

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



DECEMBER 1965

**The Future Looks
Solid-State**

Ed Leahy doesn't work for us. We work for him.

Ed Leahy believes in being his own boss. Which is what Ed likes about running his own Philco Qualified Service Center. It means that, with no strings attached, he gets better training, better service and more benefits than any other manufacturer offers.

When he needs a part, he gets it fast. His Philco Parts Distributor has what Ed needs right on hand. But even if Ed gets a job like fixing a 1947 model, he knows the oddball part he needs will be shipped in 24 hours or less through Philco's Lifeline Emergency Service.

Ed keeps up on new products with Philco Tech Data Service. He tried other services and found out that he gets the facts sooner, better and at lower cost from Philco.

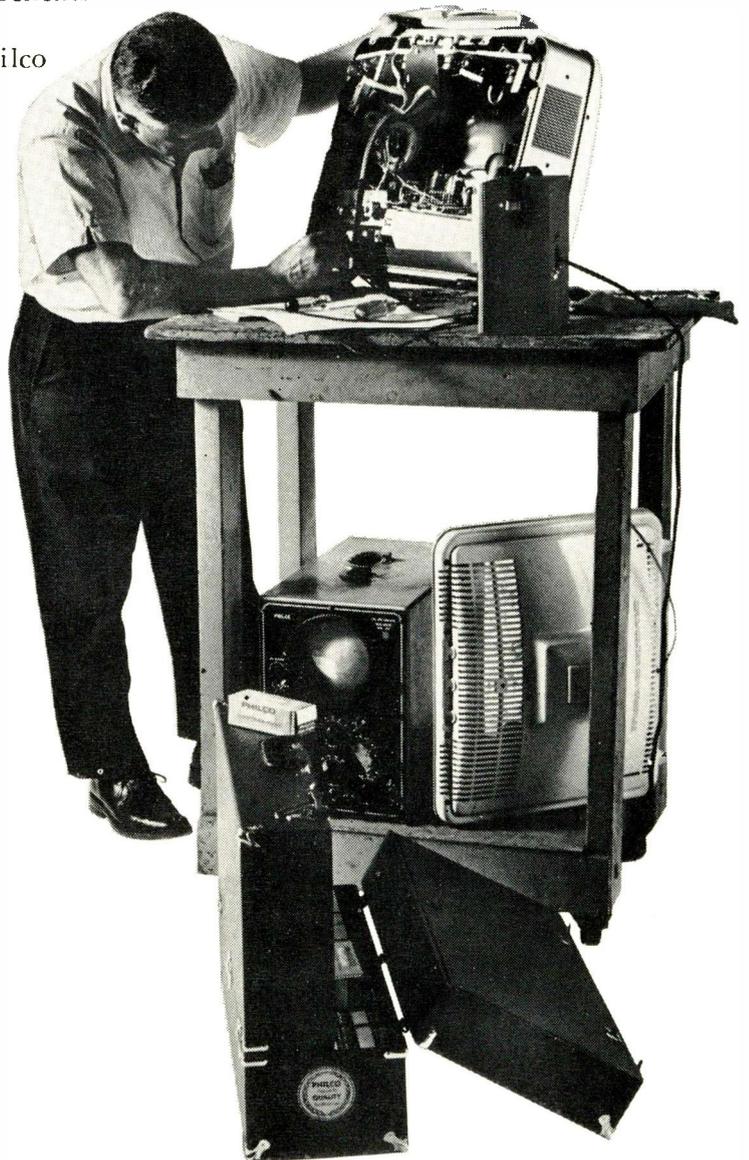
Ed likes Philco's "fringe benefits," too. A complete accident insurance program for himself and his men. Advice on business management, found in Philco's popular "Service Businessman" magazine. He gets extra business, too, when his name appears under a Philco listing in the Yellow Pages.

Ed Leahy has it good. You can, too. Talk to your Philco Parts Distributor or contact Parts & Service Department, Philco Corporation, Tioga and "C" Streets, Philadelphia, Pa. 19134.

PARTS & SERVICE DEPARTMENT

PHILCO®

A SUBSIDIARY OF *Ford Motor Company*



... for more details circle 30 on postcard

ELECTRONIC TECHNICIAN TEKFAK

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SIX NEW SETS



EMERSON	Model	Schematic No.
EMERSON	TV Model 12P50	975
PACKARD BELL	TV Chassis 88-19	970
PHILCO	TV Chassis 16N35	971
RCA VICTOR	TV Chassis KCS144E	974
SILVERTONE	TV Chassis 562.10096	972
SYLVANIA	TV Chassis BO5-1, -2, -3	973

COMPLETE CHASSIS INDEX FOR ALL CIRCUIT DIGESTS AND TEKFAK THROUGH DECEMBER 1965

MONTH IN WHICH SCHEMATIC APPEARS

Model	Month														
191-198	Sept. 1952	583-588	Sept. 1960	780-784	May 1963	191-198	Sept. 1952	583-588	Sept. 1960	780-784	May 1963	191-198	Sept. 1952	583-588	Sept. 1960
199-204	Oct. 1952	589-594	Oct. 1960	785-789	June 1963	199-204	Oct. 1952	589-594	Oct. 1960	785-789	June 1963	199-204	Oct. 1952	589-594	Oct. 1960
205-210	Nov. 1952	595-599	Nov. 1960	790-797	July 1963	205-210	Nov. 1952	595-599	Nov. 1960	790-797	July 1963	205-210	Nov. 1952	595-599	Nov. 1960
211-216	Dec. 1952	600-606	Dec. 1960	798-805	Aug. 1963	211-216	Dec. 1952	600-606	Dec. 1960	798-805	Aug. 1963	211-216	Dec. 1952	600-606	Dec. 1960
217-222	Jan. 1953	607-613	Jan. 1961	806-811	Sept. 1963	217-222	Jan. 1953	607-613	Jan. 1961	806-811	Sept. 1963	217-222	Jan. 1953	607-613	Jan. 1961
223-228	Feb. 1953	614-620	Feb. 1961	812-817	Oct. 1963	223-228	Feb. 1953	614-620	Feb. 1961	812-817	Oct. 1963	223-228	Feb. 1953	614-620	Feb. 1961
229-235	Mar. 1953	621-627	Mar. 1961	818-822	Nov. 1963	229-235	Mar. 1953	621-627	Mar. 1961	818-822	Nov. 1963	229-235	Mar. 1953	621-627	Mar. 1961
236-241	Apr. 1953	628-633	Apr. 1961	823-828	Dec. 1963	236-241	Apr. 1953	628-633	Apr. 1961	823-828	Dec. 1963	236-241	Apr. 1953	628-633	Apr. 1961
242-247	May 1953	634-636	May 1961	829-833	Jan. 1964	242-247	May 1953	634-636	May 1961	829-833	Jan. 1964	242-247	May 1953	634-636	May 1961
248-255	June 1953	637-643	June 1961	834-838	Feb. 1964	248-255	June 1953	637-643	June 1961	834-838	Feb. 1964	248-255	June 1953	637-643	June 1961
256-261	July 1953	644-650	July 1961	839-843	Mar. 1964	256-261	July 1953	644-650	July 1961	839-843	Mar. 1964	256-261	July 1953	644-650	July 1961
262-268	Aug. 1953	651-656	Aug. 1961	844-850	Apr. 1964	262-268	Aug. 1953	651-656	Aug. 1961	844-850	Apr. 1964	262-268	Aug. 1953	651-656	Aug. 1961
269-274	Sept. 1953	657-662	Sept. 1961	851-858	May 1964	269-274	Sept. 1953	657-662	Sept. 1961	851-858	May 1964	269-274	Sept. 1953	657-662	Sept. 1961
275-280	Oct. 1953	663-669	Oct. 1961	859-863	June 1964	275-280	Oct. 1953	663-669	Oct. 1961	859-863	June 1964	275-280	Oct. 1953	663-669	Oct. 1961
281-286	Nov. 1953	670-675	Nov. 1961	864-870	July 1964	281-286	Nov. 1953	670-675	Nov. 1961	864-870	July 1964	281-286	Nov. 1953	670-675	Nov. 1961
287-292	Dec. 1953	676-680	Dec. 1961	871-875	Aug. 1964	287-292	Dec. 1953	676-680	Dec. 1961	871-875	Aug. 1964	287-292	Dec. 1953	676-680	Dec. 1961
293-299	Jan. 1954	681-682	Jan. 1962	876-881	Sept. 1964	293-299	Jan. 1954	681-682	Jan. 1962	876-881	Sept. 1964	293-299	Jan. 1954	681-682	Jan. 1962
300-304	Feb. 1954	683-689	Feb. 1962	882-887	Oct. 1964	300-304	Feb. 1954	683-689	Feb. 1962	882-887	Oct. 1964	300-304	Feb. 1954	683-689	Feb. 1962
305-309	Mar. 1954	690-705	Mar. 1962	888-893	Nov. 1964	305-309	Mar. 1954	690-705	Mar. 1962	888-893	Nov. 1964	305-309	Mar. 1954	690-705	Mar. 1962
310-315	Apr. 1954	706-709	Apr. 1962	894-900	Dec. 1964	310-315	Apr. 1954	706-709	Apr. 1962	894-900	Dec. 1964	310-315	Apr. 1954	706-709	Apr. 1962
316-321	May 1954	710-716	May 1962	901-908	Jan. 1965	316-321	May 1954	710-716	May 1962	901-908	Jan. 1965	316-321	May 1954	710-716	May 1962
322-326	June 1954	717-725	June 1962	909-916	Feb. 1965	322-326	June 1954	717-725	June 1962	909-916	Feb. 1965	322-326	June 1954	717-725	June 1962
327-332	July 1954	726-732	July 1962	917-923	Mar. 1965	327-332	July 1954	726-732	July 1962	917-923	Mar. 1965	327-332	July 1954	726-732	July 1962
333-338	Aug. 1954	733-743	Aug. 1962	924-926	Apr. 1965	333-338	Aug. 1954	733-743	Aug. 1962	924-926	Apr. 1965	333-338	Aug. 1954	733-743	Aug. 1962
339-344	Sept. 1954	744-749	Sept. 1962	927-934	May 1965	339-344	Sept. 1954	744-749	Sept. 1962	927-934	May 1965	339-344	Sept. 1954	744-749	Sept. 1962
345-350	Oct. 1954	750-755	Oct. 1962	935-942	June 1965	345-350	Oct. 1954	750-755	Oct. 1962	935-942	June 1965	345-350	Oct. 1954	750-755	Oct. 1962
351-358	Nov. 1954	756-761	Nov. 1962	943-950	July 1965	351-358	Nov. 1954	756-761	Nov. 1962	943-950	July 1965	351-358	Nov. 1954	756-761	Nov. 1962
359-364	Dec. 1954	762-766	Dec. 1962	951-953	Aug. 1965	359-364	Dec. 1954	762-766	Dec. 1962	951-953	Aug. 1965	359-364	Dec. 1954	762-766	Dec. 1962
365-371	Jan. 1955	767-772	Jan. 1963	954-961	Sept. 1965	365-371	Jan. 1955	767-772	Jan. 1963	954-961	Sept. 1965	365-371	Jan. 1955	767-772	Jan. 1963
372-376	Feb. 1955	773-779	Feb. 1963	962-969	Oct. 1965	372-376	Feb. 1955	773-779	Feb. 1963	962-969	Oct. 1965	372-376	Feb. 1955	773-779	Feb. 1963
377-382	Mar. 1955		Mar. 1963	970-975	Nov. 1965	377-382	Mar. 1955		Mar. 1963	970-975	Nov. 1965	377-382	Mar. 1955		Mar. 1963
383-388	Apr. 1955		Apr. 1963		Dec. 1965	383-388	Apr. 1955		Apr. 1963		Dec. 1965	383-388	Apr. 1955		Apr. 1963

Model	Month	Model	Month	Model	Month	Model	Month	Model	Month	Model	Month	Model	Month	Model	Month
D610-1	2, -4	844	844	D614-1	-2	844	844	D610-1	2, -4	844	844	D614-1	-2	844	844
D611-1	-4, -5	844	844	D617-3		844	844	D611-1	-4, -5	844	844	D617-3		844	844
D612-1	-4, -5	844	844	D617-3		844	844	D612-1	-4, -5	844	844	D617-3		844	844
D613-1		844	844	D617-3		844	844	D613-1		844	844	D617-3		844	844
D614-1		844	844	D617-3		844	844	D614-1		844	844	D617-3		844	844
D615-1		844	844	D617-3		844	844	D615-1		844	844	D617-3		844	844
D616-1		844	844	D617-3		844	844	D616-1		844	844	D617-3		844	844
D617-1		844	844	D617-3		844	844	D617-1		844	844	D617-3		844	844
D618-1		844	844	D617-3		844	844	D618-1		844	844	D617-3		844	844
D619-1		844	844	D617-3		844	844	D619-1		844	844	D617-3		844	844
D620-1		844	844	D617-3		844	844	D620-1		844	844	D617-3		844	844
D621-1		844	844	D617-3		844	844	D621-1		844	844	D617-3		844	844
D622-1		844	844	D617-3		844	844	D622-1		844	844	D617-3		844	844
D623-1		844	844	D617-3		844	844	D623-1		844	844	D617-3		844	844
D624-1		844	844	D617-3		844	844	D624-1		844	844	D617-3		844	844
D625-1		844	844	D617-3		844	844	D625-1		844	844	D617-3		844	844
D626-1		844	844	D617-3		844	844	D626-1		844	844	D617-3		844	844
D627-1		844	844	D617-3		844	844	D627-1		844	844	D617-3		844	844
D628-1		844	844	D617-3		844	844	D628-1		844	844	D617-3		844	844
D629-1		844	844	D617-3		844	844	D629-1		844	844	D617-3		844	844
D630-1		844	844	D617-3		844	844	D630-1		844	844	D617-3		844	844
D631-1		844	844	D617-3		844	844	D631-1		844	844	D617-3		844	844
D632-1		844	844	D617-3		844	844	D632-1		844	844	D617-3		844	844
D633-1		844	844	D617-3		844	844	D633-1		844	844	D617-3		844	844
D634-1		844	844	D617-3		844	844	D634-1		844	844	D617-3		844	844
D635-1		844	844	D617-3		844	844	D635-1		844	844	D617-3		844	844
D636-1		844	844	D617-3		844	844	D636-1		844	844	D617-3		844	844
D637-1		844	844	D617-3		844	844	D637-1		844	844	D617-3		844	844
D638-1		844	844	D617-3		844	844	D638-1		844	844	D617-3		844	844
D639-1		844	844	D617-3		844	844	D639-1		844	844	D617-3		844	844
D640-1		844	844	D617-3		844	844	D640-1		844	844	D617-3		844	844
D641-1		844	844	D617-3		844	844	D641-1		844	844	D617-3		844	844
D642-1		844	844	D617-3		844									

971

PHILCO
TV Chassis 16N35

DECEMBER 1965

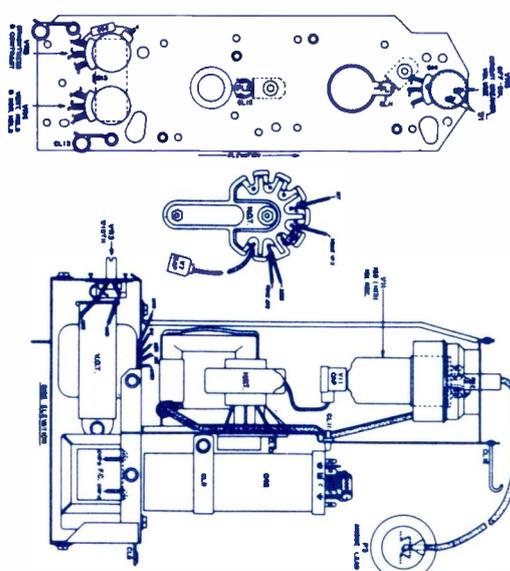
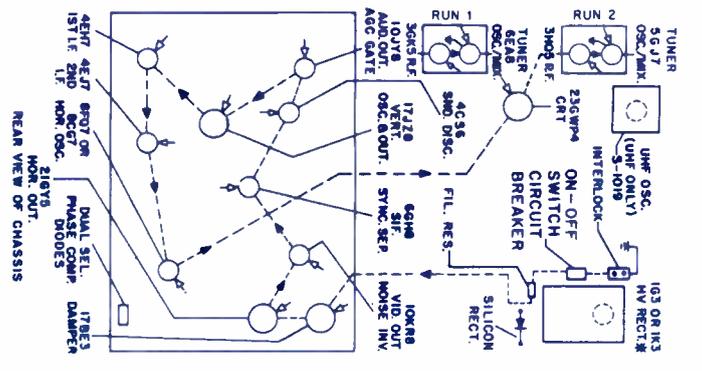
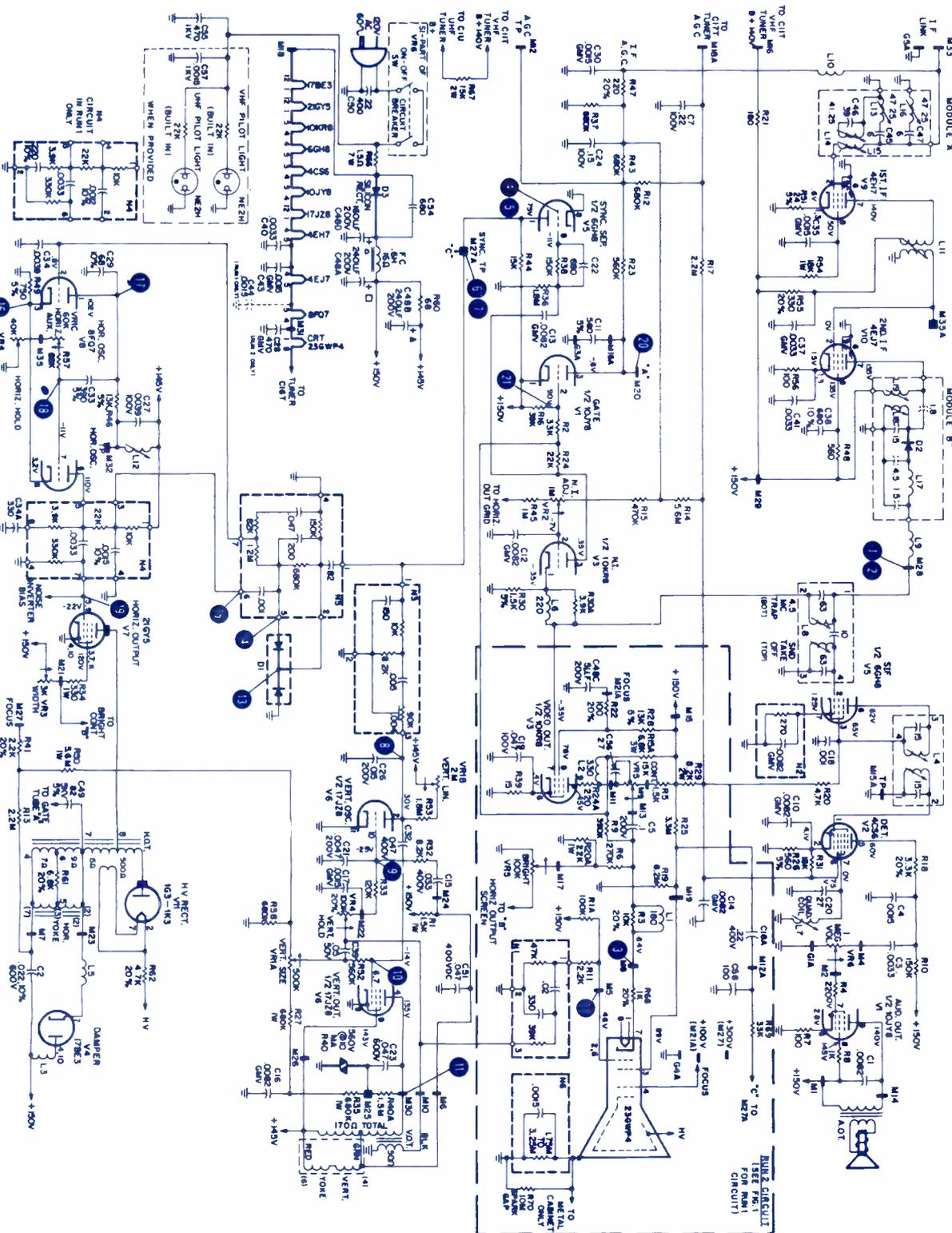
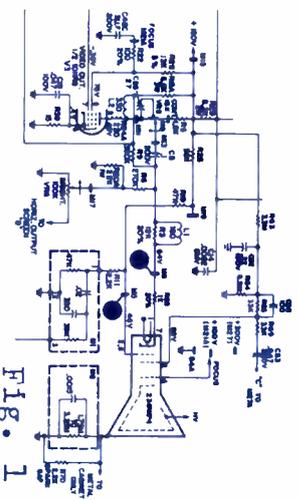
ELECTRONIC TECHNICIAN

TEKTRAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SIX NEW SETS

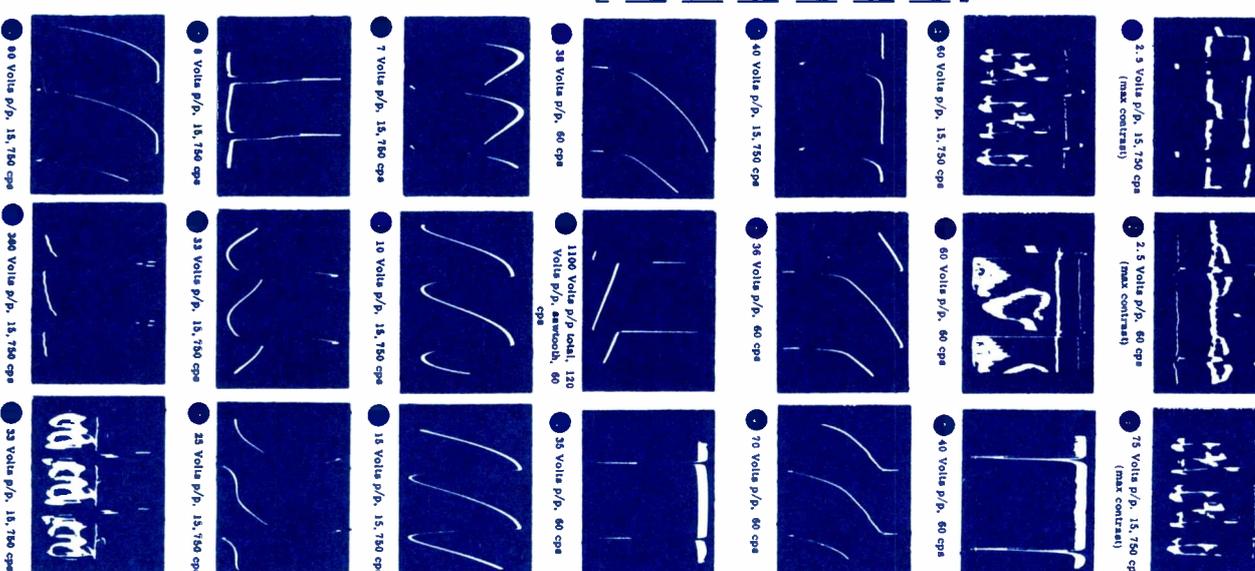
16N35 VOLTAGE AND RESISTANCE CHART

Point	1	2	3	4	5	6	7	8	9	10	11	12
110V AC												
0V												
50V												
100V												
150V												
200V												
250V												
300V												
350V												
400V												
450V												
500V												
550V												
600V												
650V												
700V												
750V												
800V												
850V												
900V												
950V												
1000V												



OSCILLOSCOPE WAVEFORMS

These waveforms were taken with the receiver adjusted for an approximate output of 2.5V p/p at the video detector. Voltages read are taken with raster just filling screen and all control sets for normal picture viewing except for Defcon 1, 2 and 3 where control was at maximum. The voltages given are approximate peak-to-peak values. The frequencies shown are those of the waveforms... not the sweep rate of the oscilloscope. All readings taken with Model ES-590B Precision Oscilloscope.



Symbol	Description	Philco Part No.
C30	.0015 μ F GMV	30-1285-14
C32	.0015 μ F GMV	30-1285-14
C43	.0015 μ F GMV	30-1285-14
C44	.0015 μ F GMV fil. byp.	30-1285-14
C49	Run 1 5K Ω	30-1285-14
C52	820 pF 5K Ω	30-1244-91
C57	100 pF 1K Ω	30-1244-97
D1	diode, dual sel., phase comp.	30-1294-35
D2	diode, crystal 2nd det.	34-8027-1
D3	rectifier, silicon-power	34-8024-9
FC	filter choke, 160 Ω , .6 H	32-10010-5
H.O.T.	transf., horiz. output	32-10008-6
L1	video plate peaking, 180 μ H	32-4762-7
L2	video plate shunt, 350 μ H	32-4762-20
L3	RF choke 60 Mc damper plate	32-4112-62
L4	transf., 2nd. interstage	32-4745-8
L5	RF choke 60 Mc damper cathode	32-4112-62
L7	sm. quadrature transf., 4.5 Mc trap & 2nd. I.O.	32-489-6-1
L8	tuner coupling	32-4688-11
L10	video detector choke	32-4652-96
L18	2nd VIF plate	32-4652-78
L19	ret. sup.	30-6024-9
N1	SIF cathode	30-6031-12
N2	vertical integrator	30-6030-1-16
N3	horiz. osc. (Run 1)	30-6031-12
N4	horiz. osc. (Run 2)	30-6031-12
N5	phase comparator	30-6037-1
N6	isolation (Run 1)	30-6030-2
R8	270K Ω , brightness	30-6040-2
R15A	6.8K Ω , 3w, video plate varistor, 500V @ 10 ma, vert. comp.	33-1363-46
R23	27 Ω , 5% 1st IF cath.	33-1373-6
R40	24 Ω , 5% 1st IF cath.	66-0278250
R51	1.5 Ω , 7w, surge transf., vert. out.	66-0248250
R66	3 section VRI-A-vert. size (500K)	33-1363-134
V.O.T.	VRI-B-vert. lin. (2M)	32-10012-6
V1	VR1C-horiz. hold noise adjust (1M)	33-5595-8
V2	dual, hold (100K)	33-5613-1
V3	dual, hold (40K)	33-5591-30
V4	dual, hold (40K)	33-5618-3
V85	dual, hold (100K)	33-5604-37
V86	on-off-volume (1M) with circuit breaker transf., ant. matching (on cab. back)	33-5605-49
V88	perm.-circuit panel VOS (Run 1)	32-8856
V89	perm.-circuit panel VOS (Run 2)	76-12942-5
V90	perm.-circuit panel VOS (Run 1)	27-10657-6
V91	perm.-circuit panel VIF trap	27-10657-9
V92	perm.-circuit panel VIF det.	27-10561-9
V93	detector panelassy. (Mod. B)	27-10561-4
V94	VIF trap panelassy. (Mod. A)	38-10115
V95	tuner UHF TT-155X Run 1	38-10116
V96	tuner UHF TT-163 Run 1	76-13388-6
V97	tuner UHF TT-152 Run 2	76-13379-2
V98	tuner UHF TT-153A Run 2	76-13822-1
V99	tuner UHF TT-153A Run 2	76-13379-5

ELECTRONIC TECHNICIAN

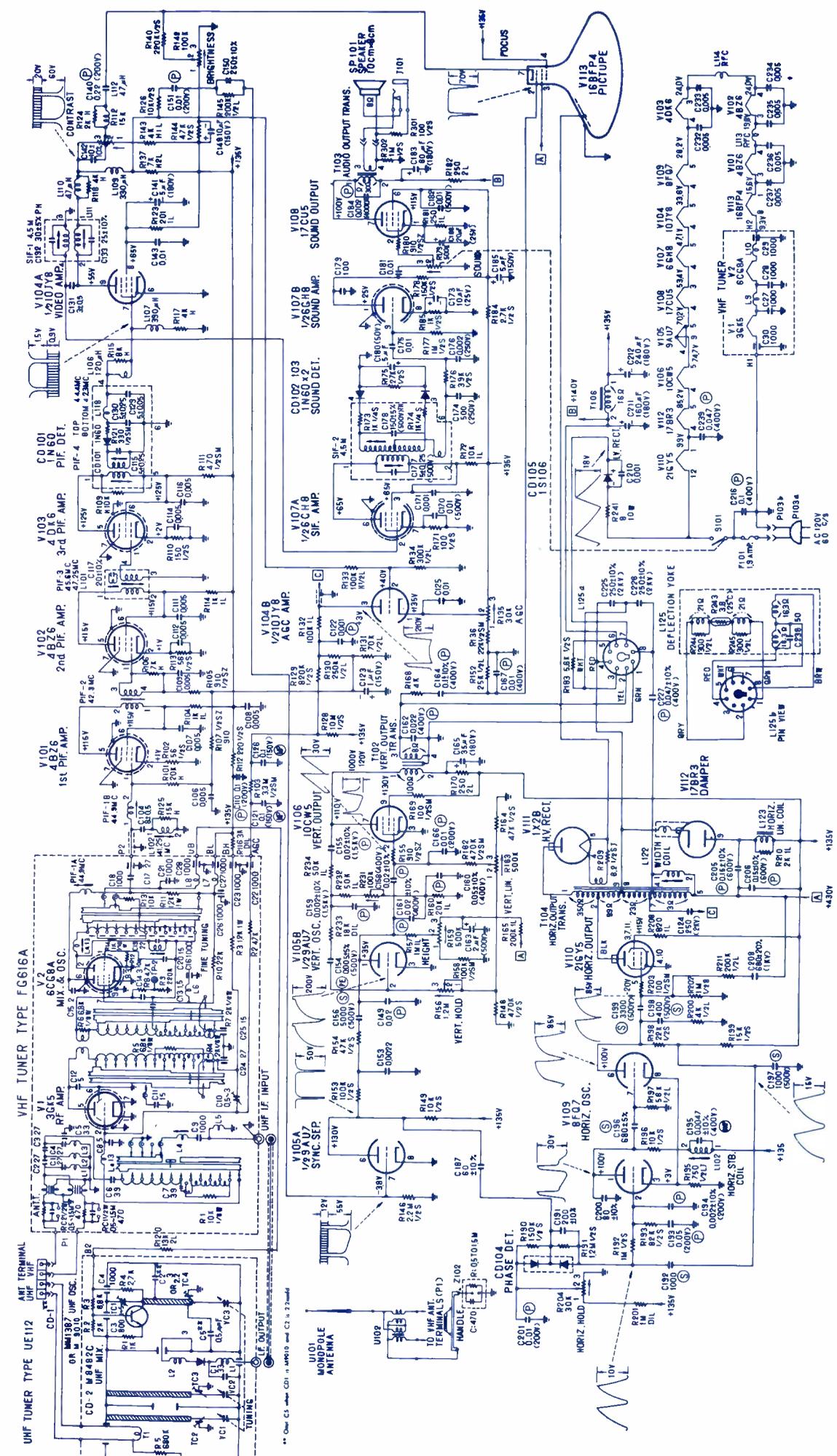
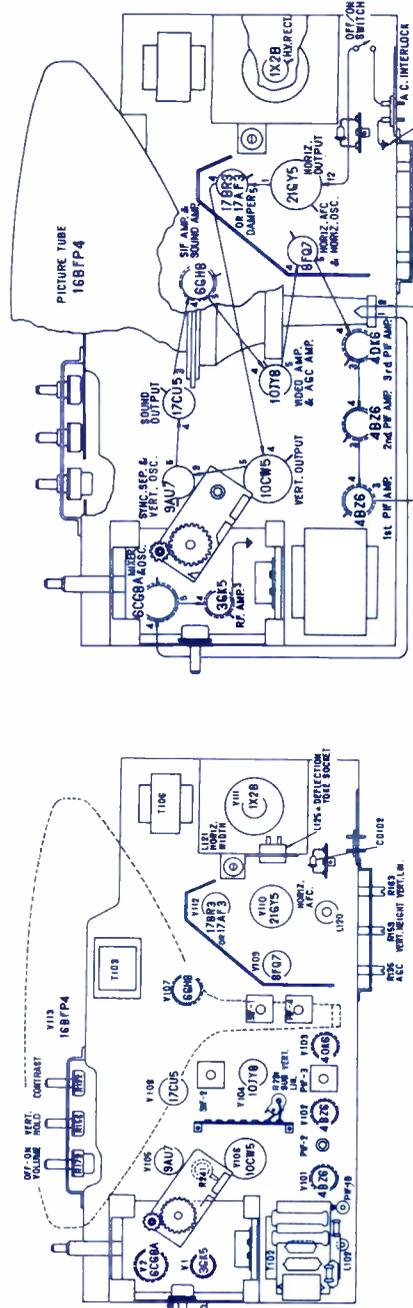
TEKFAK

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SIX NEW SETS

972

SILVERTONE
TV Chassis
562.10096

DECEMBER 1965



Symbol	Description	Silvertone Part No.
C123, C225, C226, C133	electrolytic, 1 μ f, 150v ceramic, disc, 250 pf $\pm 10\%$, 2kv	302221
C141, C165, C185, C211, C212	ceramic, disc, 25 pf, electrolytic, 5 μ f, 180 v (C141); 35 μ f, 180 v (C165); 60 μ f, 180 v (C185); 240 μ f, 180 v (C212)	300654 300362
C142	ceramic, disc 10 pf, $\pm 10\%$	302131
C148	electrolytic, 10 μ f, 150 v	300560
C155	paper .02 μ f, $\pm 10\%$, 1.5kv	301784
C156	polystyrene, 5000 pf, $\pm 10\%$	301282
C163, C171, C210	electrolytic, 2 μ f, ceramic, disc .001 μ f, $\pm 100\%$ -0%	302213 301721
C173	electrolytic, 10 μ f, $\pm 100\%$ -0%	300657
C174	ceramic, disc, 500 pf, $\pm 100\%$ -0%	301386
C176	ceramic, disc, .002 μ f, $\pm 100\%$ -0%	300683
C177	ceramic, disc, 5 pf SIF-2	302555
C180	electrolytic 5 μ f, 50v	300321
C185	electrolytic 5 μ f, 150v	301390
C186	electrolytic 20 μ f, 25v	301783
C205, C206	paper, .15 μ f, $\pm 10\%$, 600v	301385
C208	ceramic, disc 680 pf, 1kv	301349
R142	15 k Ω , brightness	301936
R144	100k Ω , brightness	401138
R156	1.2 M, vert. hold	401135
R159, R163	500 Ω , height & vert. linearity	401136
R179	500k Ω , vol. & switch	401130
R204	30k Ω , horiz. hold	401331
R231	100k Ω , sub. vert. linearity	400343
PIF1B	coil, PIF-1B	201147
PIF2 & L101	transformer, PIF2	201221
PIF4	transformer, PIF3 & 47.25 Mc trap	201319
SIF1 & L111	coil, SIF1 & 4.5 Mc trap	201223
SIF2	transformer, ratio detector	201152
L102	coil, 41.25 Mc trap	201320
L106	coil, peaking	201148
L107	coil, peaking	201170
L109	coil, peaking	201177
L110, L112, L114	coil, filament choke	200002
L120	coil, horizontal stabilizer	201207
L121	coil, horizontal lin.	201051
L122	coil, horizontal lin.	201329
L123	deflection yoke	201329
L103	transformer, vert. output	201325
T104	output transformer, sound	201328
T106	output transformer, horz. choke, filter	201327 201291

- All resistance values in ohms K=1,000, M=1,000,000.
 - Type of resistors.

