

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



NOVEMBER 1967



FRISEW10812392N869AA3A17966B
WILLIAM W FRISE
7176 GALE RD
ATLAS MI
48411

PO REMOVE 6453
SERIES 1000 10000 100000
ADDRESS AND NAME FOR 1000 10000
SERIES 1000 10000 100000
NAME TO REMOVE FROM

WARNING
DANGER
100000

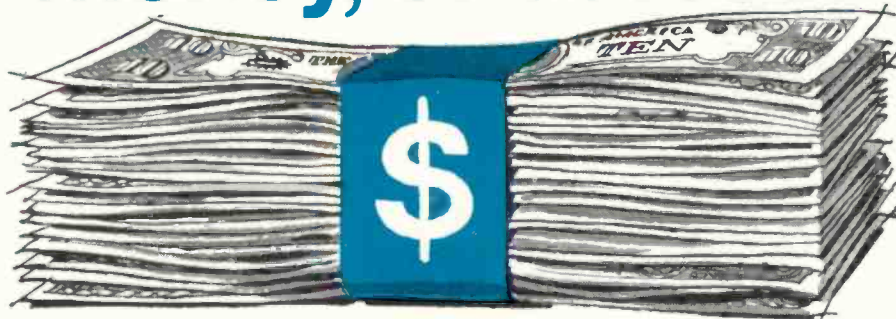
SOLVING SALES AND SERVICE PROBLEMS
MORE ON 1968 TV CIRCUITS
ELIMINATING COLOR 'BLUR' AND 'SMEAR'

fast. accurate. versatile.

what else would you want from a tube tester?



money, of course.



We know that swift and sure tube testing makes servicing more profitable. So we created the Dyna-Jet 606 Tube Tester, the professional portable loaded with the most-wanted features. Multiple 13-socket design means only 4 test settings, yet it tests the latest miniature and color receiving tubes as well as older types.

It tests for all shorts, grid emission, leakage, gas. Checks cathode emission the accurate way—under simulated load conditions. Checks each section of multi-section tubes. And the 606's exclusive front panel adjustable grid emission test spots the "tough dogs" and the weak ones. With the 606, good tubes aren't rejected, bad ones show up fast. That means less callbacks, more tube sales, better profit . . . MORE MONEY!

Few test instruments pack the profit-per-square-inch as does the Dyna-Jet 606. It's another product of B & K electronic innovation . . . of B & K's policy to provide maximum value and maximum quality. And the B & K Professional Servicing Equipment emblem assures you . . . and your customers . . . that you use the finest equipment available. Model 606 Net: \$79.95



A DIVISION OF DYNASCAN CORPORATION

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ELECTRONIC TECHNICIAN

TEKFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 6 NEW SETS

1117

CORONADO
TV Model TV2-7310A

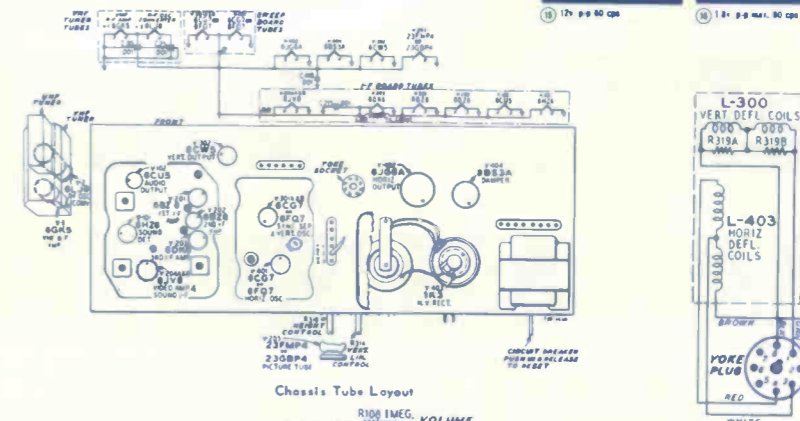
NOVEMBER • 1967

GROUP
183

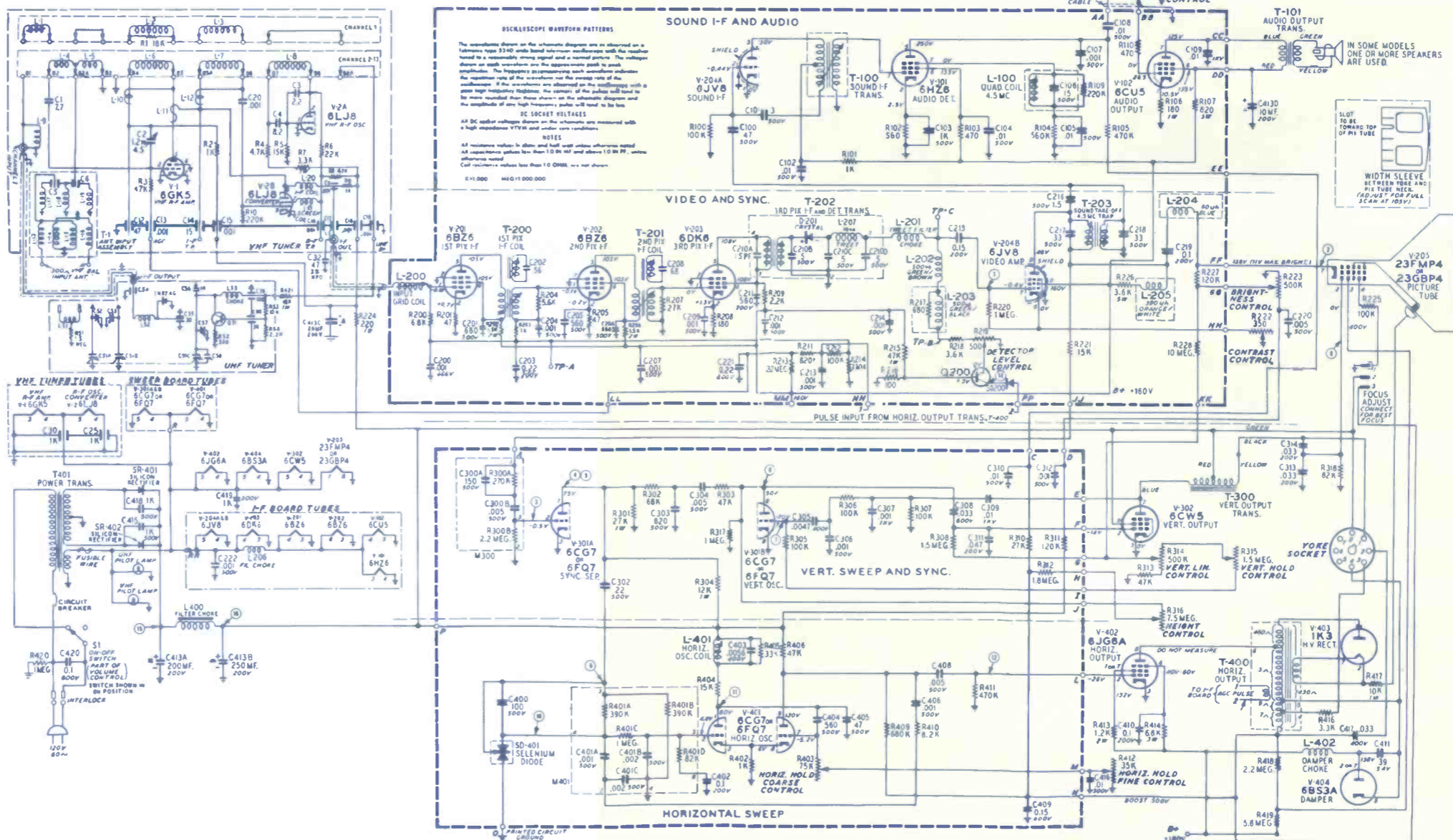
	SCHEMATIC NO.	SCHEMATIC NO.
CORONADO TV Model TV2-7310A	1117	SILVERTONE TV Chassis 528.71120
PHILCO-FORD Color TV Chassis 18QT85/18MT70	1118	SYLVANIA TV Chassis B09-1,-2
RCA-VICTOR TV Chassis KCS 158 Series	1119	WESTINGHOUSE Color TV Chassis V2656-1-2

ELECTRICAL SPECIFICATIONS

Power Supply	120 Volts AC 60 cycles only
Power Consumption	160 Watts (Maximum)
Power Output	1.0 Watts (Max.) 0.7 Watts (10% Distortion)
Tuning Ranges	VHF—Channels 2 thru 13 UHF—Channels 14 thru 83
Intermediate Freq.	Picture—45.75 MC Sound—41.25 MC
Antenna Input Imp.	300 Ohms Balanced
Intercarrier Sound System	4.5 MC
Speaker Size and Type	See Parts List
Focus	Electrostatic

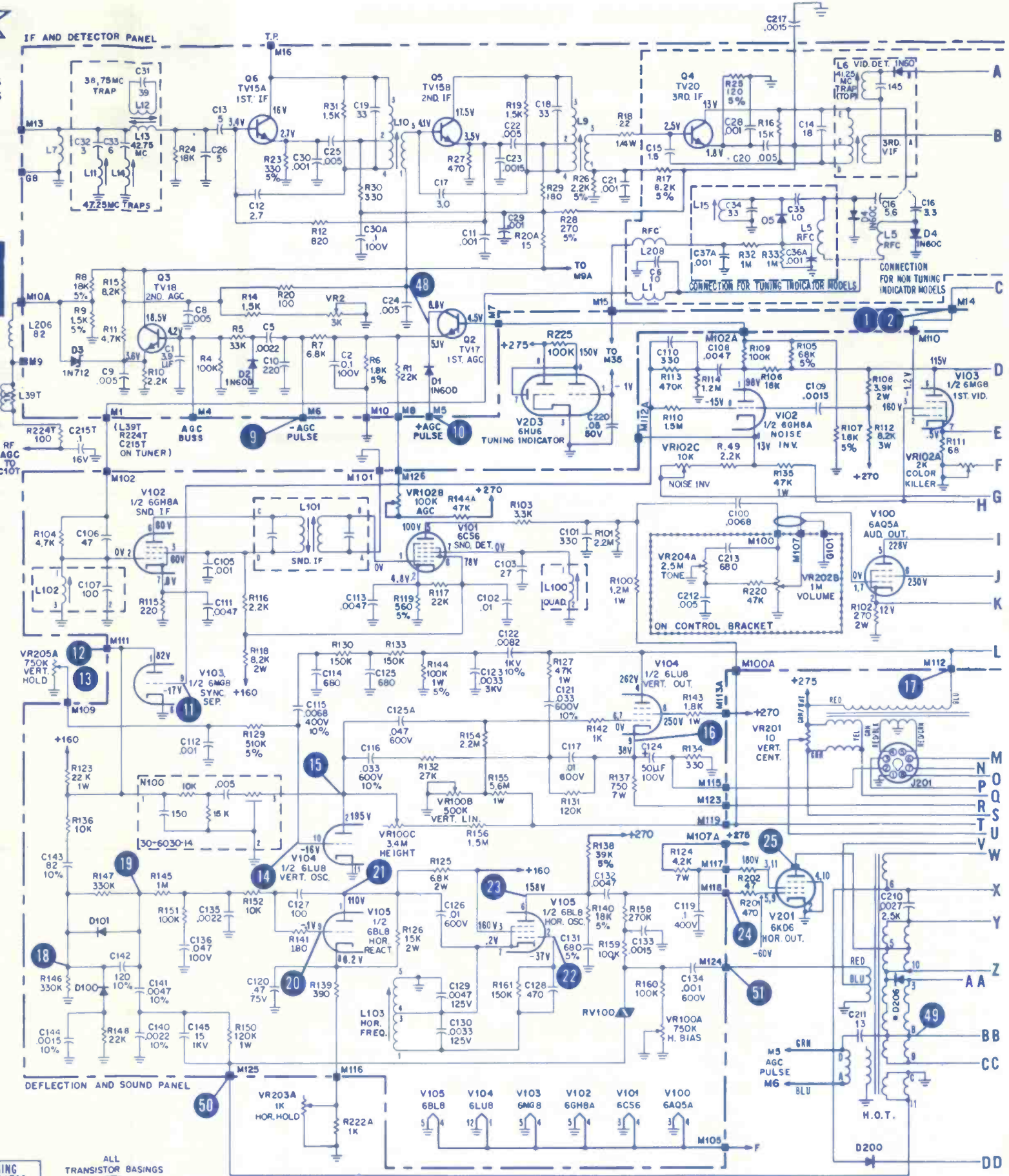
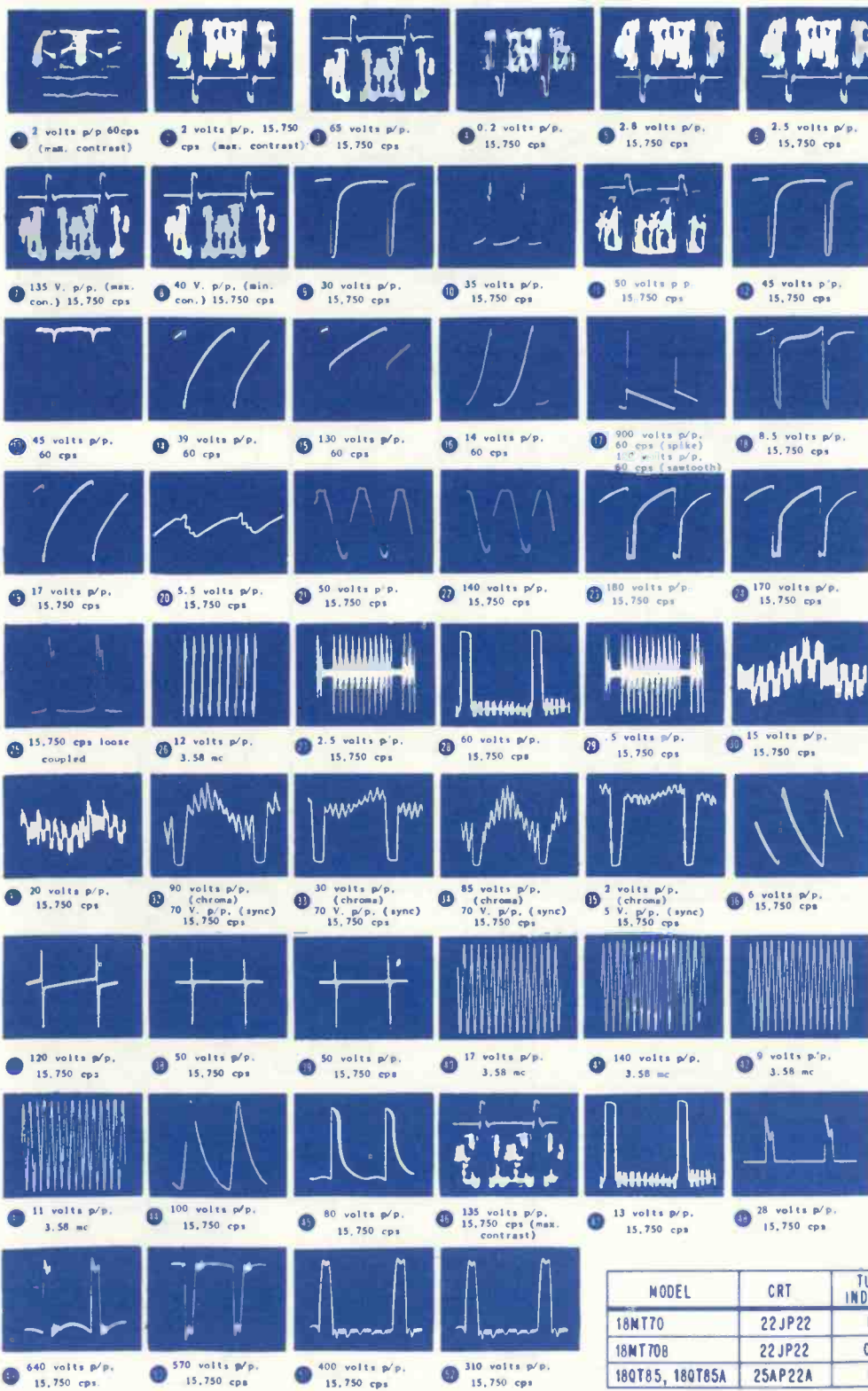


