response flat to  $\pm 2$  db from 30 to 18,000 cps. Four tone controls provide independent attenuation for the microphone channels to minus 19 db at 10,000 cps and to minus 10 db at 40 cps.; as well as equalization for the music circuits from plus 11 to minus 11 db at 40 cps, and from plus 10 db to minus 24 db at 10,000 cps. Three high-impedance microphone channels with separate gain controls and one high impedance line input are provided. Available output impedances are 4, 8, 16, 250, and 500 ohms. The amplifier operates on 110-130 V, 50-60 cycles.—Neill & Peterson Co., Inc., 1811 Carrol Ave., Chicago 12, Ill.

## Keyboard Oscillator

Any audio frequency from one cycle to 100,000 cycles is produced accurately by the Burrell keyboard oscillator, a resistance-tuned unit using negative feedback. A continuous control permits adjustment to one cycle in the 10 to 100 kc range, facilitating



production of a stationary pattern on a comparison scope when calibrating the keyboard oscillator against some frequency standard. Drift is less than .02% per hour after 15-minute warmup. Distortion is less than .3% if load is greater than 1,000 ohms on the 20 to 20,000 cycle range. Power requirements are: 105 to 125 volts, 50 to 60 cycles ac, 50 watts.—Weinschel Engineering Co., Dept. TT, 123 William St., New York 7, New York.

# Equipment

## Recorder

Simplification of the mechanical drive in the Ellinwood 116-A recorder makes possible the elimination of most vibration and noise sources. The entire unit is operated without worm or gear transmission of any kind. A belt-type turntable drive permits instantaneous change of speed from 33 1/3 to 78.26 rpm with one control knob element. The 116-A permits cutting inside-out or outside-in by the positioning of a simple cam lever. Heat treated, hardened and ground lead screw operates on full floating precision ball centers which, together with precision friction drive screw mechanism, maintain accurate line spacing free from variation or grouping inherent in gear-type mechanisms. Pitch is continuously adjustable while cutting for maximum utilization of record space. Records may be cut from six to 17 1/2 in. for 16-in. master pressings inside-out or outside-in.—Ellinwood Industries, 150 W. Slauson Ave., Los Angeles 3, Calif.

## Hand Microphone

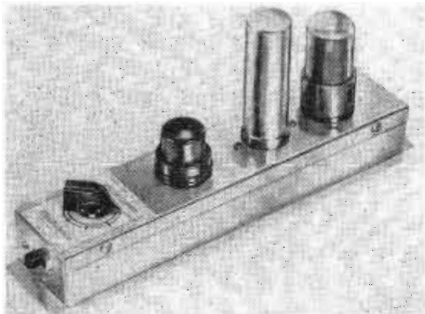
A multi-purpose, compact unit, known as the Cardinal microphone, can be held in the hand like an electric razor or laid flat on



its back on desk or table, where it may be talked across. Accessories include a sleek, squat base that serves as a desk stand, a special adapter for attachment to all conventional floor stands, and a hang-up bracket for mobile communications. It has substantially flat response from 30 to 10,000 cps. Output level is -62 db.—Astatic Corp., Cincinnati, Ohio

## Speech Clipper

The speech clipper is a peak limiting pre-amplifier that clips the tops and bottoms from speech frequencies which rise above a pre-set amplitude, providing higher articula-



tion and intelligibility in phone communications. In unclipped speech, low frequencies in the vowel sound are considerably greater in amplitude than the high frequencies that make up the consonants. The consonants contribute most to articulation, and the vowels contribute the least. Hence, the Speech clipper (E-V model 1000) increases the ratio of consonant to vowel intensity by clipping the peaks of the vowels while limiting the peaks of the consonants to the pre-set modulation percentage. Operation is directly from any high impedance microphone into the microphone input of a conventional speech amplifier.—Electro-Voice, Inc., Buchanan, Mich.

# Out in Front!

## KESTER "RESIN-FIVE" CORE SOLDER

containing a **NEW FLUX**  
that is more active, stable and  
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**ACTIVITY** "Resin-Five" will solder zinc, brass, nickel silver, nickel-plate, copper and ferrous alloys.

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The most important development in Cored Solder within the last ten years. "Resin-Five" has virtually no odor even at extreme temperatures. Available in 5 core sizes; varying percentages of flux content. Diameters ranging from .010" to .250". All practical alloys.

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# Communications Accessories

## Tension Device

A new tension device for coil winding machines gives more precise tension control and permits winding of more coils at one time. Swivel construction permits mounting of spools parallel with winding arbor and closer together. Spools up to 6 in. outside diameter and 16 to 42 gauge wire can be accommodated.—Associated Production Co., 2655 W. 19th St., Chicago 8, Ill.

## Liquid Wire Stripper

Stripping of wires is speeded with "Formula 21," a non-corrosive, non-inflammable prepara-

tion for removing "Formex", "Formavar", enamel and similar wire insulating coatings. Wire is dipped in liquid and wiped off with a rag or blown off with compressed air. No scraping, tools or special cleaning is required.—Aircraft-Marine Products, Inc., 1416 N. 4th St., Harrisburg, Pa.

## Fluorescent Lamp

A new 75-watt fluorescent lamp, the T12 Slimline, is 96 in. long and exceeds by an average of 600 lumens the output of the T8 Slimline lamp. Now available in 35000 standard white, the new lamp is instant-starting, has a single contact base and contains a spe-

cial hydrophobic coating which assures reliable starting characteristics under high humidity and sub-normal voltage conditions.—Sylvania Electric Products Inc., Emporium, Pa.

## Soldering Iron

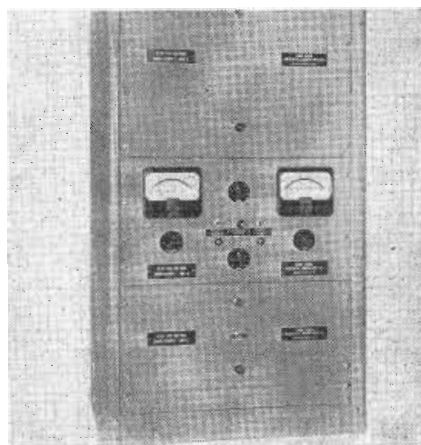
Model P212 soldering iron is the plug-tip type, rated at 200 watts, with a 1/2-in. diameter tip, which reaches a soldering tempera-



ture considerably beyond that of the conventional soldering iron. Special provisions have been made in the element construction to withstand the unusually high temperature developed. It has replaceable elements and tips and operates from regular 110 or 220 volts, ac or dc, any cycle.—Hexacon Electric Co., 157 W. Clay Ave., Roselle Park, N. J.

## Power Unit

A continuously variable dc voltage from 1,000 to 10,000 volts at current drains up to 5 ma is supplied by type IPS10000, 10 kv ISO



volt dc power supply. Regulation of 1/10 of 1% is obtained electronically and corrects the output voltage almost instantly over full line and load variations. The unit may be operated from voltage sources ranging from 105 to 130 volts ac, 60 cycles. Power drain is approximately 350 watts at full load.—Rowe Engineering Corp., 2422 N. Pulasid Rd., Chicago, Ill.


## TV Rehearsal Studio Equipment

An iconoscope camera, a studio control console, a set of camera cables, and 2 vertical lamp banks, complete with 12 reflector



spot lamps constitute type 148-C Television Rehearsal Studio Equipment. All of the units operate from 115-160 volt, 60 cycle ac. Total power consumption of the camera and console is under 1000 watts. The video system has a substantially flat frequency response from 60 cycles to 2.5 mc. Signal Output can be applied to any number of remote viewers or to the video section of any standard type TV receiver.—Television Projects, Inc., 24 Walnut St., Newark, N. J.

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RELAYS  
RESISTORS  
RHEOSTATS

## Vast Variety of Stock Units ANSWERS EVERYDAY NEEDS ECONOMICALLY

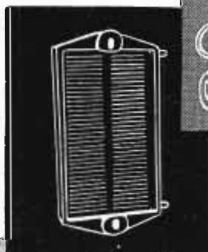
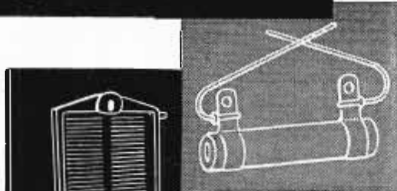
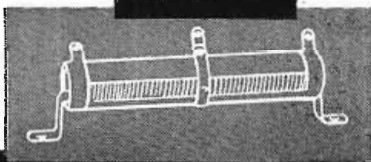
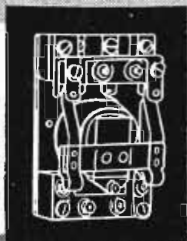
Relays are available from stock in general-purpose, industrial, and radio amateur types for continuous or intermittent duty.

Vitrohm wire-wound Fixed Resistors are available in 8 stock sizes from 5 to 200 watts. Adjustohms in 7 stock sizes from 10 to 200 watts. Plaque Resistors in 3 sizes from 20 to 125 watts. Discohms in 18 watts. Stripohm in 5 stock sizes from 30 watts to 75 watts. Ring-type close control Rheostats in 4 stock sizes from 25 to 150 watts. (Plate Type Rheostats recommended for larger sizes.) Wide variety of Resistance Values.

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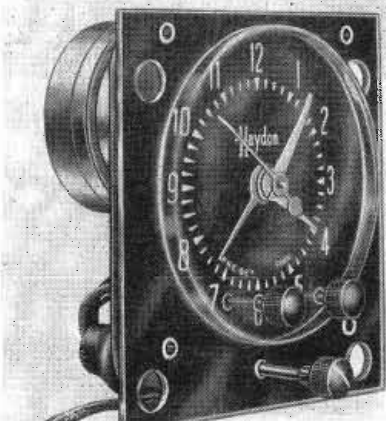
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*Basic 3R's in Current Control*



### Radio Alarm Clock

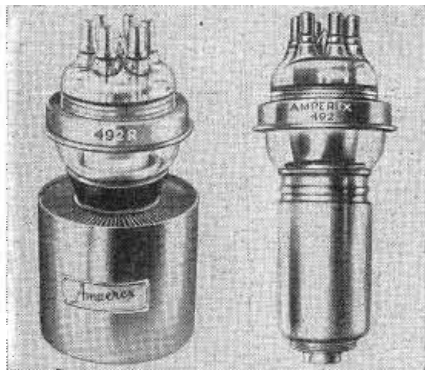
A radio alarm clock which has a three-position switch for turning a radio on, off or setting the alarm to turn the radio on at



a preselected time has been added to the Haydon line of timing motors. It may be mounted in any position and no shielding is required to prevent interference with radio reception. When the switch is in the "alarm" position the length of radio play is limited to one hour and 15 minutes. All controls are grouped at the base of the clock.—Haydon Mfg. Co., Torrington, Conn.

### Air and Water Cooled Triodes

Two new 5-kw triodes, the high-frequency water-cooled 492, and the air-cooled 492-R are ideally suited to grounded-grid high fre-



quency circuits. The maximum rating of 5 kw plate dissipation applies up to a frequency of 150 mc. An air flow of 170 cfm enables the radiator of the 492-R to dissipate full power and the 492 anode can handle 5 kw with a water flow of three to five gallons per minute. Water jacket of the 492 is an integral part of the tube and a separate adaptor provides connection to external water lines. Grids of both tubes are ruggedly mounted to a ring seal by an unperforated section of copper cone that forms an effective shield between the filament structure and the anode.—Amperex Electronic Corp., 79 Washington St., Brooklyn, N. Y.