Rating	Carbon film	High frequency carbon film	Carbon composition	Dipped carbon film
$\frac{1}{2}W$	No indication	H	—	—
$\frac{1}{4}W$	$\frac{1}{4}L$	H $\frac{1}{4}L$	$\frac{1}{4}S$	D $\frac{1}{4}L$
1W	1L	H 1L	—	D 1L
2W	2L	H 2L	—	D 2L
- All resistors $\pm 10\%$ unless otherwise noted.
Y: $\pm 5\%$ (for carbon film), S: $\pm 5\%$ (for carbon composition)
M: $\pm 20\%$
 - Type of capacitors.

Symbol	Electrolytics	Polystyrene
C	C	P
C	C	P
C	C	P
 - All capacitors not designated as above are Ceramic capacitors. Unless otherwise noted in schematic, all capacitor values less than 1 are expressed in mfd, and the values more than 1 are in mmfd.
 - Five section electrolytic capacitors.
C212 (240mfd.) C211 (160mfd.) C183 (60mfd.)
C165 (35mfd.) C141 (5mfd.)
 - Voltage reading taken with "VTVM" from point indicated to chassis ground, tuner on unselected channel contrast at maximum, AGC at maximum clockwise, rather control of normal line voltage 120 volts.
 - All wave forms measured with strong signal input, contrast set to give normal picture and AGC line operating normally.
 - Voltage readings may vary $\pm 20\%$.
CAUTION: Discharge or metering of second anode of picture tube must be to main chassis only.

973

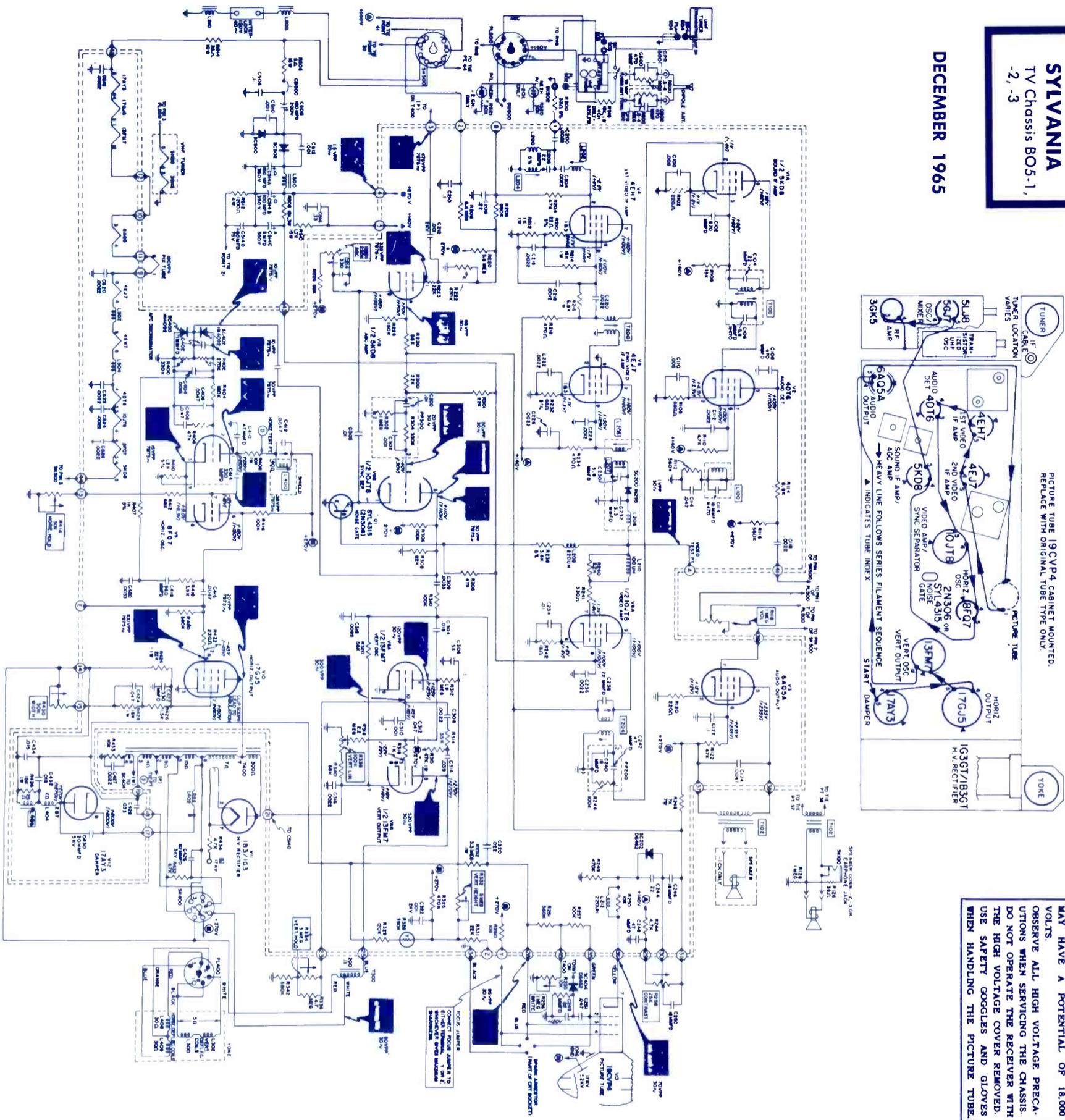
SYLVANIA
TV Chassis BO5-1,
-2, -3

DECEMBER 1965

ELECTRONIC TECHNICIAN

TEKTRAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS
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READ THESE INSTRUCTIONS CAREFULLY AND OBSERVE THE CONDITIONS NOTED WHEN TAKING VOLTAGE READINGS OR OBSERVING WAVEFORMS.

PICTURE TUBE HIGH VOLTAGE ANODE MAY HAVE A POTENTIAL OF 18,000 VOLTS. OBSERVE ALL HIGH VOLTAGE PRECAUTIONS WHEN SERVICING THE CHASSIS. DO NOT OPERATE THE RECEIVER WITH THE HIGH VOLTAGE COVER REMOVED. USE SAFETY GOGGLES AND GLOVES WHEN HANDLING THE PICTURE TUBE.

SCHEMATIC NOTES

1. Voltages measured to chassis using VTVM. LESS OTHERWISE SPECIFIED.
2. AC power source 120 volt 60 cycle line.
3. Voltage readings in brackets taken with no input; channel selector set to a free channel; antenna disconnected; antenna terminals shorted together and grounded to chassis.
4. Voltage readings not in brackets taken with a strong signal input; tuner set to a strong local station developing approximately -7 volt on AGC Bias. NOTE: AGC VOLTAGE AT TEST POINT (B) WILL VARY FROM -7 VOLT ON A VERY STRONG SIGNAL TO A +20 VOLT ON A VERY WEAK SIGNAL.
5. Contrast control set to maximum. Brightness control set to minimum.
6. Voltage values shown are average readings. Variations may be observed due to normal production tolerances.

GENERAL SCHEMATIC NOTES

1. Voltage sources are indicated by encircled symbols, corresponding symbols without circles indicate voltage tap points.
2. Average resistances of coils and transformers are shown and measured with component connected in circuit.
3. Encircled numbers on edge of printed circuit indicate the points corresponding with those shown on parts layout of printed board.
4. All capacitors are in microfarads unless otherwise specified.
5. Coils, transformers, plugs and sockets are shown as viewed from the bottom.
6. Arrows on controls indicate direction of clockwise rotation.

SPECIAL VOLTAGE MEASUREMENT CONDITIONS

1. Picture tube anode voltage measured with VTVM high voltage probe at line voltage of 120 volts under conditions of normal signal, no brightness and correct scan size.
2. High peak voltage of short duration may damage meter used for this measurement.

WAVEFORM MEASUREMENT CONDITIONS

1. Channel selector set to strong channel.
2. Contrast control set for signal of 70 volt peak to peak at yellow lead of picture tube.
3. Waveforms measured with respect to chassis using a wide band oscilloscope. (Other type oscilloscopes may alter waveform shapes or amplitudes.)
4. The terms 30W or 7875W refer to scope frequency used.

Symbol	Description	Sylvania Part No.
C112	0022 μ F 50V	43-15009-1
C118	0022 μ F 50V	43-15008-1
C200	0022 μ F 50V	43-15009-1
C204	0022 μ F 50V	43-15009-1
C206	22 pf-NP0	43-11028-7
C212	0022 μ F 50V	43-11028-7
C220	0022 μ F 50V	43-11028-7
C230	5.6 pf-NP0	169-0062
C308	0022 μ F 50V	169-0062
C400	92 pf-NP0	169-0062
C414	350 pf-mica	169-0062
C426	20 pf-5KV	169-0062
C430	4 section electrolytic	43-15008-1
C514	7,000 μ F-7W	169-0062
R248	390 000 Ω -thermistor	35-92898-18
R328	18,000 Ω -3W	35-92898-18
R506	1,700 Ω -15W	35-92898-18
R510	1,200 Ω -4W	35-92898-18
R512	36 Ω -10W	35-92898-21
R514	coil-4.5 Mc	37-11602-1
L100	coil-video detector	37-11634-1
L205	coil-freq	37-11634-1
L206	coil-horiz. frequency	37-11634-1
L400	coil-filter	18-0010
L402	coil-filter	50-92043-3
L404	coil-filter	50-15019-1
L406	coil-horiz. int.	36-11651-1
L500	coil-choke	50-15023-1
L508	coil-choke	50-15023-1
L510	coil-choke	50-15023-1
T100	transformer-sound inter.	57-11606-1
T102	transformer-audio output	56-97301-2
T200	transformer-IF interstage	57-11604-1
T204	transformer-sound take-off	57-11604-1
T300	transformer-vert. output	56-13476-1
T400	transformer-HV	50-11685-1
CB500	circuit breaker	29-88808-5
CPR500	capacitor	190-0094
SC200	diode-video detector	1N295
SC202	diode-AFC	1N4092
SC400	diode-AFC	1N4092
SC402	diode-AFC	1N4092
SC500	diode	1N4092
SC502	diode	1N4092
R118	1 M-volume/on/off	13-10102-1
R224	220 000 Ω -AGC	13-10102-1
R256	1 M-brightness	37-11632-6
R258	25 000 Ω -contrast	37-15064-3
R332	3 M-vert. height	37-15065-4
R334	100 000 Ω -vert. hold	Part of R224
R338	50 000 Ω -horiz. hold	Part of R224
R414	50 000 Ω -width	37-95323-51
R430	Yoke-deflection	153-0236

ELECTRONIC TECHNICIAN

TEKFAK

974

RCA VICTOR
TV Chassis
KCS144E

DECEMBER 1965

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR SIX NEW SETS

RCA TUBES, NUVISTOR, AND TRANSISTOR COMPLEMENT

Type	Function
RCA 6X4	1st Picture I.F. Amplifier
RCA 6X6	2nd Picture I.F. Amplifier
RCA 6X4	3rd Picture I.F. Amplifier
RCA 6X6	Sound I.F. Amplifier and Video Amp
RCA 6X4	1st Audio and Sound Director
RCA 6X6	Audio Output
RCA 6X4	Vert. Oscillator and Vert. Control
RCA 6X6	Horizontal Oscillator and Control
RCA 6X4	Horizontal Sweep Output

Type	Function
RCA 6X4	1st Picture I.F. Amplifier
RCA 6X6	2nd Picture I.F. Amplifier
RCA 6X4	3rd Picture I.F. Amplifier
RCA 6X6	Sound I.F. Amplifier and Video Amp
RCA 6X4	1st Audio and Sound Director
RCA 6X6	Audio Output
RCA 6X4	Vert. Oscillator and Vert. Control
RCA 6X6	Horizontal Oscillator and Control
RCA 6X4	Horizontal Sweep Output

Model	Name	Chassis	TMA	Tuner	Kinescope
AG-683Y, J, N	"TOP-NUMAN"	KCS144E	82A	KKK124P/120RD	19DQP4
AG-684L, W, Y	"MODERNIST"	KCS144E	82A	KKK124P/120RD	19DQP4

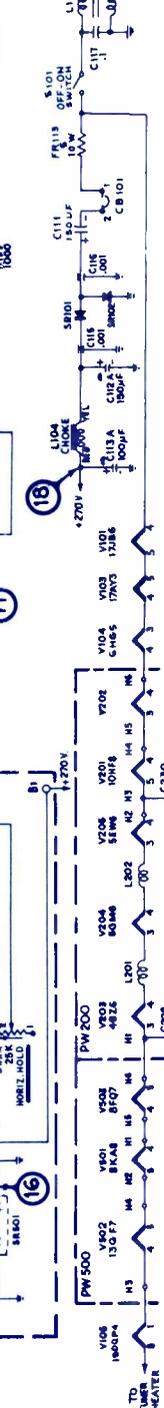
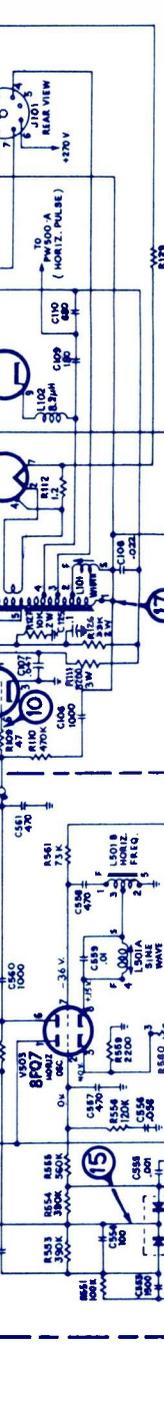
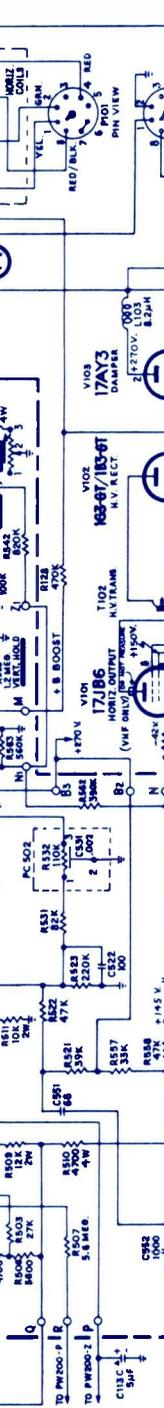
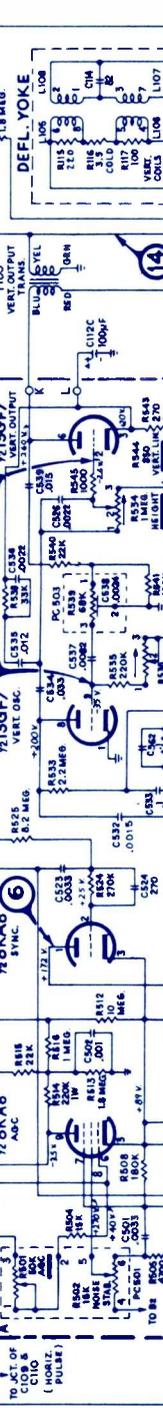
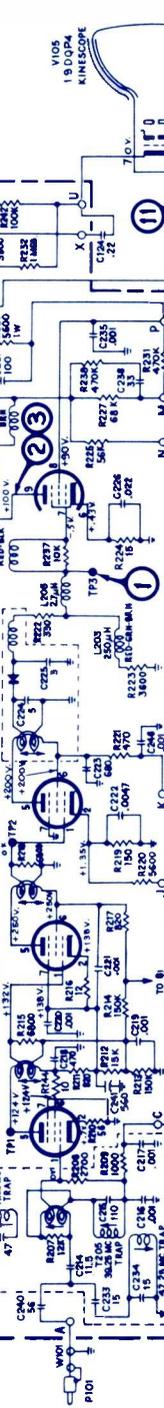
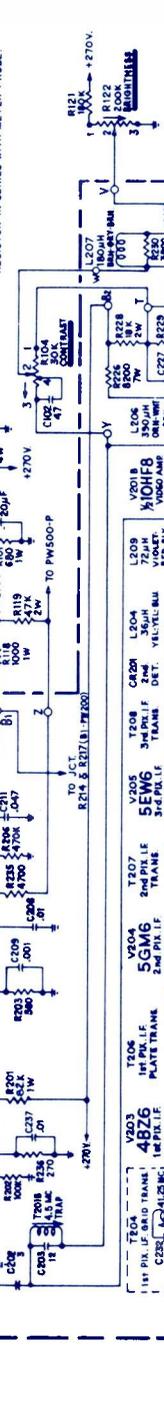
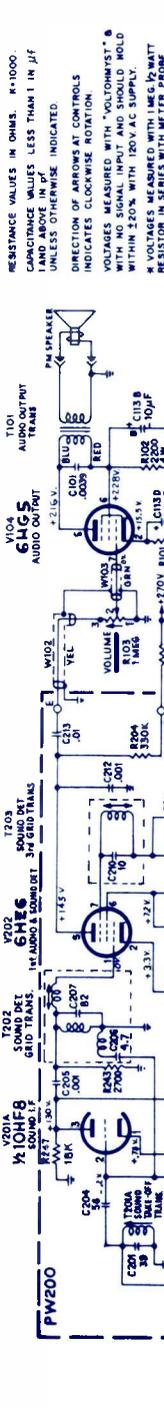
Resistance values in ohms, $\times 1000$. Capacitance values in pF, unless otherwise indicated. Direction of arrows at controls indicates clockwise rotation. Voltages measured with "VOLTOMYST" with no signal input and should hold within $\pm 20\%$ with 120V AC supply. Voltages measured with I.M.C. (R.W.ATT) resistor in series with meter probe.

CHASSIS REMOVAL

The knobs must be removed from the brightness control, volume control, VHF tuner shaft, and the UHF tuner shaft in order to remove the chassis.

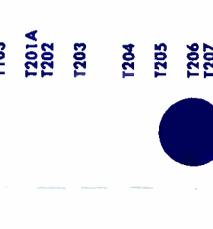
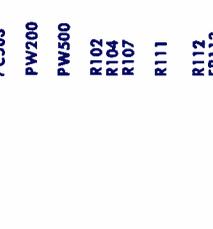
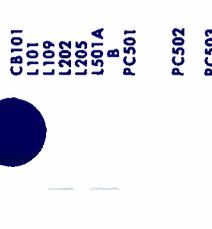
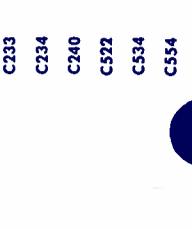
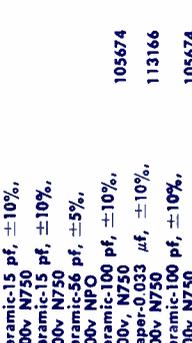
To disassemble the instrument, disconnect the VHF and UHF antennas. Remove six screws from receiver back (two at top and two at bottom), the screw at the AC power cord, and the screw just below the antenna input terminals, then remove the receiver back. Remove four hex-head nuts from tuner mounting assembly and remove assembly. Remove four hex-head fasteners (two at top and two at bottom of chassis). Disconnect the yoke plug and the two speaker pin plugs at speaker. Remove chassis partially and disconnect the second anode lead.

Remove the instrument, disconnect the VHF and UHF antennas. Remove six screws from receiver back (two at top and two at bottom), the screw at the AC power cord, and the screw just below the antenna input terminals, then remove the receiver back. Remove four hex-head nuts from tuner mounting assembly and remove assembly. Remove four hex-head fasteners (two at top and two at bottom of chassis). Disconnect the yoke plug and the two speaker pin plugs at speaker. Remove chassis partially and disconnect the second anode lead.

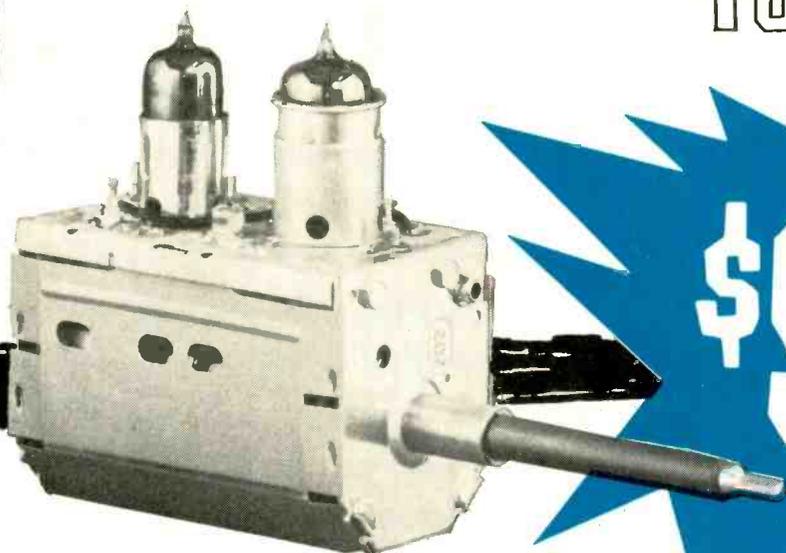


Symbol	Description
R93	Resistor-fixed film, 16,000 Ω , $\pm 10\%$, 3w
R103	Control-on-off-volume
R122	Control-brightness
C101	Ceramic-0.0039 μ f, $\pm 10\%$, 1000v
C102	ceramic-47 pf, $\pm 10\%$, 500v, N750
C103	ceramic-1.01 μ f $\pm 100-0\%$, 1000v
C106	ceramic-1000 pf, $\pm 20\%$, 1000v
C109	ceramic-180 pf, $\pm 10\%$, 4000v, N2200
C110	ceramic-680 pf, $\pm 10\%$, 3000v
C112	3 section electrolytic
A	150 μ f, 350v
B	5 μ f, 350v
C	100 μ f, 50v
C113	4 section electrolytic
A	100 μ f, 350v
B	10 μ f, 350v
C	20 μ f, 25v
D	5 μ f, 150v
C201	ceramic-39 pf, $\pm 10\%$, 500v, N150
C202	ceramic-3 pf, ± 1 pf, 1000v, N750
C203	ceramic-12 pf, $\pm 10\%$, 500v, N150
C204	ceramic-56 pf, $\pm 20\%$, 500v, N750
C214	ceramic-11.5 pf, $\pm 5\%$, 500v, NPO
C215	ceramic-110 pf, $\pm 5\%$, 500v, NPO
C224	ceramic-5 pf, ± 0.5 pf, 500v, N750
C225	ceramic-5 pf, ± 0.5 pf, 500v, N750
C233	ceramic-15 pf, $\pm 10\%$, 500v, N750
C234	ceramic-15 pf, $\pm 10\%$, 500v, N750
C240	ceramic-56 pf, $\pm 5\%$, 500v, NPO
C522	ceramic-100 pf, $\pm 10\%$, 500v, N750
C534	paper-0.033 μ f, $\pm 10\%$, 600v, N750
C554	ceramic-100 pf, $\pm 10\%$, 500v, N750

Symbol	Description
C8101	breaker-circuit
L101	coil-choke
L202	reactor-filter choke 2.7 μ h
L205	coil-horizontal sine wave
L91A	coil-horizontal frequency
PC501	circuit-compensatory
PC502	cludes R501 AGC, R502
PC503	Noisr Stabilizer circuit (includes R522, C531)
PW200	cludes C538, R529
PW500	circuit-printed IF and video circuit (less tubes)
R102	control-contrast
R104	control-contrast
R107	control-contrast
R111	control-contrast
R112	control-contrast
FR113	control-contrast
R226	control-height
R534	control-vert. hold
R543	control-vert. linearity
R544	control-vert. linearity
R560	control-horizontal hold
SR101	rectifier-silicon
SR102	rectifier-silicon
SR501	diode-selenium
T101	transformer-output
T102	transformer-hi-voltage
T103	transformer-vertical
T201A	output
T202	transformer-4.5 Mc trap
T203	transformer-IF (includes C206-C207)
T204	transformer-sound
T205	transformer-3rd grid (includes C210)
T206	transformer-1st pix IF grid
T207	transformer-1st IF grid
T208	transformer-1st IF pix trap
R115	transformer-2nd IF pix transformer-3rd IF pix resistor-220 Ω , $\pm 10\%$, 1/2w (part of yoke)
R117	transformer-100 Ω , $\pm 10\%$, 1/2w (part of yoke)
R116	thermistor-temperature compensating 3.8 Ω cold yoke-deflection (part of yoke)



Complete TUNER REPAIR for only



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inal specifications. Exclusive cleaning method makes the tuner look—as well as operate—like new.

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TARZIAN

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Call your G-E communications consultant listed in the Yellow Pages under “Radio Communication.” Or write for complete descriptive information. General Electric Company, Communication Products Dept., Section 115125, Lynchburg, Virginia.

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DECEMBER 1965
VOL. 82 NO. 6

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

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Cover

The future looks solid-state—and the future is here today (see page 47).

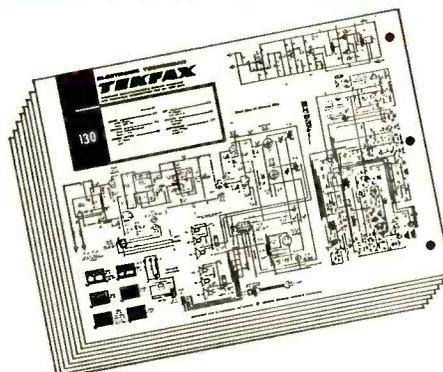
FEATURES

- Profitable Solid-State Repairs** 43
E. G. Huber tells how to select transistors to match circuit functions, make a profit and keep the customers happy
- The Future Looks Solid-State—and The Future Is Here Today** 47
A look at some of the solid-state items you'll be servicing soon
- Another Approach to Semiconductor Checking** 49
R. H. McDonald looks at scope traces to check out semiconductors
- Adventures of A Color TV Expert** 51
Bob Carlson, a skilled color TV technician, reveals some 'spider-webs' you'll have to watch out for
- Troubleshooting Color TV Vertical Circuits** 54
Homer Davidson advises you to keep a sharp eye on problems that may develop into "tough dogs"
- Color Bar/Dot Generators** 57
Another generator is reviewed in ET's TEKLAB
- The Secret Weapon** 60
Frank Salerno says 'We've got some heavy pieces of artillery at our disposal—the scope, the VTVM or VOM, the signal generator, the set analyzer, but . . .'
- Direct Mail Advertising** 62
An advertising medium no wide-awake service-dealer can afford to pass up
- Meeting High Labor Costs** 64
Some important reminders that every service-dealer will have to consider in the space-age business world

DEPARTMENTS

- | | | | |
|-----------------------|----|---------------------|----|
| Letters to the Editor | 24 | Colorfax | 72 |
| Editor's Memo | 28 | New Products | 76 |
| Sync on Business | 32 | New Literature | 85 |
| Technical Digest | 36 | Advertisers Index | 86 |
| | | Reader Service Card | 87 |

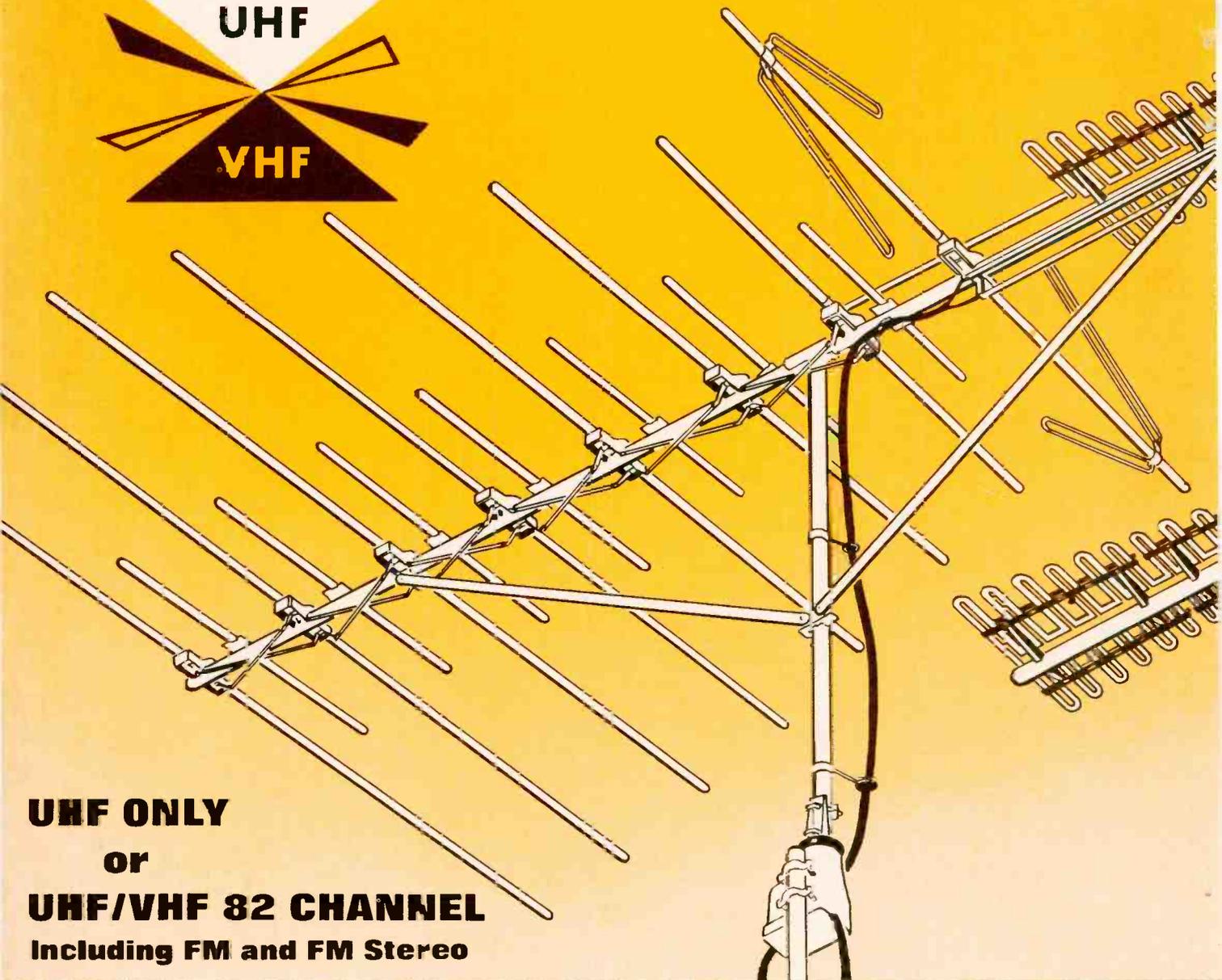
TEKFAX 16 PAGES OF THE LATEST SCHEMATICS



- EMERSON:** TV Model 12P50
- PACKARD BELL:** TV Chassis 88-19
- PHILCO:** TV Chassis 16N35
- RCA VICTOR:** TV Chassis KCS144E
- SILVERTONE:** TV Chassis 562.10096
- SYLVANIA:** TV Chassis B05-1, -2, -3

The first completely new antenna concept in years...

Revolutionary **CHANNEL** **ULTRADYNE SERIES**

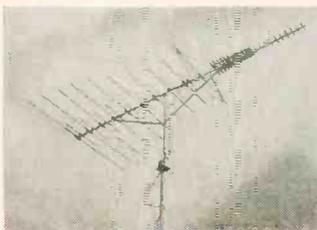


UHF ONLY
or
UHF/VHF 82 CHANNEL
Including FM and FM Stereo

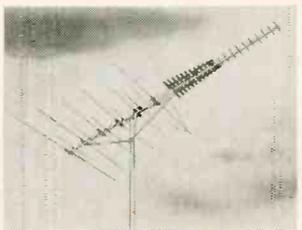
Model 0032 U-V Band Splitter included with all 82 channel antennas.

BREAKTHROUGH!

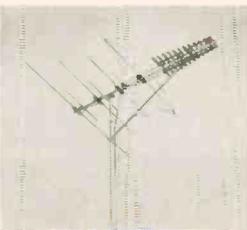
Five new ULTRADYNE CROSS-FIRE antenna models provide the first high gain FM and FM Stereo performance ever attained in an 82 channel TV antenna. Channel Master's exclusive, patented Tri-Band Directors make it possible. All ULTRADYNE series antennas feature the famous EPC golden coating.