SYMBOL	DESCRIPTION	CORONADO PARTS NO.
R108	1.0M on-off val control	78X0056-007
R219	500Ω def level control	40X0592-001
R222	350Ω contrast control	78X0056-007
R223	500K brightness control	40X0585-021
R314	500K vert lin control	40X0585-020
R315	1.5M vert hold control	40X0585-023
R316	7.5M height control	40X0585-012
R403	75K horiz hold control coarse	40X0590-003
R412	35K horiz hold control fine	40X0585-046
C109	0.1μf 1kv ceramic	80X0099-061
C307	0.1μf 1kv ceramic	80X0099-016
C309	0.1μf 1kv ceramic	80X0099-061
C404	560pf 500v poly	46X0528-005
C411	39pf 5kv ceramic	80X0098-005
C413A	200μf	80X0098-005
C413B	250μf	
C413C	20μf 200v elect	45X0519-001
C413D	10μf	
C420	1μf 600v special U.L. Listed	35GX1044-004
R107	820 3.0 film	43X0450-018
R202	1.5K 2.0 film	43X0450-013
R206		
R226	3.6K 5.0 film	43X0331-000
R414	6.8K 3.0 film	43X0378-000
R421	12K 1.0 carbon	340X4123-810
L100	quad coil	9A2595-001
L200	IF input coil	9A2666
L201	choke coil 500μh	9A2432-006
L202	peaking coil 500μh	36A0094-006
L203	peaking coil 500μh	36A0094-005
L204	peaking coil 60μh	36A0094-015
L205	peaking coil 390μh	36A0094-017
L206	choke filament	9A2543-000
L400	choke filter	52X0102-001
L401	horiz osc coil	9A2515-000
L402	damp choke	9A2380-000
T100	snd IF interstage trans	9A2597-001
T101	audio output xformer	51X0235-002
T200	1st PIF xformer	9A2540-000
T201	2nd PIF xformer	9A2676-001
T202	3rd PIF xformer	9A2602-001
T203	snd IF take off & trap coil	9A2599-001
T300	vert output xformer	51X0229-007
T400	horiz output xformer	53X0432-001
T401	power xformer	53X0435-001
T402	tuner VHF	25A1245-011
T403	tuner UHF	25A1271-002
	deflection yoke assy	9A2605-002
	selenium rectifier (SR401,402)	66X0023-007
	selenium diode (SC401)	66X0025-000
	capristor (M-300)	76X0068-001
	capristor (M401)	76X0069-001
	transistor (Q200)	13X1013-002
	circuit breaker	86X0006-001
	printed circuit board & components Assy with tubes (sweep) P041	38A3227-000
	Printed circuit board & components assy with tubes (IF) P108	38A3741-000



OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver AGC control adjusted for an approximate peak-to-peak output of two volts at the video detector, using an air signal. Do not reset AGC control when using color bar generator. All monochrome voltages taken with average air signal and all chroma voltages taken with a color bar generator connected to the antenna input terminals. The chroma peak-to-peak voltages were taken with the chroma control set for 0.5V peak-to-peak at Pin 2 of V40 and the tint control set for proper color bars (approximately mid-range), all other controls set for normal viewing. The frequencies shown are those of the waveforms...not the sweep rate of the oscilloscope. All voltages taken with a wide band scope having a 5MC bandwidth similar to B & K Model 1450.



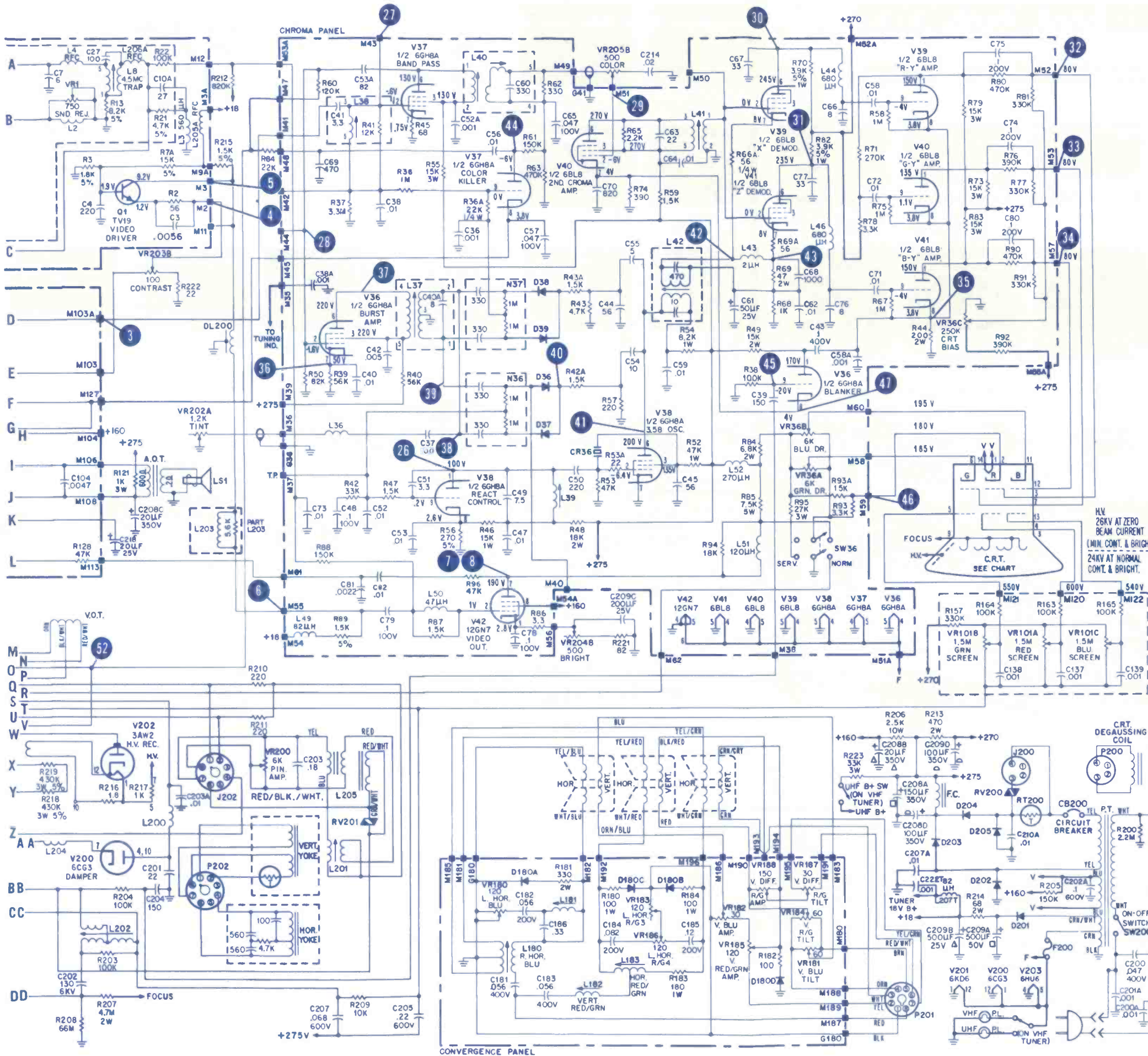
MODEL	CRT	TUNING INDICATOR
18MT70	22JP22	USE
18MT70B	22JP22	OMIT
18QT85, 18QT85A	25AP22A	USE



NOTES
 1. ALL VOLTAGE MEASUREMENTS ARE TAKEN WITH NO SIGNAL UNLESS INDICATED OTHERWISE.
 2. VOLTAGE READINGS ARE TAKEN WITH VTVM B & K MODEL 175 WITH ALL CONTROLS SET FOR NORMAL OPERATION. ALL VOLTAGES ARE NOMINAL.
 3. RESISTANCE ARE MEASURED WITH YOKE AND CONVERGENCE PANEL DISCONNECTED.

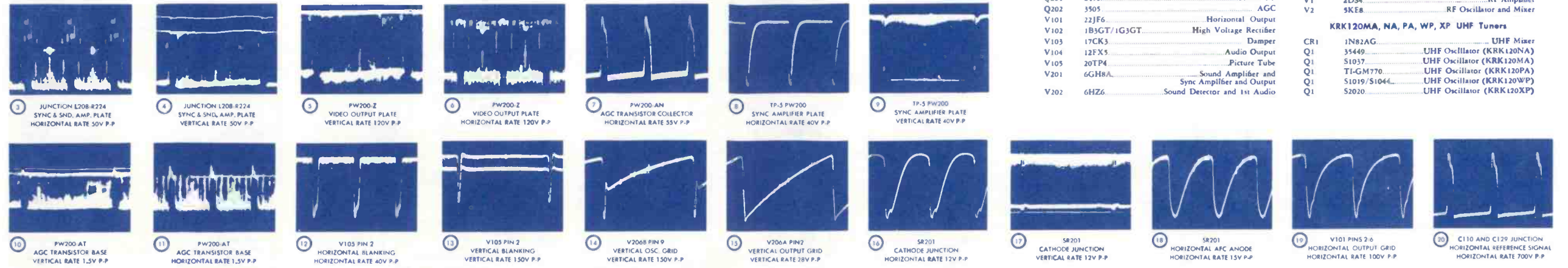
4. BALLOONS 1, 2, ETC. INDICATE WAVE FORM TEST POINTS.