### Subminiature Triode

The CK5703/CK6Q8CX is a heater cathode triode with rated mutual conductance of 5,000 micromhos and an amplification factor of 25. It has a three-watt plate dissipation and is



capable of an output of nearly one watt at 500 mc with usable output at higher frequencies. This type may be soldered into the circuit or plugged into commercial sockets.—Raytheon Mfg. Co., 60 East 42nd St., New York 17, N. Y.

### Silicone Rubber Adhesive

Designed for bonding silicone rubber to itself and to glass, metals, and ceramics, GE adhesive no. 12503 remains flexible and resilient over temperatures ranging from  $-70^{\circ}\text{F}$ . to  $520^{\circ}\text{F}$ . and withstands continuous temperatures of 300 to  $350^{\circ}\text{F}$ . in a dry air circulating oven.—General Electric Chemical Dept., Pittsfield, Mass.

### Air Velocity Meter

Capable of measuring accurately wind or cooling air velocities as low as 5 ft. per minute, the Hastings air velocity meter incorporates a basic noble-metal thermopile mounted in a  $\frac{1}{2}$  in. dia. probe. The lower half of the scale on the meter is expanded for accurate reading of velocities from 0 to 200 ft. and the upper half is compressed logarithmically for readings up to 6000 ft. per

minute. The meter may be operated from an ac power outlet or from a portable-battery-operated power pack.—Hastings Instrument Co., Hampton, Va.

### Transformers

A new line of audio components, input transformers, modulation, power, and filament transformers has been designed for use by industry, radio, and public address purposes. Designed with low temperature rise and good insulation factors, these units have coil structures which are vacuum impregnated and cases which are poured with special sealing compounds to assure stability under adverse climatic conditions. The new series includes audio components for all applications ranging from low level humbucking, multiple alloy shielded input transformers to 600 watt modulation transformers.—United Transformer Corp., 150 Varick St., New York 13.

# COMPARE THE QUALITY

# COMPARE THE PRICE

Deliveries of all BUD items now greatly improved. Your jobber should be able to supply you with almost any BUD item from stock. Of any of the items listed in this ad and for further comparison write for the NEW BUD CATALOG NO. 148.

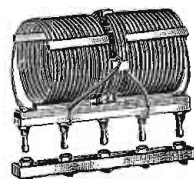
Variable Condensers. BUD makes 248 different sizes and types of condensers. We list here the most widely used condensers, known as the BUD MIDGET, for your comparison.

15 mmfd. — \$1.14	140 mmfd. — \$1.80
33 mmfd. — 1.22	190 mmfd. — 1.95
50 mmfd. — 1.45	235 mmfd. — 2.18
100 mmfd. — 1.62	300 mmfd. — 2.40

For prices on other sizes and types, see NEW BUD CATALOG. Ask your jobber for one.



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500 watt rating	
80 meter — \$3.65	15 meter — 2.97
40 meter — 3.30	10 meter — 2.88
20 meter — 3.00	6 meter — 2.64

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WE WELCOME THE OPPORTUNITY TO QUOTE ON YOUR REQUIREMENTS FOR SPECIAL CABINETS, CHASSIS, COILS, OR VARIABLE CONDENSERS TO HARMONIZE WITH YOUR PRODUCTS.



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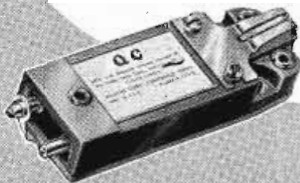
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Astatic again assumes a pioneer role . . . in making available, for the first time, the unique physical advantages of the amazing, piezoelectric ceramic element, in a microphone and phonograph pickup cartridge of advanced quality and fidelity. Unaffected by heat, moisture or dryness, they can go virtually anywhere . . . provide transcription quality reproduction, troublefree service, in tropical climates, under exposure to direct sunlight, heat from klieg lights or automotive interiors, when subjected to the many other conditions that threaten damage or impaired performance to other type instruments. These, plus other important advantages, combine to assure an immediate, enthusiastic reception for Astatic ceramic devices.

**NOW AVAILABLE** Astatic has incorporated ceramic elements in two of its most popular product designs—the convertible "Velvet Voice" Microphone and the "Quiet Talk" series pickup cartridges. Now moving through Astatic production lines, they are immediately available.



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 specifications



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*Larvie Laboratories*

RADIO ENGINEERS AND MANUFACTURERS  
 MORGANVILLE, N. J.

## FM Monitor Design

(Continued from page 57)

Many of the tests on the monitor require a frequency modulated rf signal, modulated 100% at a signal level of from 7 to 10 volts rms. It is necessary that this level be adjustable over the range. The distortion limit in the signal that would permit over-all distortion measurements on the monitors to less than a 0.25% has been set at 0.1%. Since this signal is required for several of the tests, it is necessary to adjust and calibrate all the monitors at one frequency. It was apparent that the most difficulty would be encountered at the high frequency end of the FM band; i.e., 108 mc; therefore, this frequency was selected for the signal generator. To meet these requirements, a special crystal controlled FM signal generator with several output circuits had to be developed and built.

The servicing of the signal generator to maintain the required low level of distortion presented somewhat of a problem. For continuous monitoring of the generator one of the FM broadcast station monitors was installed in the rack with the generator. This provided a secondary standard for frequency deviation, percent of modulation and periodic checks of distortion.

In order to detect changes in either the calibration of the monitor or in the operation of the generator more fundamental methods were required. For example, the Bessels Zero or null method was used to establish the 100% modulation point; i.e.,  $\pm 75$  kc carrier swing.

At the start of each work period and whenever a measurement of distortion from the signal generator monitor showed an increase in distortion, a new calibration of the signal generator was made with special discriminator equipment. This equipment permitted turning to either side of the generator frequency, making it possible to balance out the residual distortion in the discriminator and thus obtain an accurate measurement of distortion in the generator.

The power supply is tested as a whole. The total test time does not exceed 15 minutes per unit. All connections to the power supply are made by the cable terminating in spade terminals rigidly spaced for easy assembly on the terminal board of the power supply. Load resistors are provided so that each circuit operates under the normal current load. The instruments are

marked with "go" and "no go" limits. Special test record sheets are made for each unit, recording among other things the ripple and noise present in the output and the percentage variation in dc output voltage for changes in 60-cycle power-line voltage.

The power supplies for the monitor has to meet the rigid specifications of a maximum of 3 millivolts, rms noise and ripple in the dc output voltage and a maximum of  $\pm 1\%$  dc voltage variations with power line changes within the specified voltage range.

Considerable time has been saved in test by providing pre-heating circuits at each test position for the temperature controlled test crystals, the 6H6 rectifiers, and in some cases for a complete indicator unit. Additional time is saved by having test limits printed on the prepared test record sheets instead of having test personnel draw complete response curves and compare them to standard curves.

Each test position has been made flexible enough to permit its change for use on either the preceding or following test. The test personnel are trained to handle the work in adjacent stations. This procedure pays dividends when difficulties are encountered in any one position and has made it possible to maintain a continuous flow of units.

### FCC Approves New England Common Carrier System

Authorization for constructing fixed-station and mobile radio-telephone facilities in 21 cities throughout New England and New York for the U-Dryvit Auto Rental Co., Inc., Cambridge, Mass., has been made by the FCC. Plans for what will be the largest limited common carrier radio-telephone system in the country will use 1915 mobile units. The 21 fixed-station equipment and the mobile units will be supplied by Philco.

### 13,750 TV Sets in D.C.

A recent report of the Washington Television Circulation Committee revealed that as of July 1, 1948 13,750 television receivers had been installed and are operating in the Washington metropolitan area. Monthly estimates are made from figures supplied by the Electric Institute of Washington and other sources.

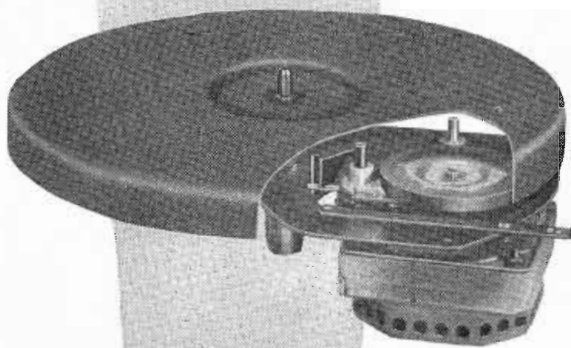
### WTTG Buys New Equipment

Over \$115,000 has been authorized for new equipment for WTTG, Washington, D. C. outlet of the DuMont television network and the Capitol's pioneer TV station. WTTG's master control room, studio and mobile operations department will benefit under the expenditure.

*For the first time . . .*

## RIM DRIVE DUAL SPEED PHONOMOTORS!

for the NEW  $33\frac{1}{3}$  R.P.M. RECORDS



**MODEL DR**—Deluxe model 4 pole, shaded pole motor designed for use in all high-grade instruments in which the ultimate in performance is desired. Novel speed change mechanism is both simple and positive in operation.



**MODEL DM**—Compact low cost 2 pole, shaded pole motor designed for portables, table models, and other instruments in which space is an important factor. Ingenious speed change mechanism incorporates highest quality molded rubber belt.

Another General Industries' first . . . low cost, dual speed phonomotors that will play both the new  $33\frac{1}{3}$  R.P.M. and conventional 78 R.P.M. records. Both motors have external speed change control levers . . . both are engineered and built to the same high quality standards which distinguish all phonomotors, recorders and record changer-recorders in the famous GI *Smooth Power* line.

Complete information about this newest development in the phonomotor industry is available upon request. Write or wire *today* to:

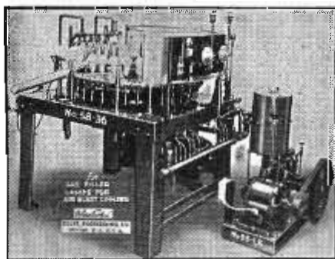


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DEPARTMENT L • ELYRIA, OHIO

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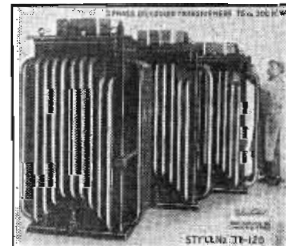


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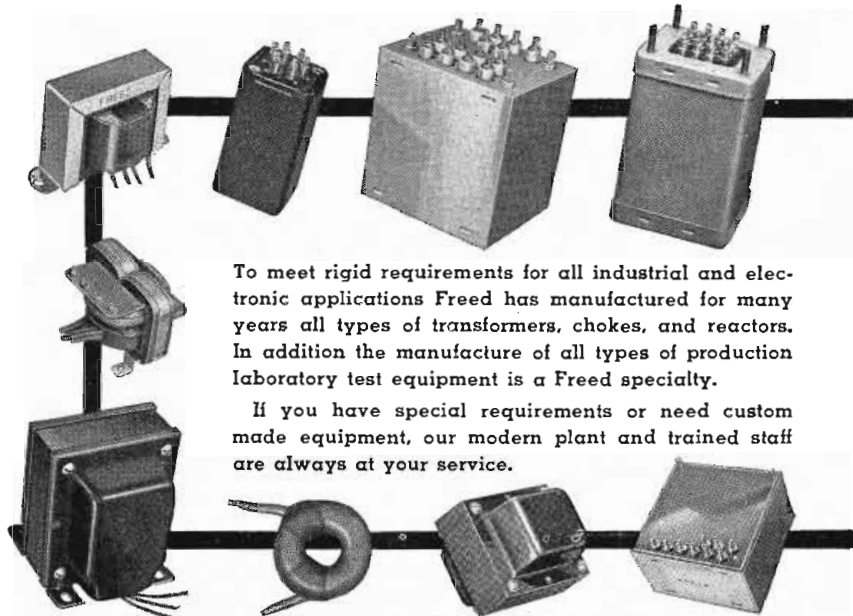
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**FREED TRANSFORMER CO., Inc.**  
78 SPRING STREET NEW YORK CITY 12, N. Y.