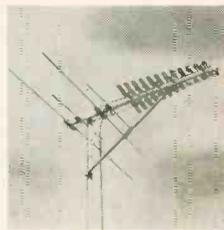
Model 3632G
for deep fringe areas



Model 3634G
for near fringe areas

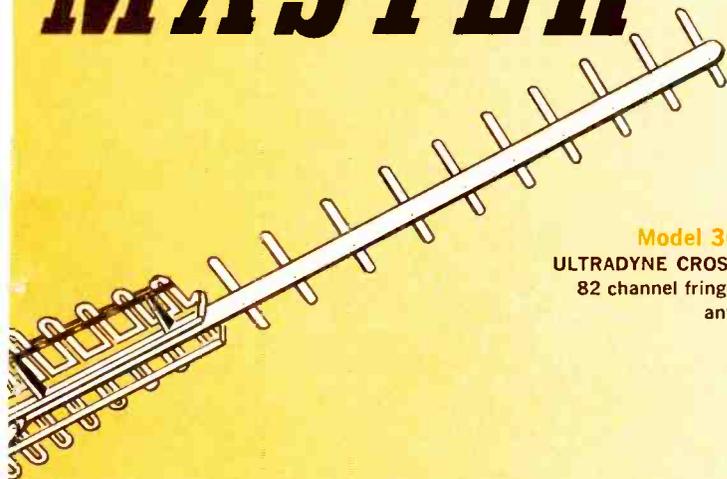


Model 3635G
for suburban areas

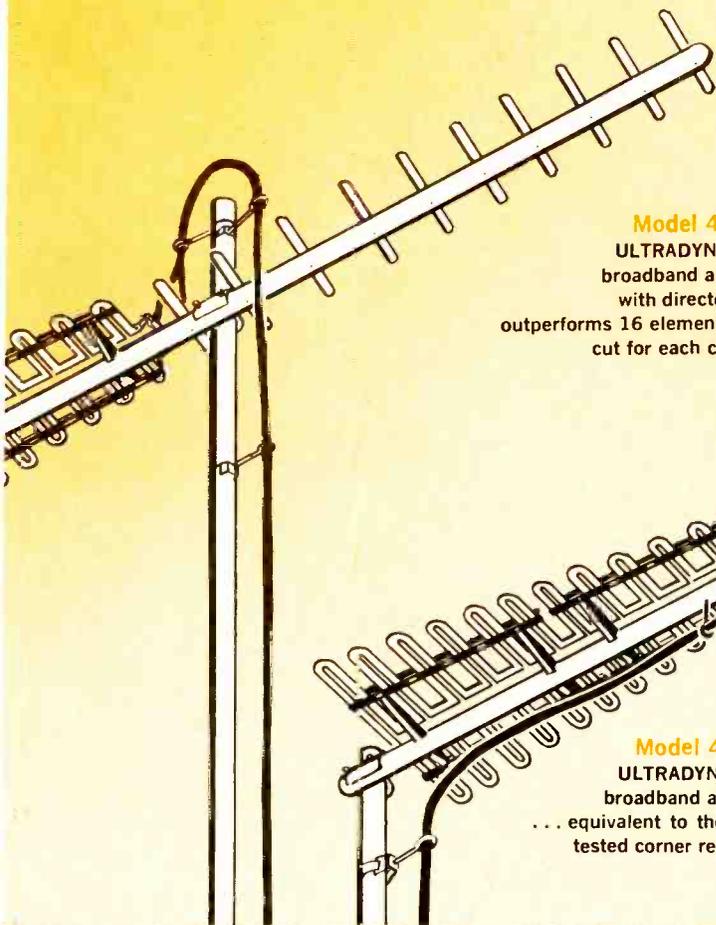


Model 3636G
for metropolitan areas

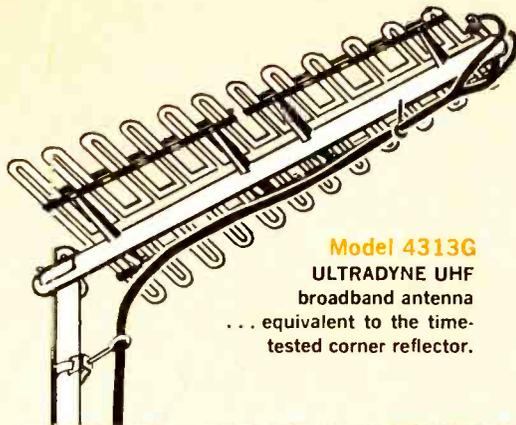
MASTER[®]



Model 3633G
ULTRADYNE CROSSFIRE
82 channel fringe area
antenna.



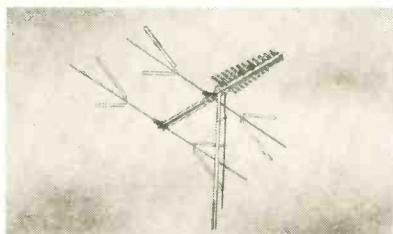
Model 4314G
ULTRADYNE UHF
broadband antenna
with directors . . .
outperforms 16 element Yagis
cut for each channel



Model 4313G
ULTRADYNE UHF
broadband antenna
. . . equivalent to the time-
tested corner reflector.

BREAKTHROUGH!

The amazing electronic ghost-killing power of Channel Master's famous Coloray antenna is now combined with the ULTRADYNE principle to create an 82 channel antenna for superb color reception as well as FM and FM Stereo in ghost-plagued areas.



Model 3637G
ULTRADYNE COLORAY

. . . for more details circle 14 on postcard

COLOR AGE BREAKTHROUGH!

Model for model, new ULTRADYNE CROSS-FIRES are the highest gain, highest front-to-back ratio 82 channel antennas ever developed. Unprecedented acceptance has made Channel Master Color Crossfires the best-selling VHF-FM antennas in TV history. Now, in combination with the ULTRADYNE UHF antenna, new standards of 82 channel performance are achieved.

BREAKTHROUGH!

Obsoletes so-called log periodic antennas. ULTRADYNE antennas, employing an entirely new principle, have higher gain than any log periodic antenna type on the market.

BREAKTHROUGH!

"Built-In" 300 ohm impedance actually makes the ULTRADYNE function as a length of 300 ohm transmission line at VHF. This eliminates the need for an antenna coupler when the ULTRADYNE is used in conjunction with any 300 ohm VHF antenna such as Channel Master's Famous Color Crossfires (models 3617G, 3610G, 3611G, 3612G, 3613G, 3614G, and 3615G).

BREAKTHROUGH!

Fantastic front-to-back ratios . . . over 15:1 across the entire UHF band.

BREAKTHROUGH!

Unique construction. Two stamped aluminum sections make up the entire driven element section of the antenna. This means precise control of dimensions and the elimination of connection and corrosion problems.

BREAKTHROUGH!

Three separate United States patents and two patents pending cover the exclusive design features of Channel Master's new ULTRADYNE series. No other antenna line incorporates such important technical advances. Yes, from the standpoint of gain, front-to-back ratio, impedance, construction simplicity and versatility, no other antenna comes close to the ULTRADYNE series. No wonder the entire industry knows that the truly significant advances in antenna design traditionally come from . . .

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LETTERS TO THE EDITOR

Likes Color Articles

Finally finished reading the August issue of *ELECTRONIC TECHNICIAN* which I enjoyed as much as every issue since September 1952. Keep up the good work. I like especially the articles on color TV. I file all of them for study and reference. We are selling a lot of color TV sets this year and I can use all the information I can get. Also your *TEKFAK* schematics are a big help because they come out long before any others . . .

JOHN LIND

Flushing, N.Y.

Information Retrieval Problem

You hit the nail on the head with your "Editor's Memo" in the April issue . . . I built many instruments of my own design for special uses, to speed up troubleshooting and repairs. But often I beat around the bush not knowing exactly how to tackle a problem. I think one big factor for the beating around is the memory. We see so many things and ideas that we fre-

quently do not remember what we once knew or did about a particular problem and we have to do a lot of thinking before we remember it again. I believe all technical material should bear a memorandum column with a specific headline so it could be cut-out and filed in a test section . . .

J. ROULEAU

Senneterre, Que. Canada

• *Until we find a better way to locate information, suggest you use the contents page for locating specific information. Some technicians file these for reference—Ed.*

Needs Scope Info

Can any ET reader tell me where I can get a schematic for a Realistic, dual trace scope, Model No. 102?

CALVIN AKIN

Thermopolis, Wyo.

Needs Ancient Vintage Schematic

I recently acquired an old Pilot TV-37 TV set and need a replacement bakelite grille and a 3KP4 CRT. Unable to locate either through Pilot. Can anyone help me?

B. E. PRESCOTT

Seattle, Wash.



The boss didn't believe us, so we borrowed his new Cadillac and came to a dead stop on top of one of the new all steel Sencore cases . . . and without an ounce of damage. We wanted to prove once and for all that only Sencore was rugged enough for constant field use. We doubted that you would run over your new Mighty Mite tube tester, CRT checker, solid state color generator, or any of the other fine Sencore time saving testers but we do know that you toss them around plenty . . . all day long. This requires all steel construction. Only Sencore has a complete line of all steel ruggedized testers. Wood and fabric just aren't good enough for today's technician on the go. That's why Sencore is the World's leaders in portable testers.

SENCORE ■ 426 WESTGATE ■ ADDISON, ILLINOIS

. . . for more details circle 39 on postcard
ELECTRONIC TECHNICIAN

Have you tried **KWIKETTE**[★] connectors?

Not just another wire spring connector!

The 3-in-1 KWIKETTE is brand new and different... Copperweld wire inner core, a layer of flux, and an outer jacket of solder... all you need is heat!

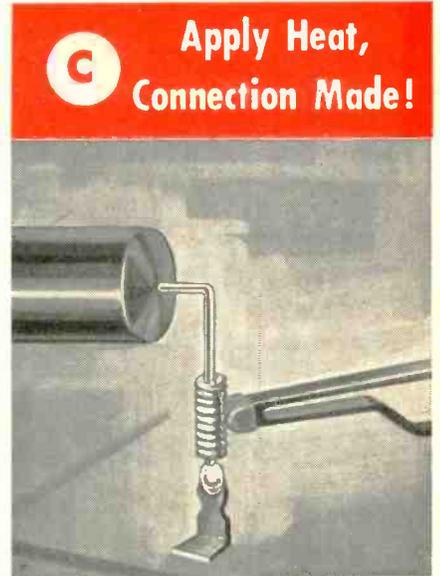
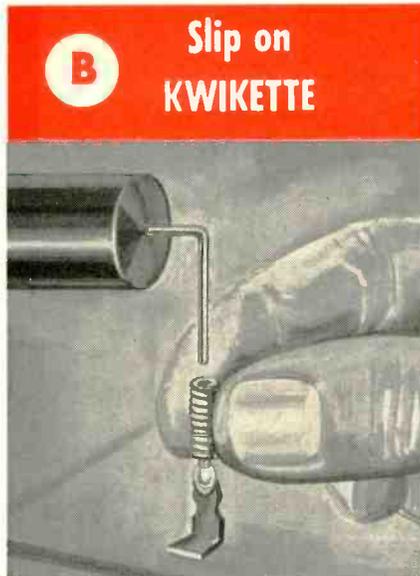
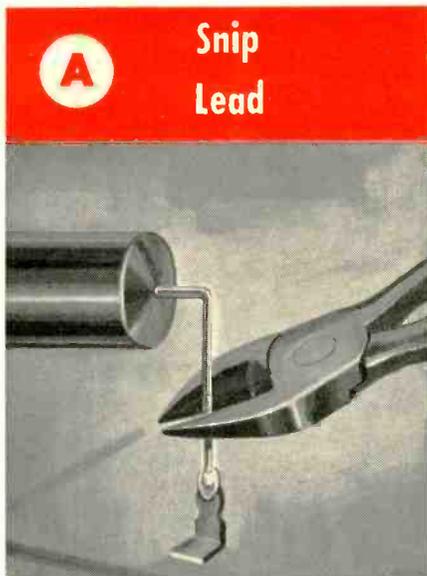
Makes one-handed soldering possible!

Once again, Sprague helps the TV-radio service industry by solving two increasingly serious problems... parts replacement in those "inaccessible" chassis nooks, such as crowded tube sockets, as well as soldering onto printed wiring boards.

Mechanically sturdy and electrically reliable, the revolutionary KWIKETTE provides fast, expertly-soldered connections as easy as A-B-C!



Ten times actual size



**NOBODY ELSE HAS KWIKETTE CONNECTORS...
YOU GET 'EM ONLY FROM SPRAGUE PRODUCTS!**

KWIKETTES are now being packed with Sprague Atom[®] Capacitors at no extra cost to you! Whenever you need tubular electrolytics, insist on pre-packaged Sprague Atoms from your parts distributor and you'll automatically get your KWIKETTE component connectors... the biggest boon to the service technician since the soldering gun!

★TRADEMARK



WORLD'S LARGEST MANUFACTURER OF CAPACITORS

65 4104 RT

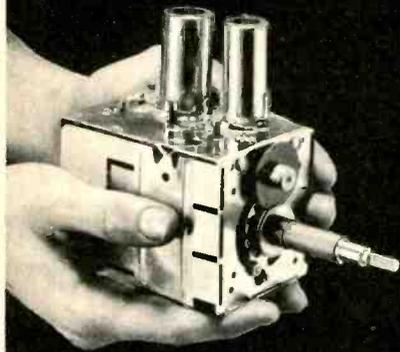
DECEMBER 1965

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25

COMPLETE TUNER OVERHAUL

ALL MAKES—ONE PRICE



ALL LABOR AND PARTS

(EXCEPT TUBES & TRANSISTORS)*

995



VHF



UHF



COLOR



U-V



COLOR TUNERS



TRANSISTOR

Guaranteed Color Alignment—No Addit. Charge

Simply send us the defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint. Your tuner will be expertly overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.

UV combination tuner must be single chassis type; dismantle tandem UHF and VHF tuners and send in the defective unit only.

Exact Replacements are available for tuners unfit for overhaul. As low as \$12.95 exchange. (Replacements are new or rebuilt.)

Pioneers in TV Tuner Overhauling

CASTLE

TV TUNER SERVICE, INC.

MAIN PLANT: 5713 N. Western Ave., Chicago 45, Illinois
EAST: 41-92 Vernon Blvd., Long Island City 1, N.Y.
CANADA: 136 Main Street, Toronto 13, Ontario

*Major Parts are additional in Canada

... for more details circle 13 on postcard

LETTERS TO THE EDITOR

He Quits

Ten years ago I retired from AT&T after 45 years of service. Have built and serviced radios since 1921, adding TV, tape recorders, etc., in later years. At 75 I'm retiring from it all. Have enjoyed the valuable information that I have obtained from *ELECTRONIC TECHNICIAN* and I thank you very much.

BERL SAIN

Alexander, Pa.

Likes Reader Service

Excellent magazine! I find the information cards a convenient means to obtain information on the latest products.

WILLIAM P. HENNIG

Williston Park, N.Y.

Silicon Rectifiers

Thanks for the information concerning silicon rectifiers in radios . . .

EDDIE PROSISEY

Chicago, Ill.

Offers Info

Tell everyone that NRI model 71 tube tester data can be obtained from Coletronics Service Inc., 78-63 76th St., Glendale, N.Y. 11227.

RONALD BYBEE

Scottsville, Ky.

Needs Auto Radio Schematic

I wonder if any of your readers would have a schematic for a Delco model RU-1142C radio? United Motors Service say they have no such model in their service manuals.

CHARLES PRATER

Wonnies, Ky.

Another 'Old Timer'

Have been in this business for the past 35 years . . . I have been a subscriber to your wonderful magazine ever since it has been published for the past 20 years and think it is the best. Keep up the good work.

LEO C. SCHMIT

Evansville, Ind.

Needs Info

I recently purchased some used test equipment among which was a Boland & Boyce tube tester, model 701. I have

no other information on the tester and need a schematic and operating instructions for it. Can any of your readers help?

JOHN BORST

Schenectady, N.Y.

Wants Compactrons Updated

In your May 1964 issue you published "Condensed Specifications for Compactrons." This data was very valuable for setting up test data for tube-testers and I was very thankful to you for this article. I would like to see other compactrons included in a new list.

Z. FRANKIEWIEZ

New York

• *We're working on it.—Ed.*

He's Still At It

Am renewing my subscription for 3 years. I wouldn't be without *ET*. Keeps my brain working . . . After 37 years in this business, I sure can use it. Would like to see more information on transistor behavior in various configurations.

THEO VITOLO

Bay Shore, L.I., N.Y.

Needs Hickok Tester Manual

Can any reader help me. I am trying to locate an instruction manual for the Hickok Model 534 tube tester?

L. DAVIS

Adel, Iowa

Cause and Effect

Maybe this one will help some reader. I recently had a Philco portable chassis 13J28 in the shop for repair. The set had poor vertical linearity with a band at the top. After checking all the parts which would obviously cause this trouble, I noted that three resistors in the horizontal oscillator network were part of the vertical circuit. A 470K resistor in this circuit was open. After replacing this PC network, vertical linearity returned to normal. I have been a subscriber to *ET* for many years and wouldn't think of missing a copy. Keep up the good work.

BOB HUGHES

Elwood, Ind.

Strong Opinions

This is my honest opinion of your magazine. I believe that it is not one of the best in its field, *it's the best* . . . Keep up the good work and don't change anything.

EARL LINDSAY, JR.

Houston, Texas



The quality goes in before the name goes on

**Choose from the complete line
built to Zenith's high quality standards!**

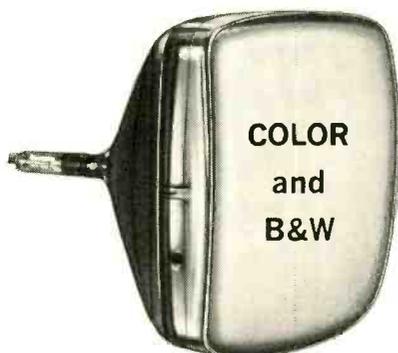
ZENITH FAMOUS QUALITY TUBES

Zenith replacement picture tubes and receiving tubes meet the famous quality standards set for Zenith "original" parts—your assurance of the

world's finest performance! Wherever you are located, there's a Zenith Distributor near you, who can supply you quickly on a day-to-day basis.

ZENITH QUALITY TELEVISION PICTURE TUBES

Complete line of more than 180 top-quality picture tubes . . . color, black-and-white, special purpose. These picture tubes have the same standard of quality that goes into Zenith television sets as original Zenith equipment.



Zenith black-and-white replacement picture tubes are made only from new parts and material except for the envelope which, prior to re-use, is inspected to the same standards as a new envelope. In color tubes the screen, aperture mask assembly and envelope are inspected and tested to meet Zenith's high quality standards prior to re-use. *All* electron guns are new.

ZENITH QUALITY "ROYALTY CREST" RECEIVING TUBES



Complete line of more than 800 top-quality receiving tubes . . . made to the *same* quality standards as original equipment in Zenith products! More than 1,500,000 tube hours are accumulated every month by Zenith's life-testing under actual operating conditions. This insures that Zenith "Royalty Crest" tubes have greater reliability which reduces costly call-backs . . . and longer life which increases customer satisfaction!

Check the Yellow Pages for the Zenith Distributor nearest you.
Or write to Zenith Sales Corporation, Parts & Accessories Division,
5801 West Dickens Avenue, Chicago, Illinois 60639,
for Distributor name and information on Zenith quality
replacement picture tubes and receiving tubes.

Specifications subject to change without notice.

. . . for more details circle 49 on postcard

And We'll Never 'Graduate'

Once again, at the risk of being monotonous, we call attention to a situation that many service-dealers and technicians still ignore.

It has been obvious, for more than a decade, that the impact of scientific and technological developments — goaded primarily by space and military research — were bringing about vast changes in our educational, economic and social (not to mention political) ways of life. No area was immune — least of all the electronics service business. But this process is going on in *every* business today.

We urged TV-radio service-dealers and technicians to "keep up" with these developments through some form of educational activity — especially with color TV, solid-state and micro-electronic circuit developments. We said new circuit principles and servicing techniques — new business and merchandising methods — would have to be learned. It would be impossible, we pointed out, to remain in the same old "rut" and survive. These things are here but there's more to come.

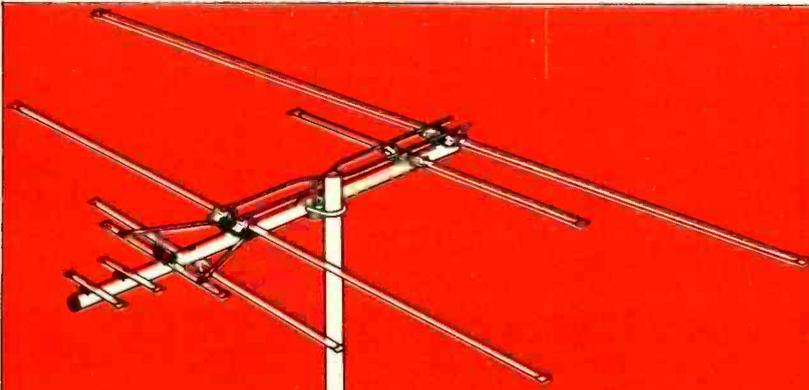
The circuitry contained in today's space and military electronic instruments, for example, will influence the design of tomorrow's industrial and consumer electronic products. Unheard of items will be created for plant, business and home.

To understand why all this is so — and will become more intense in the future — we need to look only at one facet of the situation.

Scientific and technological developments, spurred forward by high-speed electronic computers, are undergoing an *accelerating* rate of change. Hence, electronic equipment on the drawing board has an increasingly larger element of obsolescence.

Observe, for example, the many revisions and production changes made *before* this equipment reaches the field. And note the changes made in the very next production run. Observe, too, how a piece of equipment — particularly in space and military areas — is quickly replaced by another of more advanced concept and design.

It should be obvious at this late date that we have approached a period of *continuous* education in all areas. We'll go to school throughout the rest of our lives to keep up with this process — and we'll never graduate!



the new Winegard "HOT-SHOT"

eliminates ghosts far better than any other metropolitan-type antenna

IT'S THE DESIGN that does it! The Hot-Shot's high front-to-back and extremely high front-to-side ratios (without side lobes that pick-up ghost signals) provide sharper directivity for more distinct, clearer reception.

AND WHEN the Hot-Shot isn't eliminating ghosts, it's helping to make color TV more colorful and all-band (UHF, VHF and FM) reception better than ever.

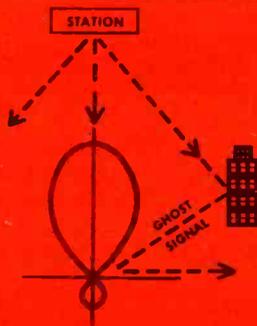
THE ALL PURPOSE, super-compact Hot-Shot is the perfect replacement for conicals, vees, in-lines and rabbit ears. It has Winegard's new Gold Vinylized finish to triple antenna life. And, with only one down-lead, it's a cinch to install on roofs or in attics.

SOUND EXPENSIVE? It isn't! In fact, Winegard's new Hot-Shot lists for only \$8.80 — far less than comparable outdoor antennas — and about the same as good indoor antennas that do far less. Want to know more? Your customers will. Ask your Distributor or write today for Hot-Shot Fact-Finder #241.

INCIDENTALLY, the Hot-Shot is now available in Kit form — with tripod-mast, 50 ft. lead-in and standoffs. Ask about it.

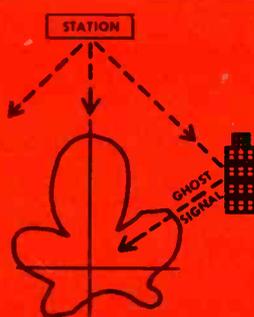
Give your metropolitan (and suburban) customers

this



The Hot-Shot's sharper directivity (no side lobes to pick-up ghost signals) delivers more distinct, clearer reception!

...not this



Conicals, vees, rabbit ears, etc. (with side lobes that pick-up ghost signals) provide inferior directivity that results in ghostly, blurry reception.

Winegard Co.

ANTENNA SYSTEMS
3000 Kirkwood • Burlington, Iowa

... for more details circle 47 on postcard



FREE!

From now through December 15, 1965

Get a Color-TV TEST Picture Tube with every RCA WR-64B Color Bar/Dot/Crosshatch Generator you buy

Yes! You read right!

From now through December 15, 1965—with every purchase of an RCA WR-64B Color Bar Generator—you get a FREE color-TV TEST picture tube for use in your color-TV test jig. This is a 21-inch 70° round color-TV TEST picture tube, electrically guaranteed six months from first installation date. These tubes will have minor mechanical (not electrical) defects... they're not quite good enough to go into a new TV set but perfectly adequate for testing purposes.

How to get your FREE Color Test Tube

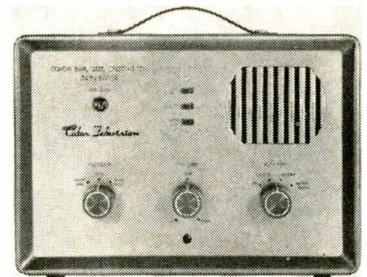
Simply buy an RCA WR-64B Color Bar Generator—*THE* essential color-TV test instrument—between now and December 15, 1965. Fill out your warranty registration card and attach the red identification label on the WR-64B carton. Send them to RCA, Test Equip-

ment Headquarters, Bldg. 17-2, Harrison, N. J. We send you the tube (either from Lancaster, Pa. or Marion, Ind.) freight charges collect. To allow for postal delay, we will honor cards received up until December 31st.

Don't miss out on this never-before offer. You've got to have a color-bar generator anyway—so be sure you buy it now—at the regular price—while you can get a FREE color test tube.

\$189.50*

Optional distributor resale price! subject to change without notice. Price may be higher in Alaska, Hawaii and the West.

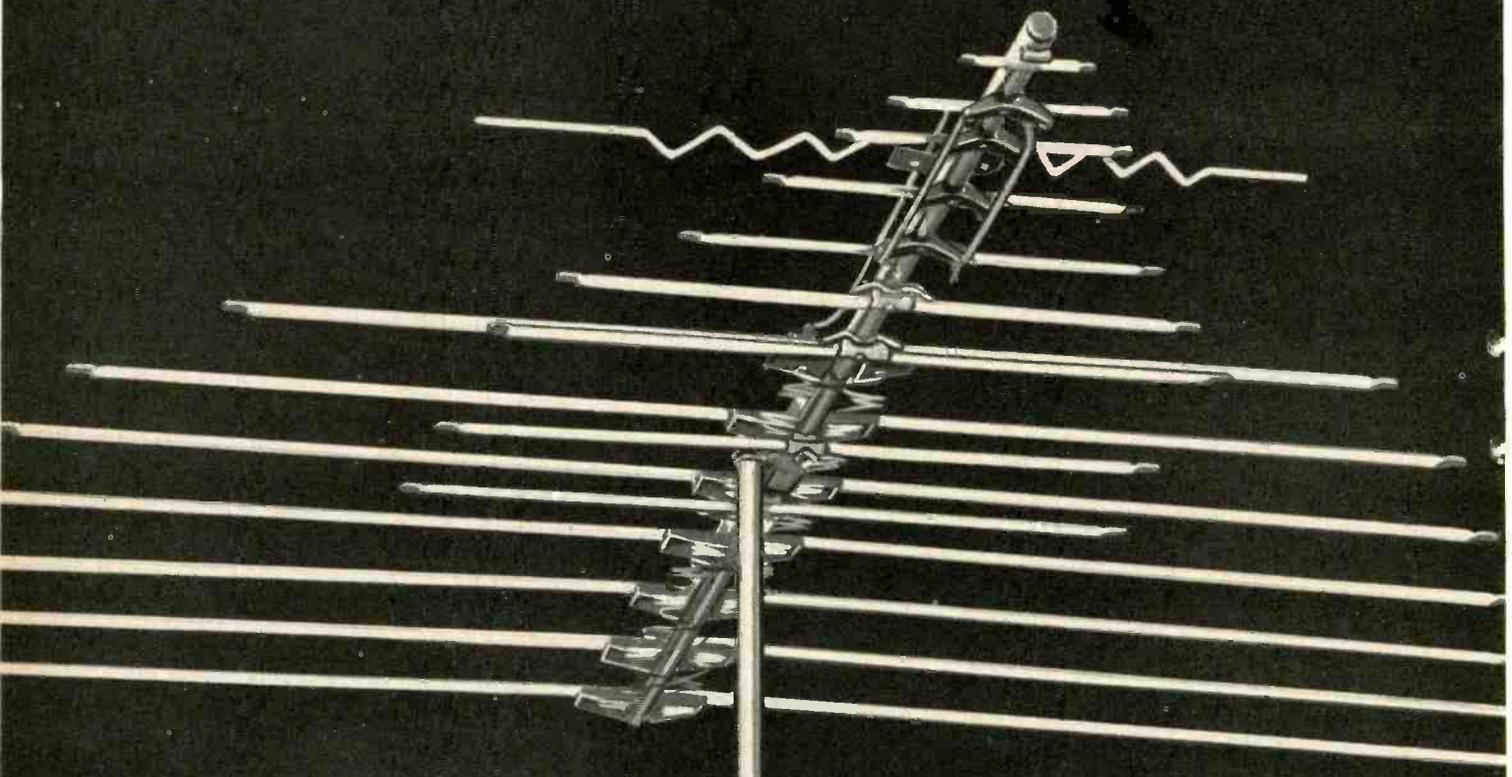


RCA WR-64B Color Bar/Dot/Crosshatch Generator

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, NEW JERSEY



The Most Trusted Name in Electronics



HOW DID
WINEGARD
PUT
FULL SIZE
POWER IN A
1/2 SIZE ALL-BAND
(UHF-VHF-FM)
COLOR
ANTENNA?

WITH
WINEGARD
CHROMA-TEL

the new
super-compact high
gain antenna
designed specifically
for all-band UHF-VHF
Color Reception and FM

A big disadvantage of most all-band (UHF, VHF, FM) antennas is that they are larger and heavier than necessary. This is because they are really VHF antennas with UHF antennas tacked on the front end. *Chroma-Tel isn't.* It's super-compact and the

first integrated antenna designed specifically for all-band UHF-VHF color operation.

How did we reduce the size so drastically without sacrificing performance?

Two ways. First with our new *Chroma-Lens*

Director System. With this unique system, we are, for the first time, able to intermix *both* VHF and UHF directors on the same linear plane without any sacrifice of performance.

Second, with *Impedance Correlators*. These are the special phasing wires that automatically step up the impedance of Chroma-Tel's 72 ohm driven elements to 300 ohms. The correlators make sure each element has an accurate 300 ohm impedance at its given frequency. No other antennas with multiple driven elements have this! They also allow us to place the elements *only* 5 $\frac{3}{4}$ " apart instead of 10" to 14" apart as on other all-band antennas, reducing antenna length by one-half.

With the new Winegard Chroma-Tel antenna, we have eliminated *half* the bulk, *half* the wind loading, *half* the storage space, *half* the truck space, and *half* the weight . . . yet still have the best working, easiest installing UHF-VHF-FM antenna ever developed!

You give your customers a neater installation that performs as well or better than any other all-band antenna on the market . . . and at a much lower price.



Exclusive Winegard Impedance Correlators insure 300 ohm impedance on each element

Compare Performance. You can't find an all-channel UHF-VHF-FM antenna that will give you better results than Chroma-Tel. Look at the polar patterns. There are no side lobes with Chroma-Tel because the elements are straight . . . unlike V'd elements that offer an element surface sideways to the signal, Chroma-Tel's straight ele-

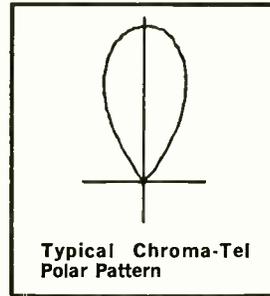
ments will not pick up ghosts from sides or back. Chroma-Tel's front-to-side ratio is practically infinite—Chroma-Tel's exceptional front-to-back ratio is up to 30 db.

Compare Construction. The Chroma-Tel is Winegard quality throughout . . . from its sales-making compact 4-color box, to its weather resistant Gold Vinylized Finish, to its first quality snap-lock hardware.

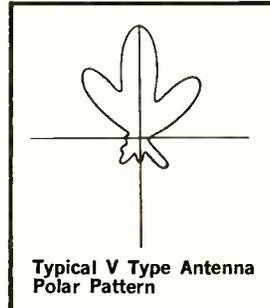
For complete information on the exciting new Winegard Chroma-Tel All-Band Antenna, ask your distributor or write for Fact-Finder #242 today.



So compact it fits in the back seat of a car



Typical Chroma-Tel Polar Pattern

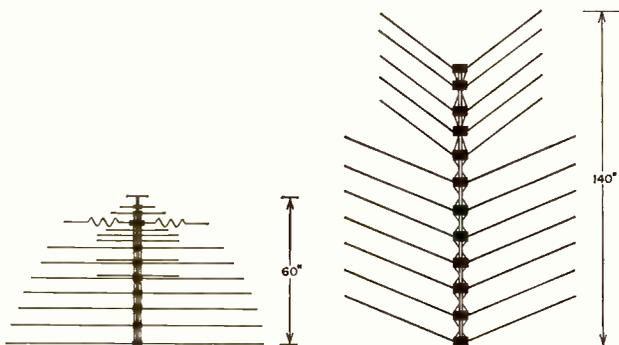


Typical V Type Antenna Polar Pattern

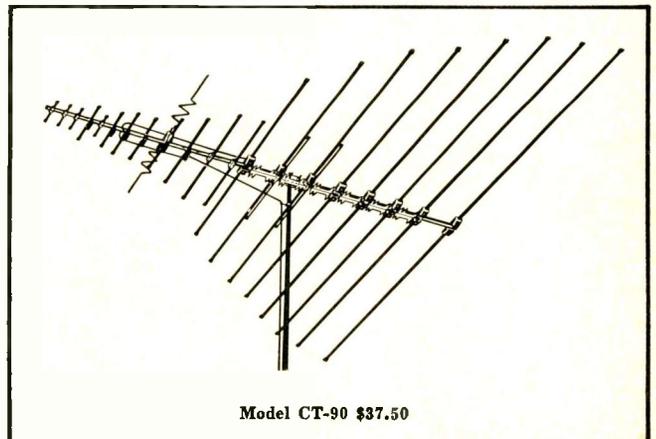


All Chroma-Tels include Winegard's model CS-283 UHF-VHF signal splitter. Splitter hangs conveniently behind TV set. Separates UHF and VHF signals coming from antenna to the two sets of terminals on your set. It's yours FREE when you buy Chroma-Tel.

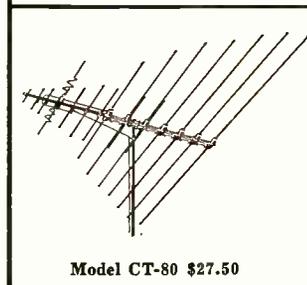
Compare Size and Price. We've illustrated the super-compact Chroma-Tel CT-80 and a comparable V type antenna. Note the difference in size, price and weight for equal or better performance. Because it's even much smaller than ordinary VHF antennas of comparable performance, it is perfect for attic installations, too!