PHILCO-FORD
Color TV Chassis 18QT85/18MT70



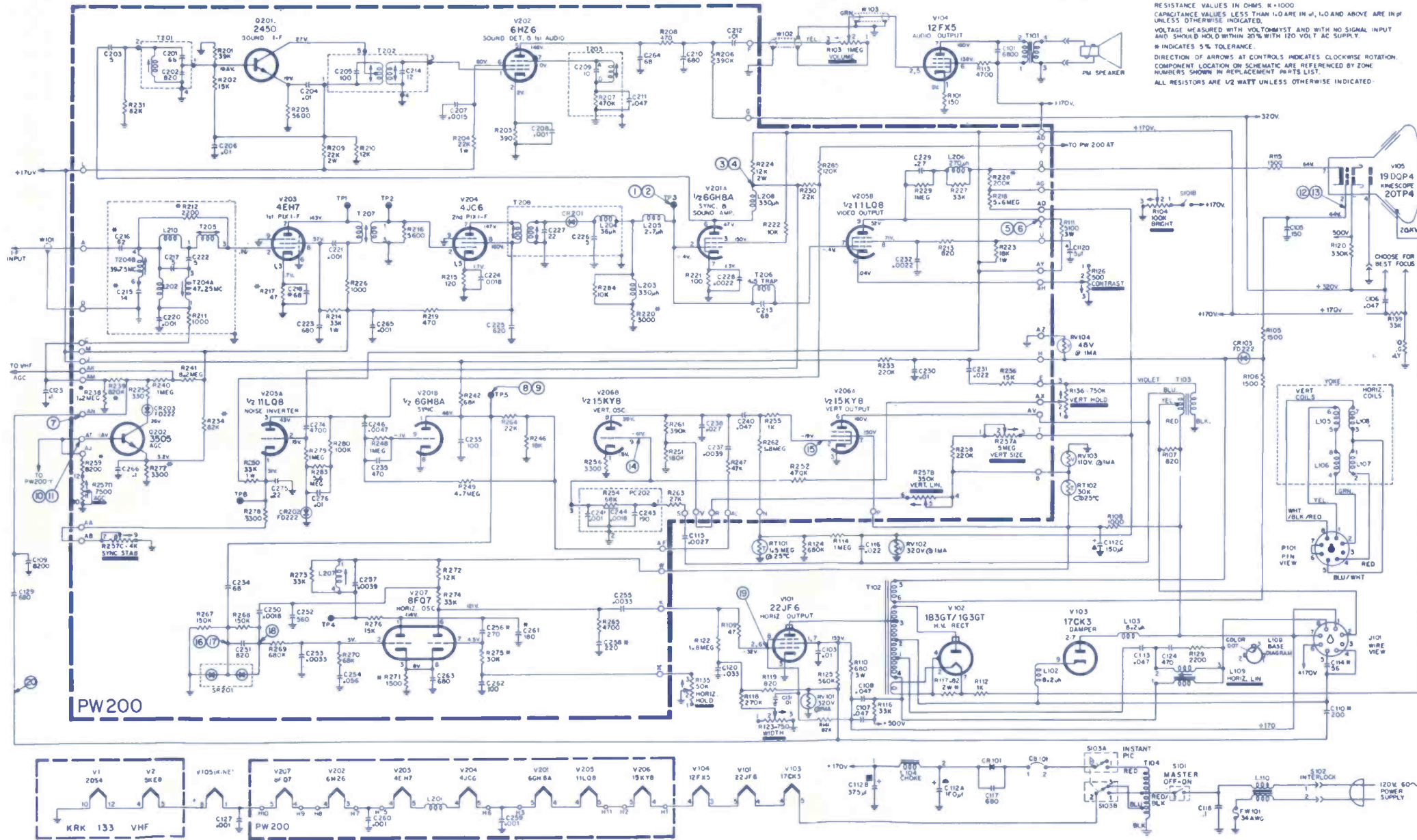
SYMBOL	DESCRIPTION	PHILCO-FORD PART No.
C208	150-200-20-100/350v 8+ filter	30-2601-40
C209	500-500/40v 200-25v 50/350v 8+ filter	30-2601-48
C8200	power ac	42-2136-6
CR36	3.58MHz osc	34-8043-4
D1	1N60C AGC	34-8022-6
D2	1N60D AGC	34-8022-7
D3	1N712 zener	34-8057-9
D200	sel rect focus	34-8053-3
L1	ch 8 beat	32-4645-44
L2	12mh snd reject	32-4762-23
L3	560mh det peak	32-4762-13
L4	RF 40MHz	32-4837-1
L5	RFC 40MHz	32-4837-1
L6	x-former 3rd IF	32-4868-2
L7	IF input	32-4652-66
L8	x-former 4.5MHz trap	32-4869-1
L9	x-former 2nd IF	32-4893-2
L10	x-former 1st IF	32-4893-1
L11	47.25MHz trap	32-4652-78
L12	39.75MHz trap	32-4652-80
L13	1st IF pole	32-4652-79
L14	47.25MHz trap	32-4652-78
L15	variable tun indic	32-4912-1
L36	tint control	32-4645-44
L37	x-former burst amp plate	32-4890-1
L38	1st chroma grid	32-4878-2
L39T	tuner AGC (on tuner)	32-4887-1
L40	x-former 1st chroma plate	32-4888-1
L41	x-former 2nd chroma plate	32-4889-1
L42	x-former 3.58MHz ref	32-4879-3
L44	680mh demod plate	32-4762-14
L49	82mh delay line	32-4762-3
L51	120mh video plate	32-4762-5
L52	270mh video plate	32-4762-9
L100	quad	32-4876-1
L101	x-former snd interstage	32-4745-12
L102	SIF grid	32-4876-3
L103	horiz freq	32-4891-1
L182	R/G vert	32-4881-1
L200	damp	32-4112-62
L201	pincushion	32-4894-1
L202	focus	32-4895-1
L203	13mh delay line choke	32-4838-2
L205	x-former pincushion	32-10049-1
L208	tuning ind	32-4837-2
DL200	delay line	32-4839-2
N36	phase det	30-6055-1
N37	phase det	30-6055-1
N100	vert int	30-6030-14
Q1	TV19 video drive	34-6001-65
Q2	TV17 1st AGC	34-6001-63
Q3	TV18 2nd AGC	34-6001-64
Q4	TV20 3rd IF	34-6000-72
Q5	TV15B 2nd IF	34-6000-70
Q6	TV15A 1st IF	34-6000-69
R48	18K 2w react plate	33-1363-136
R49	15K 2w blanker plate	33-1363-137
R55	15K 3w 1st chroma screen	33-1363-135
R84	6.8K 2w video out plate	33-1363-142
R85	7.5K 5w video out plate	33-3451-1
R95	27K 3w video plate	33-3451-2
R124	4.2K 7w horiz out screen	33-1363-143
R125	6.8K 2w horiz react plate	33-1363-142
R126	15K 2w horiz react cath	33-1363-137
R206	2.5K 160v drop	33-1363-147
R208	66M focus	33-1352-10
RT200	degaussing	33-1376-3
RV100	horiz bias	33-1379-2
RV200	degaussing	33-1379-1
VR1	pincushion clamp	33-1379-3
VR2	750K 41.25MHz trap	33-5613-2
VR3	AGC	33-5613-3
VR36	A-grn drive B-blur drive C-CRT bias	33-5595-19
VR100	A-horiz bias, B-v lin, C-height	33-5627-2
VR101	A-red scrn B-grn scrn C-blue scrn	33-5595-20
VR102	A-color killer B-AGC C-noise inv	33-5627-1
VR180	120Ω left horiz blue	33-5609-10
VR181	60Ω vert blue tilt	33-5609-4
VR182	30Ω vert blue amp	33-5609-3
VR183	120Ω horiz R/G3	33-5609-5
VR184	60Ω vert R/G tilt	33-5609-4
VR185	120Ω vert R/G amp	33-5609-5
VR186	120Ω L horiz R/G 4	33-5609-5
VR187	30Ω V diff tilt	33-5609-3
VR188	150Ω V diff R/G amp	33-5609-6
VR200	6K pincushion amp	33-5623-19
VR201	10Ω vert cent	33-5609-1
VR202A	1.2K tint (omit for 18QT85A)	33-5623-20
VR202	1M val 1.2K tint (18QT85A only)	33-5618-28
VR202	1M val on-off (omit for 18QT85A)	33-5623-26
VR203	1K H hold 100Ω contrast	33-5618-25
VR204	2.5M tone 500Ω bright	33-5618-27
VR205	750K v hold 500Ω color	33-5618-22
A.O.T.	audio output	32-10057-1
F.C.	filter choke	32-10044-1
H.O.T.	horiz output	32-10079-1
P.T.	power	32-10048-1
V.O.T.	vert output	32-10080-1
	chroma assy w/comp	38-10371
	chroma (less comp)	27-11236-3
	defl. & snd (less comp)	27-11237-2
	tuning indicator w/comp (omit for 18MT70B)	38-10240
	tuner UHF (TT152F) (18QT85A only)	76-13827-7
	tuner UHF (TT147)	76-14011-1
	tuner VHF (TT204) (18QT85A only)	76-13962-1
	tuner vhf (TT204A)	76-13962-2
	yoke assy	76-13910-3

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TUBE AND SOLID STATE COMPONENT COMPLEMENT

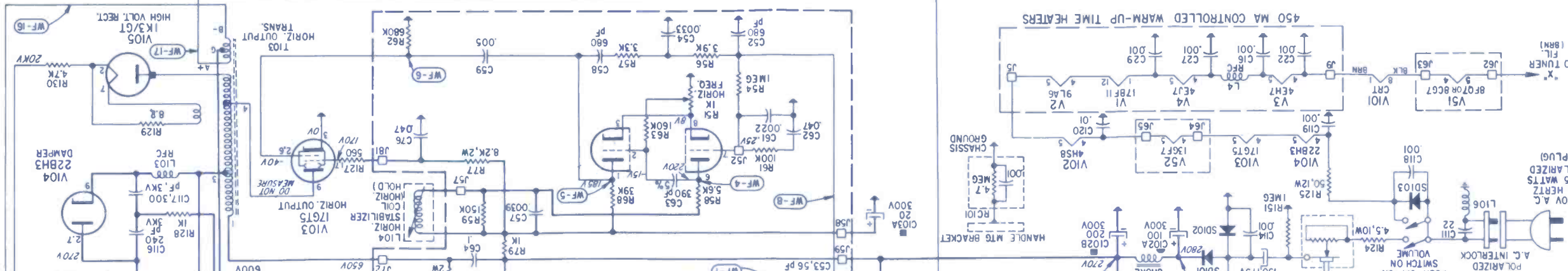
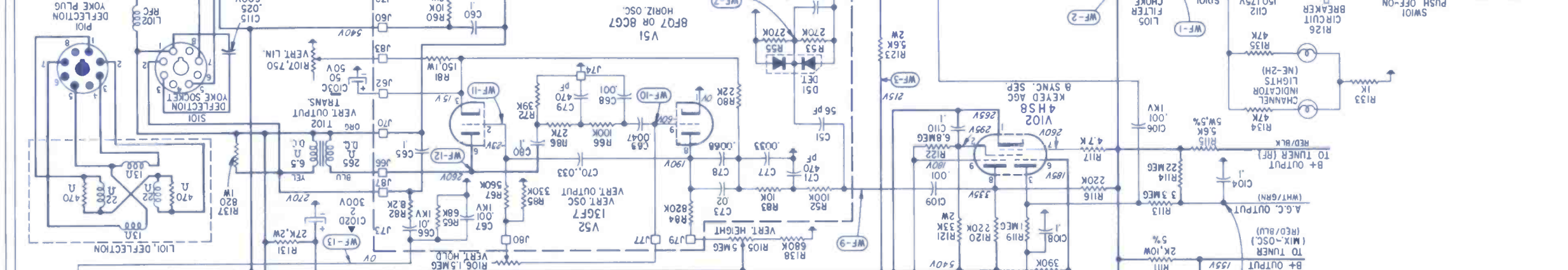
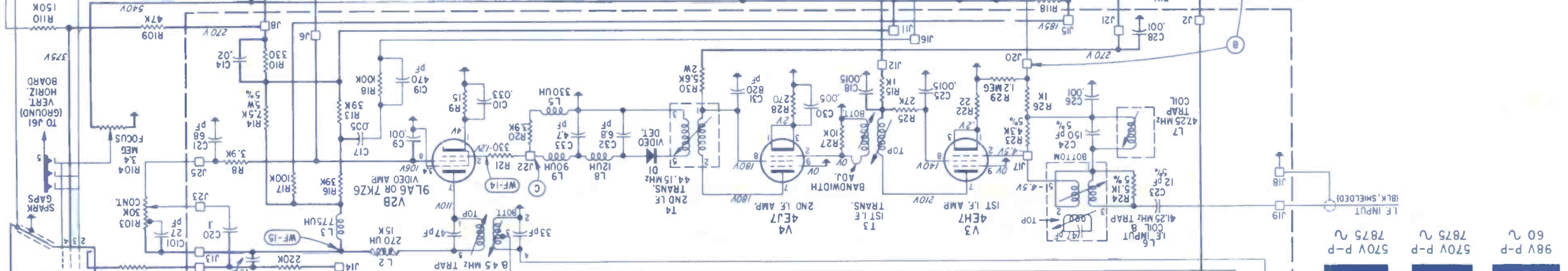
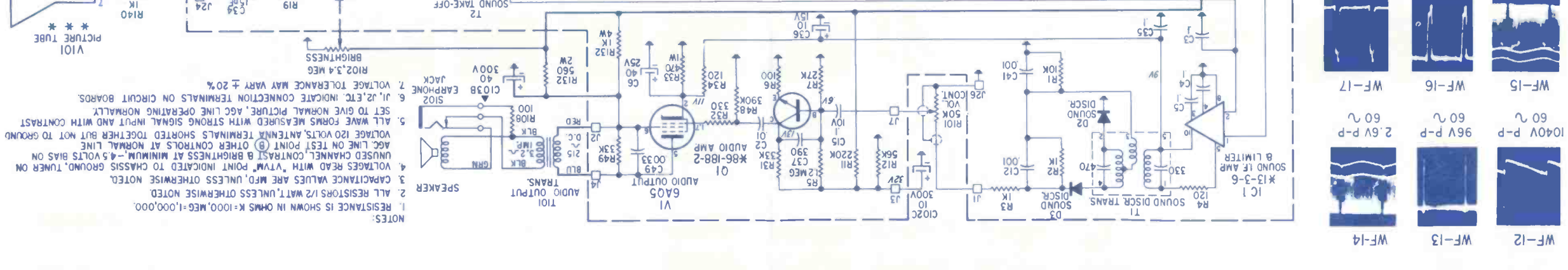
Symbol No.	Type	Function	Symbol No.	Type	Function
KCS158B, C Chassis					
CR101	1N3194	Low Voltage Rectifier	V205	4EH7	1st Picture I-F
CR201	Crystal Diode	Picture 2nd Detector	V204	4JC6	2nd Picture I-F
CR202	FD222	Noise Gate	V205	11LQ8	Video Output and Noise Inverter
CR203	FD222	AGC Blocking	V206	15KY8	Vertical Oscillator and Control
Q201	2450	Sound I-F	KRK133N VHF Tuner		
Q202	3505	AGC	V1	2DS4	RF Amplifier
V101	22JF6	Horizontal Output	V2	5KE8	RF Oscillator and Mixer
V102	1B3GT/1G3GT	High Voltage Rectifier	KRK120MA, NA, PA, WP, XP UHF Tuners		
V103	17CK3	Damper	CR1	1N82AG	UHF Mixer
V104	12FX5	Audio Output	Q1	35449	UHF Oscillator (KRK120NA)
V105	20TP4	Picture Tube	Q1	51037	UHF Oscillator (KRK120MA)
V201	6GH8A	Sound Amplifier and Sync Amplifier and Output	Q1	TI-GM770	UHF Oscillator (KRK120PA)
V202	6HZ6	Sound Detector and 1st Audio	Q1	51019/51044	UHF Oscillator (KRK120WP)
			Q1	52020	UHF Oscillator (KRK120XP)



SYMBOL	DESCRIPTION	RCA VICTOR PART NO.
R123	control width	121773
R126	control contrast	121777
R135	control horiz hold	121778
R136	control vert hold	118504
R257A	control vert size vert lin sinc stob AGC	121774
R257B	control vert size vert lin sinc stob AGC 1	121774
R257C	control vert size vert lin sinc stob AGC 2	121774
R257D	control vert size vert lin sinc stob AGC	121774
	VHF tuner ossy	KRK133N
	UHF tuner ossy	KRK120WP
C110	200pf \pm 5% 4kv ceramic N1500	119193
C112	4 section elect	121781
A	160 μ f 200v	121781
B	375 μ f 200v	121781
C	150 μ f 175v	121781
D	5 μ f 175v	121781
C114	56pf 10% 2kv ceramic N2200	109293
CB101	breaker circuit 1.75 amp	113950
CPR101	circuit printed component	109956
CPR102	circuit printed component	109956
CR202	diode 60v PIV at .200 amp	116052
CR203	diode 60v PIV at .200 amp	116052
FW101	fuse #34 wire	
L102	8.2 μ H	107385
L103	8.2 μ H	107385
L104	filter choke	115426
L109	horiz lin	118712
L110	line choke	115504
L202	AGC	114315
L203	330 μ H	118710
L204	36 μ H	116056
L205	2.7 μ H	107463
L206	270 μ H	115427
L207	horiz freq	114486
PC202	circuit printed component (includes C241, C243, C244, R254)	114916
Q201	transistor snd # (2450)	116079
Q202	transistor AGC (3505)	118713
R110	680 Ω 3w	115628
R111	5100 Ω 3w	113420
R212	2200 Ω \pm 5%	502222
R217	47 Ω \pm 5%	502047
R220	3000 Ω \pm 5%	502230
R224	12K 2w	522312
R271	1500 Ω \pm 5%	502215
R275	30,000 Ω \pm 5%	118716
RT101	thermistor 1.5M at 25°C	118739
RT102	thermistor 30,000 at 25°C	118740
RV101	varistor 320v at 1ma	118742
RV102	varistor 320v at 1ma	118742
RV103	varistor 110v at 1ma	118741
RV104	varistor 48v at 1ma	118506
SR201	diode AFC	109474
T101	audio output	118409
T102	hi voltage	121780
T103	vert output	121783
T104	power	122537
T201	snd takeoff	118744
T202	snd IF	118738
T203	quad	118410
T204A	39.75MHz & 47.25 traps	114313
T204B	39.75MHz & 47.25 traps	114313
T205	1st pix grid	118696
T206	4.5MHz trap	118736
T207	1st pix IF	109158
T208	2nd pix output	121779
RT101	thermistor-temperature compensating 5.0 Ω cold (part of yoke) yoke deflection	118375 122394