**Component Parts  
Standardization**

(Continued from page 38)

own markings, and his own requirements. Economic pressure to reach the market first forces each manufacturer to adopt those sizes which best fit his requirements regardless of the rest of the industry.

One other point is of importance. In any program of standardization with respect to performance as well as with respect to size, standards that are set up must necessarily be such that will allow the largest number of producers to meet their requirements. In effect this means that the marginal producers actually set the standards. These standards are, therefore, not acceptable to the manufacturers of quality radio equipment, and they in turn add to or supplement the standards by their own requirements, thus setting up new standards. No manufacturer would like to have the stigma of being a marginal producer; therefore, the use of grade or quality level is studiously avoided in setting up these standards although in effect this is exactly what is done when the manufacturer adds to the standards as established by the industry.

I realize that these are conditions with which we must cope every day. I do not see any hope in standardization for the industry except in one respect and that is the elimination of part numbers or special markings or the use of a standardized marking for all manufacturers. If this goal can be attained, the radio industry, especially the capacitor industry, will have gone a long way in reducing the number of special units with a consequent reduction in cost and a speed-up in production.

**ENGINEERS INSIST  
ON WASTEFUL RE-DESIGN**

(Author's Name Withheld by Request)

There is less standardization in the radio parts field today than there was 20 years ago. This is true of practically every component that goes into the average set.

Speaking specifically of capacitors, 20 years ago there were only a few types of capacitors available to manufacturers. Surprisingly enough, manufacturers at that time were able to get along quite satisfactorily on this limited selection.

Today, during any average year, a component manufacturer will

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Size YOU need!**

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SPIRAL  
WOUND PAPER TUBES**

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cludes many odd sizes.  
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produce many thousands of different types of capacitors. The cost of this design work, retooling, and clerical detail incidental in the writing up of specifications, etc., is tremendous. Multiply this factor by the 27 odd components that go into the average receiver, and you will find that the cost to consumers, and to manufacturers as well, over the past decade, has been appalling.

It is fair to ask at this point why all this re-design work, sampling, etc., is necessary. It appears that the average engineer is not satisfied to accept the word of an established manufacturer and will promptly sit down and re-design a component part to justify his personal egotism. This may sound rather far-fetched and prejudicial. However, a check with any of the large companies will show that engineers are exceedingly loath to use designs of components that have proved satisfactory over the past several years. Every time a new model has been put on the rack, new design of components is automatically put through. Some of these re-designs are obviously necessary. However, the majority of them are completely unnecessary.

The cost of this re-design work—and include in that the cost of sampling—is terrific and must be paid for by some one. Inasmuch as most of the component manufacturers are fairly successful in their operations, it is only fair to assume that this cost has, in turn, been passed along to the manufacturer who promptly adds it on to the retail value of the set.

[Ed. Note: Further comments from readers, pro and con, on the need (or no need) for standardization of component parts, is invited. Your name will be withheld if desired, so write freely.]

### Telemetering Rocket

A 3,000-mile-an-hour rocket equipped with instruments which respond to changes in pressure, speed, heat, light and other physical effects has been tested successfully by the Navy at the White Sands Proving Grounds, New Mexico. The telemetering equipment was installed in the Navy's Aerobee, the rocket which recently climbed almost 72 miles. Six radio channels were used to transmit changes in 24 physical conditions.

### Sylvania Specialist Lectures

A series of lectures on the physics of metals will be delivered at the National Univ., Bogota, Colombia, by Dr. G. C. Kuczynski, specialist in the electron theory of metals, Metallurgical Research Laboratories of Sylvania Electric Products, Inc.

# ZOPHAR

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Materials for potting, dipping or impregnating all types of radio components or all kinds of electrical units. • Tropicalized fungus proofing waxes. • Waterproofing finishes for wire jackets. • Rubber finishes. • Inquiries and problems invited by our engineering and development laboratories.

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ARE USED IN THIS HIGH-SPEED GEIGER-MULLER COUNTER

They're used in the quenching circuit. Herbach & Rademan, Inc., Philadelphia, Pa. the manufacturer says—"We have been using and will continue to use S.S. White Resistors since we find them extremely satisfactory and most compact of all types available."



Photo courtesy of Herbach & Rademan, Inc. Philadelphia, Pa.

WRITE FOR BULLETIN 4505

It will give you full details about S.S. White Resistors including construction, characteristics, dimensions, etc. A copy, with Price List, will be mailed at your request.



### S.S. WHITE RESISTORS

are of particular interest to all who need resistors with inherent low noise level and good stability in all climates.

HIGH VALUE RANGE  
15 to 10,000,000 MEGOHMS

STANDARD RANGE  
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**VERTICAL ATTENUATORS**  
 for new **CONSOLE INSTALLATION**



The flick of a finger operates the patented "Gove" Vertical Attenuator. Representing the very latest in broadcast components, these units are suitable for every type of sound equipment from elaborate broadcast stations to the simplest P.A. system. Unit gives smooth easy operation and can be cleaned from front of panel by removing escutcheon. Completely shielded and dust proof.

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Write for Descriptive Bulletin

# NEWS . . .

## WSB-TV in NBC Network

Both inter-connected and non-inter-connected affiliation contracts with the NBC network have been signed by WSB-TV, Atlanta, Ga. Regular television programming will begin Sept. 29, according to J. Leonard Reinsch, managing director of the Cox radio stations.

## TBA TV Report Released

The initial report of the TBA committee on television operations, standards and personnel was distributed to members of the association last week. O. B. Hanson, vice president and chief engineer of NBC, and formerly director of TBA, headed the committee which prepared the 70-page report.

## NAB Conference Planned

Problems connected with higher frequencies for television, standards for magnetic tape recording and the agenda of next April's Third Annual NAB Engineering Conference were discussed at recent meetings of the association's Engineering Executive Committee and All-Industry Engineering Planning Group. The conference is scheduled to be held April 5-7, 1949, according to Engineering Dept. Director Royal V. Howard.

## Motorola Wage Increase

A ten-cent an hour wage increase for all Motorola hourly-paid employees has been announced by Paul V. Galvin, president. He said that the company does not plan to raise the prices of its products.

## TV Society 10 Years Old

The Lawrence Tech Television Society, Detroit, Mich., will celebrate the 10th anniversary of its founding on September 9th. Since its inception the society has constructed 30 complete receivers designed by Clark Quinn, present coordinator and charter member. The members of the society built the first complete television transmitting and receiving equipment in the state and also built the first sets to operate on present commercial standards.

## WSEE Joins ABC

WSEE, St. Petersburg-Tampa, Fla. television station, has become a TV affiliate of the American Broadcasting Co. to bring the total of ABC video affiliates, including those owned and operated by the network, to 14. As ABC's ninth independent affiliate, WSEE is expected to go on the air early in 1949, operating on channel 7 with 26.2 kw visual and 13.1 aural power.

## GE Hires Over 1400 Grads

More than 1400 graduates in the 1948 classes of 150 colleges and universities have been hired by the General Electric Co. this year, according

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**MANUFACTURE**  
 and **OPERATION** of  
*ALL*  
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**5th** of preceding month— For complete plates only. No setting.

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to Maynard M. Boring, assistant to the vice-president in charge of engineering policy. Of this group, 50 were chemistry majors, 15 were physics graduates, and 1,046 were electrical, mechanical, and industrial engineers.

### Jobs for Engineers

Recently organized as a non-profit organization to encourage the most efficient use of engineering knowledge and experience, The Scientists' and Engineers' Assoc., Rock Rimmon Rd., Stamford, Conn., specializes in finding employment for unattached scientists and engineers. The services of the association are available to all electrical, electronic and radio engineers throughout the United States and to employers everywhere.

### RTC Constitution Proposed

A proposed constitution for the Radio Technical Commission for Land-Mobile services which was reviewed at the organization's June conference contains provisions that membership in the RTC be confined to users groups in the Public Safety, Land Transportation and Industrial Services. All common carriers and radio equipment manufacturers will be excluded from voting membership.

### More 10-in. TV Tubes

A prediction that production of 10 and 12½-in. glass bulbs for television viewing tubes would catch up with demand "reasonably soon" was advanced last month by Stanley J. McGiveran, vice president of Owens-Illinois Glass Co. Basis for step-up is laid to rapid mechanization of production by Owens-Illinois Kimble glass division which has proceeded much faster than expected.

### Sylvania Licenses RCA

Licenses for some 200 radio and television tube patents which have resulted from research by the Sylvania Electric Corp. have been granted to RCA, according to an agreement between the two companies. The licenses run for seven years with royalties at 0.75% but not exceeding \$200,000 in any one year.

### Army to Test Transistor

Immediate tests of the transistor, an electronic device recently developed by Bell Laboratories, have been ordered by Major General S. B. Akin, Chief Signal Officer, U. S. Army. Capable of many functions of a vacuum tube, the transistor is important to the army because it has no filament and requires no heating current to do its job of amplifying voltages.

### Frank Rieber

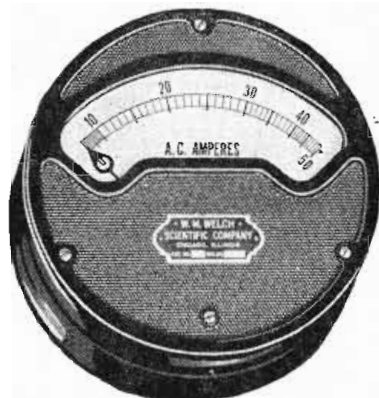
Frank Rieber, 57, well known physicist and inventor, died at his home and laboratory at 127 East 73rd St., New York, N. Y. on June 30th. He was a member of the IRE, American Institute of Physics, American Meteorological Society, and the Seismological Society of America. He held 48 United States and foreign patents and 27 patent applications pending on inventions in electronics, acoustics, telemetering and geophysics.