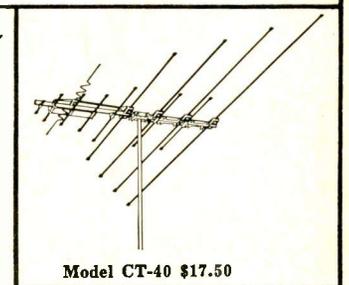
Winegard Chroma-Tel	V type (Approximate Figures)
Boom Length: 60"	140"
Total Weight: 5 lb., 1 oz.	10 lb., 3 oz.
Carton Size: .97 cu. ft. (less than 1)	5.8 cu. ft.
Number of Elements: 17	12
List Price: \$27.50	\$50.00



Model CT-90 \$37.50



Model CT-80 \$27.50



Model CT-40 \$17.50

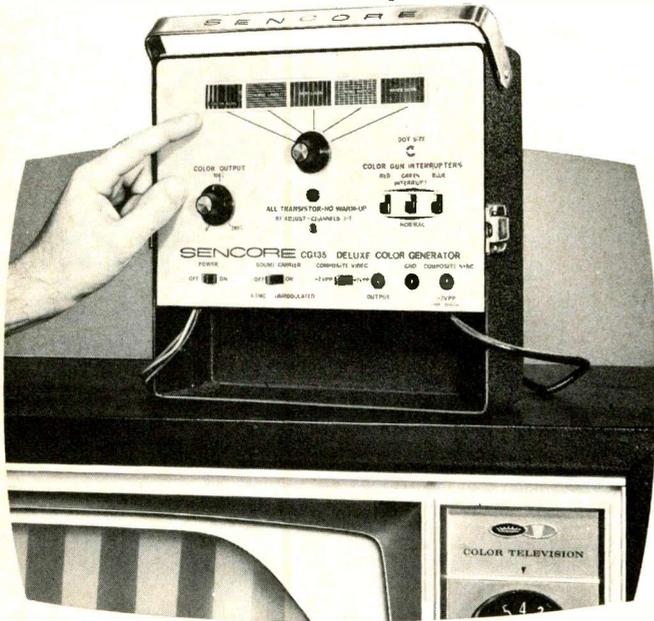
Winegard Co.

Antenna Systems

3000 Kirkwood • Burlington, Iowa

. . . for more details circle 48 on postcard

at last...
instant color patterns
at your finger tips...
zero warm-up time



THE ALL NEW SENCORE CG135 DELUXE TRANSISTORIZED COLOR GENERATOR

The big push is on in Color TV. Equip yourself now with the new, solid state Sencore CG135 and cash in on the zooming volume of new service business as Color-TV booms! Instant, service-ready RCA standard color bars, cross-hatch, white dots and individual vertical and horizontal bars enable you to set up or trouble-shoot more Color TV sets per day; earn top money in this fast growing service field. It's an analyzer too: Color gun interruptors, unmodulated video for chroma circuit trouble isolation and unmodulated sync pulses to keep Zenith receivers in sync for this test, make color trouble shooting a snap. Sturdy all-steel construction for rugged, heavy duty in the field or shop. Another Best Buy in profit-building service instruments from Sencore at

\$149⁹⁵

COMPARE THESE FEATURES: SEE WHY THE CG135 IS IN A CLASS BY ITSELF

- Solid state construction employs high priced GE "Unijunctions" to develop six "jump out proof counters" that guarantee stable patterns at all times with no warm-up
- Standard RCA licensed patterns as shown on schematics throughout the industry
- Handy universal color gun interruptors on front panel
- Lead piercing clips insure non-obsolence
- CRT adaptors optional
- Crystal-Controlled 4.5mc Sound Carrier Analyzing Signal to insure correct setting of fine tuning control
- RF output on Channel 4 adjustable to Channel 3 or 5 from front of generator when Channel 4 is being used
- No batteries to run down; uses 115 V AC
- Less than one foot square, weighs only 8 lbs.

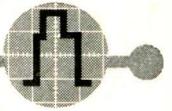
professional quality — that's the difference!

SENCORE

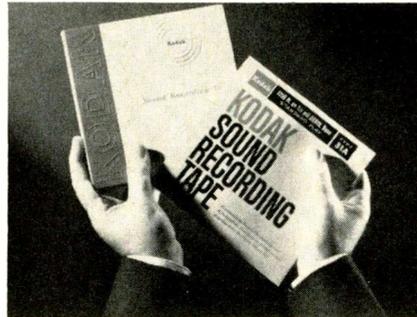
426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

... for more details circle 35 on postcard

SYNC ON BUSINESS



An authorized factory tuner repair center to serve the Eastern states has been opened by Sarkes Tarzian. Known as Tuner Service Corp., the center is located at 547-49 Tonnele Ave., Jersey City, N.J. Complete tuner overhaul service is being offered on a 24-hour basis. Other tuner repair centers are located in Bloomington, Ind., and North Hollywood, Calif.



Audio recording tape in a decorator-styled box is being offered by International Resistance Co. through its consumer and distributor products div. The package, called a Library Box, contains tape

made by Kodak. Complete technical data is printed on the inside of the box and space is provided for identification of recorded selections. Address inquiries to International Resistance Co., 414 N. 13th St., Philadelphia, Pa. 19108.

Car stereo solid-state tape players with two-channel stereo amplifiers, dual-stereo playback heads, electronic track selector, push-pull output and a self-activating cartridge system are now available from Auto Sound Div., Craig Panorama, Inc., 3412 So. La Cienega Blvd., Los Angeles, Calif. 90016.

National service and parts for Rossorder Model 1000 tape recorders are available from Electronics Engineers, Inc., 5615 West Division St., Chicago, Ill. It is expected that other Ross products may be added later. E/E is one of the largest tape recorder and audio service agencies in the country and is now contracting with qualified service companies throughout the United States to service Ross products in local areas. Incidentally, ask for their booklet, "The story of a Unique Company."

A directory of accredited private home study schools lists the 72 National Home Study Council Schools. A copy is available from the National Home Study Council at 1601 18th St., N.W., Washington, D.C. 20009.

Family Fun In Tape Recording is only one of a number of aids you may be able to use on your way up the tape-recorder business ladder. In a number of ways this 192-page "popular library" paperback book is unique. "It is strictly an educational effort designed to promote greater interest in recorders," Wybo Semmelink, assistant vice president of North American Philips and manager of the Norelco High Fidelity Products Dept., said. You may be able to get these books, in volume, at a reasonable discount for resale or promotional purposes.



U.H.F.

HERE

TO STAY

More and more UHF television stations and UHF translator stations are going on the air every day across the country. And the number is increasing rapidly. UHF is accepted... is here to stay.

Every new UHF station represents a whole new untapped profit area for electronics distributors and independent television repair men. Most of the existing television sets now in use were manufactured prior to 1965, and are not equipped with UHF reception. Every TV set owner in your trading area is practically a sure sale for a UHF television converter... *either a built-in or "on-the-top" unit.*

NOW, WHICH MAKE ARE YOU GOING TO SELL TO INSURE HIGH PROFITS?

It's always smart business to stick with a winner. Wherever UHF has gone on the air—Los Angeles, Chicago, Detroit, Boston, Philadelphia,—Standard Kollsman UHF Converters have consistently been Number 1 in distributor preference, dealer preference and consumer preference. *And in the small translator communities, SK's superior performance at the top of the band makes it especially preferred.*

Standard Kollsman quality and dependability means a Final Sale—No Returns. Reliable, service-free tuning elements. Built-in safeguards against spurious radiation. Guaranteed by the world's largest manufacturer of television tuners.



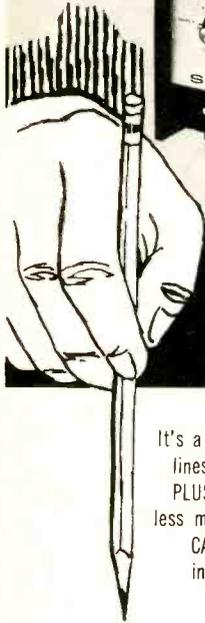
Standard Kollsman
INDUSTRIES INC.

2085 NORTH HAWTHORNE AVE., MELROSE PARK, ILLINOIS

... for more details circle 41 on postcard

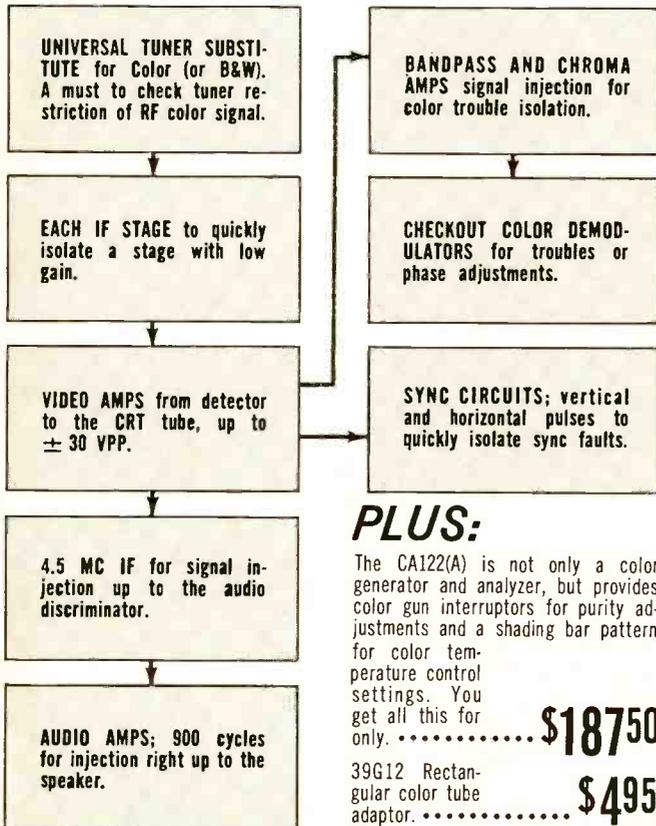
sk means Final Sale, No Returns — Service-free Tuning Element, No Spurious Radiation — Guaranteed 1 Yr. by the World's Largest Manufacturer of T. V. Tuners

PINPOINT COLOR TV TROUBLES IN SECONDS...



WITH THE NEW IMPROVED SENCORE CA122(A) COLOR CIRCUIT ANALYZER

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SYNC ON BUSINESS

Two-way radio communications moves on. The British Home Office, for example, has purchased 300 solid-state walkie-talkies from Cossor Communications, a Raytheon subsidiary, as a first step in providing every British patrolman with direct communications between fellow officers and headquarters. The FM/VHF sets may reach 30,000 units. We'll have them here too—eventually.

Our X-ray equipment specialists may like to know that Sola is now manufacturing an all-transistorized and highly regulated 50kv power supply. The supply can also be used for special electron guns, ion-beam devices, micro-probes and a variety of similar applications. Takes 117vac ($\pm 10\%$) 50/60 cycle input. Output (dc) variable from 0 to 50kv at 0 to 1ma.

A catalog of capacitors specifically designed for service-dealers and technicians—covering TV-radio, audio service, filter systems, hardware and other items is available at your local Aerovox distributor.

A conversion kit for the models CR125 and CR128 CRT checkers is available from Sencore. The latest B/W and color CRTs can be checked more accurately after conversion.

All the necessary lubricants and cleaners you'll need in your shop are contained in a plastic sealed package by



Workman. The package, model number LK5, is available at your electronics distributor.

Television set manufacturers are being offered a U.S.A. made UHF TV tuner to compete with foreign made tuners. The transistorized unit will out-perform any UHF tuner from Taiwan, Hong Kong, Japan or anywhere else in the world, according to Arnold L. Svanascini, vice president, marketing, Standard Kollsman Industries.

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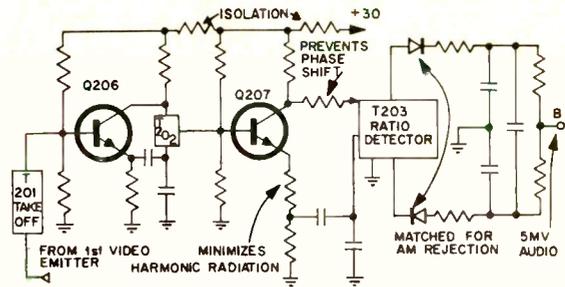
TECHNICAL DIGEST

RCA VICTOR

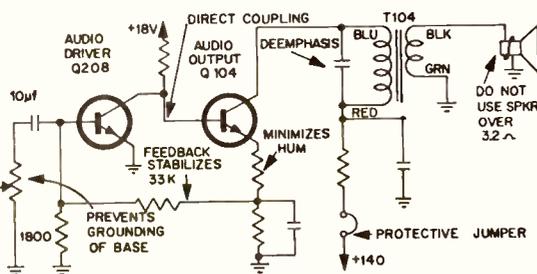
TV Chassis KCS153, Sound Stages—Circuit Descriptions

The sound portion of the KCS153 consists of two stages of 4.5Mc IF amplification, a ratio detector and two stages of audio amplification.

Provision is made in some models for earphone listening. A jumper connector on the speaker plug protects the audio output transistor from damage when the speaker is disconnected. The speaker is 3.2Ω; when operating the receiver on a test speaker for service purpose use a 3.2Ω or lower impedance speaker. A higher impedance speaker will cause damage to the audio output transistor because



SIMPLIFIED CIRCUIT SOUND IF



of inductive coupling of high audio peaks into the audio output transformer primary. The earphone jack permits a 10Ω earphone.

The sound IF take-off is at the emitter of the 1st video amplifier through a sharply tuned (100kc bw) series resonant circuit, T201 and C242 (39pf). A gain of approximately 2 to 3 is realized from the base of the 1st video to the base of the 1st sound IF. The 4.5Mc signal is amplified by Q206, then broadly tuned by the transformer T202 in the collector of the first sound IF and coupled to the base of the 2nd sound IF. A gain of 15 is obtained from the base of the 1st IF to the base of the 2nd IF.

At the collector of the 2nd sound IF additional limiting takes place and the 4.5Mc IF is fed to the ratio detector transformer, T203. The emitter of the 2nd IF has some degeneration via R250 (15Ω). This improves linearity which minimizes the production of beats or harmonics.

The audio at terminal "B" is then fed to the wiper arm of the volume control. The high side of the volume control is coupled through C255 (10μf) to the base of the audio driver. The collector of the audio driver is directly coupled to the base of the audio output transistor, Q104.

Q104 operates in a common emitter circuit and the collector is fed from a +140v source. Approximately 90v appear at the collector, 13v at the base and 12.5v at the emitter. The emitter of this stage furnishes negative feedback to the base of Q208, the audio driver. T104, the audio output transformer, is the collector load for the audio output transistor, and provides an impedance match to the 3.2Ω speaker. A protective jumper disconnects the +140v source when the speaker is disconnected.

On models employing the earphone jack, speaker operation is unaffected when the jack is not used. A resistor, R269 (68K), is tied from the base of the audio driver

to ground (through the jack) under these conditions.

When an earphone plug is inserted, the earphone is connected across the output transformer secondary and the ground connection is opened. This causes high level audio to be applied to the base of the driver which reduces the gain of the system considerably and permits higher impedance earphone units. Ground for the circuit with earphone inserted is made through the speaker voice coil; no appreciable sound is produced from the speaker when the earphone jack is used.

GENERAL ELECTRIC

TV Chassis AA—Horizontal Weave or Hum

Some AA receivers have exhibited a horizontal weaving, hum or streaking in the picture. These symptoms may result from a poor 6GE5 pin 12 filament ground at the circuit board mounting screw. The filament return circuit for the 6GE5 depends entirely on this board mounting screw being tight. Even a tight ground screw may at times develop a poor connection and result in voltage drop.

It is suggested that an additional wire be added between lug 12 of the 6GE5 socket and lug 12 of the 6B10 socket. This may be done from the copper side of the board. An alternate method is to run a wire from lug 12 of the 6GE5 socket to the filament ground at the transformer. Be sure and tighten all of the sweep and power supply board mounting screws, as an additional precaution.

ADMIRAL

TV Chassis G2 and 1G3—Service Hint

You may encounter a condition of vertical instability on the G2 chassis used in the 15 in. portable TV Models (PG1530 and PG1540 series), or on the 1G3 chassis used in the 17 in. Models (PG7030 and PG7040 series). This is usually caused by overscan or poor linearity and can usually be corrected by adjusting the size so that it just overscans at the bottom of the picture, and the vertical linearity so that it just overscans the top of the picture.

Should the above adjustments not correct the condition, and if you are certain that the vertical output tube is operating normally, it may then be necessary to replace the vertical output transformer. Any one of the following parts may be used: 79D100-8, -10 or -12.

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Watertight construction; resistance to damage by weather, water, salt spray or corrosive fumes permit use of TRON fuseholders in exposed locations where safety and long life are of vital importance.

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The crimp-type tubular terminals on TRON fuseholders are available in sizes to take many sizes of solid or stranded wire.

If desired, Load-side terminals can take one size wire, while Line-side terminals take another size wire.

A crimpable insulating sleeve covers each terminal. This provides a good surface for taping after crimping. When properly taped the crimped terminal is completely insulated and waterproof.

CAN BE USED AS TAP-OFF CONNECTOR



TRON Waterproof Fuseholders can also be used as Tap-Off connectors by having the Line-side terminal large enough to permit the two ends of the Line-wire to be crimped into it. This eliminates costly line connections and labor.

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Both rated at 30 amps. at 600 volts or less

The TRON HEB Fuseholder takes fuses 13/32 inch diameter by 1 1/2 inches long.

The TRON HEH Fuseholder takes fuses 13/32 inch by 1 3/8 inches long.

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TECHNICAL DIGEST

PHILCO

Color TV Chassis, 16QT85—Tuner Circuit Descriptions

RF Amplifier. The RF amplifier is a common emitter circuit. Both input (base circuit) and output (collector circuit) channel coils are incremental types. This, and the following tuner circuits, are shown without channel switching to simplify the circuit. There are several impedance transformations to properly match the traps, the tuned circuit and the base input. Base bias is determined by the tuner AGC line. The RF choke and 1000 pf capacitor in the AGC feed is to provide ac isolation by decoupling. Emitter stabilization is employed with emitter bypassed to prevent degeneration.

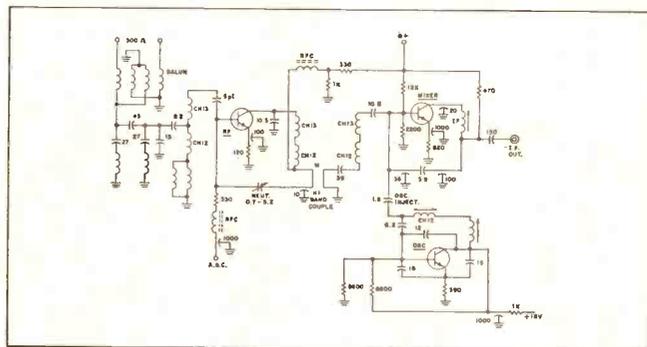
The output couples, through mutual inductance, to the mixer base coils. Highband coupling is accomplished by the hair-pin loops. As with any triode RF equipment, neutralization is necessary. This is done with a variable capacitor from the lower end of the coupling loop back to the base.

B+ is fed to the collector circuit through an RF choke to the junction of the channel coils with the coupling loop.

Mixer. The mixer stage is connected as a common emitter circuit. Base bias is provided by a voltage divider from the 18v B+ to ground. Emitter stabilization is used with the emitter bypassed by the 1000pf capacitor.

RF signal is coupled into the mixer coils by mutual inductance on the low bands and assisted by the coupling loops on the high channels. The mixer channel coils are incremental types. This RF signal is fed to the base. The oscillator signal is also injected to the base through the 1.8pf capacitor.

The collector circuit is a π type output coupling network which acts as a lowpass filter and impedance match between collector and IF link. This π network also provides the 180 deg phase shift necessary for neutralization.

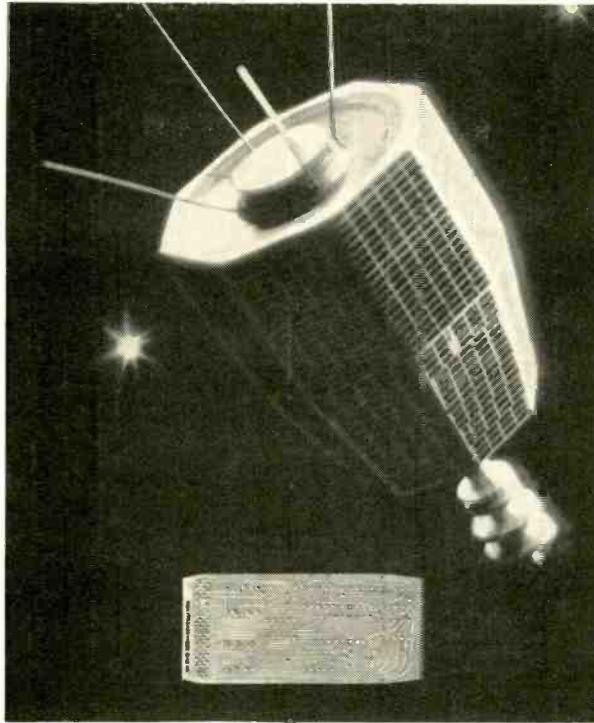


Neutralization is provided by the 3.9pf capacitor from the IF take-off point back to the base. The π network has provided the necessary phase shift.

The 150pf capacitor connects the shielded IF link to the main chassis circuits.

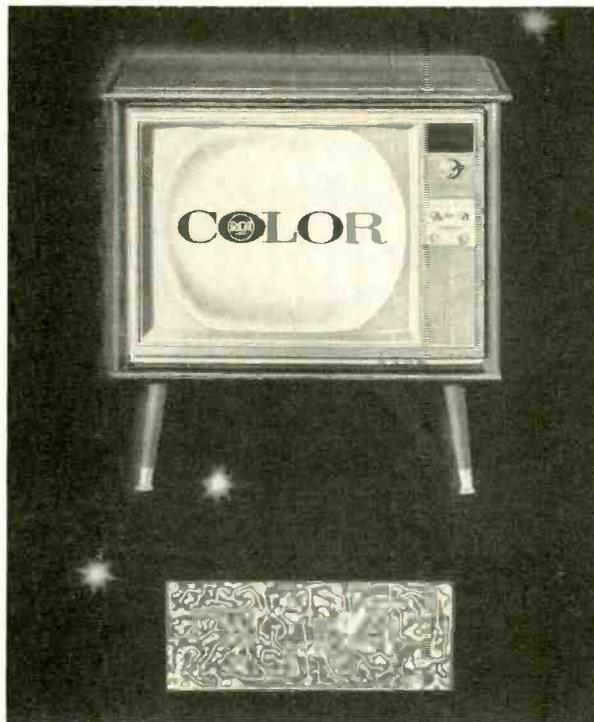
The 10.5pf coupling and 36pf bypass capacitors in the base circuit form an impedance transformation to match the high impedance tuned circuit to the lower base input impedance.

Oscillator. The oscillator used in the VHF tuner is connected as a common collector Colpitts. The common collector circuit was chosen as it gives the best frequency stability. This is because the collector circuit parameters



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exhibit the greatest variations with both voltage and temperature change. By placing the collector at signal ground, by the 1000pf bypass capacitor, these variables do not affect the frequency determining circuits as they would in either of the other two possible circuits.

Bias is established for the base through the voltage divider formed by the 8200 and 5600Ω resistors. Additional bias stabilization is obtained by dividing from the collector rather than from B+, what is called "self-bias." Also, the emitter resistor contributes to bias stability.

Further contributing to the stability of the oscillator frequency are the three capacitors shown between the transistor terminals. These capacitor values are at least ten times the transistor's capacitances. Therefore, small changes in transistor capacitance will have negligible effect on total circuit values. The 6.2pf capacitor is in series with the inductance and changes the tank impedance to match the base. It also allows larger values of tuning capacity to be used so the transistor's capacitance can be swamped. The 12pf capacitance is directly across the tank. The two 15pf capacitors are in series across the tank and form the Colpitts tap for feedback to the emitter.

Channel coils are switched rather than adding increments for each successively lower channel. The tuner uses "pre-set" fine tuning. The coil indicated as "fine tuning" is an adjustment to set the range of the channel coils.

The oscillator signal take-off for mixer injection is through a 1.8pf capacitor from the junction of the 6.2pf capacitor and the channel coil.

G-E Console Phonos T7, 15, 25, 50C and T113—Bass Boost

The bass boost circuit compensates for the human ear's inability to hear bass sounds at a low level. Should more bass be desired at a low volume setting, push this switch to on. The switch has no effect at high volume levels.

An explanation of how the circuit operates is as follows: The bass boost circuit consists of three parts, a resistor, a capacitor and a two position ON/OFF slide action switch. The capacitor and resistor are connected in series from the 2nd tap of the loudness control (1st tap from ground). The capacitor is connected across the slide switch.

When the switch is closed (bass boost is off) the capacitor is shunted by the switch and only the resistor is connected in parallel with the lower portion of the loudness control. The resistor is not frequently sensitive, therefore, the input signal, consisting of many frequencies, sees the same impedance. The ratio of bass to higher frequencies presented to the preamplifier is unchanged.

When the switch is opened (bass boost is on) the capacitor is now in series with the resistor. The reactance (effective resistance) of the capacitor increases inversely with frequency. At the lower or bass frequencies the shunting effect of this network will be much less. It will allow more of the bass frequency input to be developed across this portion of the loudness control and will in turn present to the preamplifier transistor a great ratio of bass to higher frequencies.

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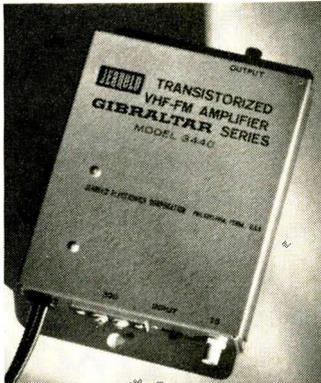
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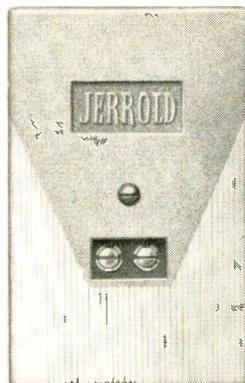
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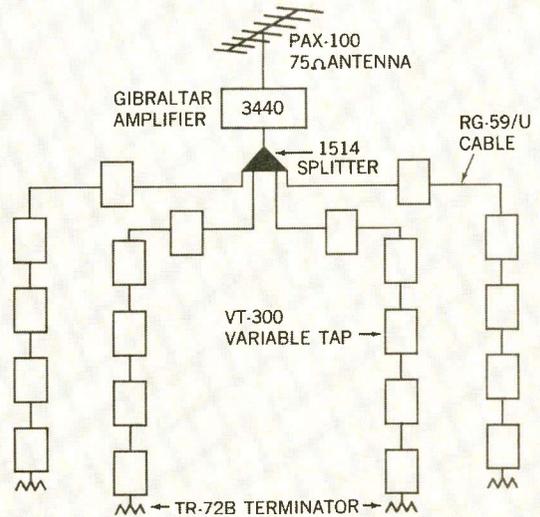
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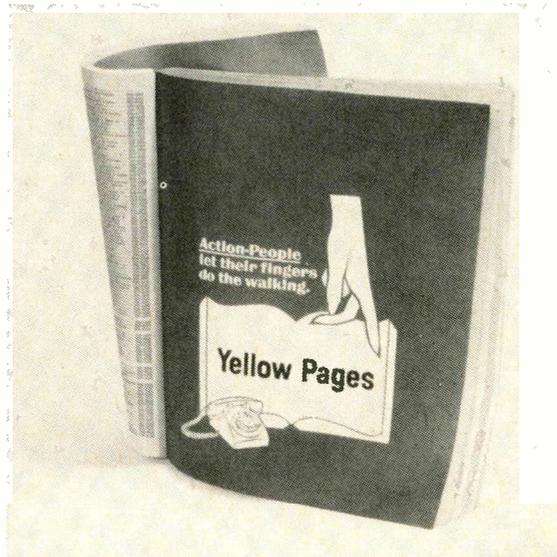
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TUNG-SOL ELECTRIC CO.



■ Service-dealers and technicians face two primary problems when making solid-state repairs: The *technical* problem and the *business* problem — the problem of making a profit and at the same time keeping the customer satisfied. Every technician knows from experience that the technical problems would be simpler and life would be happier if it were not for the business problems.

But there is an organized approach, certain short-cut techniques of diagnosing troubles and consummating the repair successfully. We have seen, for example, how a technician and a helper can repair upward of 75 transistor radios in 8 hours (ELECTRONIC TECHNICIAN April 1963) without difficulty.

The economics of solid-state repairs is usually introduced when you try to avoid the three horned dilemma of customer reaction:

It cost too much.

It took too long.

Pick it up again, you didn't fix it properly.

It doesn't take too much experience to learn that you can easily invest more in a repair job than you can hope to get back from the cus-

tomers. This is especially true when replacement can be an expensive headache. But before we can do much about all this, we must first understand what the major problems are.

Replacement Problems

One big problem is selecting transistor replacements. And this arises primarily from the myriad of types used. The difficulty in repair is not so much a technical one but one of procurement. More often than not, exact replacement of a transistor is a complicated affair because:

1. The identical transistor type is not available. (a) It is an off-brand with no domestic distribution (b) It is no longer made.

2. It is not readily available. It may be a contemporary type manufactured domestically but not stocked by a local distributor. It can be had by writing the factory and waiting a week for shipment (or a letter saying that the type is now obsolete).

3. The type is readily available but the customer is in a hurry. A special trip to the distributor may be required to pick it up (or to find

3

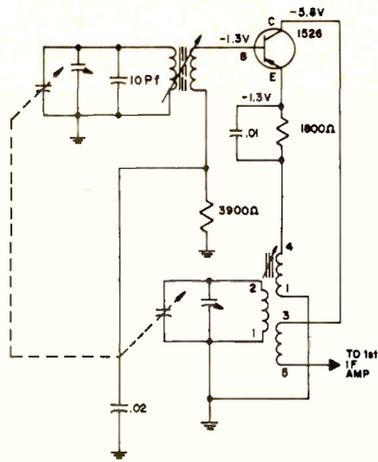
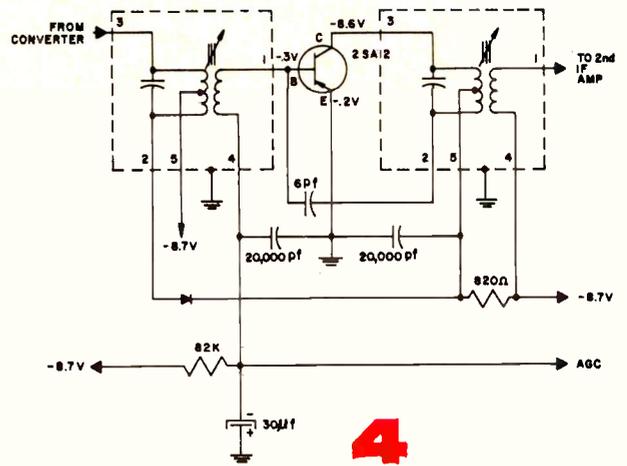


Fig. 3—Typical transistorized mixer-oscillator-converter stages.



4

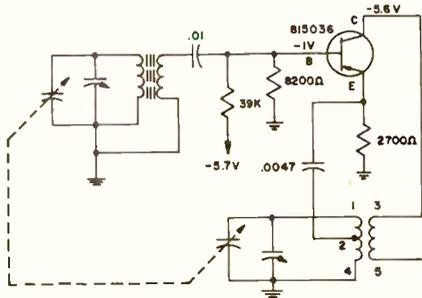
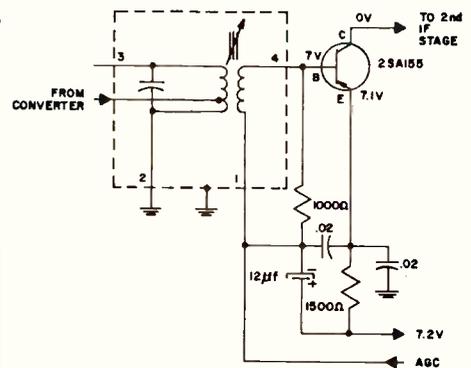
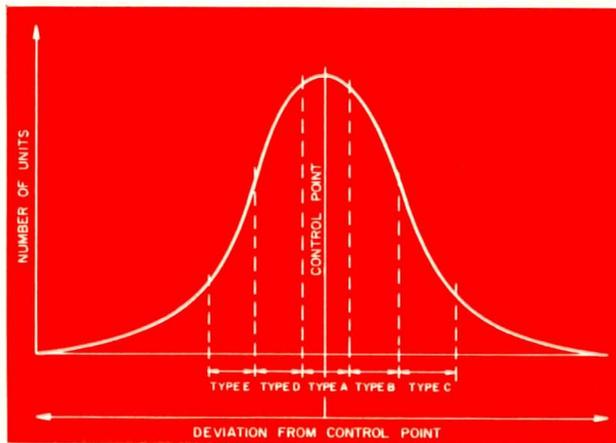


Fig. 4—Typical transistorized IF amplifier stages.



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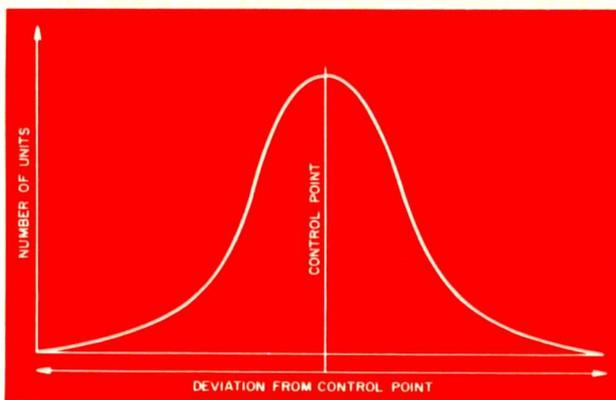


Fig. 1—Normal distribution of items in production run.

Fig. 2—The generation of multiple types from one family.

that the dealer is temporarily out of stock).

Neither the technician nor the distributor can be expected to stock all transistor types encountered in equipment, and searching for a source for each type can be a long and costly job. Obviously, substitutions must be made. But this, too, can be costly. If the substitute doesn't operate satisfactorily, a call-back is required. And very often the suggested substitutes are as difficult to get as the original.