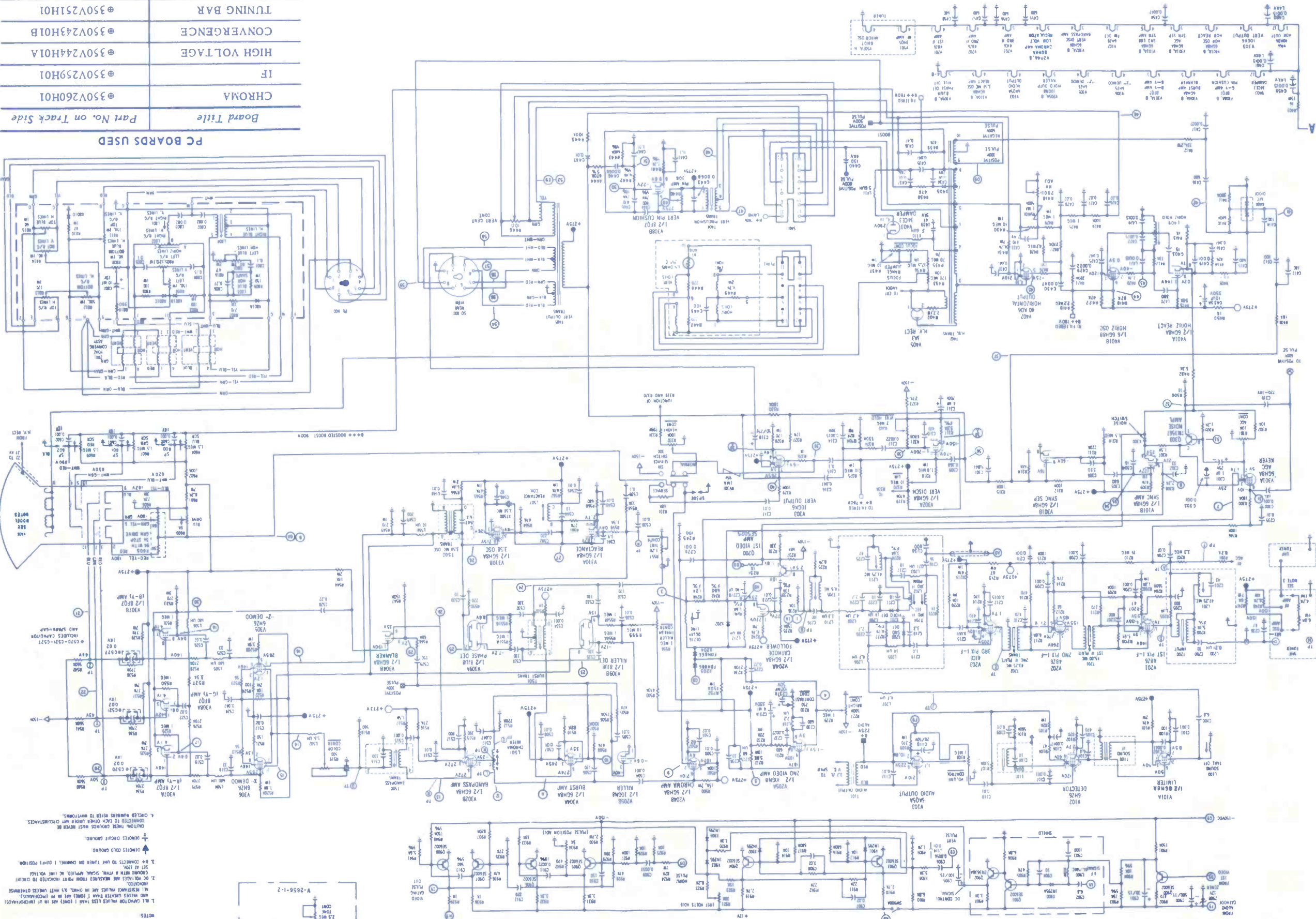
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TEKTRAX
 COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
 AND TECHNICAL INFORMATION FOR 6 NEW SETS

WF-11	WF-10	WF-9	WF-8	WF-7	WF-6	WF-5	WF-4	WF-3	WF-2	WF-1
200V P-P	128V P-P	56V P-P	18V P-P	8V P-P	150V P-P	150V P-P	50V P-P	2V P-P	3V P-P	35V P-P



PC BOARDS USED	Board Title	Part No. on Track Side
	CHROMA	@ 350V260H01
	IF	@ 350V259H01
	HIGH VOLTAGE	@ 350V244H01A
	CONVERGENCE	@ 350V243H01B
	TUNING BAR	@ 350V251H01

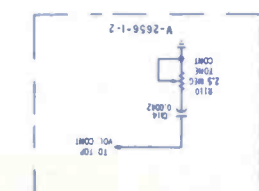
*Part Number used for identification only



WESTINGHOUSE
Color TV Chassis V2656-1-2

NOTES

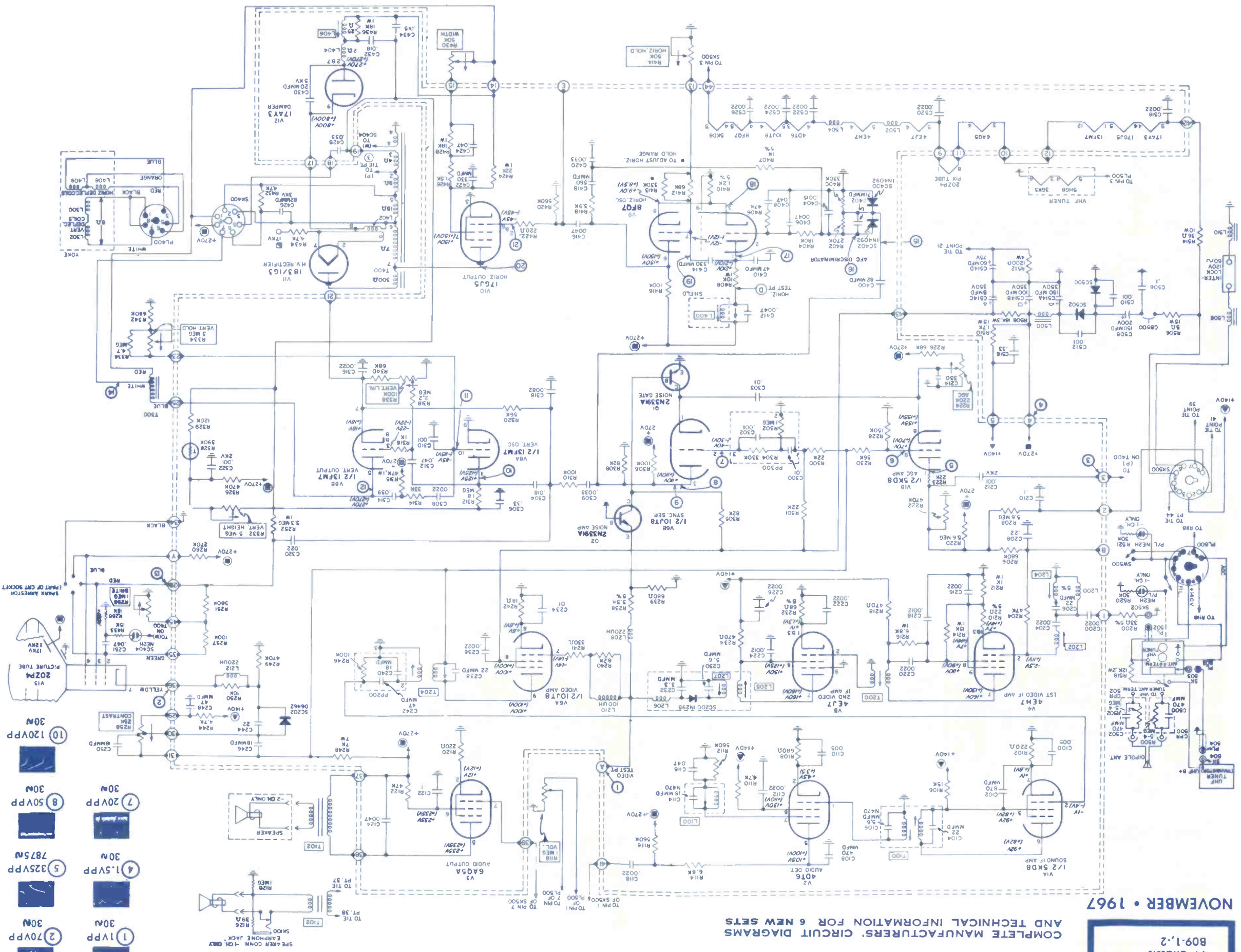
1. ALL CAPACITOR VALUES LESS THAN 1000 P.F. ARE IN MICROFARADS. AND VALUES GREATER THAN 1000 P.F. ARE IN MICROFARADS.
2. DC RESISTANCE AND MEASURED FROM POINT INDICATED TO CENTER OF COMPONENT WITH A VARYING SIGNAL APPLIED. AC LINE VOLTAGE IS 120V.
3. SET AT 100%.
4. * DENOTES COLD GROUND.
5. † DENOTES COLD GROUND.
6. CAUTION: THESE CIRCUITS MUST BE KEPT SHORTED TO GROUND WHEN ADJUSTING.
7. C, CD NUMBERS REFER TO PARTS LISTS.



VIDEO PEAK DETECTOR SLOPE DETECTOR BUFFER PEAK AMP DETECTOR GATE MULTI COMPARATOR NONSTAMP

ELECTRONIC TECHNICIAN

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS



- ① 1VPP 30N
- ② 70VPP 30N
- ③ 475VPP 7875N
- ④ 1.5VPP 30N
- ⑤ 325VPP 7875N
- ⑥ 65VPP 30N
- ⑦ 20VPP 30N
- ⑧ 50VPP 30N
- ⑨ 30VPP 7875N
- ⑩ 120VPP 30N
- ⑪ 300VPP 30N
- ⑫ 520VPP 30N
- ⑬ 85VPP 30N
- ⑭ 80VPP 30N
- ⑮ 10VPP 7875N
- ⑯ 10VPP 7875N
- ⑰ 50VPP 7875N
- ⑱ 38VPP 7875N
- ⑲ 20VPP 7875N
- ⑳ 100VPP 7875N

WAVEFORMS



\$975

EFFECTIVE 8/1/67

GUARANTEED

Nine-seventy-five buys you a complete tuner overhaul—including parts (except tubes or transistors)—and absolutely no hidden charges. All makes, color or black and white. UV combos only \$15.

Guaranteed means a full 12-month warranty against defective workmanship and parts failure due to normal usage. That's 9 months to a year better than others. And it's backed up by the only tuner repair service authorized and supervised by the world's largest tuner manufacturer—Sarkes Tarzian, Inc.

Four conveniently located service centers assure speedy in-and-out service. All tuners thoroughly cleaned, inside and out . . . needed repairs made . . . all channels aligned to factory specs, then rushed back to you. They look—and perform—like new.

Prefer a replacement? Sarkes Tarzian universal replacements are only \$10.45, customized replacements \$18.25. Shipped same day order received. Order custom tuners by TV make, chassis, and model number. Order universal replacement by part number:

Part #	Intermediate Frequency	AF Amp Tube	Osc. Mixer Tube	Heater
MFT-1	41.25 mc Sound 45.75 mc Video	6GK5	6LJ8	Parallel 6.3V
MFT-2	41.25 mc Sound 45.75 mc Video	3GK5	5LJ8	Series 450 MA
MFT-3	41.25 mc Sound 45.75 mc Video	2GK5	5CG8	Series 600 MA

Genuine Sarkes Tarzian universal replacement tuners with Memory Fine Tuning—UHF Plug In for 82-channel sets—Pre-set fine tuning—13-position detent—HI gain—Lo noise—Universal mounting

FOR FASTEST SERVICE, SEND FAULTY TUNER WITH TV MAKE, CHASSIS, AND MODEL NUMBER, TO TUNER SERVICE CENTER NEAREST YOU



TUNER SERVICE CORPORATION FACTORY-SUPERVISED TUNER SERVICE

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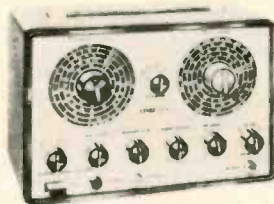
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ELECTRONIC TECHNICIAN

ELECTRONIC TECHNICIAN

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

NOVEMBER 1967 • VOL. 86, NO. 5

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New York, N.Y. 10017
Phone: (212) 686-2200

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43 East Ohio Street
Chicago, Illinois 60611
Phone: (312) 467-0670
Telex: 02-53549

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39 Solving Color 'Blur' and 'Smear' Problems

A color TV bench expert tells you how to eliminate problems which most customers find extremely irritating

44 What's New in 1968 TV Sets

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The concluding article of a two-part series covers this all-solid-state TV receiver circuitry

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The sixteenth article of this series digs into AM, FM radio and TV tuning circuits which use varicap diodes

66 How To Upgrade Your Business in One Easy Step

This article will tell you how to make your service department pay and clear the way for more sales

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How one Texas service-dealer has boosted his sales 35 percent during the past few years by TV and radio station advertising

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COVER

The vectorscope principle is not new. We wrote about it 10 years ago. Our cover this month shows Bob Goodman, electronics technical consultant and author, checking a Zenith color TV receiver with a vectorscope.

TEKFAK • 16 PAGES OF THE LATEST SCHEMATICS • Group 183

CORONADO: TV Model TV2-7310A

PHILCO-FORD: Color TV Chassis 18QT85/18MT70

RCA-VICTOR: TV Chassis KCS 158 Series

SILVERTONE: TV Chassis 528.71120

SYLVANIA: TV Chassis B09-1,-2

WESTINGHOUSE: Color TV Chassis V2656-1-2

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LETTERS

TO THE EDITOR

In Defense

Why does the public unfairly malign TV-radio technicians while at the same time they endure worse gouging from auto mechanics? Buy a copy of "Motor Trend," August 1967 and read the article "The Piece Work Caper" on page 53. I am sure you will come up with some real dandies to help clear the long suf-

fering TV-radio technicians. You will read about mechanics polishing up old "shocks" and charging for new ones — plus the labor rate for installation as well. Can you imagine a technician polishing up a tube and leaving it in as new? A tube might run to \$5 but a set of shocks will go past the \$20 mark and the sad part of this is, it is done with the approval of the management who takes 50 percent of the ill-gotten gains. TV set owners are a queer lot, frankly speaking. They own an electronic entertainment "brain" that costs around \$500 that has hundreds of parts and intricate circuitry. And because they get a bill for a few

bucks more than expected, they shout to high heaven. Yet, they'll buy an automobile costing up to five-grand or more without wincing — a mechanical thing which has been so haphazardly tossed together that frequently it has to be sent back to the shop dozens of times before it operates properly. The owner grins and bears it but doesn't get up on a soap box when the auto mechanics and builders charge him for service. Don't you think it is time for the public to stop pointing their fingers at TV-radio technicians?