# Welch

## Electrical Measuring Instruments

— P A N E L —  
METERS FOR PRODUCTION

— S W I T C H B O A R D —  
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PORTABLE  
LABORATORY STANDARDS

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- Quick-Reference Chart, Miniature Tubes (Free). [A]
- HB-3 Tube Handbook (\$10.00)\*. [B]
- RC-15 Receiving Tube Manual (35 cents). [C]
- Receiving Tubes for AM, FM, and Television Broadcast (10 cents). [D]
- Radiotron Designers Handbook (\$1.25). [E]
- Quick Selection Guide, Non-Receiving Types (Free). [F]
- Power and Gas Tubes for Radio and Industry (10 cents). [G]
- Phototubes, Cathode-Ray and Special Types (10 cents). [H]
- RCA Preferred Types List (Free). [I]
- Headliners for Hams (Free). [J]

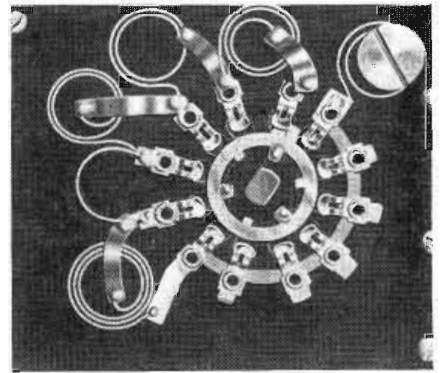
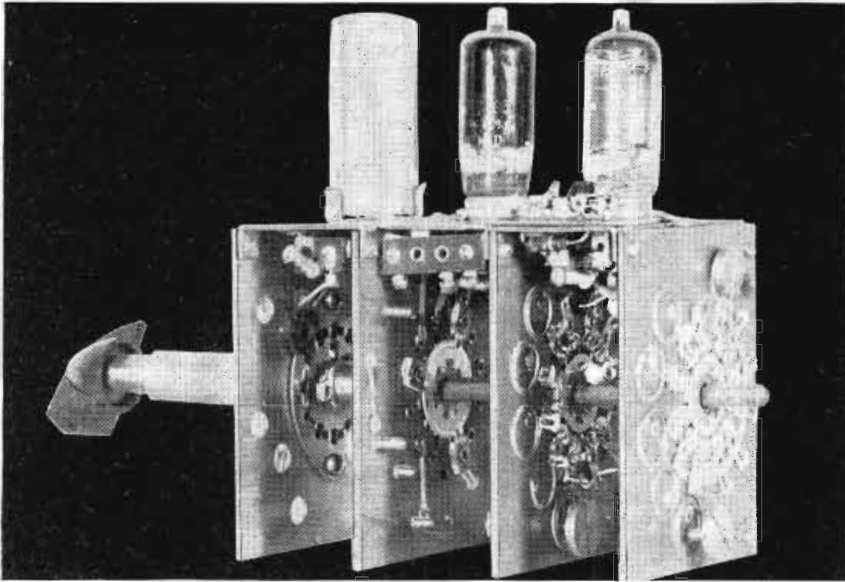
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TUBE DEPARTMENT

**RADIO CORPORATION of AMERICA**  
HARRISON, N. J.





Left: Typical 12-channel television selector switch assembly without steel housing. Above: Bakelite switch wafer showing layout of stamped coils and adjustable slugs

## New TV Switch Stamping Process

• The new television channel selector switch assembly, developed by the Franklin Airloop Corporation, Long Island City, N. Y., can be classed as a major step toward reducing receiver manufacturing costs. Tuning inductances for 12 channels are die-stamped

directly onto bakelite rotary tap switching wafers using specially designed die-cutting machines developed for this process. The spiral coils are formed out of paper-thin sheet copper which has been coated on one side with thermoplastic cement for positive

binding on the base insulating material. Complete switching and tuning assemblies incorporate rf, oscillator and converter stages and are packaged in a cadmium steel plated housing measuring approximately 4 x 2½ x 3 inches.

Each unit employs three rotary tap switching wafers with the taps operating over a single coil of distributed length. Two brass tuning slugs, one for channel six and the other for channel 12, are included on each wafer. These slugs are factory tuned for the set of tubes that accompany the switching assembly and may require readjustment if a wide varia-



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The specifications for Formica "YN-25" tell their own amazing story far better than adjectives. Note particularly that impact strength is 10 times greater... insulation resistance 200 times higher than standard electrical grades of laminated insulation.

PROPERTY	VALUE
Power Factor @ 1 megacycle.....	.014
Dielectric Constant @ 1 megacycle.....	3.9
Insulation Resistance after 96 hrs. @ 95% R.H.....	Over 50,000 megohms
Impact strength @ 90° F.....	10 ft. lbs. per inch of notch
Flatwise.....	6 ft. lbs. per inch of notch
Edgewise.....	

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full engineering data to Formica,  
4644 Spring Grove Avenue, Cincinnati 32, Ohio.

Excellent machining, punching and post-forming characteristics mean limitless variety of possible sizes and shapes.



**FORMICA "YN-25" - 200 TIMES BETTER INSULATION RESISTANCE**



tion in the constants of replacement tubes is encountered. As supplied, a 6BH6 is the rf amplifier, a 6AG5 the converter and a 6C4 the oscillator. Tube sockets included in the assembly provide for mounting all tubes in the same plane, one behind the other. Leads brought out of the housing allow for filament and plate power connections.

Because of the simplicity of assembly and the ease with which replacement wafers can be installed, owners of television receivers using this type switch are promised lower service and maintenance costs. For servicing, the switch detent section, together with the common wafer tap shaft, is removable in one piece by loosening the four machine screws holding the front housing plate to the switch assembly. Specially cut tongues on the bakelite wafers permit them to be snapped in and out of the slots provided in the steel housing easily.

The Franklin Corporation has been a pioneer in developing die stamping processes as a means of reducing manufacturing costs of communications equipment. Most noteworthy is their loop antenna which has been adopted as a standard component by many AM table model receiver manufacturers. These units are now turned out in spool form to be cut off as required. The television channel selector switch is the result of experience gained in developing these antennas and experiments are currently in progress to determine the requirements for die stamping other types of complex multi-tuned circuits. In line with this, entire receiver IF amplifiers, complete with coils and condensers, have been produced. Condensers are formed by binding the sheet copper on both sides of the insulating medium which then acts as the required dielectric. The values of capacitance acquired by this method depends of course on the surface area covered, but in normal production, values of from five to 25  $\mu\text{fd.}$  are readily obtainable.

Two other television channel selector switches are planned for an early production. One of these is an assembly with provision for AFC. This unit is being produced to obviate vernier tuning requirements. The other model will be similar to the current assembly but will have an additional rf stage included.

### NBS Official Receives Award

Dr. Robert D. Huntoon, chief of the Atomic Physics Division, National Bureau of Standards, was presented one of the 2 distinguished achievement awards given by the Washington Academy of Sciences for 1947. He was the recipient of the Academy's physical science award and was cited for his research in "the advancement of electronics and its application to other sciences and to modern ordnance."

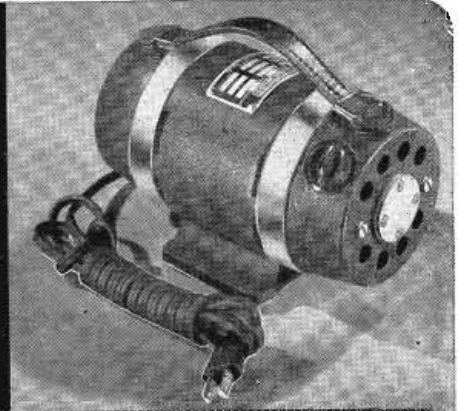
### Electronic Labs Reorganized

F. T. Hageman has been appointed general sales manager of Electronic Laboratories, Inc., Indianapolis, Ind., by the corporation's court-appointed trustee, Jack I. Kahn. George L. Turnquist has been named general manager, in addition to his present duties of treasurer-controller.

*Exclusively*  
**Carter**

THE **ONLY** DC - AC ROTARY  
**CONVERTERS**

SPECIALLY DESIGNED TO OPERATE  
WIRE AND TAPE RECORDERS



To fill the growing demand for a portable power supply for operating wire and tape recorders and sound projectors on DC, CARTER now provides a specially engineered line of rotary converters. Compact. Smart in appearance. Equipped with carrying handle, cord set, and AC receptacle as illustrated. Two basic models cover every requirement. Designed for 6, 12, and 115 volt DC input.

NEW CONVERTER BULLETIN No. 748, with Carter Selector Chart, tells which converter to buy. Your Carter distributor has this bulletin. If you make, sell, or use wire or tape recording equipment, WRITE for bulletin 748 today, without obligation.



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# BULLETINS

## Protective Padding

New ways to protect merchandise in shipment and to cut packaging costs are presented in "Tufflex Protective Padding," a new bulletin released by the Wood Conversion Co., First National Bank Bldg., St. Paul 1, Minn. Tufflex is a felted, resilient wood fiber padding material developed by the makers of Balsam-Wool and Nu-Wood. (Mention T-T)

## Tube Diagram Reference

The RCA "Triple PindeX" provides three complete and separate base-diagram booklets covering 475 types which are joined in a single cover with a spiral wire binding. The three-in-one booklet design facilitates simultaneous study of any two or three tube base diagrams. It is available from RCA Tube Distributors for 75 cents. (Mention T-T)

## Components

Resistors, rheostats and radio amateur relays are illustrated and described in catalog D-130 issued by Ward Leonard Electric Co., Mount Vernon, N. Y. A copy may be procured by writing to Radio and Electronic Distributor Div., Ward Electric Co., 53 W. Jackson Blvd., Chicago 4, Ill. (Mention T-T)

## Tube Pin Straightener

Hytron Radio & Electronic Corp., Salem, Mass., has published an engineering bulletin covering the Hytron tube tapper and miniature tube pin straightener and is available to radio and parts manufacturers. (Mention T-T)

## Broadcast Transmitters

Comprehensive information on RCA 5-kw and 10-kw AM broadcast transmitters is now available to broadcasters requesting it on their letterheads. Entitled "AM Broadcast Transmitter, Types BTA-5F and 10F," the new brochure can be obtained from any of

the RCA district sales offices or by writing to Dept. 516, RCA Engineering Products Dept., Camden, N. J. (Mention T-T)

## 30-ke Carrier System

Folder CX39A shows the relationship between maximum performance and minimum maintenance, characteristics of the Lenkurt Type 32 Carrier Systems manufactured by Lenkurt Electric Co., 1120 County Rd., San Carlos, Calif. Particular emphasis is placed on the filter engineering which has opened up new spectrum space for use as a narrow-band voice circuit or with a nine-channel FM or AM telegraph system. (Mention T-T)

## Flexible Tubing

"Titeflex" all-metal flexible tubing is the subject of a 24-page catalog published by Titeflex, Inc., 614 Frelinghuysen Ave., Newark 5, N. J. In addition to brass tubing, the catalog describes the company's bronze tubing for nominal steam pressure applications, monel and stainless steel tubing for higher temperatures and corrosion resistance, and inconel tubing for extremely high temperatures. (Mention T-T)

## Electrostatic Voltmeters

Model ESH is featured in the bulletin describing the line of electrostatic voltmeters manufactured by Sensitive Research Instrument Corp., 9-11 Elm Ave., Mount Vernon, N. Y. Models ESD and UEP are also covered. (Mention T-T)

## Cardioid Dynamic Microphones

A bulletin on the improved Cardyne Cardioid Dynamic Microphones has been issued by Electro-Voice, Inc., Buchanan, Mich. Known as bulletin 139, it gives complete information on the performance and utility of the Broadcast Cardyne, together with technical data and specifications. (Mention T-T)