The problem of transistor replacement has resulted in a number of approaches ranging from repair kits and replacement guides to "universal" transistors. Each approach has its own degree of practicality. But serious attempts are being made to solve the problem based on thorough scientific research.

One Approach

One approach to the problem of transistor replacement involves a set of twelve especially designed transistors each intended for a specific function. These twelve types

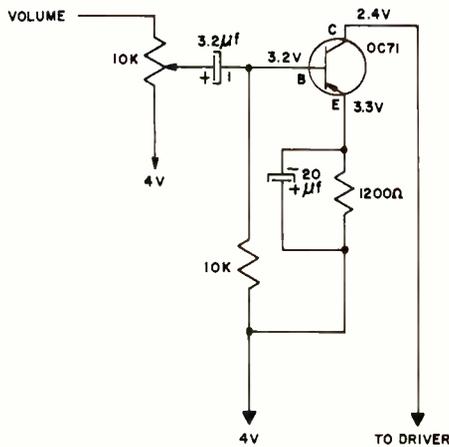
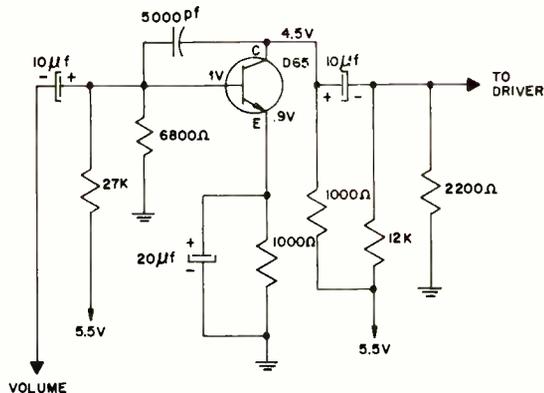


Fig. 5—Typical transistorized audio frequency amplifiers.

5



cover every replacement problem encountered in the entertainment type broadcast receiver. They simplify the selection of replacement units, reduce the problem of availability and inventory, and guarantee the insertion of a high quality component in the set.

The chief features of this concept are simplicity and effectiveness. It is necessary only to identify the stage in which the defective unit occurs. Selection is made on the basis of function, voltage and polarity (NPN or PNP). By looking up these three factors in a chart (Chart I), the proper type can be selected. Where the faulty transistor is identified but its voltage and polarity are not known, a substitution chart is available for identifying the transistor replacement.

Although this concept has been widely used for the past four years, many technicians are not familiar with certain aspects of the system. It may be helpful to discuss some of these points here.

Perhaps the best way to explain the principle underlying this concept is to discuss four questions which service technicians frequently raise:

- (1) Why do transistors fail?
- (2) Why are so many transistor types made?
- (3) How does this concept differ from the "universal

transistor concept"? (4) How can only 12 transistors replace the thousands of types used?

Why do transistors fail? A primary element of uncertainty in replacing a transistor is the notion that a transistor can't go bad. This stems from a well publicized statement that the life of transistors is infinite, as compared to electron tubes. This is not true — transistors fail, and failure is not an uncommon occurrence. Three common causes account for transistor failure: *Abuse, improper application* and *poor quality*.

Abuse. A significant percentage of faulty transistors is caused by mechanical failure. This is to be expected in portable radios. The rough treatment they receive results in a variety of broken leads or cracked junctions.

Improper application. Putting a replacement transistor in a circuit which exceeds the voltage or power rating of the unit will cause junction destruction. And the failure of a resistor or capacitor, for example, in original equipment, can change the voltage or power applied to the transistor with similar results. Using transistors which have a marginal thermal rating can be dangerous. Operating a portable during long exposure to sun, for example, can generate extremely high tempera-

tures within the case. In many instances, these may be sufficient to exceed marginal unit ratings.

Poor quality. Many transistors show degradation of performance with age. This is not necessarily caused by inherent characteristics; it can be a result of poor quality control. A faulty seal, moisture inside the can, an unclean semiconductor surface — all can result in chemical changes which change transistors' characteristics. Parameters like gain and leakage, for example, can be affected so it is important when replacing transistors to be sure of the product's quality.

Why So Many Types?

The primary area of confusion in semiconductor replacement is the number of types used.

A number of reasons exist for manufacturer's to introduce new types. Sometimes new specifications are required by the equipment designer for a special application. Frequently, competition has prompted manufacturers to turn out a steady stream of units with unusual performance specifications. And sometimes the requirements of reliability force the manufacturer to incorporate special production and testing standards. Transistors produced under these conditions are given special designation.

Multiplicity of type numbers arise primarily because transistors are manufactured in families. This means that process controls are set to produce a transistor with certain specifications. Because of the micro-dimensions involved and the extreme purity of the material required, it is impossible to turn out a steady stream of identical units. What happens is shown in Fig. 1. The graph centerline indicates desired specifications. If manufacturing controls are good, the majority of the units will fall on this line. Some units will fall on either side of this line, however, and if we plot the distribution of the units according to their deviation from the desired specification, the bell shaped Gaussian curve will result.

This means that the manufacturer ends up with a large number of transistors when the production run is finished. All are perfectly good, but some will have the desired specifications and others will differ in certain parameters. This is the family. And the standard practice is to divide the family into certain groups or types as shown

in Fig 2 and give each type a number. These types are similar and may differ only in one or two parameters. Thus, for each new transistor type designed by the manufacturer, an entire family is produced.

More numbers are generated by the practice of using "House Numbers" as well as EIA registered type numbers. For certain reasons, many manufacturers will not register a given transistor with EIA. Or, if they are foreign made, they will not be registered. These transistors are designated by "House Numbers." Although specifications may be similar to an EIA type — they receive different numbers. And, of course, they are also made in families. From this it can be seen that a smaller number of families occur underneath the "Number Explosion" in transistor types, and of these families an even smaller number apply to a given area of application.

From this viewpoint, then, it is difficult to speak scientifically about a "universal transistor." It is absurd to think that a single transistor can encompass the specifica-

tions of all transistors. Something like a key that will open any lock made. There are too many transistors and they range too widely. For this same reason it is impractical to attempt to find substitutes by "matching specs." The task is endless and virtually impossible. Besides, the published specifications of two different manufacturers may be derived from entirely different procedures. Consequently, they cannot be compared.

The concept under review here is not that of a "universal transistor." It is felt the proper approach to replacement is not to attempt number duplication but to produce units that meet the requirements of the circuit. Considering transistor "families" for what they are, this seems a sensible and practical solution to transistor replacement problems.

How can twelve transistors replace so many types? The answer can be seen from what has been previously said. The method provides the unit which matches the requirements of the circuit. This can be shown by specific examples to follow:

Mixer oscillator converters. To meet replacement requirements we can select in this area the ET1 and its NPN version, the ET8, which provides flat gain over the critical frequency range of AM receivers. For the high frequency FM sets the ET12 will function in RF amplifiers, converters and IF amplifier stages. Consider the two converter stages shown in Fig. 3. The transistor in each circuit differs from the other in certain parameters. The essential parameter, however, is similar. The ET1 will function satisfactorily in both circuits.

IF amplifiers. The ET2 and the NPN version, the ET9, are specifically designed to match the gain-versus-frequency and other requirements of the IF stage of AM sets. For FM receivers the ET12 is recommended. The ET2 will function in each circuit shown in Fig. 4.

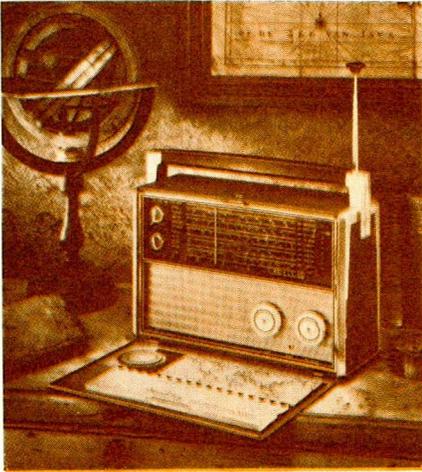
AF amplifiers. The units ET3, 4 and 5 and their NPN equivalents ET10 and 11 cover the three voltages required by this stage. Transistors shown in the circuits of Fig. 5 can be replaced by ET4. ■

CHART I			
	MIXER OSCILLATOR CONVERTER	IF AMPLIFIER	AF AMPLIFIER
AM RECEIVERS	PNP — ET 1 NPN — ET 8	PNP — ET 2 NPN — ET 9	PNP NPN 6V ET 3 12V ET 4* ET 11* 9V ET 5* ET 9*
AUTO RADIOS			ET 6 Power Amp ET 7 High Power Amp
FM RECEIVERS	RF AMP MIXER OSCILLATOR CONVERTER IF AMP		SAME AS AM SETS
	ET 12		

* Check Battery Voltage to Assure Proper Replacement

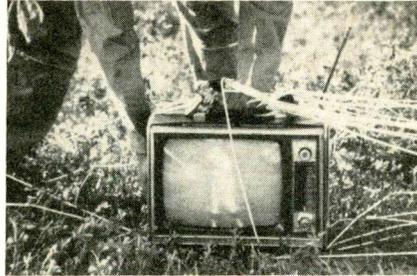


The Future Looks Solid-State-- and the Future Is Here Today



ABOVE—Admiral 'All World' transistor radio has FM, standard BC, shortwave, longwave, marine and navigation broadcasts.

TOP RIGHT—Zenith solid-state TV, parachuted from a plane, is still working when a ground crew finally halted its tumbling.



■ Some people will stare in the face for years and still say "it isn't so."

Just to make certain that we haven't been kidding ourselves and electronic technicians regarding solid-state developments, we recently went "shopping" for the latest in TVs, radios, tape recorders and Hi Fi equipment. We ended up with a truck load. Some of it appears on the front cover of this issue. There's not an electron tube in a carload. The equipment is solid-state. And you'll see more of it in your shop for service as time passes.

Hi Fi component packages have also gone solid-state. Plug-in transistorized portable TVs, table and clock radios and CB transceivers have been converging on the market for some time.

Stereo AM/FM/phono console combinations are already being sold. Solid-state stereo auto tape players are being sold in many areas. And so it goes.

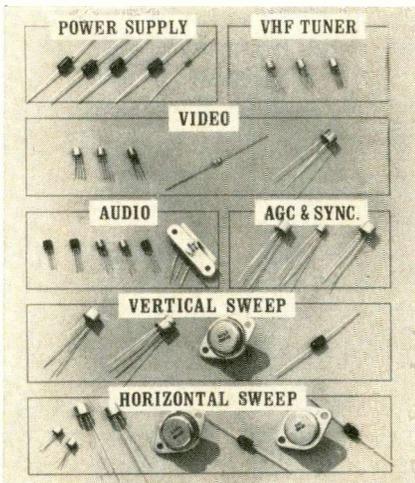
But what does this mean to service-dealers and technicians? It

means the same as always: If you're not prepared by now to handle this equipment — give rapid, high-class service — you won't celebrate many more business anniversaries.

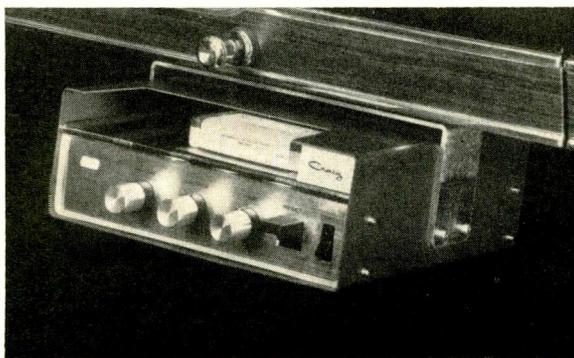
It means new servicing techniques and new test instruments for more rapid servicing and repair. It means new problems to solve, different organizational and management methods to be learned and applied. In substance, it means another opportunity to make more money and live better.

Tomorrow, new consumer products will offer other opportunities and pose new problems. Perhaps it will be home video tape recorders. They may create a vast new market within the next few years. And the integrated microcircuit components now going into space and military and industrial electronic equipment will eventually end up in consumer electronic products — to create more new problems and other opportunities. After all, the plug-in-ear radio is just around the corner. ■

Solid-state components, transistors and diodes by Texas Instruments, used in Emerson Radio's 11-inch portable TV.



Craig C502 solid state auto tape player.





Another Approach to

Use your scope to graphically display diode and transistor characteristics

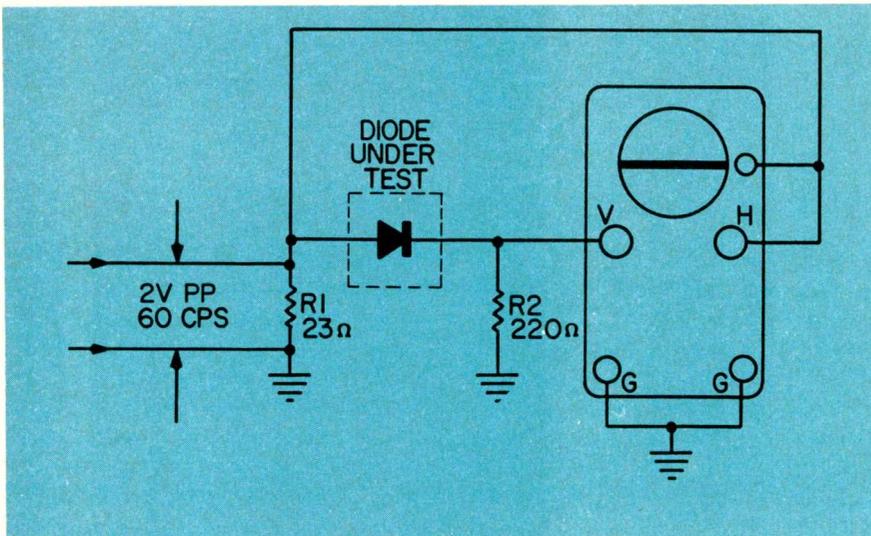


Fig. 1—Test set-up using oscilloscope.

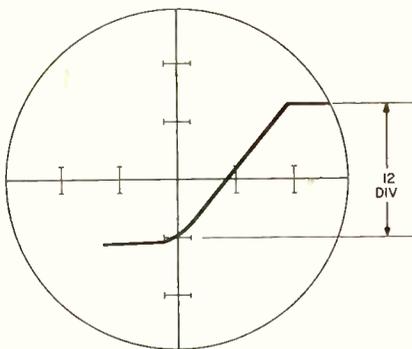


Fig. 2—Typical characteristic curve of silicon diode.

■ Semiconductors — transistors and diodes — are being used in larger numbers in consumer and industrial electronic products, including audio and RF communications equipment, TV and Hi Fi sets, test and troubleshooting instruments. And semiconductor servicing techniques are different from those used in electron-tube equipment.

In electron-tube equipment the tube is usually the main suspect when failures occur. This is not so with equipment and instruments using semiconductors. Because the failure rate is low in semiconductors, they are usually wired into the equipment circuits like resistors, capacitors and other components.

Although substituting a suspected transistor or diode with a known-good unit is a simple and excellent technique to pin-point a defective component, this method should never be used until *after* you have made voltage, resistance or cur-

rent checks to determine if dangerous circuit defects exist. These defects can damage a semiconductor.

If you suspect more than one defective semiconductor in a previously isolated area, then the substitution technique may become cumbersome and time consuming. Several substitutions may have to be made before you pinpoint the defective unit or units. Hence, you may save considerable time by checking the components first.

Checking Diodes

A conventional and convenient method for checking semiconductor diodes employs the ohms function of a VOM or VTVM. Every technician is familiar with this check. The back and forward resistance is measured at a potential determined by the meter's battery voltage and the resistance range at which the meter is set. The leads are simply connected across the diode, the reading noted, and then the leads are reversed and the second reading noted. The larger resistance reading is the "back" resistance value.

If the ratio of back-to-forward resistance is greater than 10:1, the diode should be capable of functioning properly as a rectifier. We observe, however, that this is a very limited check. It does not tell how the diode will operate at different voltages and frequencies.

But you can graphically display the back and forward resistance characteristics of a diode on your scope. The set-up for making this check is shown in Fig. 1. The line test voltage of your scope is used as the check signal. A series cir-

Semiconductor Checking

by R. H. McDonald

cuit (R1 and the internal resistance of the line test circuit) drops the 3v P-P open-circuit potential to approximately 2v. The diode test signal is also connected to the scope's horizontal input. Since this voltage is proportional to the diode current, the scope's vertical deflection indicates diode current. The resulting scope trace resembles the curve shown in Fig. 2.

It is also possible to analyze the diode's reserve voltage/current portion of the characteristic curve. Various diode conditions that may be observed by this test are shown in Fig. 3.

To check Zener diodes, a higher voltage is required. This is possible with a diode test set or with the circuit shown in Fig. 4. Rheostat R1 adjusts the input voltage to a value suitable for the Zener diode. Resistor R2 limits current through the diode. The signal voltage applied to the diode is also connected to the scope's horizontal input. Then, the horizontal sweep represents the applied voltage, while the vertical deflection indicates current through the diode. For the Zener diode to be acceptable, the measured voltages must be within limits specified by the manufacturer.

Readjusting Cartridge-Type Diodes

Cartridge-type diodes, like the 1N21B, for example, can be adjusted with a screw in the cartridge head. Referring to Fig. 5, the following adjustment procedure can often prolong the usable life of this type diode.

First, make the head of the cartridge loosely secure in a small vice.

Then turn the adjusting screw slightly counterclockwise with the proper size screwdriver. Connect an ammeter or scope test circuit to the diode and monitor its back-resistance. One test lead should be connected to the head, the other to the brass contact pin of the cartridge.

Now turn the diode-adjusting screw clockwise while watching for a change in resistance; a change indicates a variation in contact pressure between the diode and metal point. Sometimes the screw must be turned a complete revolution or more past the original setting to get the desired resistance indication. To be acceptable, the back-to-forward resistance of silicon diodes of this type (1N21B) should be at least 10:1. The forward resistance should be less than 500Ω .

Checking Transistors

When trouble occurs in transistorized equipment, make power supply voltage measurements first. Then make current load checks, check waveforms, employ signal substitutions or signal-trace the circuit. If you isolate a faulty stage with these checks, then make voltage, resistance and current measurements to pin-point the defective parts. When making voltage or resistance measurements, use a VT-VM.

If the transistors are not soldered in the circuit, remove them from the sockets before making resistance checks. And transistors should always be removed from or reinserted in their sockets only *after* power has been disconnected from the stage. Otherwise, surges may damage the transistors.

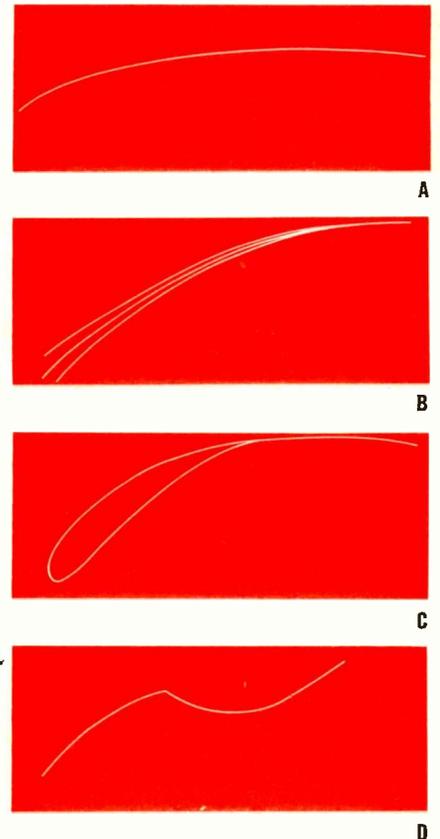


Fig. 3 (A)—Good diode reverse current-voltage characteristics trace. (B)—Flutter (or drift) characteristic. (C)—Hysteresis characteristic. (D)—Negative resistance trace.

Other than pulse and power amplifier stages, transistors are usually biased so the emitter current is between 0.5 and 3ma. The collector potential is from 3 to 15v. The emitter current can be measured by opening the emitter connection and inserting a milliammeter. When making this measurement, you should expect the meter resistance to change the bias somewhat.

Resistance Tests

You can use the ohms function on a VTVM or high input resist-

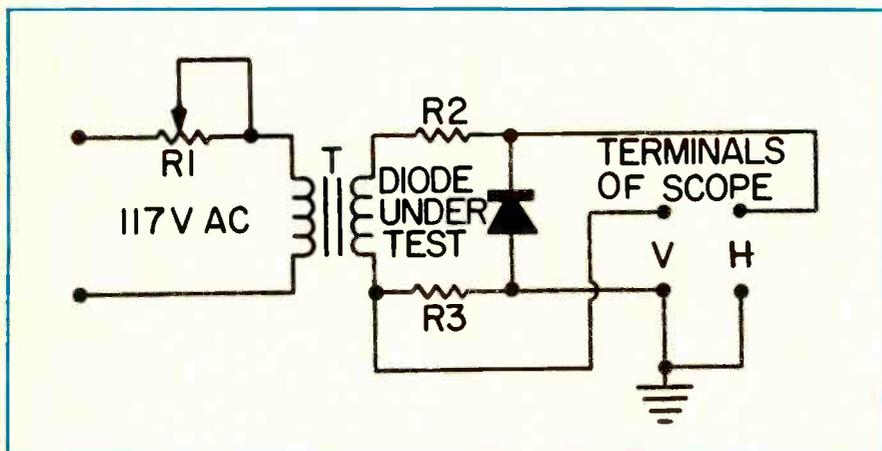


Fig. 4—Semiconductor test circuit for Zener diodes.

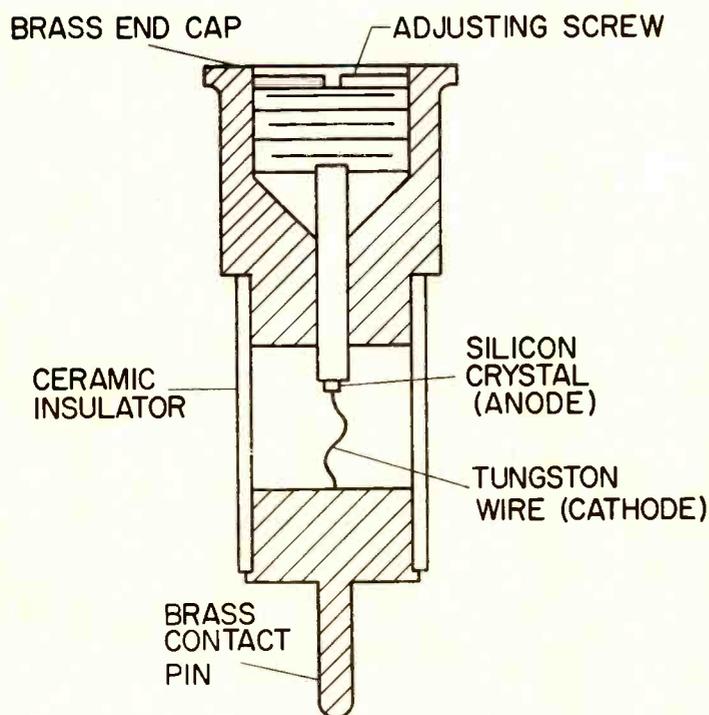


Fig. 5—Cartridge type silicon diode.

ance VOM to check transistors by measuring the emitter-collector, base-emitter, and base-collector forward and back resistances. A back-to-forward resistance ratio of 100:1 should be obtained for the collector-to-base and emitter-to-base measurements. The forward and back resistances between the emitter and collector should be nearly equal.

It is advisable that you make all three of these measurements for all transistors you check because experience shows that transistors can develop shorts between collector and emitter and still have satisfactory forward and reverse resistances

for the other two measurements.

Because of shunting resistances in transistor circuits, you will probably have to disconnect at least two transistor leads from the associated circuit for the resistance checks. You must exercise caution during these checks to make sure current does not exceed the transistor rating. Ohmmeter ranges which require a current greater than 1ma should never be used for checking transistors. The RX1 scale on many meters will allow 100ma or more current to flow through a component being checked. If the RX1 scale of the multimeter used to check a

transistor has too much current, it may be damaged.

Graphical Display of Transistor Characteristics

A scope and curve-tracing test circuit can be used to graphically display the IE characteristics of transistors. If the scope you use is calibrated, the dynamic collector resistance can be computed and the transistor linear range determined.

Handling Transistors

Although generally more rugged mechanically than electron tubes, transistors are very susceptible to damage from excessive heat and electrical overload. Several precautions should always be taken when servicing transistorized equipment.

Always check test instruments and soldering irons to ensure that no leakage current comes from the power source; if leakage current is present, use an isolation xformer.

Meter ranges requiring current of more than 1ma in the test circuit should not be used for testing transistors. Regular auto battery eliminators should not be used to furnish power for transistors because they have poor regulation and possibly high ripple voltage.

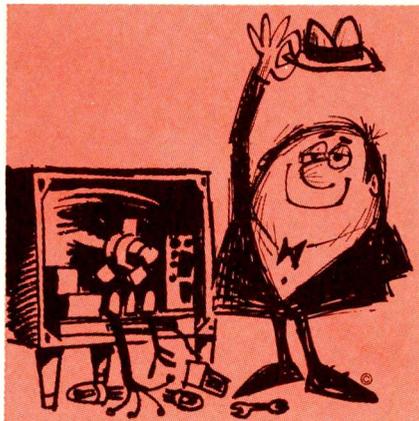
When connections are soldered the heat applied to a transistor should be kept to a minimum by using a low-wattage iron and suitable heat sinks long-nose pliers will do for heat sink — on the leads between the transistor body and soldered connection.

Once again: Check all circuits for defects before replacing a transistor. Always remove power from the equipment or test instruments being repaired before removing or replacing a transistor or other circuit element.

When working on equipment having closely spaced parts — as is almost all transistorized equipment — conventional checking procedures are often the cause of accidental short circuits. FM's rarely cause damage to an electron tube but may ruin a transistor. To avoid accidental shorts, cover the instrument probes with insulation for all but a short portion of the tips. ■

Adventures Of A Color TV Expert

by Roger Carlson



Beware of 'doodlebugs' and unusual problems

■ I saw the future possibilities in color TV many years ago and began intensive and sustained preparation for it. I have been servicing color steadily for four years and was well prepared when the boom began a year and a half ago.

During this period I have been confronted with a few unusual problems. And I would like to sound a few warnings to other technicians who may not have been as fortunate as I have. We'll begin with some of the less unusual problems and work up from there.

A Tricky Job

This one was a RCA CTC16 and the customer said "Sometimes the color comes in and sometimes it doesn't." I connected the dot/bar generator to the antenna input and the color bars appeared but were "barber-poling." All tube checks, substitutions and adjustments failed to stop the barber-poling effect. We took it to the shop. Here, with the dot/bar generator as a signal source, we traced the signal with a scope. A loss of signal was revealed across C705 (Fig. 1), a 120pf coupling capacitor.

As shown, C705 couples the video signal from the 1st video amplifier plate circuit to the burst amplifier grid. Attenuation of the video signal at this point reduces the burst amplifier output which feeds to the chroma sync phase detector and color killer detector. Reduced signal at the chroma sync phase detector reduces the ability of the chroma reactance control tube to keep the chroma oscillator in phase. Reduced signal to the color killer detector adversely affects color killer operation and in turn reduces amplification of the chroma bandpass amplifier. The

scope was used to determine the video signal amplitude at the burst amplifier grid because a horizontal pulse from the flyback is also present at this point. A check of C705 on a capacitor tester showed it had reduced its capacity to about half — from 120 to about 60pf.

After we replaced C705, adjusted the burst amplifier and color oscillator circuits, the set operated fine on an air check. Some weeks after this set was returned to the customer he reported that the color reception was better than ever.

Focus Problems

The most unusual focus problem I have encountered was in an RCA CTC16 chassis. The picture could not be focused, focus voltage was low — about 3.5kv. The set was brought to the shop, the chassis removed and connected with extension cables. Within a few minutes after the set was switched on the focus coil began to smoke. All parts in the focus circuit were checked but we could not locate any defective parts. We substituted the focus coil, a 66M, 6kv resistor and a 130pf, 6kv capacitor. The set was switched on.

After 10 minutes the picture was out of focus. We then readjusted the focus and it changed again. All parts in the circuit were disconnected (at one end) for leakage checks. With a capacitor tester, I checked each part and wire for leakage to ground. Current leakage was indicated on the focus voltage wire going to the CRT socket.

I removed the CRT socket from the CRT and the leakage was still there. I installed a new socket and the focus was OK. After removing the old socket I

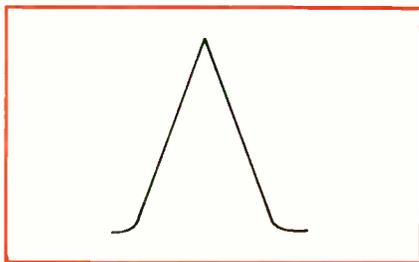


Fig. 2—Sharply peaked response curve.

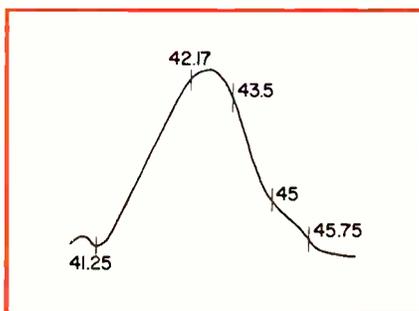


Fig. 3—'If you tried to tune in a good picture, the color signal at 42.17Mc would slide down the curve and be lost.'

cious. Fortunately, I do not believe we'll have these few characters around very long — so much the better for the industry.

'Doodled-up' Jobs

Our local CATV system has signals on all VHF channels. I was called in by a customer to look over an RCA CTC11D. All it would receive was channel 2. Channel 2 was not on continuously that day and when it was off, channel 3 could be received. All other channels were a mad scramble — which looked like a case of severe regeneration. When I connected the dot/bar generator I got "crazy" color bars.

After questioning the customer I learned the set had recently been returned from a "repair" job and hadn't worked properly since. I took it to the shop immediately and set the chassis up for an alignment check. The response curve on the scope was sharply peaked as shown in Fig. 2. This "doodler" hadn't missed an adjustment.

Believe it or not, the core in the chroma oscillator transformer was jammed to the bottom and broken. I had to change the transformer. I aligned the video IF and found the response curve changed when the video IF board was pressed. I removed the bottom cover and properly resoldered all the ground connections. That helped — but some change still took place in the curve when the board was pressed. This was corrected by using tape between the last video IF transformer shield and the chassis top shield to prevent intermittent grounding. After complete alignment of burst, chroma-bandpass and chroma-oscillator, the set produced a good color picture.

This set was so far out of alignment that we decided, as a starter, to use the signal generator and VTVM method according to manufacturer's instruc-

tions. Sweep response was checked after this procedure was carried out and a peaked curve still remained as before. I have obtained similar results on other sets. I believe this alignment procedure is either faulty or is intended to be only a rough alignment. The sweep method is the only procedure that gives me the proper response curve.

Another "doodled-up" job was a CTC15. The IF response curve looked like that shown in Fig. 3. It had other troubles too. The 1000Ω resistor in the 6BK4 cathode circuit was burned up and the 0.01, 1kv capacitor to grid, was leaky. After replacing these parts and a few defective tubes, the set was switched on. A color picture was obtainable but it was extremely poor. A video IF response curve check proved why. If you tried to tune in a good picture, the 42.17-Mc color signal would slide down the curve.

The capacitor from the 6BK4 high voltage regulator grid-to-cathode has to be in top condition. The slightest leakage will upset the regulator circuit. Some sets use a 0.0033μf disc. More recent models use a 0.01, 1kv disc. When replacing these capacitors I've found it desirable to use higher voltage rated components. I use 3kv for the 0.0033's and 1.6kv for the 0.01's. Be sure to replace these as you found the old ones — with the leads inserted through the fiber insulator. Lead spacing forms a spark gap protector.

An additional weird experience came by way of another CTC11D — with a red screen on a black and white picture. I thought, this is easy, one of the color output tubes is bad. I'll be off on another house call in a few minutes. The tubes were checked and they were OK. Then I adjusted the gray scale for a black and white picture. After a few minutes, the picture turned green. To make sure a tube was not defective I substituted the two 6CG7 color output and the 12AZ7 color demodulator tubes and adjusted the gray scale again. The picture was OK for a few minutes then changed color.

I left the set on and soon the screen changed from red to green and then back to red again. I decided to take it to the shop.

At the shop I checked voltages in the chroma output section and CRT, all were within reason. I checked the CRT with no conclusive results. I had an RCA CTC15 in the shop waiting for focus circuit parts, it was OK otherwise, so I connected the CRT cable from the bad chassis to the CTC15. I switched on both sets and tuned them to the same channel. I adjusted the gray scale and sat back and waited. The gray scale was OK after an hour, so I knew the CRT in the CTC11D had a bad gun—the red one.

I installed the new CRT when it arrived — gray scale was now fine. During convergence and color check with the color dot/bar generator I noticed the colors seemed weak. I checked the color operation on a color show and found I had very little color on some channels and none on others. To make a long story short, I found I had to align this one too. It was some time later that I learned this one had suffered at the hands of a "doodler."

Watch for the "doodlebugs"! They're real sad. ■

Troubleshooting Color TV

■ Most vertical troubles in color sets are caused by tubes, capacitors and resistors; this is comparable to breakdowns in monochrome vertical circuits.

A large majority of recent color receivers use a dual triode as vertical oscillator and vertical output amplifier. Most customer complaints are: horizontal white line, insufficient height, vertical foldover, rolling pictures.

A typical vertical circuit is shown in Fig. 1. This circuit is used in RCA CTC11C chassis. The vertical tube is a 6EM7—a type commonly used in present-day color receivers. One half of the tube functions as an oscillator and the other half performs as sweep amplifier.

Vertical Input

The input circuit is fed by a vertical sync signal through an integration network, R504, R507, C504 and C505. Poor vertical sync is quite common in many early color chassis. But you can frequently improve the vertical sync by shunting a 100K resistor across R504. In deep fringe areas it may be necessary to parallel a 50K resistor across R504. The resistors and capacitors in later color chassis have been more carefully chosen to correct this critical sync condition.