EDWARD OTTNEY
Huntingdon, Que., Canada

Knuckle-Saver.



Putting a sleeve on a connection can be frustrating. (If your hand slips, it can also be rough on the knuckles.)

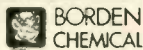
Why not use Krylon Crystal Clear Spray Coating instead?

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Make-Do Chart

Regarding L. M. Jenne's letter concerning a roll chart for a Hickok 550X tube tester. I have a 547A (which is supposed also to be obsolete) but I bought a 600A tester chart and it works out very well. The chart number is "Model 533A-600A-605A". Perhaps he can also get a chart which will work with the 550X. Regarding a phono needle microscope: Olson Electronics of Akron, Ohio, advertises one for \$1.19 — probably made in Japan.

DAMIAN COSTA
Hollywood, Calif.

Edison Still Around

Can anyone let me know where I can find a diamond-disc needle for an Edison phono which plays diamond-disc re-creations at 80rpm?

CECIL K. CARVER
Box 156
Gothenburg, Neb. 69138

Help Coming

Tell Frank Szpiech that I have a Silver Spark Signal Tracer manual that I can send him.

H. A. SYLVESTER
4461A Laclede Ave.
St. Louis, Mo. 63108

Pleased

It's a pleasure to write this letter and say thank you for the fast answer to my previous letter and the help you gave.

EDWIN MENENDEZ INCLAN
Mexico City, Mexico

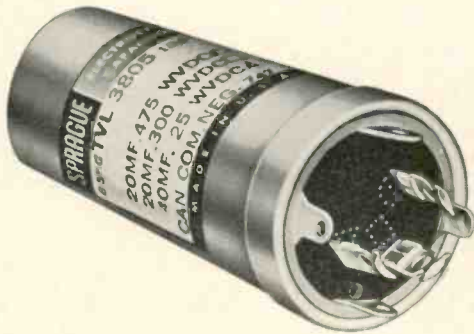
German Radio Info

I have been able to get information on German equipment from Euro Electronics, Inc., 4329 N. Western Ave., Chicago, Ill. 60618.

B. WAUREUCE
Bremerton, Wash.



LET'S FACE IT . . . TWIST-PRONG
CAPACITORS JUST DON'T HAVE
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Some people claim that you can use multi-rating twist-prong capacitors to make replacements "as exact as they need be." Putting it another way, some other people say that you can take "a certain amount of leeway in the matching of ratings and sizes."

BUT — there is nothing exactly like an exact replacement, particularly when working with the exacting requirements of Color TV circuitry.

Yes, you can replace one twist-prong capacitor with another that has a higher voltage rating and everything's OK. That is, everything except the cost. You have to pay for the extra voltage.

True, too: Circuit tolerances may allow you to make successful replacements without matching original ca-

pacitance values exactly. However, if you pick a replacement that's at the high end of the circuit's tolerance, its own manufacturing tolerance may throw it out of the ball park. For example, you pull out a 100 μF @ 350 V unit and figure that the 150 μF capacitor on your shelf is a close enough replacement. But the standard industry tolerance on this part is +50%, -10%. Therefore, it may actually have a capacitance of 225 μF — more than double the value your circuit calls for. And probably will get you called back.

We repeat: There is nothing exactly like an exact replacement.

And . . . we make Twist-Lok Capacitors in 2,365 ratings and sizes so you can make exact replacements.

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**DON'T FORGET TO ASK YOUR CUSTOMERS
"WHAT ELSE NEEDS FIXING?"**



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LETTERS TO THE EDITOR

Reader Problem

I have been a subscriber and follower of ET for many years and have derived much help from its articles and schematics. Now I need more help — in the form of information.

I have Blonder-Tongue UHF antenna boosters to service which use 6DL4 tubes. I have been advised that these tubes are no longer available

from the distributor who sold me the boosters. I've tried, without success, other tube companies also. Is there a substitute you know of (listed or unlisted) — or a company having these tubes of which I do not know of? Thanks.

L. J. BURROW

Fort Difiance, Ariz.

•Our understanding is that the Mullard ET88 is the only replacement for a 6DL4. And we're not even sure about this. ET does not publish a tube replacement guide. The last known address we have had for a Mullard representative was International

Electronics Corp., 81 Spring St., New York, N.Y. That was a couple of years ago — and, as you know, addresses sometimes change quickly in the electronics business — Ed.

Old Tube Source

Note that some readers have difficulty locating some old tubes. I have a good supply on hand. Try me.

G. C. GOODWIN

Rankin, Ill. 60960

A Repeat

I have just read part of ELECTRONIC TECHNICIAN, August issue, and saw my request for a schematic. There is no wonder you didn't recognize it. The manufacturer of the Acrosound 20/20 was misspelled Aerosound. I don't know who made the error, it's possible that it might have been my printing when I originally wrote you with my request for a schematic for that amplifier. I still need the schematic. I also want to inform you that you have me on your mailing list again for another three years. I guess I can't do without you. I do find a lot of good information in your magazine — so I guess we'll be friends for a long time to come. Thank you.

JAMES B. CARTER

Bethesda, Md.

•If anyone has a schematic of this amplifier please let us know. — Ed.

Thanks

I want to thank you and the readers of ET who helped me locate a 35A3 and 35L5 tube which enabled me to repair two sets. I received the tubes and a lot of help from readers. Thanks again to all. ET is a great magazine.

HAROLD KAUTSKY

Latrobe, Pa.

Needs Schematic

Can anyone tell me where I can get a schematic for a Model 730 VTVM/Signal Tracer, made by Coastwise Electronics, 130 N. Baudry Ave., Los Angeles, Calif?

WM K. WHITE

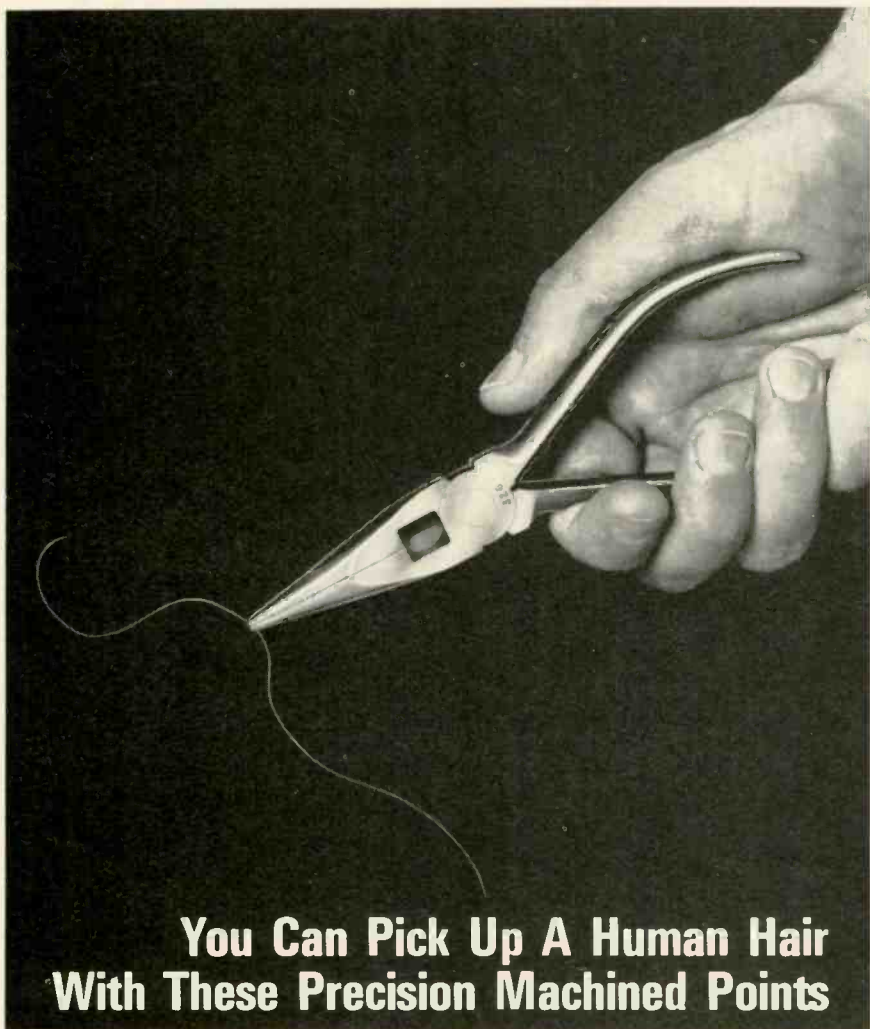
185 Carol Drive
Toms River, N.J.

Needs 6ME5

Can anyone tell me where to obtain a 6ME5 tuning eye (or equivalent) made by Toyo of Japan? It's a 7-pin miniature base.

R. E. NICHOLS

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All measurements are made with a sturdy, wired-in single-unit probe with fully shielded input cable. The probe is quickly adapted to either dc measurement or ac and resistance measurement by a convenient built-in switch. *And an accessory slip-on high-voltage probe is also available to make possible measurements up to 50,000 dc volts.*

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Extra features . . . RCA reliability . . . for only \$66.75*

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Ask to see them at your Authorized RCA Test Equipment Distributor, or write RCA Commercial Engineering Department 46W, 415 South Fifth Street, Harrison, N.J.



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EDITOR'S MEMO

Discounter Squawks

We've heard some sad stories in our lives. But this one isn't really sad at all. For the sentimental, it rates at the top of the list for "pityability." To anyone with a smidgen of humor-appreciating Irish blood in his veins, it's downright humorous, laughable—bellyshaking.

At first, we were alerted to this story by TSA SERVICE NEWS, a publication issued by the King County Television Service Assn., of Seattle, Wash.

Then we looked up the story ourselves. It appeared a few months ago in a trade magazine which apparently goes to not a few "hot-shot" discount operators in the appliance industry who dabble heavily in home-entertainment equipment sales as a major sideline.

At least this story dealt with a discount appliance outfit which reputedly does a \$3 million gross annual business. And, according to the article, this operator sold 2600 color sets last year.

But the operator complains that his service department lost \$130,000 in 1966. Not only that, but this discounter believes, according to the article, that the manufacturers should help out on labor and other costs incidental to selling color TV!

"To hear a discounter complain that he is being mistreated is refreshing," commented TSA SERVICE NEWS.

We read the entire original article but we did not find it refreshing. After the discounter had cut his profit margin close to the point of diminishing returns (and incidentally making life a little more challenging for a few legitimate service-dealers in the surrounding area), he then gives a one-year free service contract on all sets sold. Then he thinks the manufacturer should give him a rebate on sets that have to be serviced during that period!

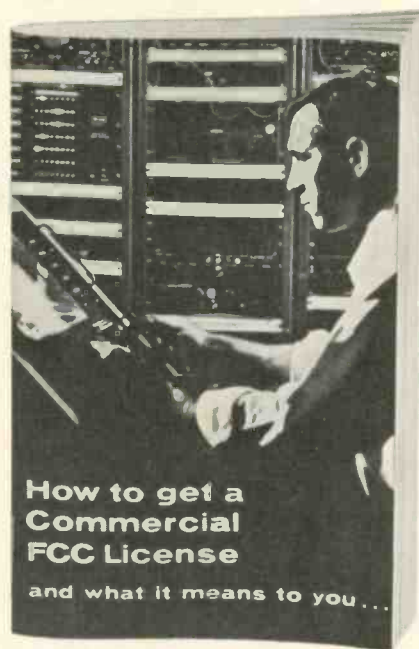
We agree with TSA SERVICE NEWS that no doubt the operator's complaints have some basis in fact, and likewise we cannot help feeling he made the bed he is now lying in and we have absolutely no sympathy for him nor for his type of operation.

And if a single one of the 80,000 service-dealer and technician readers of ET have any doubts about it, let it be made clear now: an operator of this type would find it very difficult to use the pages of ELECTRONIC TECHNICIAN to advertise his self-inflicted woes.

Want a high-pay career in Electronics?

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It tells how to go about getting the key to job success in the growing electronics boom—a Government FCC License



THERE'S A BIG BOOM IN ELECTRONICS. And YOU can be part of it. You don't need a college education or any previous experience in electronics. The free book shown here tells you how.

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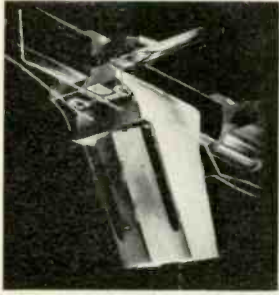
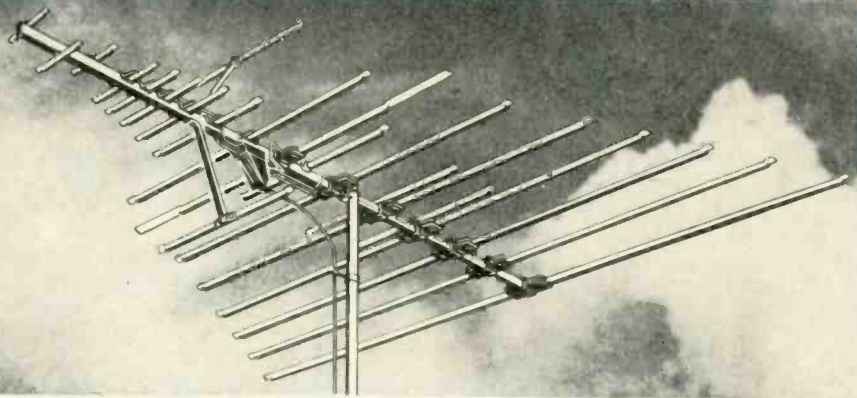
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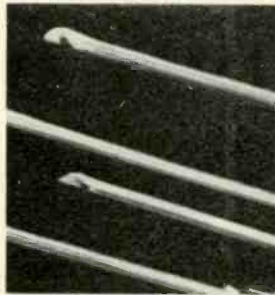
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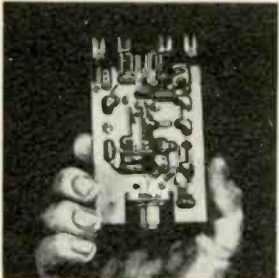
Winegard put these features in to bring the best color out



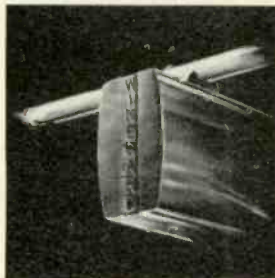
Download and Pre-Amplifier Housing—permanent housing is built into the antenna; provides complete weather-proofing for download connector cartridge or pre-amp cartridge.