## Rolling Spring Switches

Rolling spring switches, exclusively constructed by the Acro Electric Co., 1305 Superior Ave., Cleveland 14, Ohio, are the subject of a bulletin recently published by Acro. The rolling springs are made of Beryllium copper. (Mention T-T)

## Antennas

FM and television antennas and accessories, manufactured by JFD Mfg. Co., 4111 Fort Hamilton Pkwy., Brooklyn 19, N. Y., are described in a 16-page brochure published by the company. Over 27 arrays are included in the "Super-Beam" line, ranging from a simple straight dipole to a double-section multi-dipole all channel array. (Mention T-T)

## Panel Etching

How some of America's largest companies have employed the Premier Metal Etching Co. to give maximum utility and sales value to their panels, dials and nameplates is illustrated in a color folder recently released by Premier. It is available upon request to Sales Development Div., Premier Metal Etching Co., 21-09 44th Ave., Long Island City 1, New York. (Mention T-T)

## Vibration Control

Vibration and shock control is the subject of a brochure published by the Barry Corp., 179 Sidney St., Cambridge 39, Mass., designers and manufacturers of isolators for electrical and aircraft equipment. Instrument, machinery and industrial mountings are described in addition to a line of heavy equipment mountings with load ranges up to 3300 lb. (Mention T-T)

## AC Solenoid Contactors

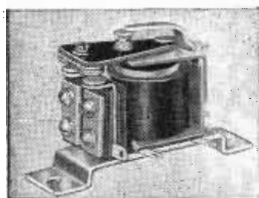
Descriptions and specifications of two new ac solenoid contactors (sizes 2 and 3) are presented in bulletins 4452 and 4453, published by the Ward Leonard Electric Co., 31 South St., Mount Vernon, New York. (Mention T-T)

## Door Interlock Switch

Designed for high frequency radio, radar, X-ray and television equipment cabinets, induction heating equipment and all types of electronic controls, the Micro-door interlock switch is manufactured by the Micro Switch Corp., Freeport, Ill. Details, operation and specifications are presented in Micro Switch's data sheet no. 45 (Mention T-T)



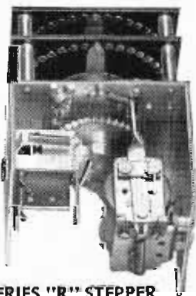
## of ELECTRO-MAGNETIC CONTROL



SERIES 220 RELAY

This small relay is capable of handling 20 amps at 220 v., the leader in its size and price field for inexpensive, compact, heavy current control. A very widely used small relay for industrial control such as welding machines, x-ray, motor starters, etc.

Write—tell us your control problem. Get specific recommendations.



SERIES "R" STEPPER

Used for cycle control requiring continuous sequence repetitive operations; to remotely select and control multiple circuits; can be furnished to rotate continuously, reset automatically or to pulse both clockwise and counter clockwise on the same unit with up to 100 contacts on a disc.

**GUARDIAN ELECTRIC**  
W. WALNUT STREET CHICAGO 12, ILLINOIS  
COMPLETE LINE OF RELAYS SERVING AMERICAN INDUSTRY

For higher values of Q  
IN TELEVISION • FM • AM & AUDIO

Use  
**MOLDITE**  
PRECISION  
**IRON CORES**

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MOLDITE CORES are made to exact specifications, using an exclusive powder mix for each specific requirement, plus new methods of processing and mass production.

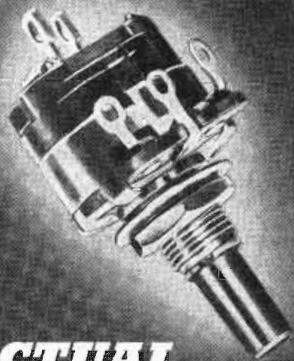
RESULT—Higher quality and economy; greater circuit stability and flux density.

SAMPLES on request for design, test and pre-production purposes. For quick, exact duplication of cores, send for Moldite mix numbers plotted on frequency graph.

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Iron Core Specialists . . . Member R. M. A.

WESTERN REP. Perlmuth-Colman Assoc. 942 Maple Avenue Los Angeles, Calif.	MID-WESTERN REP. Irving Rose 314 No. Michigan Ave. Chicago, Ill.	SO. AMERICAN REP. Jose Luis Pantef Cordoba 1472 Buenos Aires, Argentina
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**NEW 15/16" CONTROLS**



**ACTUAL SIZE!**

★ Yes sir, a brand new member of the well-known Clarostat family of controls. Type 47 or 15/16" diameter miniature control is smaller, handier, yet just as tough as its bigger brother, Type 37 composition-element control.

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*Controls and Resistors*

CLAROSTAT MFG. CO., Inc. - 285-7 N. 6th St., Brooklyn, N. Y.

In Canada: CANADIAN MARCONI CO., Ltd. Montreal, P.Q., and branches

## PERSONNEL

**Ken Jarvis**, consulting engineer and president of Jarvis Electronics Corp., Chicago, has been elected chairman of the Chicago section of the IRE for the 1948-1949 season.

**John C. Van Groos** will represent the Shallcross Mfg. Co., Collingdale, Pa., as field engineer for the states of California, Nevada, and Arizona.

**Robert Blodget** has been named television product manager for the Philco Corp. and **James M. Skinner, Jr.** has been appointed vice president—service and parts division.

**F. J. Bingley**, chief television engineer of the Philco Corp., has been appointed chief engineer of WOIC, Washington and WOR-TV, N. Y. He will supervise transmitters, microwave relays, studios and network operation for the two outlets.



**Henry T. Killingsworth** has assumed the general managership of the Long Lines Dept. of the A. T. & T. Co. Previously he was in Atlanta for Southern Area of Long Lines. He succeeds L. G. Woodford, general manager since 1943

**A. D. Sobel**, chief television engineer of the Franklin Airloop Corp., has been elevated to the post of vice president in charge of television engineering.

**Ralph A. Krause** has been designated director of research of the Stanford Research Institute, Palo Alto, Calif. Formerly he was assistant to the president of Raytheon Mfg. Co., Waltham, Mass.

**Harold W. Schaefer**, formerly in charge of engineering development and research, has been appointed assistant manager of the Westinghouse Home Radio Div., Sunbury, Pa.

**E. R. Glauber** and **Martin L. Scher** have been promoted to the post of general manager and sales manager respectively of the Admiral Corp., New York Distributing Div., Inc.

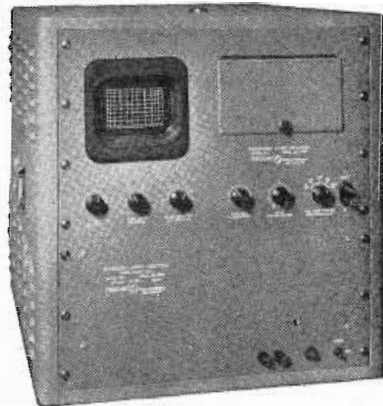
**Elton Earl Wood** has been appointed contract administrator of Langevin Mfg. Corp., N. Y., manufacturers of amplifiers, transformers and communications equipment.

**Leland W. Mosher** has been elected an assistant secretary of General Electric. He will retain his present position as manager of the insurance division in addition to his new duties.

**A. Arthur Karas** has been appointed personnel manager of Radiomarine Corp. of America. For the past eight years he had been assistant director of personnel of RCA Communications, Inc.

**Michael Kaplan** has assumed the presidency of the Sightmaster Corp., New Rochelle, N. Y. Other new officers are **F. Wakefield Minor**, vice president and general manager and **Arthur Aro**, sales manager.

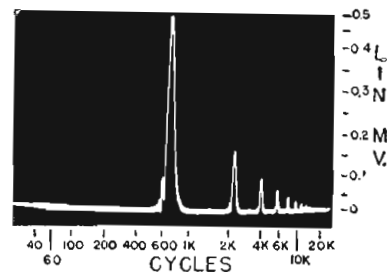
## FASTER, SIMPLER AUDIO ANALYSIS with Model AP-1



## PANORAMIC SONIC ANALYZER

Reduce time, complexity and cost of making audio measurements with the unusual advantages offered by the Panoramic Sonic Analyzer. By resolving a complex audio wave into a spectrograph showing the frequency distribution and voltage amplitude of the components, Model AP-1...

- Eliminates slow point-by-point frequency checks
- Provides a quick overall view of the audio spectrum
- Enables determination of changes in waveform content while parameters are varied
- Furnishes simple presentations for production line testing.



Panoramic Sonic Spectrograph of 750 cps square wave.

Use Model AP-1 for analyzing...

- Harmonics
- Intermodulation
- Vibration
- Noise
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- Materials

**Features...** Continuous scanning from 40-20,000 cps in one second • Wide input voltage range • Linear and log voltage scale • Closely logarithmic frequency scale • Built-in voltage and frequency calibrator • Simple operation.

WRITE for detailed specs, price and delivery.

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RADIO CORP.

92 Gold St.  
New York 7, N. Y.

Cable Address  
**PANORAMIC, NEW YORK**

Exclusive Canadian Representative: Canadian Marconi, Ltd.

# BOOKS



## FM Transmission and Reception

By J. F. Rider, S. D. Uslan. Published by J. F. Rider Publisher, Inc., 404 Fourth Avenue, New York 16, N. Y. 416 pages. Price \$2.70 cloth, \$1.80 paper binding.

This book covers the basic principles and the operation of a complete FM transmitter and receiver. The first section discusses both the narrow-band and wide-band transmitters manufactured today for service in television, amateur, aviation, marine, police, point-to-point, and mobile radio communication systems. Both direct and indirect FM transmitter theory is explained.

The second section of the book explains the parts of an FM receiver, including types of FM detectors and tuners.

## Relativity—The Special and General Theory

By Albert Einstein, Ph.D. Published by Hartsdale House, New York, N. Y. 168 pages, \$2.50.

The author of this small volume hardly needs any introduction. The present book is intended, as far as possible, to give an exact insight into the theory of Relativity to those readers "... who are not conversant with the mathematical apparatus of theoretical physics." They will find here the

main ideas and concepts involved in the theory of Relativity and their close relation to experiments. This attempt to bring his theory within reach of the layman is certainly to the author's credit. The execution indicates that he is an excellent teacher. It is a very of a scientific theory or theorems and book to attempt to convey the essence of a scientific theory or theorems and not something vaguely resembling it. Consequently this book will require serious interest and patience on the part of the reader, but he is almost certain to be rewarded and to derive knowledge and pleasure from this study of the text.

## Vacuum Tubes

By Karl R. Spangenberg. Published by McGraw Hill Book Co., New York, N. Y. 860 pages. Price \$7.50.

A comprehensive survey of the physical laws which determine vacuum tube behavior. The outstanding tube types are dealt with individually and their operating characteristics explained in terms of their internal fields and their influence upon the electron flow. Attention is concentrated upon the internal factors which contribute to the operating characteristics of tubes such as determination of the shape of potential fields, solution of electron path equations, determination of space charge relations.

Recent advances in the field are thoroughly covered, and the material includes many items not previously available in book form, such as space charge flow, noise, specific characteristics of triodes, tetrodes, and pentodes.

## Constant-Frequency Cavity Generator

By Arnold Braun, Dr. Sc. Techn., Reports of the Institute for High Frequency Engineering, Eidgenossische Technische Hochschule, Zurich, published by Verlag AG. Gebr. Leemann & Co., Zurich, Switzerland, 79 pages, Swiss Fr. 7.50.