If C506 opens, vertical sync will be lost. Likewise, if C505's resistance leakage is around 50K, the set will hold vertical sync only when strong signals are being received. A 10K leakage will cause the set to barely sync under strong signal conditions and station program switching and noise pulses in the sync signals will probably cause the set to roll and sometimes bounce. If C505 becomes shorted, however, adjustment of the vertical hold control will not lock the pic-

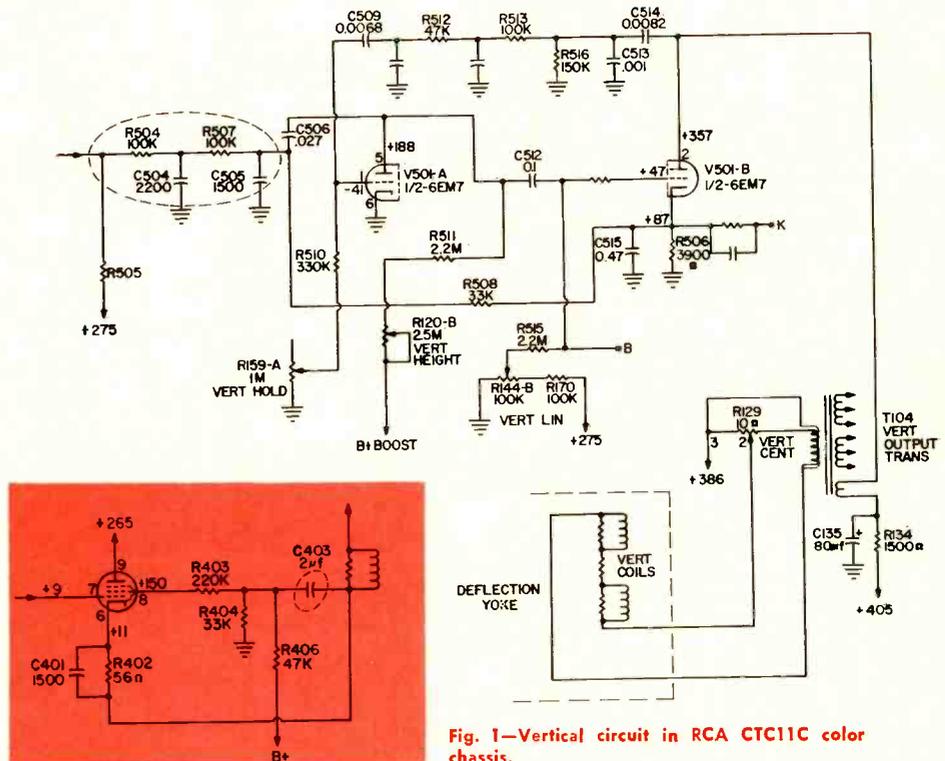


Fig. 1—Vertical circuit in RCA CTC11C color chassis.

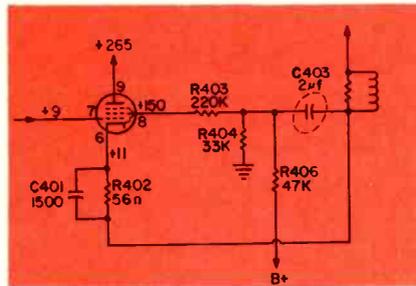


Fig. 2—Video circuit where C403 caused poor AGC action and poor vertical sync. Poor horizontal sync may also be caused by a defective capacitor here.

ture—although the picture can be made to roll either up or down.

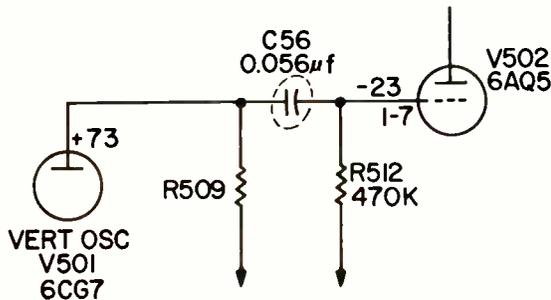
If a leakage of 10K develops in C506, a 0.027 μ f capacitor, the picture will be folded over and will shrink to about six inches. Additionally, the B+ on pin 3 will drop to about 70v. Looking at the circuit, you may think the cathode voltage of V501B would increase since the B+ on the other end of C506 is 188v. But the vertical oscillator almost quits oscillating, reducing the vertical drive on the vertical output section, hence, lowering the cathode voltage. If C506 shorts, this will result in a vertical sweep of about four inches and the scanning lines at the top of the screen will be wide.

We found this 0.027 μ f capacitor shorted in one RCA CTC11D chassis. Although you can clip one end of C506 from the integration network and use a voltmeter to determine if the capacitor is shorted—by reading the amount of B+ leakage—I suggest the scope be used first to check the shape and P-P values of the waveforms. Otherwise you may be confused by tricky voltage readings here. If you have the proper waveforms and P-P voltage values listed in service

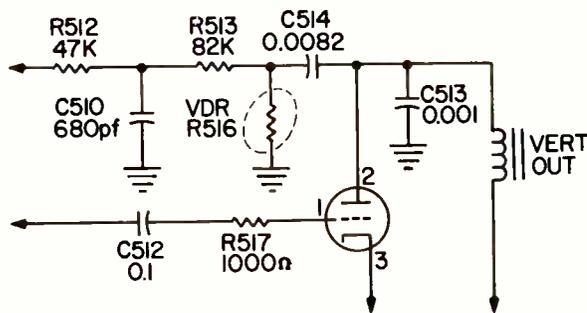
Vertical Circuits

by Homer L. Davidson

Keep a sharp eye on problems that may develop into 'tough dogs' if you are not alert



C56, a 0.056 μ f capacitor in an RCA CTC5C chassis caused vertical foldover when leaking.



If capacitor C514 shorts, a horizontal white line will appear on the screen. Leakage will cause a foldover at bottom of the screen (RCA CTC12 chassis).

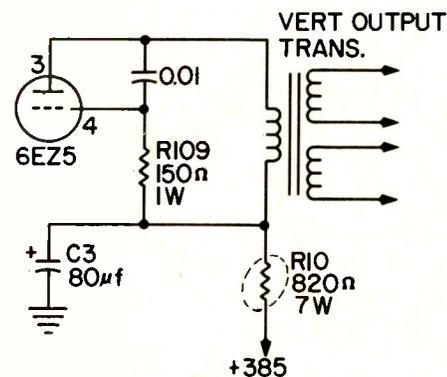
literature, you may save time by first using the scope before trying to check voltages with the VTVM.

If you find vertical sync-lock poor—on the "soft" side—and the horizontal sync is good, check the vertical input for increased resistance and the input capacitors for leakage. An increase in vertical oscillator grid resistance, in series with the vertical hold control, will cause a "vertical-rushing" picture. Two or more frames may appear on the screen and the vertical hold control won't lock-in the picture. If either R510 or R519 (vertical hold control) opens, a white thin horizontal line will appear on the screen.

Vertical Complaints

One common vertical complaint in the 1958-59 RCA, Admiral and many other color receivers is rolling and "soft" sync caused by a 2μ f electrolytic capacitor. This 6AW8 video amplifier screen bypass may also cause poor AGC action and horizontal sync troubles. The capacitor is located on top of the video section and can be clipped and replaced without removing the set's chassis. See Fig. 2 for capacitor location in the video circuit.

If resistor R10 opens up, very little voltage will appear on tube pin 3 in Motorola VTS — WTS-907 chassis.



A resistance increase of R511 will usually cause the picture to roll only one way when the vertical hold control is adjusted. If this resistor changes value after the set is on for several minutes, the vertical hold control may have to be readjusted. Also, a value change in this resistor can cause vertical "flipping" and rolling. Generally, when the customer complains of rolling after the set warms, you can usually suspect this resistor and change it at once.

If the vertical coupling capacitor, C512, develops leakage or a short, the picture will probably roll. Also, the picture will usually pull up about eight inches from the bottom of the screen and be folded over at the bottom. If vertical height control rotation is erratic, indicating a badly pitted control with attendant arcing inside, or if the vertical height collapses, replace the control. The linear characteristics of this control can be checked with an ohmmeter. A spot will frequently be burned in the control since practically all vertical height controls are fed from the B+ boost circuit—providing sufficient power for arcing.

Feedback capacitor, C514, connected to the vertical output tube plate, can be a trouble-maker. The

capacitor either leaks or shorts. Always replace it with one rated at not less than 1600v.

If capacitor C514 shorts, a horizontal white line will appear on the screen. This shorting allows positive feedback voltage on the vertical oscillator stage—crippling it. If a 10K leakage resistance develops in C514, the picture will be narrow with vertical fold-over at the bottom of the screen. When the vertical hold control is rotated, it is usually possible to stop the picture at one end of the hold control. If the leakage is 50K, or greater, the picture will not sync. One way to find this trouble is to place a VTVM probe on the opposite end of C514 and see if B+ appears at this point. If not, it is always wise to clip the capacitor lead and measure the amount of leakage voltage. If this capacitor opens, a white horizontal line—indicating no vertical sweep—will appear on the screen.

The vertical output transformer can be checked by making voltage readings on each side of the transformer windings. As yet, I haven't seen a bad vertical output transformer, even in the older color receivers. One big vertical sweep problem is the resistor supplying power to the vertical output transformer. These are generally wire-wound types and they either open or increase in value. This trouble is frequent in older color sets and capacitor C135 will sometimes short, burning open R134 (see diagram).

If C135 opens, the supply voltage at this point will remain the same. But the picture will shrink from 2 to 4 in. at the bottom — with scanning lines at

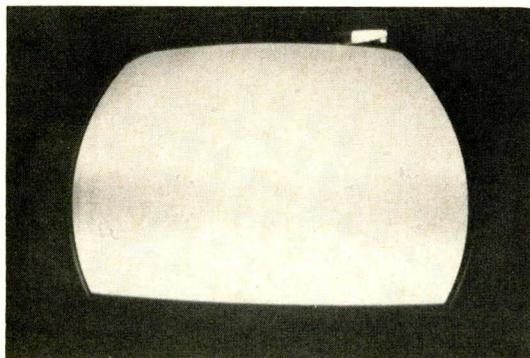
the top of the screen and 60cps hum in the background. The dark 60cps area can be seen in Fig. 3. It is best to tune the set off channel so the dark section can be seen better. This happened in an RCA CTC7 we were repairing. When a picture is tuned in, a crawling effect is noted throughout the picture.

Another cause of vertical foldover will result from a short in C515, a 0.47 μ f cathode bypass capacitor. The picture will roll and a two in. foldover will appear at the bottom. Then, by varying the vertical hold control, the size of the vertical raster will change and a loud 60cps buzz will come from the vertical output transformer. You will note on the schematic that a +47v potential appears on the vertical output tube grid. When this capacitor shorts, the grid swings from -10 to -15v. Sometimes the vertical hum can be heard in the speaker—varying in pitch as the hold control is rotated.

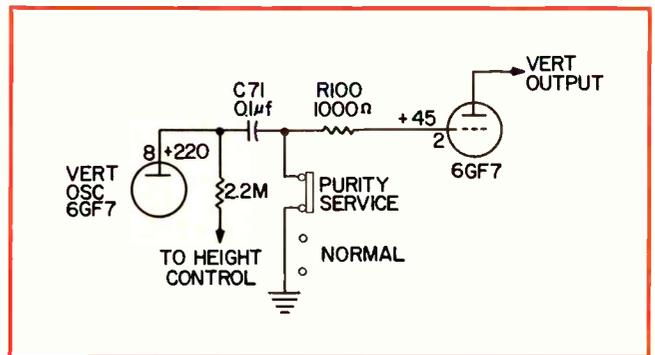
Additional Troubles

The vertical centering control is connected from the vertical output transformer secondary to the vertical yoke coils. The vertical centering control will frequently short to the center post and blow the fuse or throw out the interlock switch. You can easily spot these burned controls by a "tobacco juice" substance leaking from the controls—or it has a tell-tale burned smell. These controls are 10 Ω wire-wound.

In the Motorola TS908 chassis, vertical buzz in
Continued on page 81

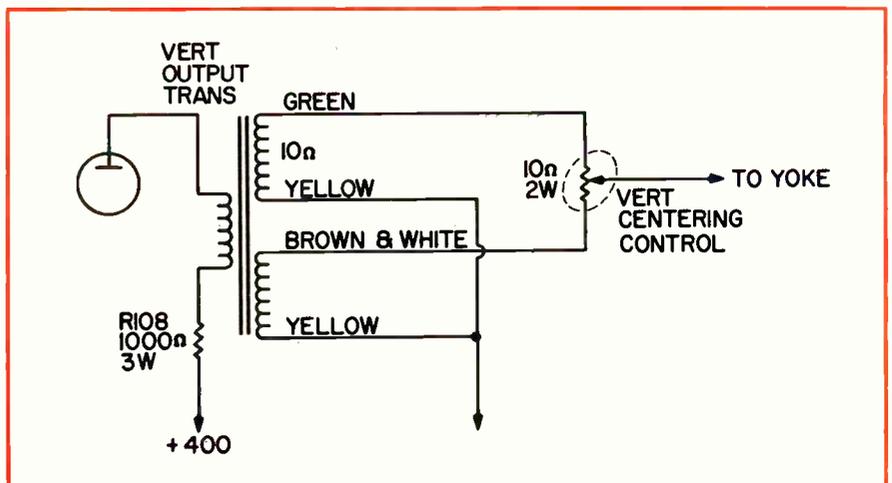


A 60 cps hum bar in a RCA CTC7 chassis and shrinkage at the bottom caused by C135 opening.



Schematic showing setup-purity switch in Magnavox chassis.

The vertical centering control will frequently short to the center post and blow the fuse or throw the interlock switch (DuMont chassis T20642).

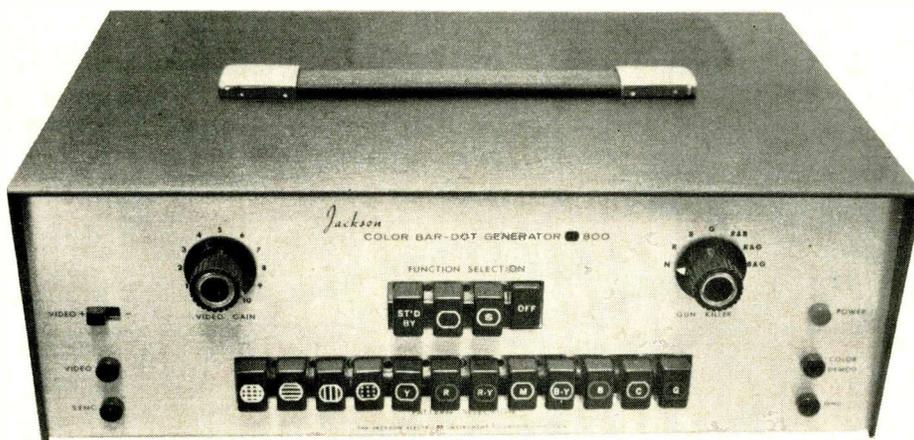


Jackson

Model 800

Color Generator

Functions, controls, signals and circuit description



Jackson Model 800 Color Generator

■ Dot, crosshatch, vertical lines and horizontal lines are generated by this unit. Eight different individual color bars similar to NTSC specifications are also available. The desired colors are displayed one at a time in the form of a wide vertical bar. Eight colors are available—yellow, red, R-Y, magenta, B-Y, blue, cyan and green. The color selected conforms to the NTSC standard phase angle. (Fig. 1)

An important feature of the instrument is the gun killer switch which enables the user to disable the guns either singly or in combination. In conjunction with the gun killer switch a jack is provided for displaying scope waveforms at each of the color gun grids.

A video signal containing horizontal and vertical sync pulses (without the RF carrier) is available at a separate jack. This video signal (either + or -) is regulated by a gain control and may be injected into the video and color cir-

cuits of a receiver. Any one of the twelve patterns may be used.

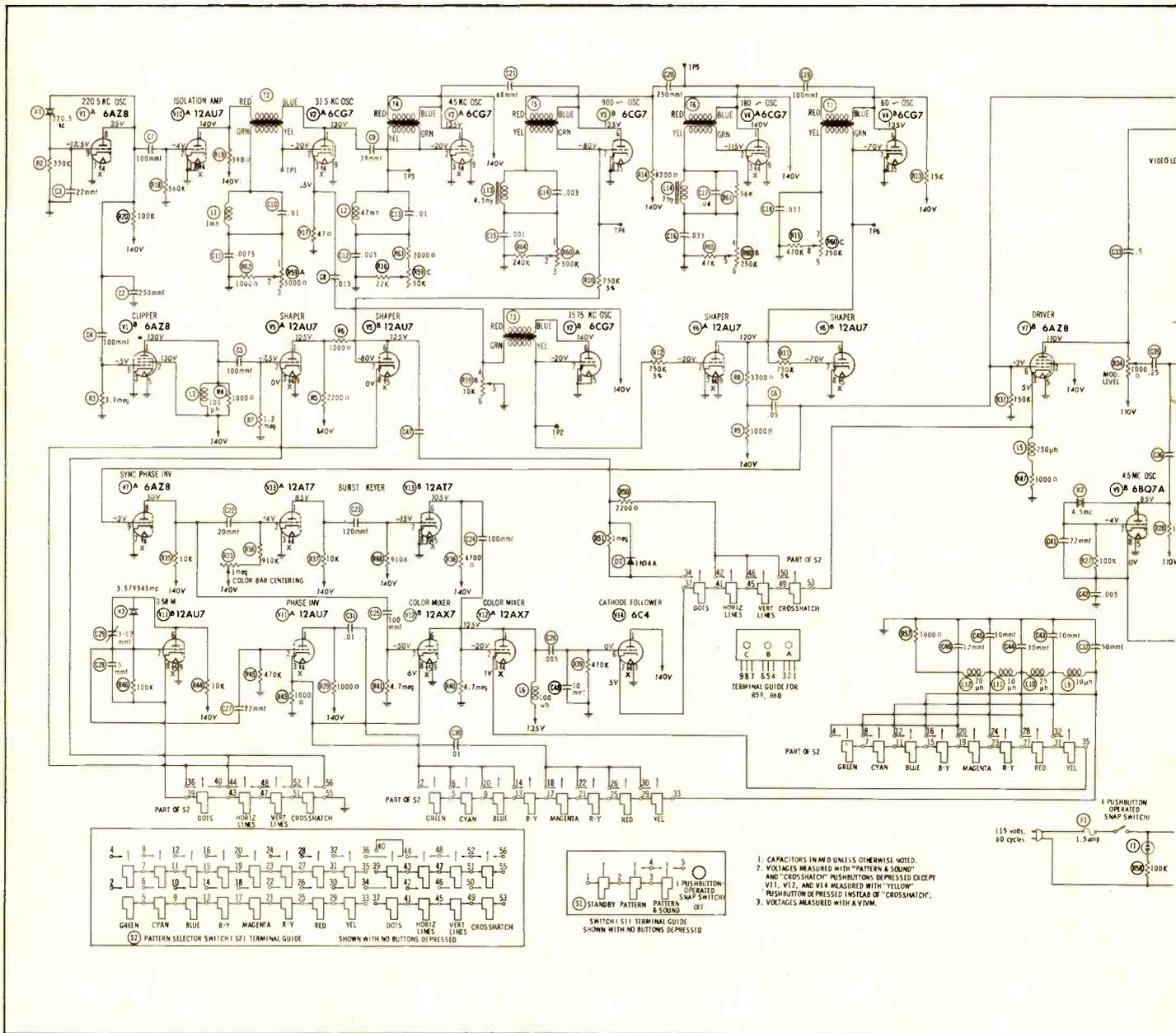
The generator can provide an output on channel 3, 4, or 5. A switch is used to select the desired channel.

A 4.5Mc crystal controlled sound carrier is available for fine tuning adjustment of the color set under test.

A series of pushbuttons are used for selecting the proper function and pattern wanted. A power standby switch can be used to keep the tube filaments "on" while B+ is turned off.

Circuit Functions

The output of a 220.5kc crystal controlled oscillator (V1A) is fed through an isolation amplifier (V1-0A) to V2, a 31.5kc oscillator. The 220.5kc signal keys the 31.5kc oscillator every 7th pulse and the 31.5kc signal is again divided seven times by V3A. The 4.5kc output of V3A is then counted down fur-



Schematic Of Model 800 Color Generator

ther by V3B with the 900cps output being fed to a shaper tube, V5B, which is used to form horizontal lines in the output. The 900cps is further reduced by two stages to 60cps for vertical sync purposes.

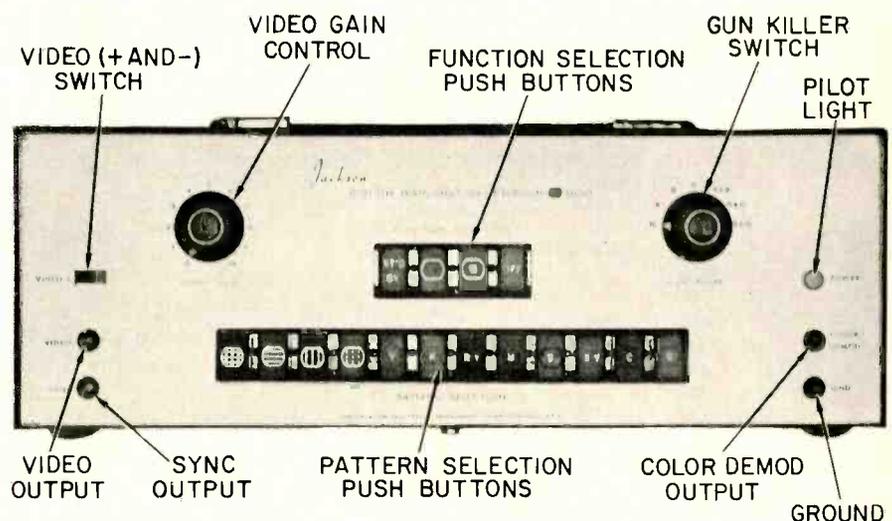
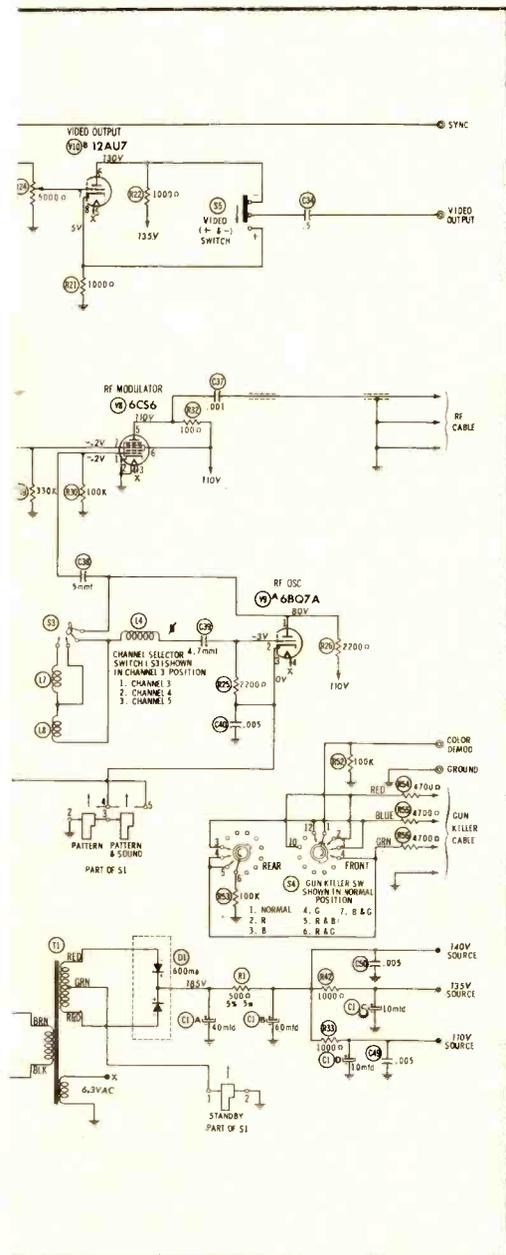
A portion of the 31.5kc signal is removed at the cathode of V2A and counted down to 15.75kc and used for horizontal synchronization. The original 220.5kc signal is passed through a clipper stage (V1B), a shaper (V5A) and then used to form the vertical line output. With the crosshatch button depressed, vertical and horizontal

lines are fed simultaneously to driver stage, (V7B) and the composite vertical line and horizontal line signal is applied to diode D2 when the dot button is depressed. The diode conducts only when the vertical and horizontal signals are coincident in time and the result is a dot pattern on the screen of the color TV set.

The color signal is generated by V11B, a crystal controlled oscillator operating at 3.579545Mc. Output of this oscillator is fed to the grid of V11A, a phase inverter tube. The desired output taken from either the cathode or plate of this

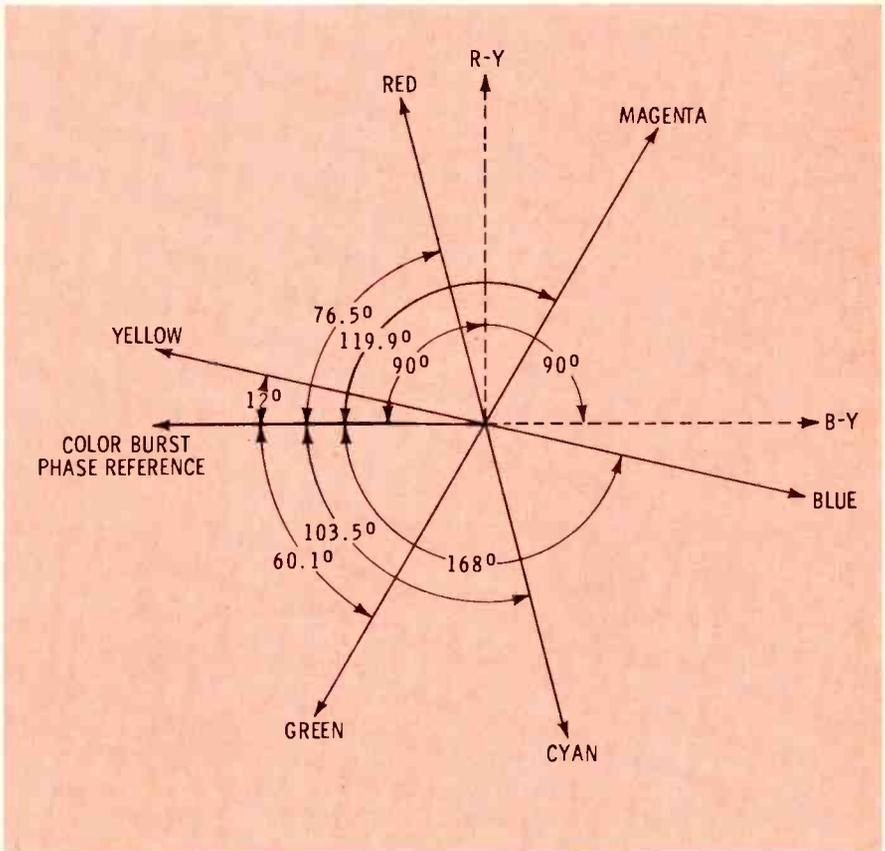
tube, depending on the color desired, is applied to a series of delay lines. Individual pushbuttons are used to select the delay time required. A variation in the delay time of the signal by the network made up of R57, C46, C45, C44, C43, C32, L9, L10, L11 and L12 will cause a change in signal phase which will cause the hue of the color bar on the screen to change.

The signal from the delay line is then fed to color mixer stage V12A. A wide color stripe with contrasting background is desired so this mixer stage is keyed by a pulse from the burst keyer stage to ac-



Control locations of Jackson Model 800

Fig. 1—Color phase angles

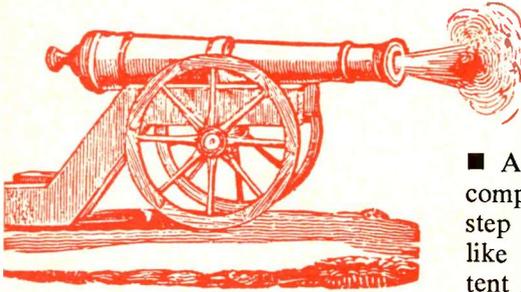


comply with this important objective.

Sync information is added to the signal in mixer stage V12B. The composite color signal is then fed through cathode follower stage V-14, to driver stage V7. The output of the driver is then applied to either the video output or the RF modulator (V8).

The RF signal is generated by oscillator stage, V9A, 1/2 of a 6BQ7 — and a 6CS6 (V8) is employed as a modulator. When the pattern and sound button is depressed a 4.5Mc crystal controlled oscillator is activated and also applied to the modulator. ■

THE SECRET WEAPON



by Frank Salerno

We've got some heavy pieces of artillery at our

■ After a day at the “battle of the components” nothing can rob your step of its homeward-bound spring like a skirmish with an intermittent AGC or a “pulling picture” or the blistering fire-power of a “heat intermittent” or a sustained barrage from an unknown “vibration sensitive” sector.

Let's face it — it's open warfare — “They” against us. If we want to survive we've got to use every weapon at our command.

We've got several good heavy pieces of artillery at our disposal: the scope, the VTVM or VOM, the signal generator, the set analyzer. But sometimes, “They” camouflage themselves so well that we must use stealth and cunning to “flame them out” of the nooks and crannies.

We *do* have a secret weapon that can be unveiled to turn the tide of a losing battle — a weapon to use when all seems lost and we're on the very brink of defeat. That weapon is a forefinger. That's right — that simple, little, unassuming, self-effacing forefinger.

I'll tell you about a few great battles I've won by tossing that finger into a “bulge” at just the right time.

The 'Finger' Technique

Some years ago when I first began to realize what a wonderful implement of war that sensitive little finger could be, I was engaged in a scouting operation with a 650 Series Magnavox. It had a very

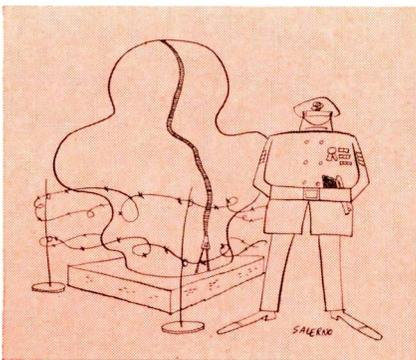
“grainy” picture with deep contrast. While charging up and down the IF strip, changing tubes, I found them so hot that I jerked my arm back the moment I touched one. So I took the enemy in tow and brought him back to headquarters. There, under heavy interrogation, I uncovered a 30 μ f electrolytic capacitor across the 6W6 regulator tube that was shorted. This resulted in full B+ on the regulator cathode which subsequently reached the IF tube plates. The IF string, indicated on the map at 140v, was running red hot at 260v. Hence, the excessive gain, plus heat.

I remembered that skirmish well as I fought various other battles and waited patiently for another encounter in which I could employ my newly discovered device of destruction.

It was only a little while later that a 17 in. 424W Emerson chassis wandered into our camp. It was suffering from an erratic tuner, poor sound and vertical drift. These problems were quickly disposed of. But there was a noticeable degree of video white-out at full contrast and I couldn't locate the sector it was coming from. I changed the 12BY7's but this did no good. Although screen quality was good, this bothered me, but being under pressure from other enemy diversions, I put this one aside but kept a watchful eye on it.

Before long my nose informed me that something in that area was overheating. No smoke, no fire —

disposal—the scope, the VTVM or VOM, the signal generator, the set analyzer, but



only a distinctive odor of something smoldering. It was time to move in. I threw the wraps off my secret weapon and began poking it into different areas of the enemy's hide-out. Then the odor I had been tracing suddenly turned into the unmistakable smell of searing flesh as I touched a 10-watter.

Then I opened up with the big gun and checked voltages. Gradually, the smoke cleared and I flushed out the culprit. A B+ wire was connected to a wrong tie point. The design of the circuit and the actual wiring were both such that no serious problems arose previously because of the wiring error, but it did have a net result of lowering the 12BY7 plate voltage somewhat. Once the error was corrected, the prisoner brightened up smartly and looked better than ever — thanks to the indestructible digit.



"Oh, Oh! Daddy's been in another battle."



One 'touch' told me what I needed to know.

In another small, but strategic engagement, I found myself face to face with a 17 in. Philco, split chassis job. It had very, very weak video — only barely noticeable behind the white raster. Again, while yanking tubes, I got that "seared" feeling I've come to know so well. When I touched the 6AQ5 video output tube, it was that battle-scarred veteran that told me what I needed to know. I turned the chassis over and checked voltages in and around the 6AQ5 socket. I found the coupling capacitor between the first video amplifier plate and the 2nd amplifier grid was shorted. This was allowing a B+

voltage on the grid and was causing the tube to over-heat.

No Fable

Of course, all this may sound like an old soldier's fable; but it's not. The truth is, this business can get mighty tricky at times and at those times we need every little bit of help we can get. Many "tough dogs" have fallen when we accidentally uncovered a hidden symptom by poking a finger around.

After hanging around TV sets for years we should learn just how much heat to expect from different components. When out in the field, without our big guns, we can put this information to good use.

How many of you have noticed that leaking or shorted electrolytic capacitors often get very warm? They give themselves away, surrendering easily to that sensitive digit.

Some resistors are expected to burn hot, some warm and some cool. A cold ten-watter is almost sure to be open. One that is too hot can easily point to a leaking or shorted capacitor. If a 2-watter is running abnormally hot it indicates excessive current flow or a shorted tube, perhaps a shorted bypass capacitor or improper tube bias. The same is true for a 1/2 watter. Defective flybacks and yokes also give themselves away very often by developing internal hotspots.

So you see, the sense of touch can really zero in on some repair problems that may otherwise be formidable. ■



DIRECT MAIL

A medium no wide-awake service-dealer and technician can afford to pass up

■ Should you include direct mail in your advertising program? Yes, if you want your share of the profits. National surveys show that direct mail advertising is being read, and if you want your material to be read too, it must compete successfully with all the other material. The record shows that it is one of the most effective advertising methods known—if properly handled.

The prerequisite to effective mailings is to know what to mail, to whom, when and what to say to your customers or prospects. First, however, you have a *problem* or you wouldn't be thinking of advertising. The first job is to consider the problem. Write it down, analyze it. Then plan a course of action to solve it with direct mail advertising.