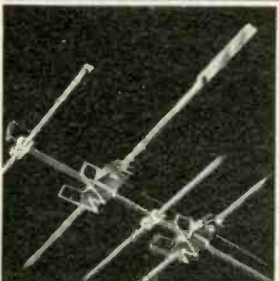
High Tensile Aluminum Elements; with Gold Anodizing—aluminum alloy has PSI rating of 38,000 compared to 27,000 PSI for alloys used in other antennas. More than 49% stronger and 29% more resistant to bend and wind distortion. Elements and boom are gold anodized for the only permanent protection against corrosion and fading.



Solid State Pre-Amplifiers—incorporate revolutionary new silicon overlay transistors, the best performing and most powerful transistors available for antenna use. Drop into pre-amplifier housing at point of signal interception.

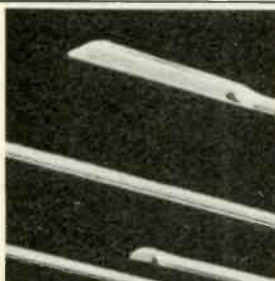


Ellipsoidal Boom—the only aluminum shape engineered especially for antenna use; proved far stronger than any other boom design.

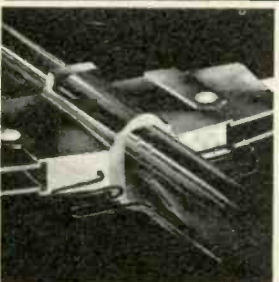


Electro-Lens* Director System—patented system absorbs entire signal and focuses it directly onto driven elements for pinpoint directivity.

*U. S. Patent No. 2700105
Canada No. 511984



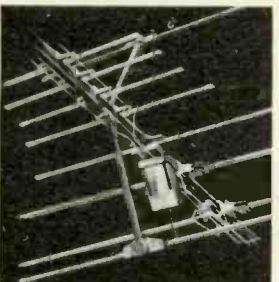
FM Control Element—provide exceptionally high gain on FM bands and provide for the attenuation of FM bands in areas where strong FM signals interfere with tv reception.



Impedance Correlators—patented correlators automatically increase 75 ohm driven elements to 300 ohms to provide 100% signal transfer from antenna to set.



CS-285 Band Separator (with printed circuit)—comes at no additional cost with all 82 channel Super Colortrons to separate UHF and VHF signals. Attaches easily to terminals on back of set.



Vertical Resonant Reflectors—UHF reflectors achieve highest realizable gain on channels 14 to 83 because of exceptionally large vertical capture area; more UHF gain than any other 82-channel design.

Antenna Model No.	Registration Number	00000
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24 Month Antenna Replacement Warranty (2 YEAR)		
See Reverse for Details SAVE FOR YOUR RECORDS		

2-Year Antenna Replacement Warranty—the only antenna in the industry that gives your customer a 2-year replacement privilege.

No wonder so many dealers are selling so many Winegard Super Colortrons so fast.

You're right, that's a lot of features. A lot more than any other antenna ever designed.

But what's really important is what happens when all those features are sandwiched into one super-performing, super-compact antenna.

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First off, you get an antenna so powerful and with such pinpoint directivity (even without solid state pre-amps) that it eliminates ghosts and snow more effectively than anything you've ever seen before.

And when you drop-in an Instant-loading pre-amplifier (there are eight to choose from not counting the color spectrum filter) you've got yourself an antenna that does just about anything you want it to do, just about anywhere—

especially when it comes to color tv.

The solid state pre-amplifiers enable you to instantly increase gain on all channels. They let you custom match the Super Colortron to any reception requirement in seconds, using either 75 ohm coax or 300 ohm downlead—and with all connections completely enclosed and protected against the weather.

You can take your choice. There are ultra high gain, low noise 82-channel UHF-VHF-FM pre-amplifiers... VHF-FM pre-amplifiers... UHF pre-amplifiers... and FM pre-amplifiers. And then there's that color spectrum filter. It shuts out electro-magnetic interference... lets only pure TV signals come through for the clearest color pictures ever.

So you see, there's really a lot to talk about when it comes to Super Colortron

antennas, all 14 models—with 7 patents and patents pending.

And that's why we're doing a lot of talking in Life and Newsweek and Sunset. 17 ads, between now and Christmas, telling more than 60,000,000 prospects exactly how remarkable the "transistorized" Super Colortron is.

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TECHNICAL DIGEST

MAGNAVOX

Radio Chassis R253 Series — Circuit Description

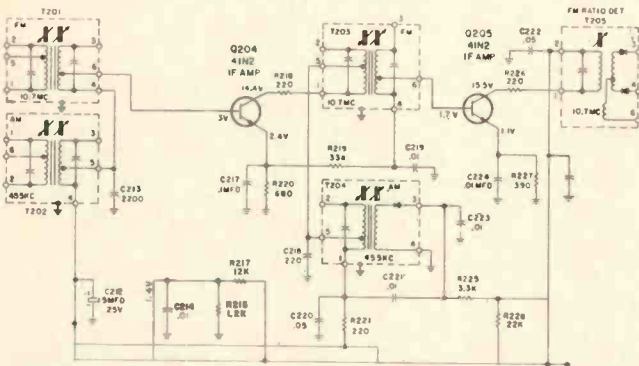
The R253 Series radio chassis is a self-contained AM/FM-stereo radio chassis providing approximately 3.0w of music power output (MPO/EIA) for each channel. These chassis are designed to be used in table model radios and require an external speaker system to reproduce the second channel during FM stereo reception.

These chassis employ 19 transistors 16 of which are contained on two printed boards. The other three are used in the FM tuner section.

The FM tuner is self-contained. The FM/RF amplifier operates in a common-base configuration with a tuned input and output. A diode is used in the collector circuit of the oscillator to provide automatic frequency control (AFC). This FM tuner also contains the two portions of the tuning gang necessary for AM operation. These tuners must always have AGC voltage applied whenever B+ is supplied to the FM tuner.

An untuned RF amplifier and converter stage is used for AM reception. The converter stage uses the conventional Armstrong oscillator circuit. AGC is supplied to the base of the RF amplifier to control the gain of this stage. Also, the collector of this RF amplifier is tied back through the band switch to the base of the IF amplifier transistor (Q204). Thus, any voltage variations appearing on the emitter, because of increase or decrease of signal strength, will change the bias on the IF transistor (Q204) and control the gain of that stage.

The IF circuitry uses three transistors (shown in partial



schematic) during FM operation but only one (Q204) during AM operation.

Q204 is AGC-controlled during AM operation as previously explained. During FM operation the base of this transistor is returned through R442 to ground. On chassis having an AA production code, an AGC voltage is applied to the base of the FM RF amplifier by the diode (D201). On chassis having a BB production code a fixed bias is applied to the base of the FM amplifier.

The IF circuitry employs a conventional AM detector circuit and a balanced FM ratio detector circuit. The AM detector is coupled to the control compensation network by the band switch. When this selector switch is in the AM position, the inputs to the control compensation circuit are connected together.

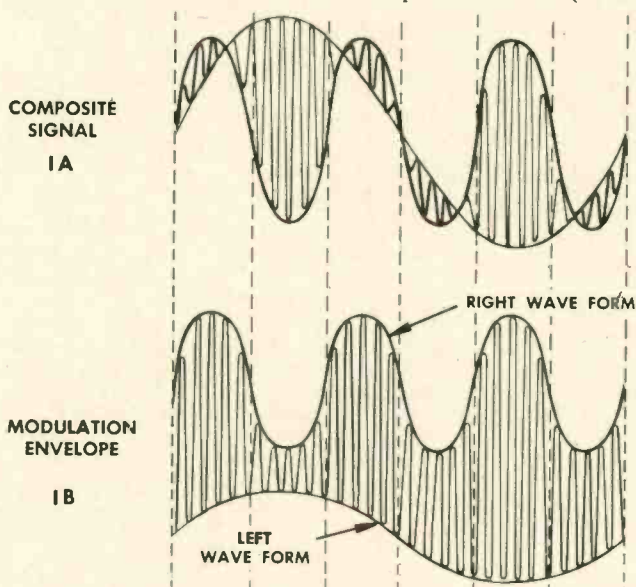
The output from the FM detector is coupled to the composite signal amplifier for additional amplification. If the

selector switch is in the FM or FM AFC position, the signal at the collector of the composite signal amplifier is deemphasized by the RC network (R242 & C242) and applied to the control compensation network through the selector switch. If the selector switch is in the FM stereo position, the signal is applied to the center top of the 38kHz transformer secondary. Since this secondary is not grounded, the signals at the top and bottom will be in phase and the demodulator diodes will demodulate the signal and couple it through the printed pacs to the input of the control compensating network. Normally, however, the unit should never be operated on a monophonic FM signal with the selector switch set to FM stereo since on weak signals the diodes in the demodulator circuit might induce some distortion into the signal.

If the signal being received is an FM stereo signal and the selector switch is in the FM stereo position, the output of the FM detector is coupled to the composite signal amplifier for additional amplification. The detected FM stereo signal, less the 19kHz pilot signal will be applied to the center top of the 38kHz transformer secondary. The 19kHz pilot signal is prevented from being coupled to the center tap of the transformer secondary by the 19kHz trap consisting of L206 and C238.

However, the 19kHz pilot signal still appearing on the collector of the composite signal amplifier is transformer-coupled to the base of the transistor Q207. This signal is amplified and the collector of this stage is tuned to 38kHz and thus the 38kHz signal is reinserted into the FM stereo signal.

The 38kHz sub-carrier sine wave will be 180deg out-of-phase at the top of the secondary of the 38kHz transformer compared with the bottom. This means that opposite phase sub-carrier signals will be applied to the left and right channel demodulator diodes. A complex waveform (shown



here) will be applied to these demodulator diodes. Notice in right waveform the right channel information appearing on the top. This is assuming that the waveform is being viewed at TP202. If the waveform is the opposite

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"As every serviceman knows, major TV repairs represent an increasingly large part of the service business and the average time per repair has increased"...

says Willard Horne of Horne Radio and Television in Evanston, Illinois.

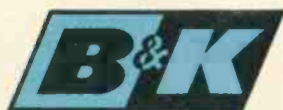
After more than 25 successful years in the service business, twenty of them in the same location, Mr. Horne can be considered an authority on how to keep a business profitable. Mr. Horne says, "In order to be successful, our 3-man shop has to be competitive on the large jobs as well as the small ones. With the increase in bench time that we were experiencing and the limitations on what we could charge, there was a reduction of profit that had to be stopped. Then we bought a B&K Model 1076 Television Analyst."

"Now our customers get the same extra-value service on the big repairs and the small ones," said Mr. Horne. "We use the Television Analyst for troubleshooting a wide variety of complaints, particularly for those that require touch-up align-

ment, location of IF overloads and color convergence. We are more competitive now that we use the B&K Television Analyst because we spend far less time on the jobs that used to be dogs, with benefits both to the shop and our customers."

* B&K Model 1076 Television Analyst checks every stage in a black and white or color TV receiver. Nine VHF RF channels, 20 to 45 MC IF, audio, video, sync, bias voltage and AGC keying pulse are available. The model 1076 provides its own standard test pattern, white dot, white line crosshatch, and color bar pattern slide transparencies. It includes a blank slide which can be used for closed-circuit-TV display floor promotion. Its net price is \$329.95.

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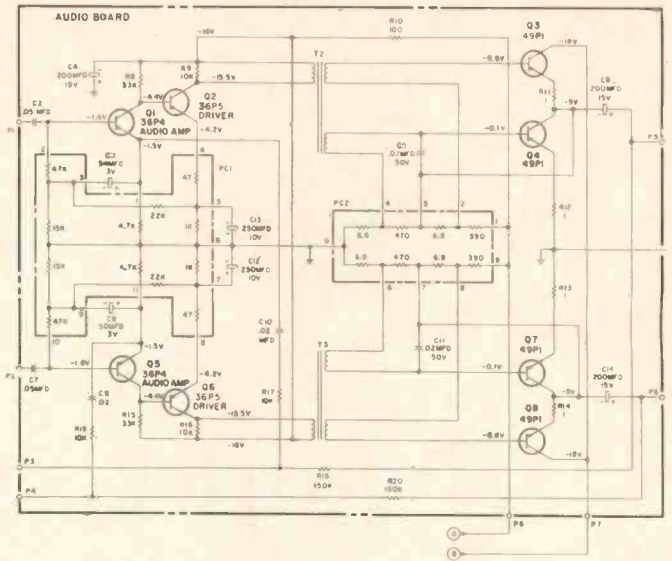
end of the secondary winding, the right channel information would then appear at the bottom.

The demodulator diodes are connected so that one diode in each channel will conduct on the positive half cycle and the other diode in each channel will conduct on the negative half cycle. Any 38kHz which may get through the diodes is filtered out in the FM de-emphasis network in the output of the demodulator circuit.

A portion of the signal available in the emitter of the 19kHz doubler/38kHz amplifier transistor is used to trigger the stereo indicator amplifier transistor (Q208). This transistor is reversed-biased and will only conduct when an FM stereo signal is present. This conduction draws current through the stereo indicator lamp causing it to light.

The output from the demodulator circuits is coupled to the audio compensation network through the selector switch. The output from the loudness control is coupled to the base of the audio amplifier transistor (Q1 and/or Q5) on the audio amplifier board.

The audio amplifier circuitry (shown here) in each channel is designed to match the high impedance of the audio compensation network and also provide amplification of the audio signal. The audio driver transistor is dc coupled to the collector of the audio amplifier. The output of the driver transistor is transformer-coupled to the output transformers in each stage.



The audio output stages are the transformerless type designed to use the speaker voice coil as the load. The voice coil plays an important part in the servicing of the set and speakers should be connected at all times during such servicing. In these output stages the circuit is designed so one transistor in each channel conducts on the positive half cycle and the other transistor conducts on the negative half cycle. Thus a complete cycle of audio information is coupled to each set of speakers by the 200μf capacitor in each output circuit.