The behavior of coaxial cavity resonators, the inner conductor of which is provided with tuning capacitor plates either at the end or in the center of the cavity, is explored in this book. Formulas are derived for the impedance, the losses caused by the skin effect, and the quality factor Q. Design for high quality factor for given volume, given inductance and volume, given inductance and outer diameter and given length and inductance, is considered, formula and curves are presented and numerical examples are included. One chapter deals with the tube-cavity coupling, the tube being represented by a capacitance and resistance in parallel. Another chapter describes two UHF oscillators and their performance.

## Vacuum Tube Circuits

By L. B. Arguimbau (MIT). Published by John Wiley & Sons, 440 - 4th Ave., New York 16, N. Y. 668 Pages, Price \$6.00.

In this book the material is edited so that topics of major importance receive the most attention such as frequency modulation, transient response and generation of microwaves. It contains chapters on inverse feedback, an extended treatment of frequency modulation, video-amplifier transients and a discussion of pulses and television.

## CORROSION

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Is corrosion one of *your* product problems? Try Synthane laminated plastics for the affected parts ... see for yourself how Synthane's corrosion resistant qualities lengthen the life of your product.

Synthane is an ideal material for resisting solvents, water, most oils, alkalis and certain acids. (Not recommended for tanks or containers.) In addition, it is strong, light weight, an excellent insulator and stable over wide variations in temperature.

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Increased Insulation

BETTER CONNECTIONS

JONES BARRIER  
TERMINAL STRIPS

Leakage path is increased—direct shorts from frayed terminal wires prevented by bakelite barriers placed between terminals. Binder screws and terminals brass, nickel-plated. Insulation, black molded bakelite. Finest construction. Add much to equipment's effect.

Jones Means Proven Quality

No. 2-142      No. 2-142-3/4 W      No. 2-142 Y

Illustrated: Screw Terminals—Screw and Solder Terminals—Screw Terminal above Panel with Solder Terminal below. Every type of connection.

Six series meet every requirement: No. 140, 5-40 screws; No. 141, 6-32 screws; No. 142, 8-32 screws; No. 150, 10-32 screws; No. 151, 12-32 screws; No. T52, 1/4-28 screws.

Catalog No. 16 lists complete line of Barrier Strips, and other Jones Electrical Connecting Devices. Send for your copy.

**HOWARD B. JONES DIVISION**  
Cinch Mfg. Corp.  
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TELE-TECH • September, 1948

www.americanradiohistory.com



## GENERAL ELECTRIC THERMOCELLS for ACCURACY

G-E thermocells are as small as it is practical to make them and still retain all of the advantages which broaden their field of application and simplify the problems of design engineers.

Design engineers will appreciate especially the octal base feature. Add in these other major advantages in G-E thermocells—then specify them for every job you have under consideration.

1. G-E thermocells are filled with an inert gas and sealed to inhibit atmospheric contamination of both crystal and thermostat contacts.
2. Warm-up time is extremely short because of the low thermal capacity of the unit as a whole.
3. The heat loss is low, which permits low operating power and consequently less load and longer life for the thermostat contacts. Radiant heat loss is minimized by the polished chromium-plated shell.
4. Durable platinum-iridium thermostat contacts are used in G-E thermocells.

A typical example of the G-E line of thermocells is the Type G31:

Frequency Range . . . . . 2500-10,000 K.C.  
 Size and Shape . . . . . Same as 6L6  
 Freq. Adj. at Normal  
 Ambient Temperature . . . . . .0015%  
 Ambient Temp. Operating Range . . 0 to 55°C.  
 Long Time Frequency Stability  
 better than . . . . . .001%  
 Heater Power . . . . . 2.6 Watts  
 Crystal Cuts Normally Used . . . . . AT & BT  
 Electrodes and Mounting . . . . . Pressure Airgap  
 Warm-up Time . . . . . 15 Minutes

For further information on this and other G-E thermocells, quartz crystals and germanium diodes write today to: General Electric Company, Electronics Park, Syracuse, New York.

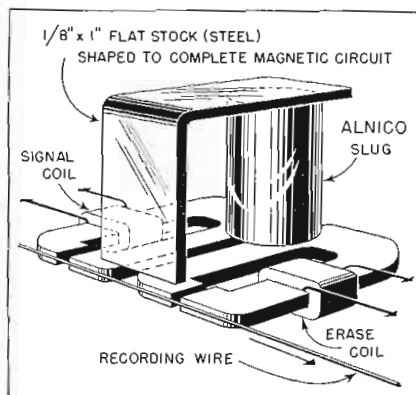
185-G2

**GENERAL ELECTRIC**

## Alnico Improves Wire Recorder

WNEW engineers were not completely satisfied with the way wire recorders erased previous signal modulations. Background residual modulation caused objectionable cross-talk. Finally, they hit on a method of accomplishing a clean magnetic wipe. What is more, subsequent recordings seemed to have higher fidelity, lower distortion — better all-round listening qualities.

An Alnico permanent magnet slug from a six in. speaker was oriented on the signal and erased magnetic circuits as shown. As the wire moved by, the pole pieces, it suf-



Detail of permanent magnet slug assembly

ferred a sharp reversal of magnetic polarity and was left with a certain component of residual magnetism (but free of magnetic modulation). When the wire thus gaussed is re-modulated, all traces of cross-talk are removed and the recording has improved quality.

The WNEW engineering staff came upon this idea somewhat empirically, and is now preparing to conduct appropriate measurements in order to determine the theoretical answer.

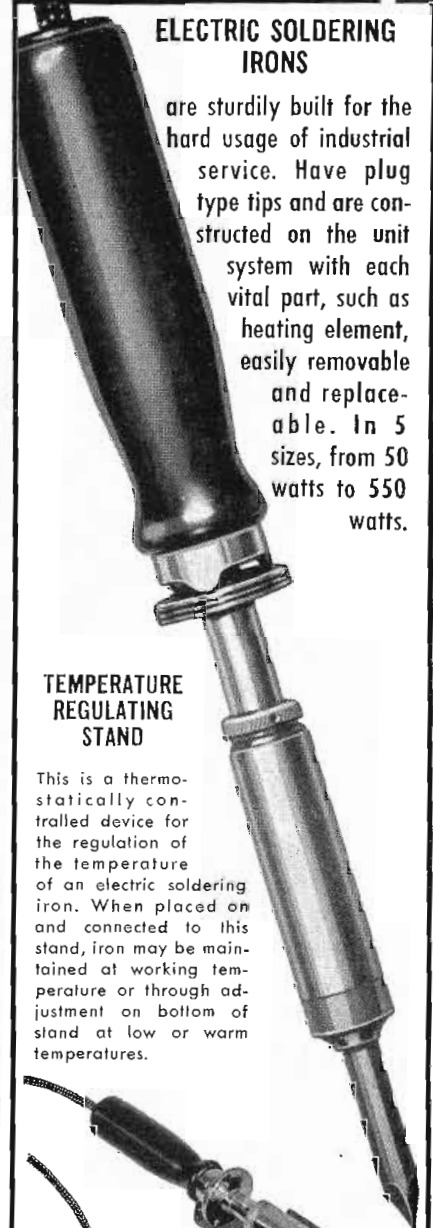
## FM Assoc. Expands

Formed on January 10, 1947 as a promotion operation, the FM Association has started full trade association functions, according to an announcement by Bill Bailey, FMA executive director. A special committee is studying a revision of the by-laws of the association and will report to the FMA board on August 24. If the by-law changes are approved they will be submitted to the membership for action at the second annual convention, Sept. 27-29, Hotel Sheraton, Chicago.

# American Beauty

## ELECTRIC SOLDERING IRONS

are sturdily built for the hard usage of industrial service. Have plug type tips and are constructed on the unit system with each vital part, such as heating element, easily removable and replaceable. In 5 sizes, from 50 watts to 550 watts.



## TEMPERATURE REGULATING STAND

This is a thermostatically controlled device for the regulation of the temperature of an electric soldering iron. When placed on and connected to this stand, iron may be maintained at working temperature or through adjustment on bottom of stand at low or warm temperatures.

For descriptive literature write

110-1

**AMERICAN ELECTRICAL  
HEATER COMPANY  
DETROIT 2, MICH., U. S. A.**

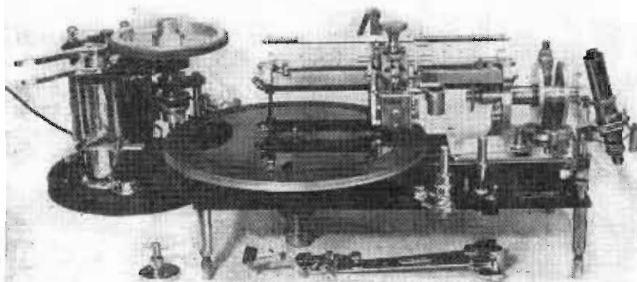
# "TIP" FOR BETTER SOLDERING

Select the NEW G-E CALROD SOLDERING IRONS with the "non-freezing," easy-to-replace, calorized-copper tips. They simplify maintenance in your shop. General Electric Company, Schenectady 5, New York.



WRITE FOR BULLETIN  
GEA-4519.

**GENERAL ELECTRIC**



Announcing . . .

## VAN EPS PRECISION RECORDER

A new design precision recorder that meets every recording need with lines from 85 to 136 and MICRO-GROOVES from 190 to 272, together with fast spiralling in and out. All changes are made instantaneously. 1/12 H.P. synchronous motor. The use of a separate drive unit eliminates motor rumble. High precision gives perfect spacing to MICRO-GROOVES. With fast spiralling, automatic cutter lift and an eccentric cutter it is possible to cut stampers complete without removal from the turntable.

**FRED VAN EPS LAB, RD. 2, PLAINFIELD, N. J.**

Laboratory at Warrenville — Bound Brook 9-0784 R-1

## 4 CONTINUOUS HOURS of PLAY with the MAGNETAPE TWIN-TRAX RECORDER



**\$495** including microphone

NO OTHER RECORDER OFFERS THESE SPECIAL FEATURES

4 hours continuous play . . . Frequency response 40 to 10,000 cycles  $\pm$  2 db . . . Individual bass and treble controls . . . Simplified tape threading . . . Heavy-duty non-overheating motor . . . No tape rewinding necessary . . . Phono pickup and turntable facilities available . . . Low hum level (DC on heaters) . . . Automatic tape reversal at end of reel . . . Sockets for VU meter and foot switch . . . Major components easily accessible . . . No mechanical noises . . . Instantaneous reverse control — without unthreading . . . Instantaneous stop — rapid start . . . High speed forward and reverse without unthreading . . . No tape spillage possible during high speed shuttle . . . Plays single track recordings made on other recorders . . . Separate recording and playback amplifiers on single chassis . . . Rubber-rimmed drive cannot develop flats . . . Complete elimination of capstan tape slippage . . . 3.2 and 500/600 ohm balanced line outputs . . . Jack for external speaker or earphone monitoring . . . Twin electronic erase heads . . . Flutter and wow  $\pm$  0.1% . . . No belts to loosen or pulleys to slip . . . Dimensions 20 1/2" x 17" x 15 1/2". Wt 55 lbs.