Generally, your problem will exist in the area of building sales or obtaining more service customers. Specifically, it would be to increase sales and service during slow periods: days of the week, weeks of the month, seasons of the year. It should be used to reach specific groups of people, to generate goodwill, to clear slow-moving stock, to get more of your share of sales or service on certain items.

Your direct mail campaign to solve one or more problems will elicit either an immediate response, to sales on specials or special services; or a pro-

longed response — general traffic builders, statements of policy, publicity of regular services, etc.

To Whom?

To whom will you address your campaign? You can divide the customers you want action from into three groups: old and new customers, live prospects and every householder in your market area. These can be divided into smaller groups: age, profession, income, specific areas, etc. Your appeal should be based on their specific tangible desires: success, financial or physical security, entertainment, recreation, etc.

An up-to-date mailing list is a must for this type of advertising. Your previous customers make your most valuable list. You should already have such a file.

Live prospects can be obtained from various sources—new residents from utility companies and church membership lists; new homeowners from the annual homeowners list from the county tax roll and building permit lists published in local newspapers.

A list of every householder in your area can be addressed by name or as occupant. Such lists can be obtained from the city directory, classified and regular telephone directories, and crisscross telephone directories which also list by name and by address. Upon request, postmasters will furnish without charge the number of post office boxholder patrons (only at post offices which do not have city or village carrier service), route numbers, and number of boxholders on each rural routes. (A check list for modernizing your mailing list appeared in the August 1963 issue of *ELECTRONIC TECHNICIAN*.)

The post office will also correct your mailing

ADVERTISING

lists for a minimum charge of \$1 per list. For a list of more than twenty names and addresses, the charge is usually 5 cents per name or street address, including individual apartments.

Typewritten or printed lists should be submitted to the post office that serves the address, on cards approximately the size and quality of a postal card, one name and address to a card. Place your name in the upper left corner of each card. At third- and fourth-class post offices, mailing lists may be submitted in sheet form.

Names to which mail cannot be delivered or forwarded will be crossed off: incorrect house, rural, or post office box numbers will be corrected; initials will be corrected where the name is known to the owner of the list; and the head of the family will be indicated, if known, when two or more names are shown for the same address. New addresses for patrons who have moved will be furnished when permanent forwarding orders are on file. If no change is necessary, an "X" will be marked in the upper right corner of the card. New names will not be added.

Lists of street addresses (for occupant lists) may be submitted on cards as previously described, or in sheet form, provided the sheets are made up separately by carrier routes.

Incorrect or nonexistent street addresses will be crossed off, but numbers will not be changed or added. Business addresses will be indicated by inserting "B" opposite the number. Addresses on a rural route will be indicated by "R." The number of separate family units will be indicated opposite addresses of apartment houses or other multiple dwellings. If no change is necessary, an "X" will be marked in the upper right corner. Corrected cards or sheets will be grouped by routes when returned so you can label mailings by routes.

When?

When to promote business would be determined by your specific needs. Take into consideration when your prospective customers can be more easily motivated to come in and buy. Catching people near a payday when they have money "burning a hole in their pockets" could be an idea. If you sell radios and TVs, you could correlate your advertising with that of your manufacturer or supplier, to connect your name with your more well-known product brands.

As an example, a minor problem might be that you have very little business repairing car radios and you want to get more of it. Your slow day of the week may be Tuesday. You might appeal to the teenage group to come into your shop during the week in the summertime when they would be using their cars more for recreation and pleasure.

How?

How is the copy, illustrations, conveyance, and the type of reproduction or print used to transmit your message and obtain the desired effects?

Copy. For a piece to be read it must (1) catch the eye with its title, a bold printed portion or an illustration; (2) instill interest by offering what the reader wants; (3) give information (service guaranteed, modern instruments to expedite service, savings obtained on labor time); and (4) get action. For immediate response, ask for action: "this week only, so act now," "offer good until . . ." "free gift with coupon while they last." For prolonged response, offer "everyday low prices," etc.

Illustrations. These should be eye-catching and informative. A picture is worth a thousand words, as the old saw goes. Just be sure it says what you want

Continued on page 82

MEETING HIGH LABOR COSTS

Stay 'on the ball' or end up 'behind number eight'

■ With the possible exception of today's tax load, no factor causes greater economic concern to TV-radio service-dealers than a high payroll. Today's wage costs are, in some cases, trimming profit margins so close that shop owners can see danger signs immediately ahead.

Since there's little likelihood of lowering this primary element in overhead costs, the man who stays in business will have to develop new business methods. The alternative of boosting service charges is seldom a solution. Competitive conditions generally prevent this easy way to handle the problem.

Many shops, however, have found the answer through better planning and organization — ultimately boosting labor productivity. Here are some of the methods they have used.

Shop job scheduling and work assignments. Maximum work output all day and every day—with no slack periods—should be the constant goal of every modern service shop. This assures that payroll dollars are not wasted through idleness between work assignments or jobs. And every job assignment must be made with payroll costs uppermost in mind. The high priced technician has to be assigned only to work where his skills are needed and on those jobs where the price being charged justifies his efforts. A \$4-an-hour technician should not be assigned to jobs that an apprentice or lower-salaried man can handle.

Promotion for 'small' jobs. To secure maximum return from payroll expenditures, no "lapses" between big jobs should exist while

payroll costs go on. It is wise procedure today to expend time and effort in promotional efforts to keep a steady flow of "small business" coming into the shop to serve as fill-in work between major jobs or work assignments. This embraces jobs we have turned down or made no effort to obtain.

Tighter control over employees.

This has also become a necessity. We have passed the era where the small-shop owner can work eight or even ten hours a day. He has to spend more time on the job and see that every employee does the same. Latenesses to work and long "coffee breaks" have to be eliminated. A \$4-an-hour man who wastes only 15 minutes a day will cost his employer \$300 a year in wasted payroll dollars. A half-hour of wasted effort a day by even a \$2-an-hour man amounts to the same thing.

Overtime problems. At time-and-a-half or double time, based on present wage scales, overtime mounts into a sizeable figure in only a few hours. The shop owner has only one choice here—when a customer demands speedy service requiring overtime work, the customer must be charged extra for the additional load.

Overhead costs. This is another area that many shop owners are giving closer attention. Every item which goes into overhead cost should be examined periodically for possible trimming or money-saving changes.

'Extra' services. Some of these may have to be eliminated. They have always been wonderful business builders and the small cost items may still be maintained. But

if they cost too much they must be eliminated.

Better buying of materials and supplies. This is a must today. We have to purchase in larger quantities to obtain better prices, take advantage of every possible discount and buy only goods and materials that give the greatest possible dollar return.

Employee fringe benefits. It is becoming more difficult to hand out fringe benefits except in the most favored situations. Some must be granted since there is little choice under certain circumstances. But they must be kept to the bare minimum in many cases.

Keep an eye open for more efficient and knowledgeable technicians. Today's shop owner has no other choice but hire the best men he can find to obtain the greatest possible return from the dollars he pays out in wages.

Tools and instruments. Good tools and test instruments cost money but they also save money when labor costs are high. The shop that tries to get by with old and inefficient tools and test instruments will be losing a significant percentage of the labor productivity and efficiency of skilled technicians.

Adjust your own prices upward. If necessary, adjust your service charges upward—but they must remain competitive or you will lose business.

Finally, we must look everywhere for new and better ways of doing everything in connection with our business. This calls for a closer and more exacting study of every phase of the business. ■

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CARRYING CASE Model 639-OS black leather carrying case, built-in stand, Flaps open to permit use of tester in the case. Suggested U.S.A. User Net. **\$12.10**

TRIPLET ELECTRICAL INSTRUMENT CO., BLUFFTON, OHIO

. . . for more details circle 42 on postcard



A Unique TV-Radio Business

■ When Alfred Lastovica decided to offer stereo for autos, he wasn't sure there'd be sufficient market in 34,000-population Temple, Texas, where he operates his shop.

To give a new import a fair trial, he installed one in his own station wagon, together with a car-top sign.

On the first day out, a man stopped him on the street and asked for details. Before quitting time, Lastovica was busy installing auto stereo for the customer — and he has been stopped at least once a day since. But not all stops result in sales. Like the fellow from New York who wanted to know how Lastovica could sell the stereos for considerably less than he had paid for one.

One source of auto stereo customers is Army personnel from nearby Fort Hood.

Lastovica's shop is unique. It combines TV-radio service with jewelry, watch repair and fine china. Not only is the quiet Texan a graduate of the National Radio Institute (NRI) in TV-radio servicing; he is also a fully qualified and practicing horologist!

These businesses are not incompatible, he finds. He has employees to help with selling the jewelry and china and others to help with the TV-radio servicing. It is not unusual for him to put his soldering iron down on the bench and walk over to his watchmaker's cage and check somebody's watch.

"Adding stereo for automobiles was not a big jump for me and not a surprise for those who know me," he says. Because he is one of the area's leading service-dealers for two-way automobile radio equipment, the addition of auto stereo was an easy step.

Having operated a growing business more than nine years in his present location, he has built the kind of service reputation that means money.

Local townspeople say: "If it has tubes, transistors or mysterious little 'doodads' inside and it doesn't work, take it to Lastovica. If he can't fix it, you may as well throw it away."

The auto stereo plays two-hour tapes, but so far Lastovica has not stocked up on music for his customers. Nobody can say for sure, however, that it won't come later. ■

. . . for more details circle 22 on postcard →

ELECTRONIC TECHNICIAN

your most profitable tool is know-how . . .

keep it up-to-date with rider books

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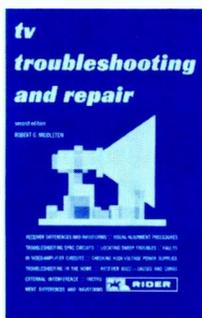


TV Troubleshooting and Repair *(second revised edition)*

Robert G. Middleton

Newly revised and updated, this book reflects the rapid changes in TV technology. It covers new circuits, new tubes and the transistor, discussing the new test equipment, and giving the latest troubleshooting methods and techniques.

Volumes I and II of the former volume are combined and expanded in this new edition, which considers visual-alignment, sweep troubles, video amplifier circuits, external interference, high voltage power supplies, and much more. 216 pages, illustrated, paper—**\$3.95.**



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Marvin Tepper

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Transistor receivers are treated in four full chapters. Later sections deal with the long neglected area of transmitter servicing. 212 pages, illustrated, paper (2 vol. set) — **\$5.30, cloth — \$5.95.**

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(second edition)—two volumes

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Prepared under the sponsorship of the Electronic Industries Association. Volume 1 covers black-and-white and color TV and gives you all the latest industry-approved trouble-shooting methods that lead you right to the source of the trouble.

The second volume includes up-to-the-minute information on maintenance, repair, and troubleshooting procedures for the latest home audio and intercom equipment.

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by Sol Libes

Presents methods for the repair of transistor radios. Includes basic transistor theory transistorized circuitry, design and superheterodyne radio receiver principles. Cover step-by-step procedures, trouble check points, charts, test equipment and tools. 159 pages, illustrated, paper—\$3.50.

BASIC TELEVISION

by Alexander Schure

Presents the basic theory, operation and circuitry of black and white television in a clear, thorough and accurate 5-volume "picture book" course. Individual volumes completely cover the transmitter, organization of the TV receiver and receiver circuit explanations. The text is supported by more than 500 informative illustrations that help you to visualize each individual concept. 5 volumes, 664 pages, illustrated, paper—\$11.25, cloth—\$12.75.

HOW TO TROUBLESHOOT TV SYNC CIRCUITS

by Ira Remer

A practical, valuable book which covers the many variations in monochrome and color television sync circuits and possible troubles that might occur in them. Discusses fundamentals of sync circuits, takeoff, clipping, limiting, noise cancellation and time consultants. The section on output circuits includes integration and horizontal circuit signals. 128 pages, illustrated, paper—\$2.90.

HOW TO USE GRID-DIP OSCILLATORS

by Rufus P. Turner

Deals with the construction and use of this versatile instrument as well as its application to all kinds of radio and television receivers. Chapters include: Principles and Circuits; Grid-Dip Adaptors; Resonant Circuit Measurement; Capacitance Measurements; Inductance Transmitter Applications; Antenna and Transmission-Line Tests; Applications; Commercial Grid-Dip Oscillators. 112 pages, illustrated, paper—\$2.50.

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ELECTRONIC TEST EQUIPMENT

by Larry Klein and Ken Gilmore

Various techniques for using electrical and electronic test instruments are completely explained in this up-to-date book. An extremely wide range of test instruments are covered, from very simple VOM to the distortion analyzer and oscilloscope.

More than 100 illustrations provide a full grasp of the test instruments and their various applications. 192 pages, illustrated, paper—\$4.00.

MATHEMATICS FOR ELECTRONICS AND ELECTRICITY

by National Radio Institute Staff

Beginning with a complete review of arithmetic, the book progresses through algebra, trigonometry, Boolean Algebra, and the binary number system. It relates every topic to its electronics applications such as finding resistor tolerance with percentages, and solving complex vector problems with trigonometry.

There are several other valuable sections which help you to save time in setting up equations, simplifying a-c and d-c circuit calculations, constructing and applying many types of widely used graphs, etc. Example problems throughout are worked out in detail. 256 pages, illustrated, paper—\$3.95, cloth—\$5.60.

LASERS AND MASERS

by Stanley Leinwoll

This introduction to a fascinating area of technology clearly explains what laser and masers are, how they work, and what they can be made to do in the future. Beginning with the development of the maser, the book goes on to discuss the ruby, gas, and injection laser with applications to medicine, biology, chemistry, weapons systems, and communications. The last chapter considers the various lasers that are commercially available, as well as some of their component parts. Includes information on do-it-yourself kits. 96 pages, illustrated, paper—\$1.95.

FUNDAMENTALS OF TELEVISION

by Walter H. Buchsbaum

Providing complete understanding of the fundamentals, this book covers the elements of television through every section of the black-and-white and color TV receiver. Emphasis is placed on circuits, both transistor and tube, used in the latest models. Troubleshooting and alignment details are given for each receiver function. 304 pages, illustrated, cloth—\$9.95.

PLANNING AND INSTALLING MASTER ANTENNA TV SYSTEMS

by Lon Cantor

Fully and clearly explains economic and technical considerations involved in setting up master antenna systems. Discusses systems for home, repair shop, showroom, as well as hotels, high rise apartment buildings and even entire communities. Gives you all the information you need to sell and install even the biggest master antenna system. 127 pages, illustrated, paper—\$3.95.

PRACTICAL OSCILLOSCOPE HANDBOOK

by Rufus Turner

This brand new, two-volume handbook, introduces the oscilloscope and explains its applications—without using technical jargon—for technicians, radio operators, servicemen and hobbyists.

The first volume covers operation principles, structure and characteristics of the instrument. In addition, step-by-step instructions explain general tests and measurements in current, frequency, phase and specialized applications, such as receiver and transmitter testing. Vol. II clearly explains specific tests and measurements. The book avoids theory wherever possible and uses simple diagrams instead of detailed circuits. 240 pages, illustrated, paper—\$5.90, cloth—\$6.95.

HOW TO READ SCHEMATIC DIAGRAMS

by David Mark

Of particular use to beginners in the field of electronics, this compact volume covers all the essential symbols and abbreviations used in schematic diagrams for electronics work. Thoroughly practical in approach, it progresses in easy-to-understand stages from individual components right up to complete receivers and similar equipment. All major components and circuits are identified and explained, including C-C and A-C circuits, electronic equipment power supply circuits, and audio amplifier circuits. Of special interest is the section on interpreting complete schematics for radio and tv circuits. 160 pages, 5½ x 8½, illustrated, paper—\$3.50.

HOW TO LOCATE AND ELIMINATE RADIO AND TV INTERFERENCE

by Fred D. Rowe

This completely revised and up-to-date book contains the latest techniques for locating and eliminating radio and TV interference. The latest electronic components are discussed at length, and their applications analyzed. Extremely practical in its approach, this book tells you what to look for, what to do and how to do it. 168 pages, illustrated, paper—\$2.90.

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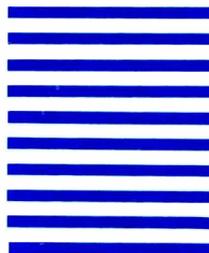
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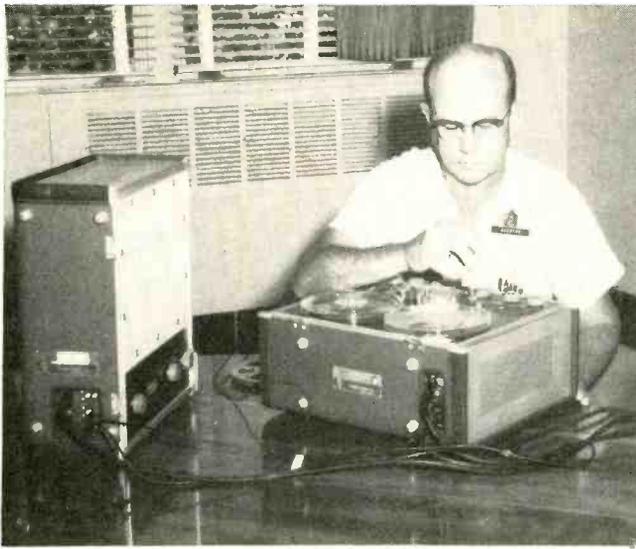
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USAF Hospital's 'Mr. Fixit' Keeps Communications Humming

■ When radios, public address and audio paging systems fail at Wilford Hall USAF Hospital, Lackland Air Force Base, Texas, Charley Brewton is the "Mr. Fixit" who responds to the call.

Brewton, who has the distinction of having been with the hospital since it opened its doors in September 1957 under the name of USAF Hospital, Lackland, will soon culminate 22 years as an Air Force employee. He is responsible for the central program distribution system, the inter-office communications network, nurses call, TV antenna distribution system, public address system and tape recorder repair.

The radio repair shop, located in the nine story structure's basement, houses a complete repair center for the hospital's communications equipment. Brewton — a one-man operation — is responsible for the upkeep and repair of 1,028 outlets in the hospital's radio program distribution system. Music or special programs are piped to the entire hospital through this system.

Wilford Hall's Mr. Fixit also maintains the hospital's radio control room, where local radio programs may originate. The nurses call system, also under Charley's jurisdiction, has 34 units, one in each ward, and each is connected to a bedside station, which enables the nurse in charge to speak with individual patients.

The TV system is only available in the T-wing of the hospital. Here are two hundred more outlets which require Brewton's attention. Finally, Brewton has charge of the repair of 31 intercom master units, and 63 remote stations located throughout the hospital.

What does his boss, Gonzalo G. Bexar, radio supervisor for the 2106 Communications Squadron, say of his work? "He is one of the best in the business, and I would hate to lose him," says Bexar. This, you can be sure, is reiterated by his fellow workers and the staff at Wilford Hall. ■

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COLORFAX

Channel 47 Color Test Pattern on in Afternoon

Channel 47 (WNJU-TV), although it doesn't officially begin its programming day until 5:50 p.m. on weekdays and 5:00 on weekends, has started beaming its test pattern from 1:30 p.m. Monday through Saturday as an aid to television service technicians.

Station President Edwin Cooperstein said the move was undertaken at the request of a number of service-dealers and technicians who pointed out that the telecasting of the test pattern during the day would be a great aid in the sale of all-channel TV sets and UHF converters.

With the test pattern available to them, the service-dealers and technicians said, they can demonstrate UHF to any potential customer for a TV set or converter and thereby aid the sale.

Mr. Cooperstein noted that Channel 47 regularly transmits its test pattern in color, as it does all station-promotion and identification signals as well as all programming available in color.

Zenith 22-In. Color CRT

Zenith Radio Corporation announces plans to begin quantity production of a new 22-in. rectangular color CRT in mid-1966.

Joseph S. Wright, president, said the new color tube, developed by the company's tube manufacturing and research subsidiary, The Rauland Corp., in conjunction with the Corning Glass Works, "is expected to become an important color tube size in the industry by the end of next year.

"Production prototypes of the new glass bulbs are scheduled for delivery from Corning during the first quarter of next year," Mr. Wright said, "to provide for pilot runs and allow ample time for preparation for later mass production.

"With the introduction of a new rectangular screen size at the midpoint between the 25-in. and 19-in. color tubes," Mr. Wright said, "there will be a sufficiently broad range of choice in rectangular color receivers to meet the rapidly growing consumer demand for sets with the more pleasing rectangular shaped screens and slim, compact cabinetry."

The 22-in. color tube, with 228 sq in. of rectangular picture area is a three-gun, shadow-mask type, and has a 90 deg deflection angle. It is approximately 19½ in. from front to back, about 2 in. shorter than the 25-in. rectangular tube. Mr. Wright noted that the company's Rauland color tube facilities, which have been expanded three times in the past two years to an annual capacity of nearly one million color tubes, "were planned to mass produce all shapes and sizes of color picture tubes, including the new 22-in. size, as well as any new tubes developed in the future."

Admiral G13 Convergence Yokes

You may encounter some early Admiral G13 convergence yokes on which the static convergence magnet sticks or becomes intermittent when the thumb-wheel is rotated. In such cases the magnet may be stuck to the coil impregnating wax or may be binding against the bronze clip core spring under the magnet wheel.

To correct this condition, loosen the clamp and remove the convergence yoke from the CRT neck. Disassemble the three pole-piece exciters. To remove the cover from the pole-piece exciter, carefully insert a screwdriver or knife blade between the plastic cover and the back near one of the four heat sealed pins. Pry the two pieces apart gently at each of the four pins and remove the cover by first separating the two pieces at the end opposite the thumb-wheel until the iron pole-shoes are cleared, then separate the thumb-wheel end and remove cover completely. Take care not to lose the spring washer from the top of the thumb-wheel. Remove the thumb-wheel assembly which consists of the round magnet, spring washer and plastic thumb-wheel.

Examine the round magnet for a copper color on the core-contacting surface. If this color shows on the magnet, then press the bronze clip core spring into the case until it is below the surface of the ferrite core to prevent rubbing. If the core shows excessive wax on the surface where the round magnet fits, remove the excess with a cleaning fluid that will not damage plastic.

Re-glue the round magnet to the thumb-wheel with a vinyl or epoxy resin cement. Before you apply the cement, check to be sure that the side of the round magnet which will contact the pole-piece has the greatest attraction to it — apply the cement to the weak side. Also be sure that the cement doesn't run down the side or the centerhole of the magnet and interfere with the fit of the magnet to the core. Allow to dry.

Replace the thumb-wheel assembly in position on the pole-piece core and assemble the unit in the reverse order of disassembly. As the cover is placed over the iron pole-shoes, guide the thumb-wheel into its socket. Press the cover and back together and re-seal the four posts with a hot soldering iron.

Assemble the three pole-piece exciters so that the clamp is on the left side of the unit with blue up and facing the thumb-wheel.

Corning Expansion

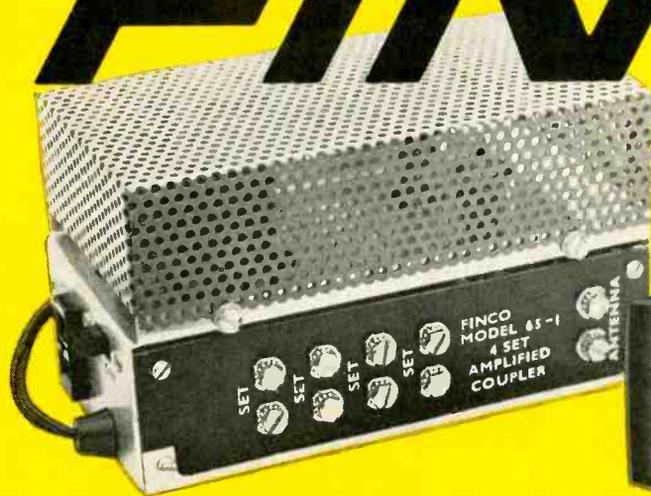
Corning Glass Works announces an expansion of its Bluffton, Ind., plant by more than 40 percent "because of the rapidly growing demand for color TV tubes." The 105,000 square-foot addition is scheduled for completion late next summer. Corning said employment will increase by approximately 150 persons, over a period of months after the addition is completed. Present employment is approximately 250. The Bluffton plant manufactures glass for color TV tubes. It began production only last February. The new addition will raise square footage to 355,000 and will provide the plant with a second glass melting tank and additional manufacturing equipment. Sales of color TV sets are expected to reach 2.5 million units this year, an increase of 78 percent over 1964. By 1970, industry sources estimate 23 to 25 million color sets will be in use.

G-E Service Notes

A peculiar problem which may be found in color receivers using any of the following chassis (CW, CX, CY, FY and CA) has been reported from the field. The usual complaint

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COLORFAX

is poor or incorrect color and the hue control will not operate properly. The screen controls appear to operate on a different gun; for instance the

red screen control may operate the green or blue gun.

It has been determined that this problem is caused by nearby lightning strokes which magnetize the CRT aperture mask. The problem can be solved by degaussing the CRT.

Serviceing Aids

Serviceing aids for color TV are

emphasized in a catalog of professional test equipment issued by B&K Division of Dynascan Corp. The catalog contains considerable detailed technical information which may prove helpful to most technicians when they are selecting new test equipment. The catalog, AP-22, is obtainable by writing to B&K Division, Dynascan Corp., 1801 West Belle Plaine Ave., Chicago, Ill., 60613.

Admiral Service Hints G13 Color Chassis

Audio output tube. Alternate audio output tubes were used to facilitate early production. The 6Y10 and 6AD10 tubes are not interchangeable because circuit components and voltages differ. Always replace with same type originally used even though both numbers are stamped on chassis. **Damper tube.** The 6CD3 damper tube used in early G11 and G13 chassis will be replaced by a 6CG3. These two tubes are interchangeable. **Vertical bar interference.** A vertical stripe may appear on nearby sets as some early G13 chassis operate. This condition is corrected when a 470pf, 1000v ceramic capacitor (part number 65-D10-350) is added across CR702. **Center convergence range.** If additional center convergence range is needed, transfer the end of R616 (a 5.6K 3w resistor on back of board) from point "T" to ground (next terminal to the right, viewing the back of the convergence board).

Sylvania D01 Color Sets

If you encounter weak color on this chassis check L602. This choke may open. It is located in 6EW6 (V8) plate circuit . . . If you run into no color and weak video, it may be caused by a shorted 2nd IF screen grid bypass capacitor (560pf) . . . It is also reported that shrinking rasters can be caused by horizontal output tubes that are new. If you run into this problem, try at least three new ones before you jump to any conclusions. It is also recommended that no tubes that have been overheated should be placed back in the set. They may give you a hard time later.

Color TV Adapter

The 170652-1 cable kit for adapting a Magnavox T904 Series color CRT test jig is available. It allows you to remove the T904 chassis and troubleshoot it on the bench. The kit also adapts the 23 and 19 in. chassis to the jig. It is pointed out, however, that all final checks and adjustments should be made with the CRT and neck components in the original instrument.

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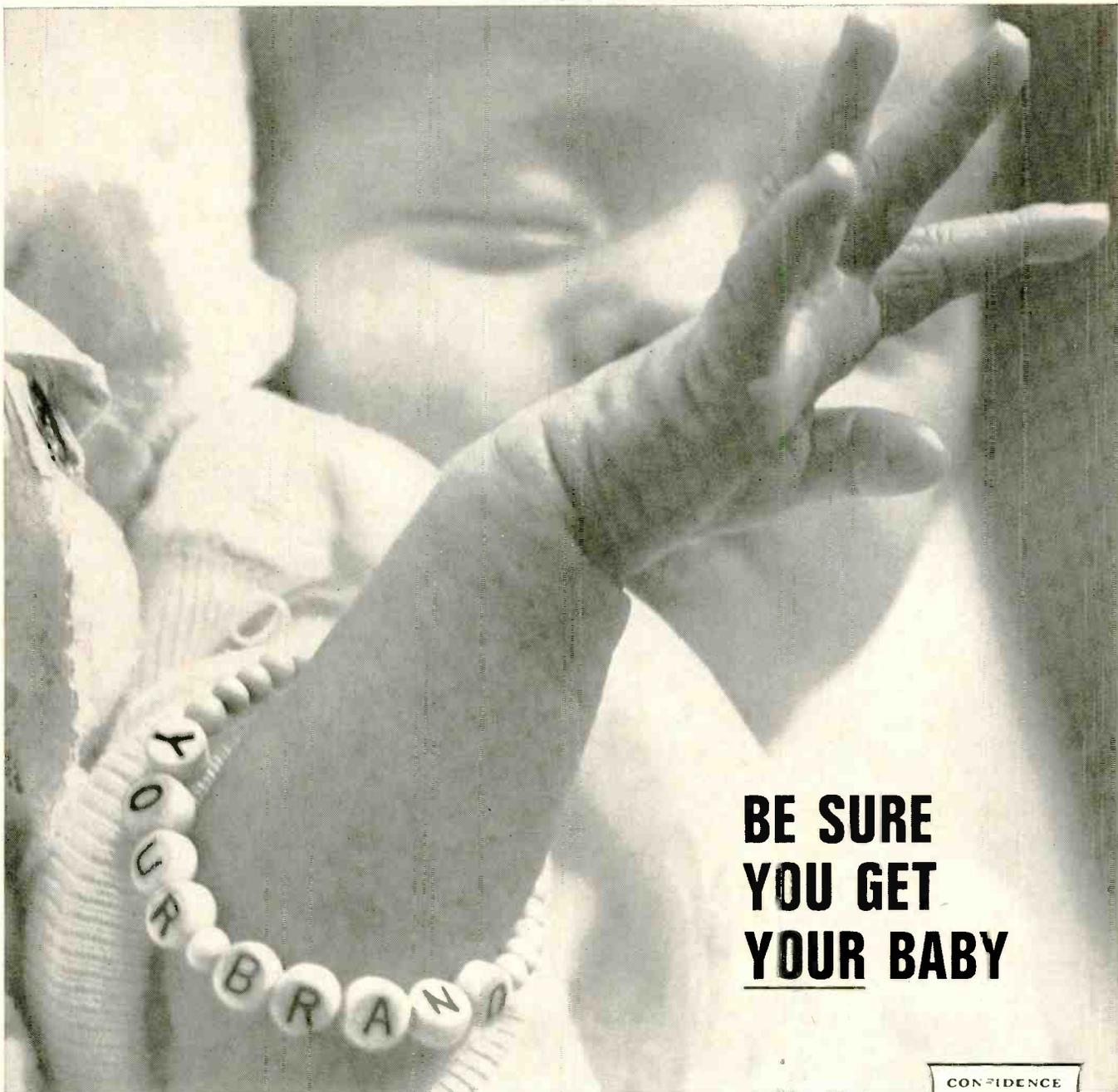
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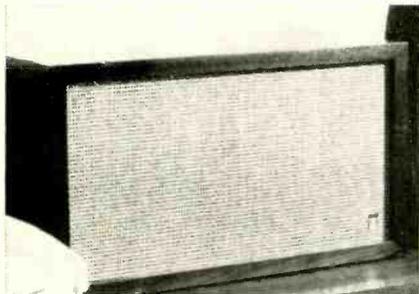
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NEW PRODUCTS

FOR MORE INFORMATION CIRCLE NEW PRODUCT NUMBERS ON POSTCARD INSIDE LAST COVER.

Eight Ohm Tweeter 200

An 8Ω tweeter is announced. The tweeter incorporated in an existing system improves power output above



10,000 cps as effectively as a 3 db increase in amplifier output at these frequencies, the manufacturer says. Jensen Mfg.

Parabolic UHF Antenna 201

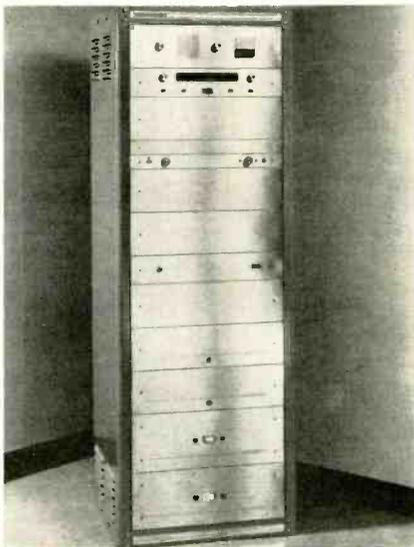
A series of all aluminum parabolic UHF antennas is introduced. The manufacturer reports that the antennas are



packed in a carton one-fifth the size normally required to ship parabolic antennas. Finney.

Paging System 202

A line of solid state hospital music and paging systems is introduced. A selection of entertainment media, including AM/FM radio, tape playback deck and record changer, is offered in addition to a full line of voice paging facilities. Solid state amplifiers are available in 50w and 100w.



The AM/FM tuner is transistorized, with temperature compensated circuits. The record changer of the system can accommodate up to eight records at a time, providing approximately three hours of entertainment. Motorola.

Booster Coupler 203

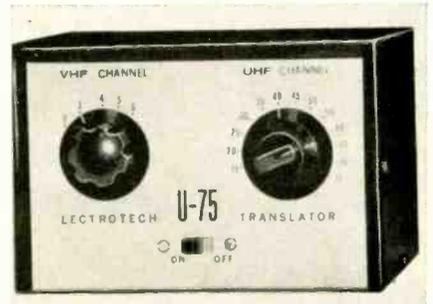
A booster coupler, Model 65-1, is announced. It is a two tube, 4 set VHF-TV and FM distribution amplifier designed for small commercial and



deluxe home distribution systems. It is housed in a perforated steel cabinet that measures 6 5/16 x 37/16 x 39/16 in. Finney.

UHF Translator 204

A UHF translator designed for servicing UHF sections of TV sets and UHF converters is introduced. The U75 converts any VHF signal from channels 2 through 6 to any UHF channel from 15 through 75. Any VHF signal source may be fed into the unit for translation to UHF: analyzers, color bar generators, test pattern generators, AM signal generators,



or similar signal sources. VHF TV programs are taken directly from the antenna and fed into the translator. Lectrotech.

Tube Tester 205

Announced is a portable tube tester, model TC136, which is designed to handle Amperex and Mullard 10-pin



tubes used in many color receivers. The set-up chart lists over 3000 tubes which can be checked and the unit sells for \$74.50. Sencore.