The speakers for the left channel information are contained in a separate speaker enclosure. Unless this speaker

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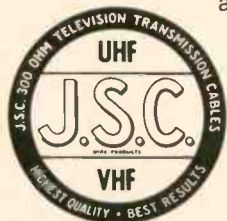
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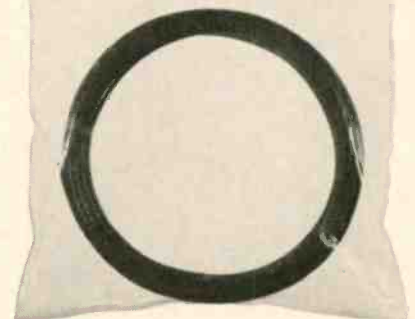
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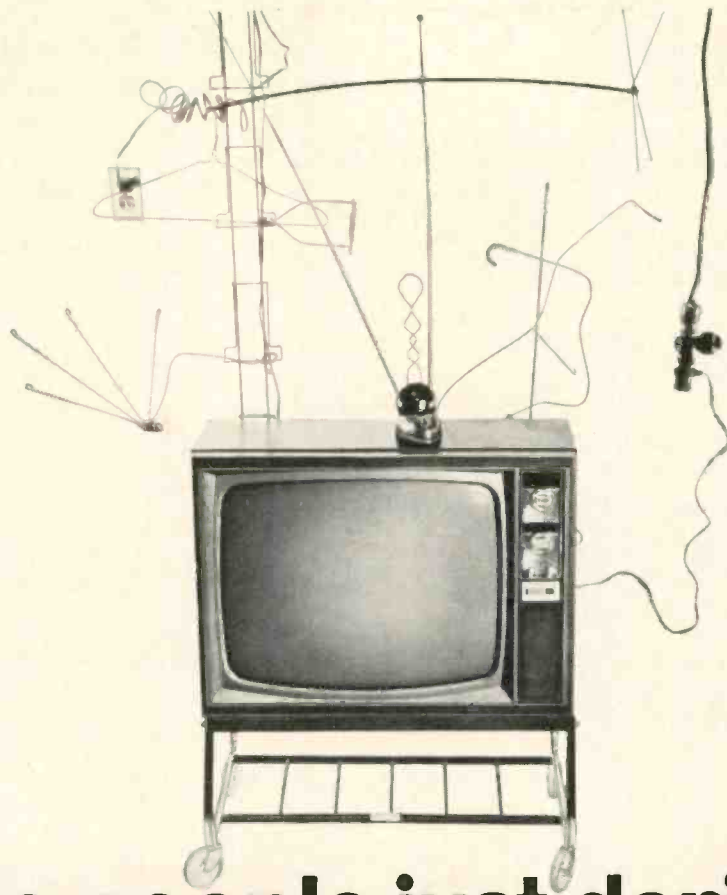
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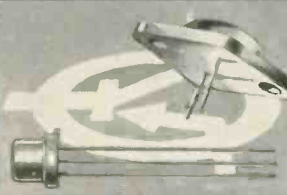
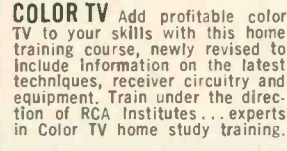
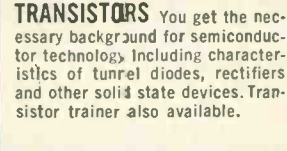


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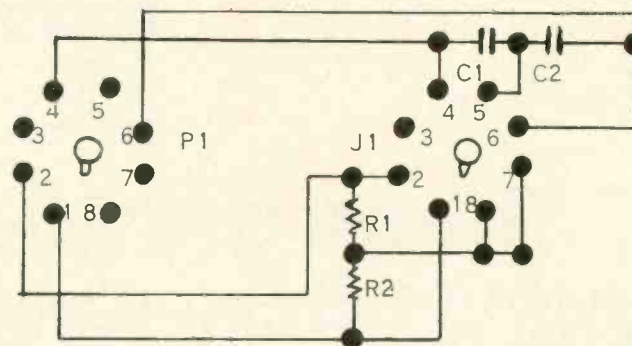
enclosure is connected to the main instrument, FM stereo reception cannot be reproduced.

The power supply for these chassis employs three silicon diodes and a zener diode. The zener regulates the 16v used for the entire RF/IF/Stereo section of the chassis. The -18v is used for the collector voltage in the output stage and the -17v is used to establish the bias voltages in the output transistors as well as power the audio amplifier stages.

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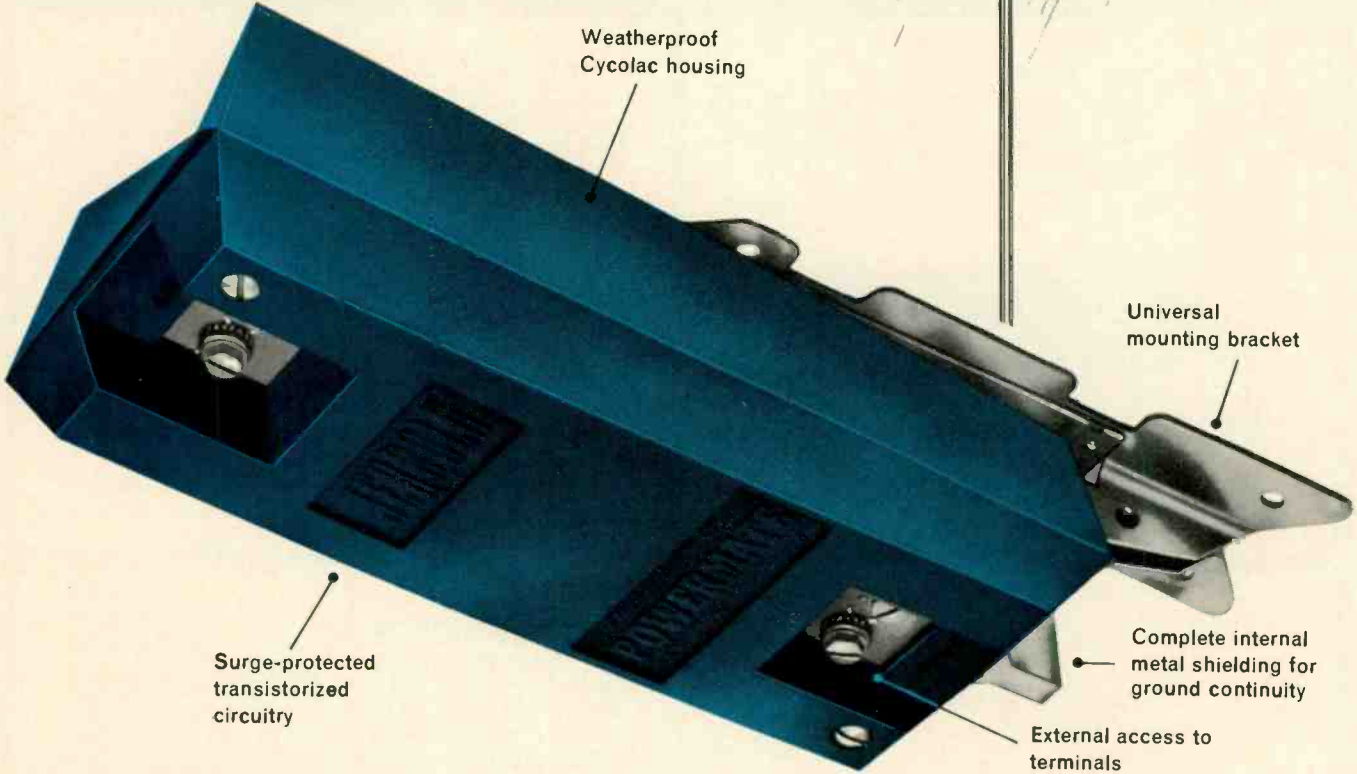
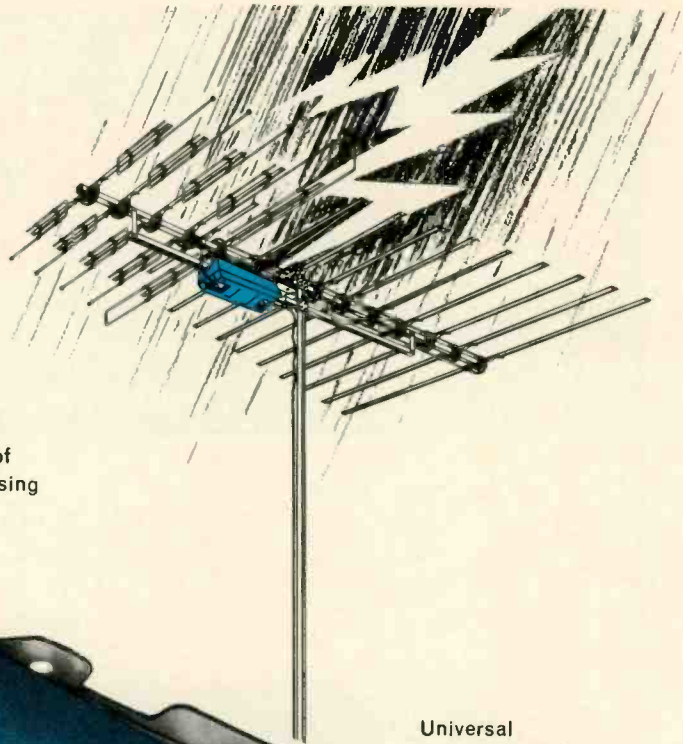


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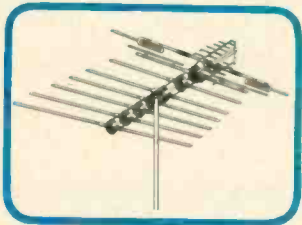
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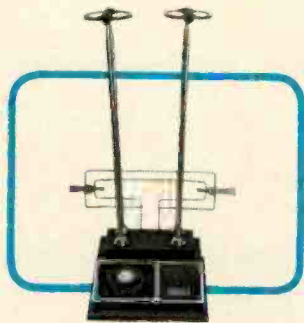
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Solving Color 'Blur' and 'Smear' Problems

How to eliminate one complaint
that customers find highly annoying

■ Most of your customers will probably tell you that nothing is more annoying than "smeared" or "blurred" pictures. And it should be recognized at the beginning, most blurred or smeary pictures affect both B/W and color. So, when you locate the defective component causing color blur — you've also solved the problem for B/W reception.

A smeared picture can be caused by a shorted IF or oscillator tube, shorted CRT, video grid-to-cathode tube leakage, burned video plate resistor, open delay line or open or shorted peaking coils.

Try to isolate the problem back to a given stage — since the problem can originate from CRT back

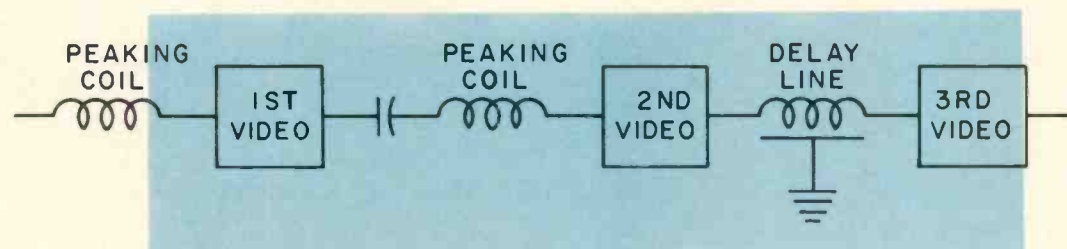
through the tuner. Then make resistance and voltage measurements at this point.

A scope can frequently be used to spot the defective stage. A VTVM is also essential in making correct voltage and resistance measurements. And a video sweep or squarewave generator is helpful for checking the frequency response of video stages. Tube substitution is also a must.

The Video Section

The cause of most smeared TV pictures will be located in the video stages. Today, B/W sets generally have only one video driver stage to drive the CRT cathode. The gain is about 20 — with approximately 50v

Fig. 1 — Block diagram of three-stage video amplifier showing peaking coils and delay line positions.



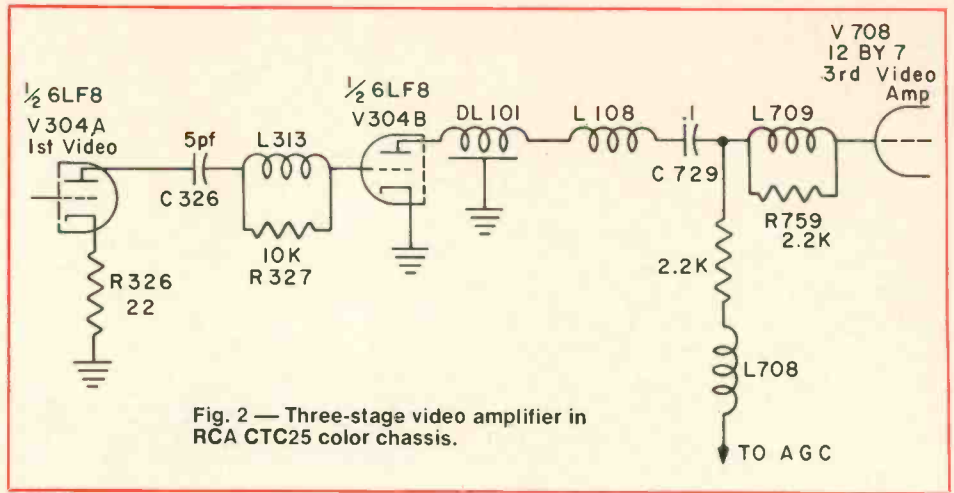


Fig. 3 — Details of 3rd video amplifier and peaking switch circuitry.

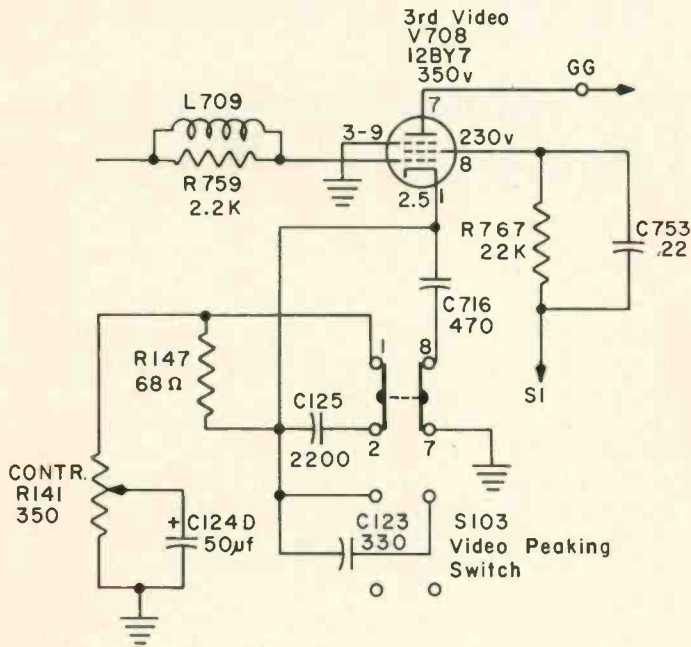


Fig. 4 — Peaking coils in a Sylvania model D-03 chassis. Note the different types. One is wound and enclosed in dipped insulating material. The other is encased in molded plastic and has leads at bottom and top. Some peaking coils have resistors shunted across them with leads protruding at the top.