Complete symphonies and operas — or any musical or variety program up to 4 hours in duration can now be recorded and played back on a single 13 1/2 inch reel of magnetic tape with the newly-developed Model 910-B Magnetape Twin-Trax Recorder. Incorporating new mechanical design features and the finest magnetic recording amplifier ever constructed, this exceptional instrument is the only answer to prolonged, uninterrupted high-fidelity recording of music or voice. Built-in reverse control and instantaneous stop feature makes this recorder ideal, also, for dictation and conference recording.

Tape costs are actually cut in half through the revolutionary use of two independent and isolated sound tracks on standard 1/4 inch reels of tape. The cabinet, ingeniously designed for compactness and beauty, covers and protects the reels during operation of the recorder.

Its many exclusive features make this recorder unmistakably the perfect unit for the home, laboratory, industry, recording studio, and broadcast station. Also available is Model 810-B Twin-Trax Recorder, which plays for one hour at high fidelity on standard 1/2-hour reels of magnetic tape. Priced at \$285.00, less microphone.



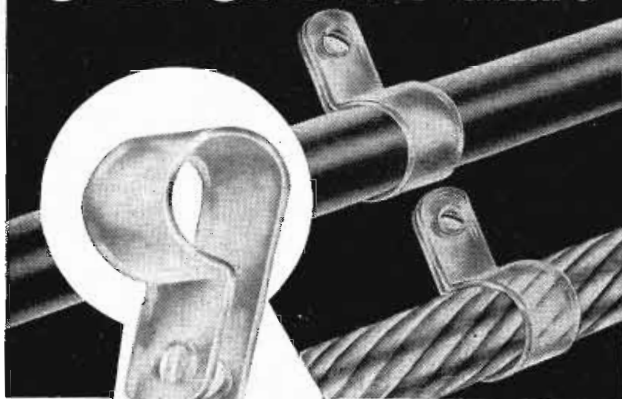
Unit operates with cover and sides closed.

If not available at your dealer, order direct

**AMPLIFIER CORP. OF AMERICA**

398-26 Broadway, New York 13, N. Y.

## C.P.C. 742 PLASTIC CLAMPS



The key to safe and enduring wiring and tubing support

Non-Shorting, non-corroding, non-tearing and as strong and durable as any type of supporting clamp that ever was made, C.P.C. 742 plastic clamps are in use wherever safety, light weight, convenience, and structural stability are paramount considerations. Send for Circular C 48.

**COMMERCIAL PLASTICS CO.**

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## Are Engineers Anti-Social?

What the woman thinks is an important part of our daily life (whether we like it or not) and what the wife of an engineer thinks about engineers is a common lament that cannot go ignored. Consequently, we publish the following letter:

Radio engineers are "laconic and cynical, competent and steady"—a species apart. They are, however, sometimes related to other people. The one I know best actually has a wife and five children. Usually he knows there are five, sometimes he can call each by name, but please don't ask him their ages. Sometime after disappearing down the "dark corridor and stairway" he appears, rather absent-mindedly, at home and after refueling, with a sigh of content and a figurative "Do Not Disturb," settles for the evening behind a very technical book on—guess what—radio engineering! If he doesn't notice his family enough to be very good company, neither does he cause any disturbance.

A radio engineer's wife perforce confines their social contacts to the families of other radio engineers. (You remember the cartoon, "They Don't Speak Our Language.") After the first ten minutes every social evening becomes highly technical and the men adjourn to the "radio shack" until the coffee begins to perk. Hardly the acme of social intercourse!

Indeed the radio engineer works hard. If paid by the hour his salary would double; but his conscientiousness and devotion to duty could not be bought at any price. An infant science like radio requires endless hours of study just to keep abreast, but this is a labor of love. He lives to work and his work always comes first. He finds his "ohm, watt and ampere" much more interesting than people and infinitely more reliable. He does apparently need a press agent. After working twenty years in one station he is not so well known as the announcer who joined the staff three months ago. Anyone who hears he works at a radio station automatically asks "Oh, are you an announcer?" That is a faux pas!

Yes, radio engineers are related to

people. They probably love their wives (though they have been known to pass them up at six feet). They are not as you and I but they are very important people—and very nice. *Mary Esther Gardner, (Reprinted from the New York Times, March, 1948)*

## New Magnetron Developed

The 50,000-watt output of a new high-power magnetron tube, developed under a Signal Corps contract with the General Electric Research Laboratory, represents the greatest cw power ever produced at the billion-cycle frequency, according to scientists assigned to the project. Unlike most conventional vacuum tubes which require an external source of power for cathode heating, the new magnetron secures heat for its cathode by secondary emission within the tube itself.

## CBS TV Network Grows

Plans for a television station network affecting more than 80 cities and their surrounding areas have been released by Herbert V. Akerberg, CBS vice-president in charge of station relations. Represented at the beginning of the year by one station, WCBS-TV, N. Y., the CBS network now links New York, Philadelphia, Baltimore, Boston and Washington. Five more stations will join the network this year, 20 stations in 1949, 36 in 1950, and 49 in 1951.

## IRE West Coast Convention

The West Coast convention of the IRE will be held at the Hotel Biltmore in Los Angeles from September 30 to October 3. Presentation of technical papers will take place in the Embassy auditorium.

Television engineers will be interested in the report to be presented by C. E. Nobles of the Westinghouse Electric Corp. on the results of video broadcasting from a B-29 flying at 29,000 ft. altitudes. D. E. Foster, Hazeltine Research, Inc., California, will discuss "Antenna Input Systems for Television Receivers." Broadcasters from both large and small stations will hear I. Gifford and A. P. Chesney describe their low-cost, high quality program switching system. The subject of very high frequency phenomena will be discussed in the paper by F. W. Shott and K. Spangenberg on the "Determination of Shunt Resistance of Cavity Resonators by means of an Electrical Network Analyzer," and the report by J. P. Day and L. G. Trolesco, U. S. Navy Electronics Laboratory, entitled "Propagation at High Radio Frequencies Over Flat Desert Terrain" should prove valuable.

## Emerson Price Increase

Retail price increases of six to 15 per cent on its television and radio receivers has been announced by the Emerson Radio & Phonograph Corp., N. Y. The increases went into effect Sept. 1 and are a result of higher material and labor costs.

**SOUND  
POWERED  
TIME  
SAVER**

**NO BATTERIES  
NO POWER  
SUPPLY  
REQUIRED**

**HANDSET  
FOR**

- **TV & FM INSTALLERS**
  - **TELEPHONE,**
  - **TELEGRAPH and**
  - **POWER LINEMEN**
- and wherever  
EMERGENCY SERVICE  
is required**

The Wheeler Sound-Powered handset — complete within the single instrument — is a new development of an old principle. It's a step and time saver on any job where temporary, convenient and inexpensive telephone service is needed. No power source, no batteries to bother with. Operates over two conductor full metallic or single wire, ground return circuit. Safe, tough, quick, dependable. Efficient talking up to 25 miles. See your local jobber or write, wire or phone Waterbury for complete details.

**MAGNET WIRE • COILS • BALLASTS**

**THE  
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INSULATED WIRE CO., INC.**  
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**WATERBURY 91, CONNECTICUT**

**DIVISION OF THE SPERRY CORPORATION**



# TV ENGINEERING & MANUFACTURING ISSUE in November

## *Philco plant chosen for comprehensive editorial study and report*

**1<sup>st</sup>**

in editorial pages in this specialized field

Feature will put new yardsticks on the No. 1 market for materials, parts, assemblies, test and production equipment.

November TELE-TECH will give its readers ANOTHER NOTABLE SCOOP—the first plant-wide analysis of television engineering and production methods.

**1<sup>st</sup>**

in tele-communications circulation

Written by staff editors and profusely illustrated with photos, charts and diagrams, this feature will cover

Research	Cost finding	Manufacturing
Design	Pricing	Standards and tests
Purchasing	Quality Control	Floor plans
Plant organization	Mechanization	Flow charts

**1<sup>st</sup>**

in volume of advertising

Under TELE-TECH's recently announced plan of complete market coverage, the November issue will have 100 percent unit coverage of the tele-communications field. Advertising rates also are based on a 100 percent wastefree circulation, enabling advertisers to buy full market coverage through a single publication at an economical rate. The print order of this memorable issue will be 20,000 copies plus.

*November Closing Date — October 1.*

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Statement Available Soon



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## Crystal Calibrator

(Continued from page 51)

output impedance. The effective length of the cathode lead is further reduced by dividing the 75-ohm output load between two paralleled 150-ohm resistors located physically as shown in Fig. 1, with one resistor at each end of the lead.

While 50  $\mu\text{f}$  variable capacitors are used throughout for tuning the oscillator plate and the multiplier tank circuits, fixed capacitors may be shunted across the trimmers to extend their respective ranges if the desired output frequencies do not fall within the tuning range of either tuned circuit. The utility of the instrument may be readily extended in this manner.

The individual channels are adjusted by tuning the oscillator to the selected crystal frequency and by adjusting the multipliers to the desired harmonic. A sensitive, accurate wavemeter is a prerequisite for this operation.

To prevent "pulling" when two frequencies very close together are required in the high frequency channel, it is advisable to select two inductors which are not immediately adjacent to each other. Otherwise, proper adjustment becomes quite critical.

This unit has been in operation for well over a year without requiring any maintenance or recalibration. Having a variety of crystal-controlled frequencies available not only saves considerable time but also serves to remove some of the tediousness from precise experimental work.

## TV Set Radiation Standard Proposed by RMA Engineers

Adoption of a standard radiation rating for TV receivers has been recommended to RMA members with the aim of improving operation of television receivers by limiting set radiation. The Executive Committee of the Receiver Section, RMA Engineering Dept., has approved the standard which was proposed by the Committee on Television Receivers, I. J. Kaar, General Electric, chairman.

The radiation rating standard for a television receiver is defined as follows: "The radiation rating of a television receiver is related to the tendency of the receiver toward local oscillator radiation and, for operation on channels two and six inclusive, is defined as numerically equal to the value of the field strength laid down at 1,000 ft. from the receiver under conditions especially favorable to oscillator radiation. . . . The rating of a television receiver on channels two to six inclusive shall not exceed 25 microvolts per meter."