Auto Tape System 206

Announced is an auto tape system which can play back through the car radio as well as record, the unit can be removed from the car to provide



a portable recorder. It consists of a miniature, cordless, cartridge-loaded recorder, placed in a specially designed sliding tray beneath the car dashboard. Norelco.



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NEW PRODUCTS

Radio Tester

207

A radio tester containing a power supply, in-circuit and out-of-circuit transistor tester, RF and audio signal generators, and a VOM is introduced. The Model 970 employs an in-circuit signal injection procedure that functions on either power or signal type transistors through introducing a dc test signal into the transistor stage and



reads good/bad directly on the built-in meter. Transistor beta and leakage may be read directly on the meter scales if the transistor is checked out-of-circuit. B&K.

Speakers

208

A line of 30w omni-purpose public address speakers is announced. The speakers have built-in 70v or 25v line transformers; watts/impedance selector switch; screw-to-line terminals; control/connect center cover plate which is also a cable strain relief clamp; omni-directional, three-way adjustable mounting bracket. Specifications include: Power, continuous, up

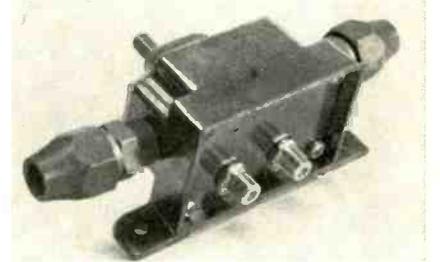


to 30w. Power, equalized to frequencies above horn cutoff, 40w. Frequency response, 225-14,000cps. Audio level, 125db measured 4 in. on axis at 30w input. Dispersion, 100 deg. Atlas.

Directional Line Tap

209

A directional line tap with two outputs for CATV application is intro-



duced. The dual taps provide matched, isolated outputs which can be used for distribution amplifiers or individual taps. Viking Hoboken.

Cord Winder

210

A cord winder designed for home or office is announced. Eight feet of



110-120v cord wind onto the reel. Attached to an electrical appliance, telephone or extension cord, the winder stores excess cord. Corova.

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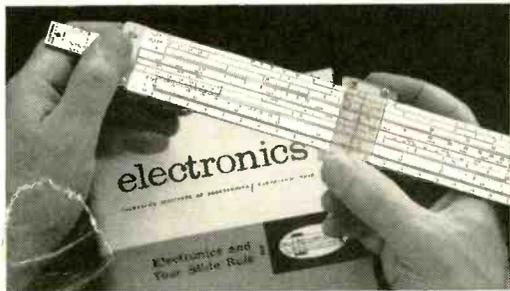
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Here's a great new way to solve electronic problems accurately, easily... a useful tool for all kinds of radio-TV servicing including CB, mobile and marine radio. The Cleveland Institute Electronics Slide Rule is the only rule designed specifically for the exacting requirements of electronics computation. It comes complete with an illustrated Self-Training Course consisting of four lessons... each with a short quiz you can send in for grading and consultation by CIE's expert instructors.

See for yourself. Learn how to whip through

all kinds of reactance, resonance, inductance, AC and DC circuitry problems in seconds... become a whiz at conventional computations too!

This all-metal 10" rule is made to our rigid specs by Pickett, Inc... comes complete with top grain leather carrying case and Instruction Course. A \$50 value for less than \$20. Send coupon for FREE illustrated booklet and FREE Pocket Electronics Data Guide, without obligation. Cleveland Institute of Electronics, 1776 E. 17th St., Dept. ET-107 Cleveland, Ohio 44114.

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A leader in Electronics Training... since 1934

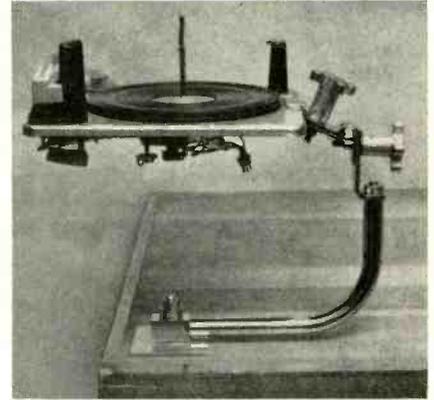
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NEW PRODUCTS

Work Holder

214

A work holder that secures parts and products in any desired position during repair, production and home workbench jobs is announced. It consists of a 1 in. diameter nickel-plated "L" shaped bar and tube that swivels



in a 22 in. horizontal arc around the base. The bar curves upward 7¼ in. to a clamp-holder and clamp containing Neoprene pads which permit rotation of the work 360 deg in both horizontal and vertical planes. Both the clamp-holder and clamp have hand-locking knobs. Konigslow.

Clip Shelving

215

A line of steel shelving for tools, supplies, hardware, parts and many other commercial applications is an-

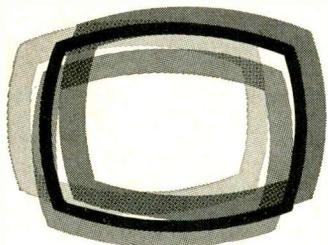


nounced. The shelves are readjusted by moving clips on 1 in. centers. Shelving color finish is oven baked gray or green enamel. Franklin.

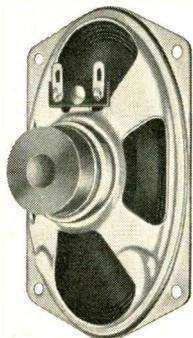
brand new
... and very important ...

QUAM COLOR TV REPLACEMENT SPEAKERS PREVENT COLOR PICTURE DISTORTION

OFTEN CAUSED BY STRAY
MAGNETIC FIELDS FROM
ORDINARY LOUSPEAKERS



When you use an ordinary loudspeaker in a color TV set, you're looking for trouble ... picture trouble. The external magnetic fields from standard loudspeakers will deflect the primary color beams, causing poor registration and distorted pictures.



QUAM RESEARCH SOLVES THIS PROBLEM

An entirely new construction technique, developed in the Quam laboratories, encases the magnet in steel, eliminating the possibility of stray magnetic fields and the problems they cause! These new Quam speakers have been eagerly adopted by leading color TV set manufacturers. Quam now takes pride in making them available for your replacement use. Five sizes (3" x 5", 4", 4" x 6", 5 1/4", 8") ... in stock at your distributor.

QUAM

QUAM-NICHOLS COMPANY

234 E. Marquette Rd. • Chicago, Ill. 60637

... for more details circle 32 on postcard
DECEMBER 1965

TROUBLESHOOTING . . .

Continued from page 56

the sound will vary with vertical hold control rotation. Dress all vertical leads away from the audio leads where they enter the 12-pin plug. This is under the chassis. The audio cable has two shielded leads. Also, a small vertical raster or complete vertical collapse may occur if C602, a 0.0033 μ f 1kv capacitor, shorts or develops leakage.

A CTC11C color receiver was brought into the shop by a customer. When switched on it showed a narrow vertical raster. The picture "jittered" also. The back was removed and it was discovered that the convergence board cable plug was not even connected. This really looked easy. The cable was plugged in but still we had trouble. It appeared that someone had been tampering with the set, so the chassis was removed from the cabinet.

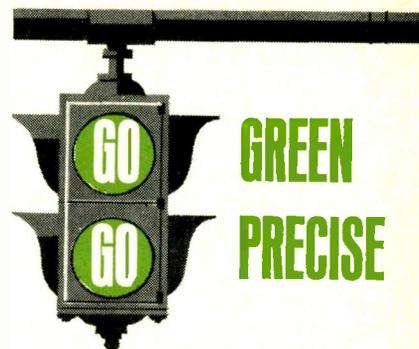
The vertical hold was real critical and the vertical height and linearity controls did not work properly. The vertical centering control would not move the picture upward. A vertical "crawling" and "bunching" appeared in the picture. Part of the picture would squeeze together, change, and then move up the screen. Someone had repaired the set recently because a new C120 had been installed.

At first the vertical tube was replaced but without results. Sometimes the picture appeared to have 60cps hum in it. The IF cable was removed from the tuner and the raster showed light and dark sections floating upward. Also, at the top of the darker sections, the raster lines bunched together.

All filter capacitors were bridged and checked but we still had the same trouble. A new capacitor was substituted for C125 without results. Voltages in the vertical, horizontal sync and video sections checked normal.

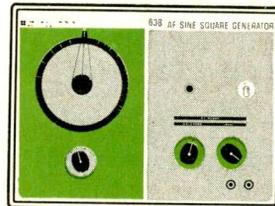
MOVING?

Be sure to let us know your new address. Please enclose a complete address label from one of your recent issues.

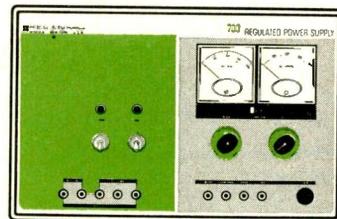


**GREEN
PRECISE**

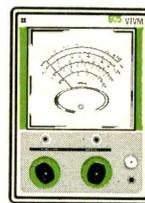
**FOR RELIABLE
TEST MEASUREMENTS**



**MODEL 636
AF SINE SQUARE GENERATOR** — 20 cps to 200 kc in four ranges. Less than 0.25% sine wave distortion at 10 vrms into 600 ohms load.
Kit: \$45.95 Net Wired: \$61.95 Net



**MODEL 780
CONTINUOUSLY VARIABLE REGULATED
VOLTAGE SUPPLY** — Regulated dc output from 0 to +400 v at 150 ma, and 0 to -150 v bias. Also provides unregulated ac. Meters for voltage and current.
Wired: \$99.95 Net



**MODEL 905
VACUUM TUBE VOLTMETER** — Comes with assembled dc/ac-ohms probe. Direct reading of p-p voltages. Separate ac low voltage scale. Low 0.5 vdc range for transistor circuit measurements.
Kit: \$32.95 Net Wired: \$49.95 Net

Go with the new PRECISE Green Line. It's the scenic route for your test measurements — headed straight for value and accuracy. These unique instruments have color dynamic front panels featuring easy-on-the-eyes Green to aid readability and accuracy. New functional design and layout make operation fast and foolproof. Underneath, they're hopped up with sophisticated circuitry checked out for reliability. That's why, now more than ever, you'll find the going's smoothest with PRECISE test instruments. Go all the way with PRECISE scopes, VTVMs, power supplies, signal generators, tube testers, decade boxes and probes.



**PRECISE
ELECTRONICS**
Division of Designatronics, Inc.
Mineola, L. I., N. Y.

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After several hours of poking around, the trouble was finally located. The wire that ties from C120A down to the bottom of the filter choke junction was broken off. This wire fits tightly against the other three leads and was difficult to see. Apparently this wire was broken off when someone installed the filter.

In the latest color receivers a vertical "setup" or purity switch is located in the vertical circuits. In the Zenith receivers when this switch is placed in the SETUP position it shorts the feedback signal to ground. RCA's setup switch grounds out the 6EM7 grid. The Magnavox color receiver does the same thing through a 1000Ω resistor. Although the service setup switch may be located at a little different place in the vertical circuits of different TV color sets, they end up doing the same thing. The idea is to collapse the vertical sweep so a sharp vertical line is present on all three color guns. Thus, monochrome adjustments can be made very easily. ■

DIRECT MAIL ADVERTISING . . .

Continued from page 63

it to say. Your complete piece is a picture in itself. Copy placement, title, illustration must be balanced and uncluttered (see article, "Writing Better Ads," *ELECTRONIC TECHNICIAN*, January, 1964).

Conveyance. A letter is your personal mail contact. It says "special for you." Your ad material should be written with the same thoughtfulness as you do your business letters or other types of advertising.

A *postcard* is a handy little "how do you do." It is not for a quality mailing but is a great teaser to precede a larger mailing. Postcards are read — who could resist when you needn't open an envelope or even unfold a paper?

A *folder* is a single sheet, folded of course. It may be made of heavy paper with address printed on it, or light paper to include a return or other correspondence. A folder would be used for a teaser mailing or overnight campaign or any other mailing too long for a post card, too elaborate for a postcard, too short to become a circular.

Broadsides are large folders to indicate something big, great, wonderful. This is not to be used alone nor too often or it will lose its effectiveness.

A *booklet*, usually containing at least eight pages, gives the effect of permanence—regular prices, services, products, your general reputation (prolonged response).

A *circular* is like a booklet except that it requires an immediate response. It should tell the whole story of your promotion all by itself even if you precede it or follow it with other pieces.

A *brochure* is longer than a booklet or circular. The printing and paper imply quality, value, stability. Few dealers can justify the cost, however.

Type of print. Handwritten or typewritten letters should be used for personal contact, such as letters concerning payments, complaints or inquiries. For a large mailing of *seemingly* personal letters an automatic typewriter or multigraph machine can be used. These reproduce with an inked ribbon and raised letters. The address is typed in giving the impression of being personal, but does not make it subject to first-class postage. *Caution:* with multigraph, if the address is done poorly the effect is reversed. It would be better not to try to make it look like a personal letter in this case. People become offended if you try to fool them.

Mimeograph is a speedy and inexpensive process. This is the only reproducing machine that many small businesses own.

Multilith reproduces with a mat instead of film negative. This can be used for letters which do not need to appear handtyped, and for bulletins and folders.

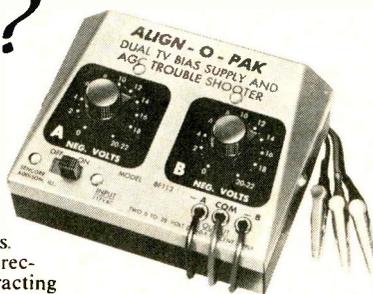
Letterpress is usually used for folders, broadsides, booklets and circulars. It is a plate of inked raised letters, the same as used to print newspapers. With it you can have die-cut, embossed, scored and perforated marks put into the paper during the press run. The process is flexible because you can use the same plates several times, and changes are less expensive.

Lithography is an offset process where a thin, flexible plate is prepared photographically — some parts of the plate are treated to receive ink, others to reject it. In the press, water and ink are applied to the plate and the image is transferred to a rubber "blanket" which then transfers it to the paper. The results of quality lithography compare with letterpress reproduction. This would be used generally for booklets and circulars containing a lot of illustrations. For printing of less than 10,000 pieces containing mostly

AGC PROBLEMS?

SENCORE BE113 ALIGN-O-PAK
DUAL TV BIAS SUPPLY

... a *MUST* for AGC trouble shooting; Quickly isolates the problem by direct substitution of TV AGC voltage with a variable bias supply. A *MUST* in B&W TV alignment, and *NOW*: a *MUST* for Chroma Bandpass amplifier alignment in color TV sets. The BE113 ALIGN-O-PAK provides all the voltages recommended by TV manufacturers with two non-interacting bias supplies of 0 to 20 volts DC at less than 1/10th of 1% ripple with calibration accuracy better than standard battery tolerances. Eliminate those messy time consuming batteries and get your BE113 from your distributor today.



\$12.75

SENCORE 426 South Westgate Drive • Addison, Illinois 60101

... for more details circle 38 on postcard



"I think this old dog has given its last bark."

copy, the letterpress would probably cost less.

Variety of form can't be over-emphasized. Anything in excess loses it's flavor. Multiplicity of choice gives you no excuse for over-using any form.

If you feel you need help at any time with your ads, you can employ an experienced advertising agency or go to your printer for advice.

Postal Regulations

Preparation and mailing of your pieces must follow strict regulations to expedite postal services.

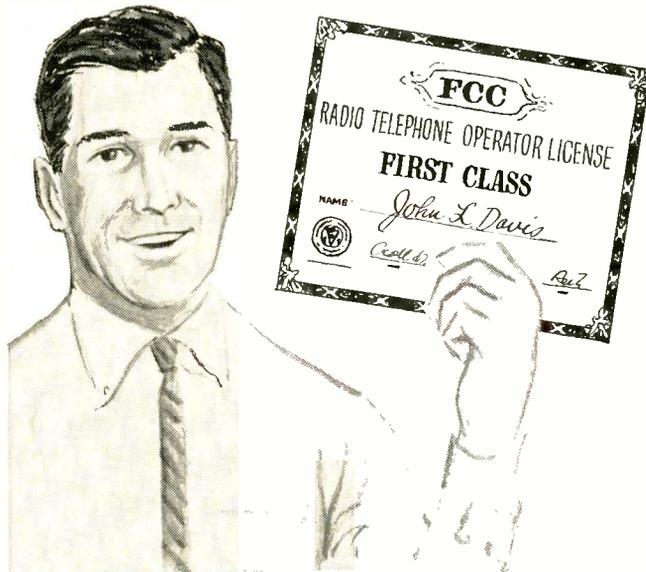
A brief summary of general information on envelopes include the following: The quality of paper must be strong enough to withstand normal handling, and not be highly glazed nor have an over-all design. It can be any light color that does not interfere with legible address and postmark. Mailable envelopes must be rectangular with a ratio of width to length of no less than 1 to 1.414 (1 to the square root of 2). Pieces less than 3 inches wide and 4½ inches long are non-mailable. There is no maximum size limit.

The proper place for the address is in the lower right portion of the address side; the postage in the upper right corner; and the return address of the sender in the upper left corner. Leave at least 3½ in. of clear space, from top to bottom, at the right end of the address side of envelopes, folders, or labels to be used for address, postage, postmark, and other prescribed endorsements. On large envelopes or mailing pieces, leave a clear rectangular space of not less than 2¾ by 4 in.

Communications, mobile radio...

A First Class FCC License

...or Your Money Back!



Your key to future success in electronics is a First-Class FCC License. It will permit you to operate and maintain transmitting equipment used in aviation, broadcasting, marine, microwave, mobile communications, or Citizens-Band. Cleveland Institute home study is the ideal way to get your FCC License. Here's why:

Our training programs will *quickly* prepare you for a First-Class Commercial Radio Telephone License with a Radar Endorsement. Should you fail to pass the FCC examination after completing your course, you will get a *full refund* of all tuition payments. You get an FCC License... or your money back!

You owe it to yourself, your family, your future to get the complete course. Our "proven effective" Cleveland Institute home study. Just send the coupon below TODAY. There's no obligation. Cleveland Institute of Electronics, 1776 E. 17th St., Cleveland, Ohio 44114.

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Cleveland Institute of Electronics

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Please send FREE Career Information prepared to help me get ahead in Electronics, without further obligation.

CHECK AREA OF MOST INTEREST—

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| <input type="checkbox"/> Industrial Electronics | <input type="checkbox"/> Electronic Communications |
| <input type="checkbox"/> Broadcast Engineering | <input type="checkbox"/> Advanced Engineering |

Your present occupation _____

Name _____ Age _____
(please print)

Address _____ County _____

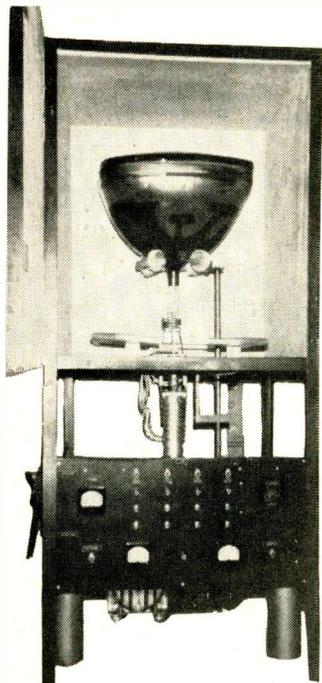
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**How to Succeed
in Electronics**

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Why Not!



Windsor Equipment
Handles Color & Bonded-Face As Well As
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So What?

Rebuilding with Windsor is a QUALITY PROCESS . . . and PROFITABLE !!!

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. . . for more details circle 46 on postcard

First-class mail. This includes letters, postal and post cards; airmail weighing not to exceed eight ounces whether sealed or unsealed; all matter wholly or partly in writing; and matter sealed or closed against inspection. The rate for first-class mail is five cents per oz or fraction of an oz, except for post cards which are four cents per oz or fraction, and business reply mail.

Third-class mail. Items in this category consist of mailable matter which is not mailed or required to be mailed first-class; not entered as second-class; and less than 16 oz in weight. Printed matter within the limit of weight set forth is third-class mail.

Twenty or more identical copies of bills and statements of account produced by any photographic or mechanical process, other than typewriting, may be mailed third-class. Otherwise, they are subject to first-class rates.

Prohibited are circulars and advertisements of other firms that are printed or manufactured elsewhere and turned over to a mailer to be inserted and mailed with his own mail at bulk rates. These are subject to the single piece rate.

The single piece rate for third-class mail is four cents for the first two oz or fraction of two oz, plus two cents for each additional ounce or fraction of an ounce.

Third-class bulk mailings are identical pieces separately addressed to different addresses in quantities of not less than 50 lb or of not less than 200 pieces. All the pieces in a bulk mailing must be identical as

to size, weight, and number of enclosures, but the printed textual matter need not be identical.

Preparation of third-class bulk mail. The identifying words Bulk Rate or its abbreviation must be printed or rubber stamped either in or immediately adjacent to permit imprints, meter stamps, or precanceled stamps. Third-class mail which is not sealed or secured so that it may be handled by machines is not recommended. All sealed pieces mailed at the third-class postage rates must be legibly marked with the two words Third-Class. This is deemed your consent to postal inspection of the contents.

You must sort, face and tie bulk mail into packages both lengthwise and crosswise with twine strong enough to withstand handling in the mail (a breaking-point of 10 lb or more will qualify). Labels should be large enough to cover the address on the exposed piece of mail and keep the label from sliding out from under the twine. When there are 10 or more pieces for any one post office, (city, state,) all addresses must be faced one way except the last which must be reversed to expose its address on the outside of the package. When there are sufficient direct packages for the same post office to fill a sack at least one-third full, you must place them in a sack.

It is recommended that you visit your local post office and obtain all information regarding third-class bulk rates, precanceling for third-class bulk mail, postage meters, permits, mailing statement forms and other valuable information which will help you in your direct mail advertising campaigns. ■

tests all tubes!

Popular low cost tester—complete with adapter for more than 400 Cathode Ray Picture Tubes!

MODEL 88—Tests receiving tubes in all sockets, novars, nuvistors, newest 10-pin types, compactrons and magnovals. PLUS: Picture tube sockets with 12-pin socket fits more than 400 cathode ray picture tubes including 110° deflection tubes. Grid Circuit Test, Tube Merit Test and Filament Test . . . quickly find cathode emission, grid emission, gas error, filament continuity and cathode-to-heater emission. Stationary tube chassis. Complete with speed-indexed setup data, pin straighteners and 12-pin picture tube socket on 2-foot cable.

\$74⁵⁰

Dealer Net

Complete picture tube test—accommodates new 10-pin sockets!

Model 98—Spots same tube faults as Model 88 above—PLUS unit features a replaceable plug-in chassis to customize or update instrument for newest tube types; built-in 12-pin picture tube socket; dial controls that isolate or transpose tube circuits and select test current. Grid Circuit; Cathode Emission; Tube Merit; and Heater Current tests for over 2500 types of receiving and picture tubes.

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Feature "set-up" testing . . . always up to date!

Model 107B—40 prewired sockets accommodate 63 basic pin arrangements for testing all modern TV, radio, industrial and foreign tubes. Has plug-in chassis wired to test tubes, circuit by circuit. Performs Grid Circuit Test, Dynamic Mutual Conductance Test and Cathode Emission Test. Data book pages covering new tubes mailed periodically to all registered owners.

\$189⁵⁰

Dealer Net



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ELECTRONIC TECHNICIAN

This tool solders faster, better, at lower cost

Microwave Measurements 300

An 80-page application note (No. 64) on microwave power measurement is an up-to-date reference on the subject. It begins with basic theory and explains how traditional methods were developed and used. It then details most recently-developed techniques to achieve higher accuracies with reduced complexity and time. Hewlett-Packard.

Variable Transformers 301

A two-page specification sheet describes and gives specifications on the Series B variable transformers. Superior Electric.

PA Systems 302

A two-page brochure details a line of compact public address amplifiers known as the Mercury Series M. Harman-Kardon.

Stereo Guide 303

A 20-page guide to custom stereo is colorfully-illustrated and features photographs, descriptions and specifications of a complete line of stereo components, kits and speakers. Scott.

PA Accessories 304

A 10-page catalog illustrates public address loudspeakers, microphone stands, baffles and other accessories for commercial sound applications. Atlas.

Capacitors 305

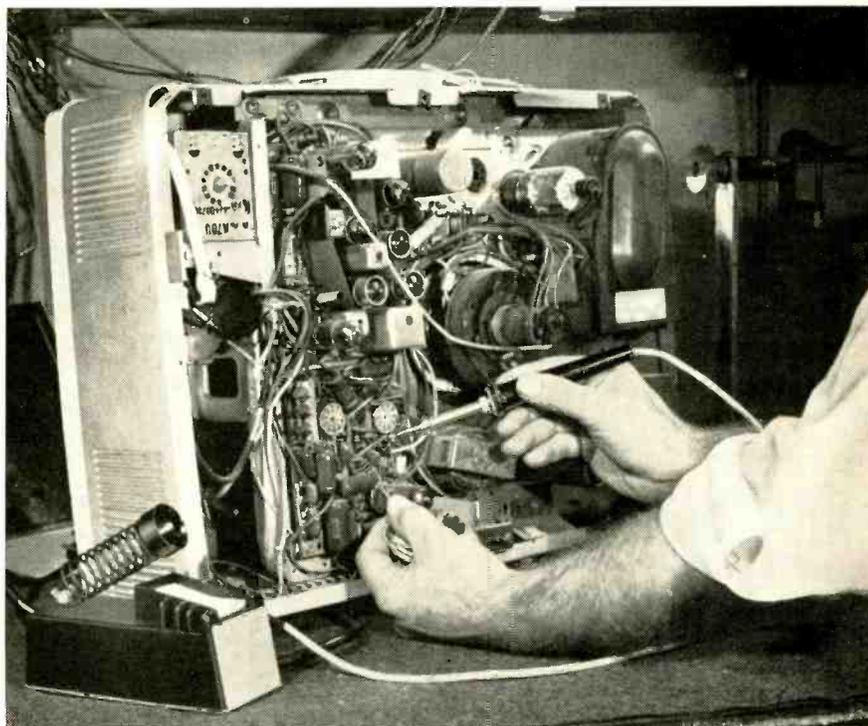
This 30-page technicians' catalog lists capacitors, resistors, filters and test gear designed for TV-radio service technicians. Aerovox.

Industrial Power Supplies 306

This is a handbook covering principles and applications of regulated power supplies in specialized segments of electronics, in physics, medicine, teaching and a wide range of related fields. Kepco.

Test Equipment 307

This catalog describes a line of test equipment used in servicing monochrome, and color television. Instruments for troubleshooting transistor radios are also included. Electrical and mechanical specifications are given. Two transistor analyzers for testing portable radios, auto radios and transistorized TV are listed. Detailed descriptions of generator outputs with waveform photos for a solid state color generator and a TV analyzer are included.



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**temperature-controlled
low voltage soldering pencil
does the work of several irons**

Extremely versatile. Use it for all your bench soldering, including heavy-duty chassis work.

Improves quality of soldered connections. Tip temperature remains constant. No peaks or lows to cause component damage or cold soldered joints.

Lightweight, highly efficient. Weighs only 2½ ounces, cord included. Yet it does the work of irons that weigh much more and have much higher wattage. Reduces fatigue and downtime.

Faster soldering. You make more soldered connections a minute. Tool has tremendous capacity, rapid recovery. Handle remains cool.

Does the work of several irons. Temperature control is in the tip. Interchangeable tips are available in 500°F, 600°F, 700°F and 800°F controlled temperatures, and in ½", ¼", ⅜", ⅛" and ⅙" screwdriver types. Merely interchange tips to change the controlled temperature of the iron.

Low cost operation. 24-volt operation provides more efficient heat transfer, and long life inherent in low voltage elements. Tips are alloy plated, low in cost, last long, won't freeze.

Saves working space. Compact transformer has soldering pencil holder and tip cleaning sponge attached. Transformer is rated at 60 watts, 120 volts or 220 volts, 50/60 cycles.

Special trade-in offer. See your Electronic Parts Distributor now about the soldering tool trade-in deal on the Weller Temperature-Controlled Low Voltage Soldering Pencil-Model W-TCP.

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WORLD LEADER IN SOLDERING TECHNOLOGY

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ADVERTISERS INDEX

American Telephone & Telegraph Co.	42
Amperex Electronic Corp.	3rd Cover
Antenna Specialists Co.	86
Bussman Mfg. Div.	37
Castle TV Tuner Service	26
Channel Master Corp.	22-23
Chemtronics, Inc.	79
Cleveland Institute of Electronics	80, 83
E. C. I. Electronics Communications, Inc.	35
Finney Co.	73
GC Electronics Co.	65
Gavin Instruments, Inc.	24
General Electric Communication Products Dept.	20
Hayden Book Companies	69-70
Jackson Electrical Instrument Co.	78
Jerrold Electronics Corp.	41
LTV University	79
Mercury Electronics Corp.	74
Miller Co., J. W.	80
Olson Electronics, Inc.	86
Philco Corp.	2nd Cover
Precise Electronics	81
Quam-Nichols Co.	81
Quietrole Co.	86
Radio Corp. of America RCA Electronics Components & Devices	4th Cover, 29
RCA Sales Corp.	39
Sarkes Tarzian Tuner Service Div.	19
Seco Electronics	84
Sencore, Inc.	24, 32, 34, 38, 82
Sprague Products Co.	25
Standard Kollsman Industries	33
Sylvania Electric Products, Inc.	77
Triplet Electrical Instrument Co.	66
Turner Co.	71
Viking Instruments, Inc.	40
Weller Electric Corp.	85
Windsor Electronics, Inc.	83
Winegard Co.	28, 30-31
Zenith Sales Corp.	27

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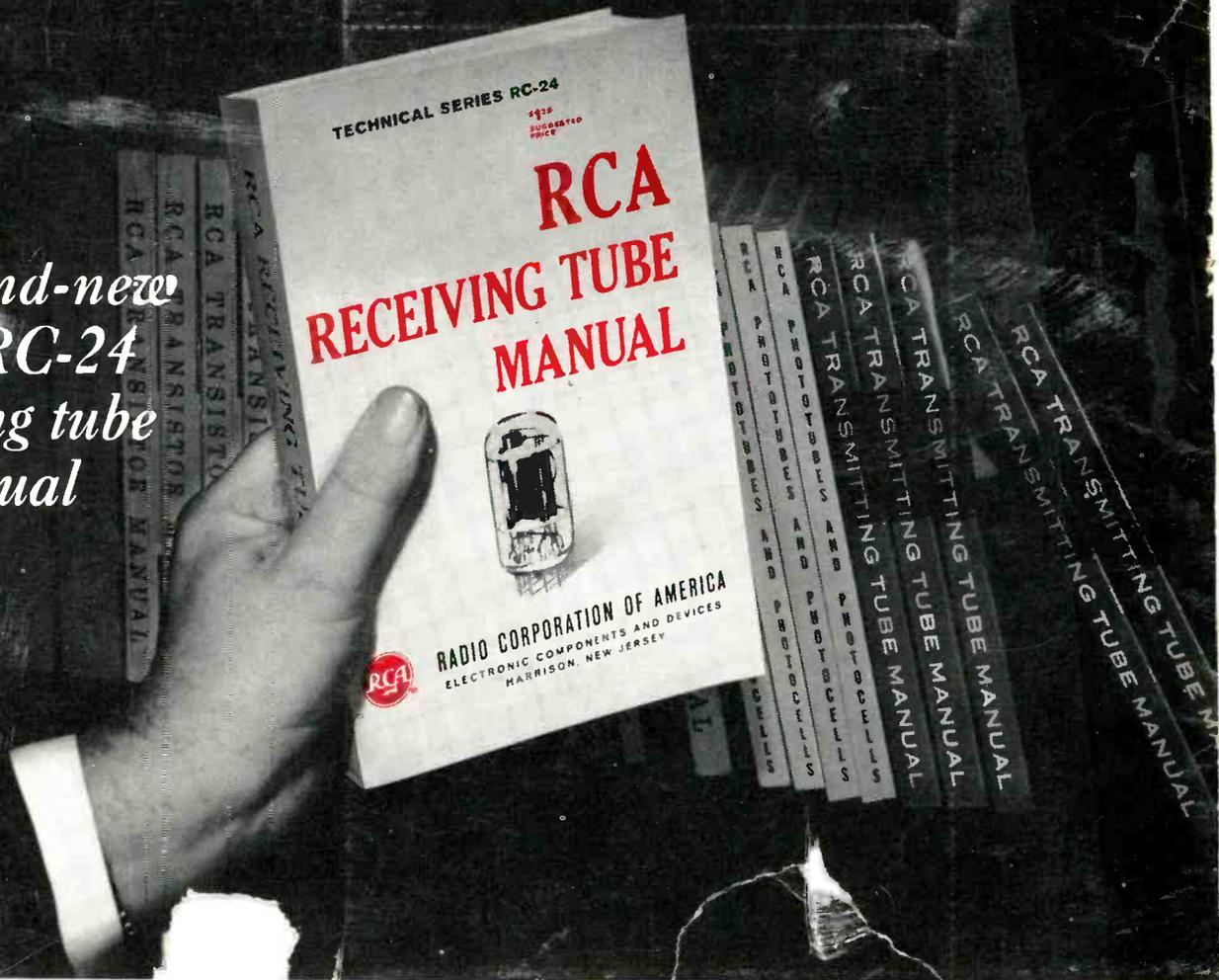
1G3GT/1B3GT	4HA5	6BZ6	6GW8	8CW5
1X2B	5HG8	6CB6A	6HA5	9A8
3BZ6	5U8	6CG7	6HG8	10CW5
3CB6	6AL5	6DT6	6S4A	12AT7
3GK5	6AU4GTA	6EH7	6SN7GTB	12AU7A
3HA5	6AU6A	6EJ7	6U8A	12AX4GTB
4BL8	6AV6	6GB5	6U9	12AX7A
4EH7	6AX4GTB	6GJ7	6X9	15CW5
4EJ7	6BA6	6GK5	6Y9	16A8
4GK5	6BL8	6GK6	8BQ5	19AU4

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manual*



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- ✓ Updated picture tube characteristics chart
- ✓ Revised and updated Applications Guide
- ✓ New tube index section for ready reference
- ✓ Data section on active types only. (Discontinued and replacement types appear in a separate section.)
- ✓ Additional text material on TV in the tube applications section

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