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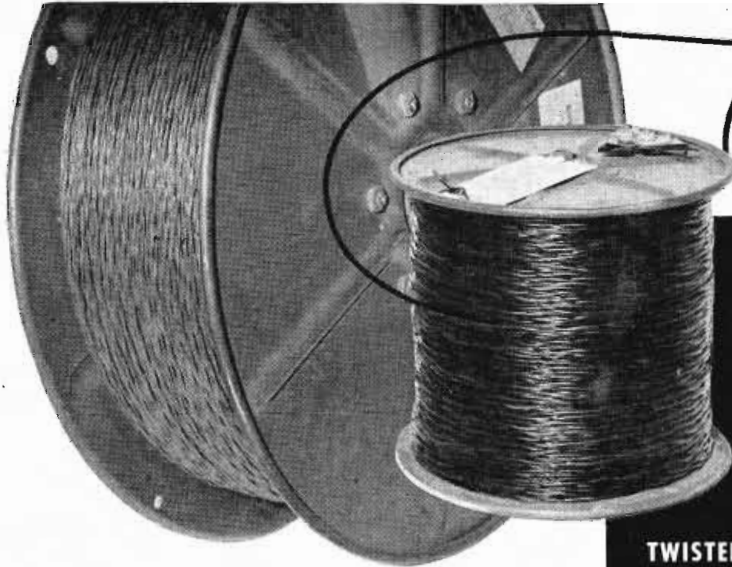
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168-G7

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Aerial wire, No. 18 copper weld, solid, 3000 ft. reels.....	Per 1000 ft. \$ 5.00
Single conductor, No. 20 shielded, overall braid, 1000 ft. reels.....	Per 1000 ft. \$15.00
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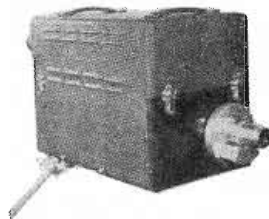
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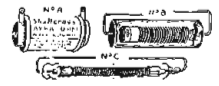
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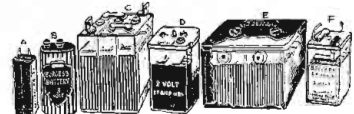


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## Indirect Microwave Relay

(Continued from page 43)

mirror system at this point consisting of one fixed reflector permanently oriented toward the broadcast transmitter and one or more reflectors which can be used to pick up microwave signals from any direction and pass these signals on to the fixed reflector.

When an inter-city microwave relay system is being laid out, it is frequently found that the most desirable locations for relay stations are mountain tops having no roads or power lines. Under such conditions the complete microwave equipment can be housed at a convenient location anywhere in the vicinity, the only restriction being that a line-of-sight path to the selected hilltop exist, at which point a set of passive repeaters is installed. This type of installation eliminates the cost of road building, wire stringing, etc., and simplifies the problem of maintenance on the microwave equipment. Fig. 3 illustrates such an installation. Another problem which arises in the laying out of an inter-city system is the selection of relay points so as to

realize the maximum range of the individual microwave transmitters. It is, of course, desirable to make as few hops as possible in order to minimize equipment and maintenance costs. Although commercial equipment will operate quite satisfactorily over distances as great as 20 to 30 miles, it is frequently impossible to obtain line-of-sight paths over such a distance. The use of passive repeaters makes it possible to separate the microwave units to their maximum range compatible with good signal-to-noise ratio even though a high point may exist between transmitter and repeater. The double mirror repeater described in a preceding paragraph can then be located at this intervening high point.

Even at relay points where roads and power permit a standard microwave installation, the passive repeater can sometimes be used to advantage. Usually the transmitter is mounted directly onto the parabolic reflector and the entire assembly installed at the top of a pole or tower. The remainder of the equipment, (video amplifiers, power supplies, etc.), is located in a small building near the foot of the tower. This type of installation necessitates running a large cable

from the building to the top of the tower and makes maintenance of the transmitter, especially during the winter, a very difficult and unpleasant task. Fig. 4 shows a typical installation at Oxford, Conn. Signals are received directly from WABD using the 4-element Yagi and a crystal-tuned receiver. The microwave transmitter and reflector are at the base of the 75-ft. pole where they can be readily serviced and the repeater near the top reflects the signals to the New Haven transmitter site for rebroadcast.

Like the parabolic dishes, the mirrors must have facilities for properly orienting them once they have been installed. It is desirable to have fairly independent azimuth and elevation controls and some means for locking the mirrors rigidly in place after the final adjustments have been made. Where the system uses several mirrors, the original alignment can be facilitated by placing a small optical mirror in the center of each reflector. A light may then be placed at various points in the system and the individual mirrors oriented. For final alignment, the microwave transmitter should be operated and each mirror adjusted to provide maximum signal at the receiver.



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## World's Largest Airport

(Continued from page 48)

tional sets will be installed from time to time to extend the effectiveness of the ground control as work continues and air traffic grows.

Ten receivers and five transmitters enable the control operators to "talk in" all types of commercial, private and military aircraft. Two operators per watch, three watches per day, make the field available all around the clock. The Civil Aeronautics Authority runs the tower. The chief controller at Idlewild is Roger Sullivan, an experienced airport man. The present tower and its equipment, while fairly elaborate, are only temporary. Eventually there will be three towers and a much more extensive communications set-up, with receivers and transmitters in isolated buildings at the edge of the field, all remotely controlled from the towers. The CAA says it will be at least two years before the permanent installation materializes.

The primary frequency used at Idlewild for communication with civilian planes is 119.1 megacycles. Almost without exception, commercial lines have equipped their planes to operate in this VHF range. Receiving and transmitting are done on the same frequency, so anyone listening with a VHF receiver can hear both sides of the conversations. For ground control, 121.9 mc is used. The tower can also work on 118.1 mc, the international VHF frequency, and in addition it can listen but not transmit on 122.5 and 126.18 mc, the latter a military frequency.

Many itinerant and private planes are equipped with medium-frequency transmitters operating on 3105, 6210 or 3117.5 kilocycles. Some military ships use 4495 kilocycles. The tower has fixed-tune receivers on these frequencies and guards them continuously. However, in answering calls on these settings, it transmits on either 119.1 megacycles or 239 kilocycles, depending on the receiver in the plane. The trend is strongly and definitely to the higher frequencies because of the virtual freedom here from noise and static; it is expected that the low-frequency equipment will disappear altogether in a few years. All operation is with amplitude modulated circuits. Since plane-to-tower communication is over very short distances, the VHF transmitters are of "flea" power: about five watts.

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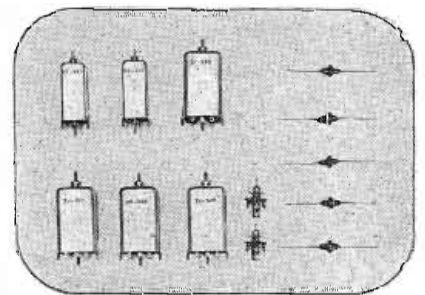
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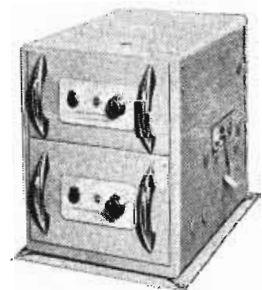
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VOLTAGE AMPLIFIERS										VOLTAGE AMPLIFIERS									
RECTIFIERS	CONVERTERS	Triodes		Pentodes			DIODE DETECTORS	POWER AMPLIFIERS	RECTIFIERS	CONVERTERS	Triodes		Pentodes			DIODE DETECTORS	POWER AMPLIFIERS		
		Single	Twin	With Diodes	Sharp Cutoff	Remote Cutoff					With Diode	Single	Twin	With Diodes	Sharp Cutoff			Remote Cutoff	With Diode
	1R5				1U4	1T4	1U5		354 3V4	1B3-GT/8016 5U4-G 5Y3-GT					5V4-G*				
6X4	6BE6	6C4	6J6	6AQ6 6AV6 6BF6	6AG5† 6AU6†	6BA6† 6BJ6		6AL5	6AQ5	6X5-GT	6SA7	6J5	6SC7 6SL7-GT 6SN7-GT	6SQ7	6SJ7	6SK7	6H6	6K6-GT 6L6-G 6V6-GT 6BG6-G	
35W4 117Z3	12BE6		12AU7 12AX7	12AV6	12AU6† 12AW6†	12BA6†		12AL5	35C5 50C5	35Z5-GT	12SA7			12SQ7		12SK7		35L6-GT 50L6-GT	

## CATHODE-RAY TUBES AND CAMERA TUBES

## GAS TUBES

## PHOTOTUBES

SCREEN SIZE Inches	KINESCOPIES		OSCILLOGRAPH TYPES PI Screen	CAMERA TYPES	MONOSCOPE	THYRATRONS	IGNITRONS	RECTIFIERS	VOLTAGE REGULATORS	GAS	VACUUM	MULTIPLIER
	Directly Viewed	Projection										
2			2BP1	5527		2D21§	5550	3B25	OA2§	1P41		
3			3KP1	2P23 5655		3D22	5551	673	OC3/VR105	921	.922	931-A
5		5TP4	5UP1		2F21	884	5552	816	OD3/VR150	927	929	
7	7DP4 7JF4					2050 5563	5553	857-B 866-A 869-B 8008		930		
8					1850-A							
10	10BP4											

## POWER AMPLIFIERS AND OSCILLATORS

TYPE	CLASS	MAXIMUM INPUT POWER VS FREQUENCY												UNITS
		Values shown are Class C Telegraphy Ratings for Continuous Commercial Service												
		1.6	7.5	15	25	50	75	110	150	200	250	300	600	Mc
802	Pentode	25	25	25	25	20	16	—	—	—	—	—	—	watts
2E26	Beam	30	30	30	30	30	30	30	25	—	—	—	—	watts
832-A	Beam	36	36	36	36	36	36	36	36	36	32	—	—	watts
2E24	Beam	40†	40†	40†	40†	40†	40†	40†	33†	—	—	—	—	watts
807	Beam	60	60	60	60	60	50	40	—	—	—	—	—	watts
815	Beam	60	60	60	60	60	60	60	55	40	—	—	—	watts
8025-A	Triode	75	75	75	75	75	75	75	75	75	75	75	75	watts
329-80	Beam	120	120	120	120	120	120	120	120	105	—	—	—	watts
826	Triode	125	125	125	125	125	125	125	125	125	100	—	—	watts
812	Triode	155	155	155	155	155	125	—	—	—	—	—	—	watts
811	Triode	155	155	155	155	155	125	—	—	—	—	—	—	watts
828	Pentode	200	200	200	200	160	130	—	—	—	—	—	—	watts
8005	Triode	240	240	240	240	195	—	—	—	—	—	—	—	watts
5588	Triode	250	250	250	250	250	250	250	250	250	250	250	250	watts
813	Beam	360	360	360	360	300	—	—	—	—	—	—	—	watts
8000	Triode	500	500	500	500	400	300	—	—	—	—	—	—	watts
4-125A/ 4D21	Tetrad	500	500	500	500	500	500	500	500	425	335	—	—	watts
6C24	Triode	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	—	—	—	—	kw
833-A	Triode	1.8	1.8	1.8	1.75	1.5	1.2	—	—	—	—	—	—	kw
7C24	Triode	5	5	5	5	5	5	5	—	—	—	—	—	kw
8D21	Tetrad	10	10	10	10	10	10	10	10	10	10	10	—	kw
889R-A	Triode	16	16	16	16	12	9.6	—	—	—	—	—	—	kw
889-A	Triode	16	16	16	16	16	14	11	8	—	—	—	—	kw
892-R	Triode	18	13.5	10.5	—	—	—	—	—	—	—	—	—	kw
892	Triode	30	22.5	17	—	—	—	—	—	—	—	—	—	kw
9C25	Triode	40	40	40	40	25	25	25	—	—	—	—	—	kw
9C27	Triode	40	40	40	40	25	25	25	—	—	—	—	—	kw
5592	Triode	50	50	50	50	50	44	33	—	—	—	—	—	kw
9C22	Triode	100	91	80	70	—	—	—	—	—	—	—	—	kw
9C21	Triode	150	150	150	105	—	—	—	—	—	—	—	—	kw

† High-Transconductance Types. \* Included for television demper applications only.

‡ Twin Type—Input values per tube for push-pull operation. § Miniature Type.

† ICAS Rating—This type is recommended only for applications of a highly intermittent nature.

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