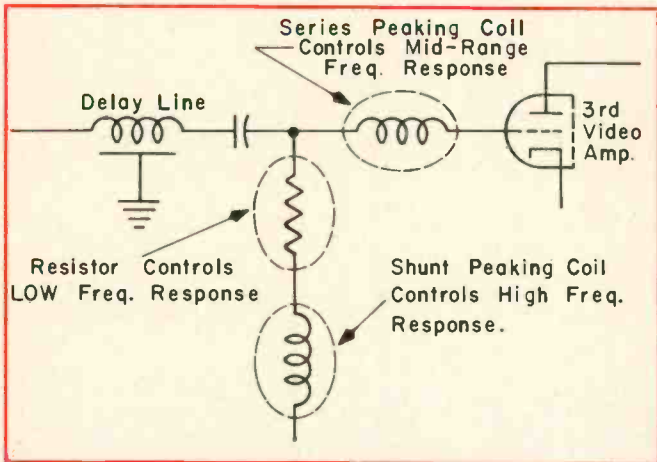


Fig. 5 — Typical schematic showing usual placement of peaking coils.



Fig. 6 — Smeary picture caused by shorted delay line.

drive to the CRT. Because the color CRT has three guns, a greater amount of driving power is necessary to drive a color CRT cathode — usually about 150v. For this reason, color receivers have up to three video amplifier stages (see the block diagram in Fig. 1). Most portable color receivers have only two video amplifiers, however.

The response of a color video amplifier should be from zero to at least 4MHz — and it should be flat across the entire range.

Let's take a quick look at a typical color video section which uses a dual purpose tube. In the RCA CTC25 chassis, for example, a 6LF8 is used as the 1st and 2nd video amplifier. A delay line is coupled between the 2nd and 3rd video amplifier tube — a 12BY7 (see Fig. 2).

Inserted in the cathode circuit of the 12BY7 tube is the contrast control and variable peaking switch. The contrast control bypasses the signal through capacitor C124D and peaking switch, S103, switches resistor and capacitor combinations in the ground circuit to provide maximum high frequency gain. By rotating the video peaking switch, pleasing reception can be found on all stations at any given location (see Fig. 3).

Low/High Frequency Response

A defective screen or cathode bypass and filter capacitor will produce poor low frequency re-

sponse. Also, a decrease of the resistance in the plate load resistor may cause poor low frequency response.

In the color video output stage, the dc component is maintained so no change will occur in color saturation. The video-signal coupling network in color circuits is designed to achieve the desired low frequency response. Direct dc coupling is used from video amplifier to the CRT cathode. Some TV receivers use only partial dc coupling with a large paper capacitor to bypass the low frequencies. A shunted resistor acts as a voltage dividing network.

High frequency response is determined by the plate load resistor and peaking coil in the video amplifier circuit. When lowering the resistance of the plate load resistor, greater high frequency response is established. But by lowering the plate load resistor, we also lower the amplification factor. To help the situation, several peaking coils are installed to extend the high frequency response and produce sharper pictures. The peaking coils may be located in a shunt or series circuit (see Fig. 4).

The smaller the peaking coil inductance, the higher the frequency response. Using a large peaking coil will produce excessive ringing effects in the picture. This appears as artificial "ghosts," or multiple pictures. The TV picture will have white or dark ghosts around the edges of the various elements.

When replacing a defective peaking coil, always replace it with an identical part number (see Fig. 5 for usual peaking coil locations).

The Delay Line

A delay line is included in a color receiver since the chroma signal is delayed by filter action and a similar delay must be made in the luminance channel to permit color and brightness to arrive simultaneously at the CRT. This line is inserted to delay the desired luminance signal.

The delay line is constructed with many turns of small wire on a long dielectric coil form. A tin-foil ground plate is located between coil and dielectric material. This provides a capacitor between coil winding and tin-foil plate which is ground potential. This special constructed coil forms the LC circuit. In most color receivers, the delay line is located between the 2nd and 3rd video amplifier tubes.

Generally, the delay line does not develop too much trouble, but if suspected, check for open or shorted turns. Check the resistance of the coil against the manufacturer's schematic. All RCA delay lines, for example, measure 120Ω. Also check for poor soldered connections around the etched board or mounting lugs. If you suspect the delay line is open, use a single test lead and jump the delay coil. The B/W picture may be fairly good but the color picture will usually be very

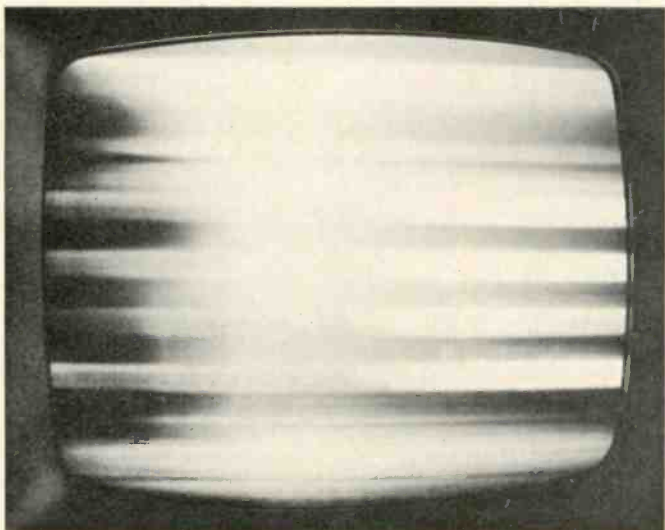


Fig. 7 — Picture caused by open peaking coil.



Fig. 8 — This picture was caused by a shorted 21CG8 CRT in a Packard-Bell color set.

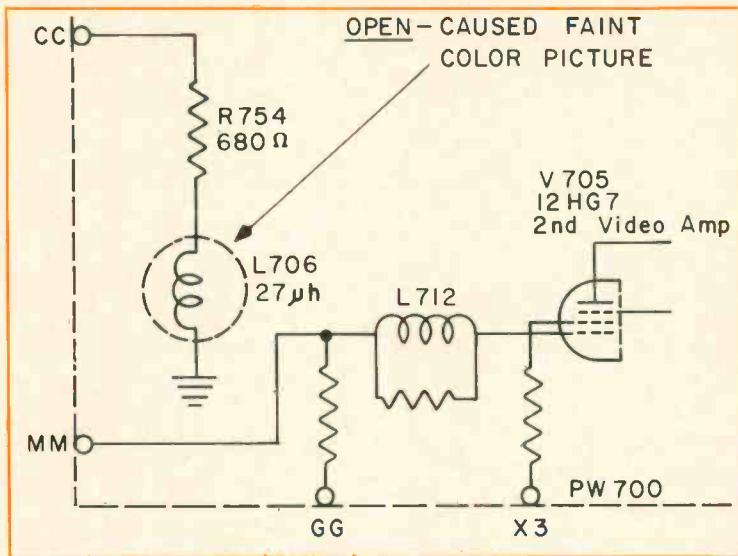


Fig. 9 — An open peaking coil here caused a faint color picture.

Fig. 10 — Lead from peaking coil was broken and became intermittent.

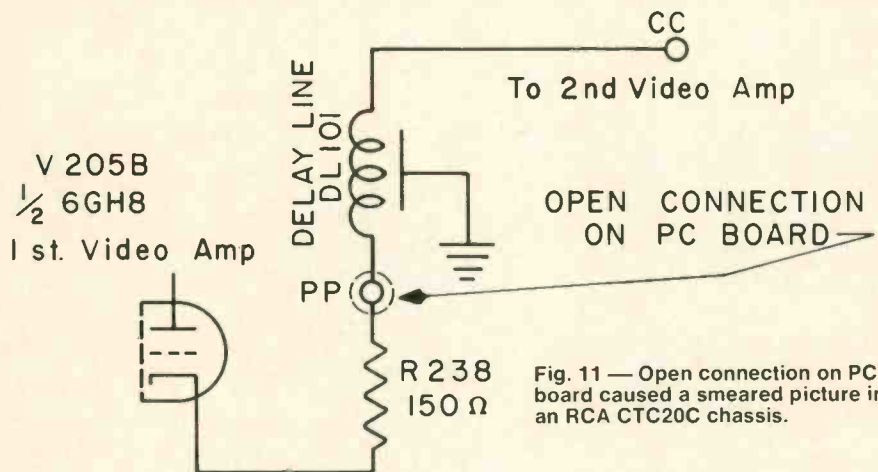
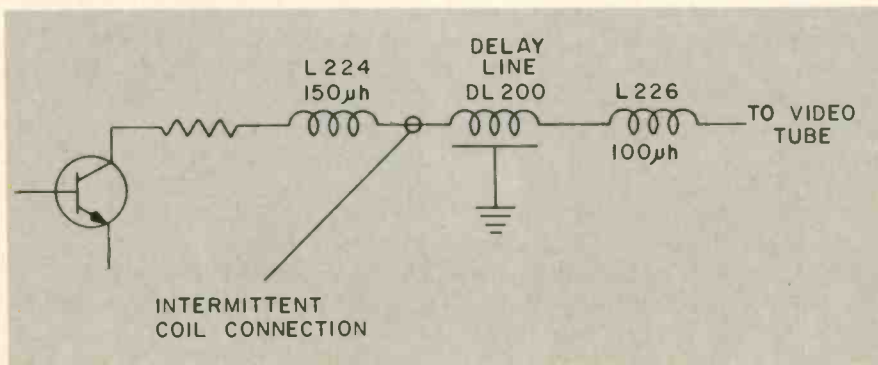


Fig. 11 — Open connection on PC board caused a smeared picture in an RCA CTC20C chassis.

poor when a delay line is open. A shorted delay line will produce a picture like that shown in Fig. 6.

Probable Troubles

When both B/W and color pictures appear as in Fig. 7, go directly to the video amplifier stages and

check for an open peaking coil. Use an ohmmeter to check the resistance of these coils which are located in the grid circuit of the video stages. They can be checked rapidly from the top of the color chassis. All peaking coils should measure under 50 Ω . Defective peaking coils

found in the plate circuit can also be located with a dc voltmeter. Shorted turns or a burned peaking coil will cause a loss of high frequency response. Many times a peaking coil will be found open because of a tight winding and very short connecting wires. When moved or touched, the small wires will frequently snap off.

Check all video tubes for possible short or leakage between grid and cathode elements. The picture will appear with several lines around the various elements and become quite smeary in appearance. A shorted IF oscillator tube can also produce a smeary B/W and color picture.

Open detector or video load resistors will show a smeary picture similar to the open peaking coil. Check all soldered connections around the video circuits. Especially take a second look where video stage components are soldered into the PC board.

Another possible source of blurry pictures may develop in video coupling capacitors. They will dry up and show a low contrast picture. Also, they can produce poor sync, resulting in unstable pictures.

Don't forget to check that color CRT for possible cause of smears in both B/W and color pictures (see Fig. 8). This picture tube was intermittent, caused by loose particles between cathode and grid elements. By tapping the end of the color CRT the picture would return to normal. In this case, the CRT was replaced.

Although the blurred or smeared picture can be caused by other defective components, 90 percent of the trouble is caused by faults in the video section.

Actual Troubles

This peaking coil problem was found in an RCA CTC19 chassis. The raster was very bright and had a faint picture. Besides appearing dim, the picture was distorted and acted like the fine tuning control was way off. With color contrast turned up we had a set of color rainbows.

The customer's complaint was "off-and-on blurry picture." When replacing the 12HG7 video tube, we noticed the picture would come and

go. Or you could push the video tube around, producing the same symptoms. Quickly checking the peaking coils, with the receiver turned off, we found L706 first checked open and then checked good again. One of the coil leads, tied to the hook-up leads, had broken off. The coil was repaired by carefully extending the broken lead wire (see Fig. 9).

Another peaking coil trouble was located in a Sylvania D-06 chassis. Again, the picture was intermittent with smeared color reception. This color receiver was brand new, so we went directly to the peaking coils. We found L224 from the collector of the transistor to the delay line would open intermittently. The peaking coil winding lead was broken off so a new one was installed (see Fig. 10).

We came across another smeared color picture in an RCA CTC20C chassis. All peaking coils were checked and resistances were good. We went to the delay line and this also was perfect. Voltages were checked on all video amplifier tubes and were quite close.

The scope was pressed into action and we started at the grid of the 1st video tube. At the cathode connection, things just didn't add up. We

checked the delay line with the ohmmeter and R238 — the video cathode resistor. Both were good. One thing we didn't try at first was to measure continuity from cathode through the delay line. Sure enough, here was our problem. We found a bad connection at point PP on the etched board (see Fig. 11).

Another trouble gave us a rough time for a while. At least, we spent too much time finding the trouble. The picture was very faint. It seemed definite that sync or AGC trouble existed. The only audio coming from the speaker was an IF "whistle."

This trouble could have originated in the tuner, IF or video section. We finally eliminated the video section, since we had no RF or IF "rush" in the audio output. We started voltage checks in the tuner and the picture plopped in. This was all we could do the first day because the picture remained perfect up to 5 o'clock.

When the bench power switch was thrown, the next morning, the color picture was bad once again. We resumed voltage checks through the IF stages. As the voltage probe touched terminal 2 of V204, the 2nd IF stage, the picture was good

again. Actually, the trouble was directly under the VTVM probe, but we didn't see it.

R225, a 6.8K resistor shunted across the IF coil had a rosin joint. One of the resistor leads soldered directly to terminal 2 bends around and connects to point "D" of the IF coil. This one made a bad connection. The defective joint was right under our nose (see Fig. 12).

We fired up a brand new RCA CTC25 chassis before adjusting the color controls for a color demonstration. The picture came on with "firing" ragged lines. Then out she went. Then we had a tell-tale smell — something was burning.

The TV's back cover was removed and we plugged in the cheater cord. Sure enough, a small wisp of smoke curled up from back of the TV chassis. Removing the chassis, dejectedly, we located the trouble.

One winding of a peaking coil circuit, T106, was burning. Naturally, we didn't have the coil in stock, so we rested the chassis for a couple of days. This always happens when you want to deliver a new color receiver. After the peaking-coupling coil was replaced, we had a new color receiver operating again (see Fig. 13). ■

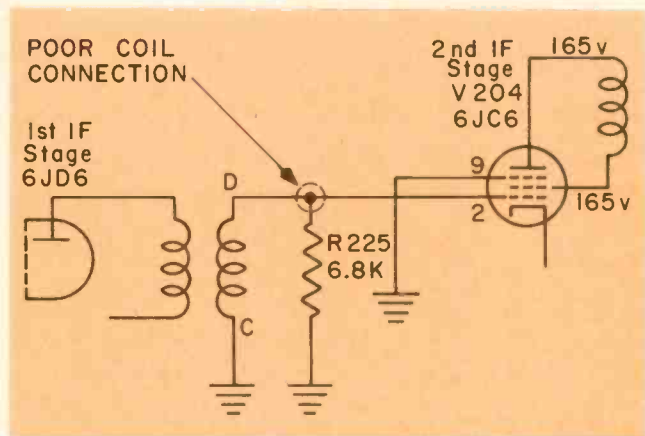
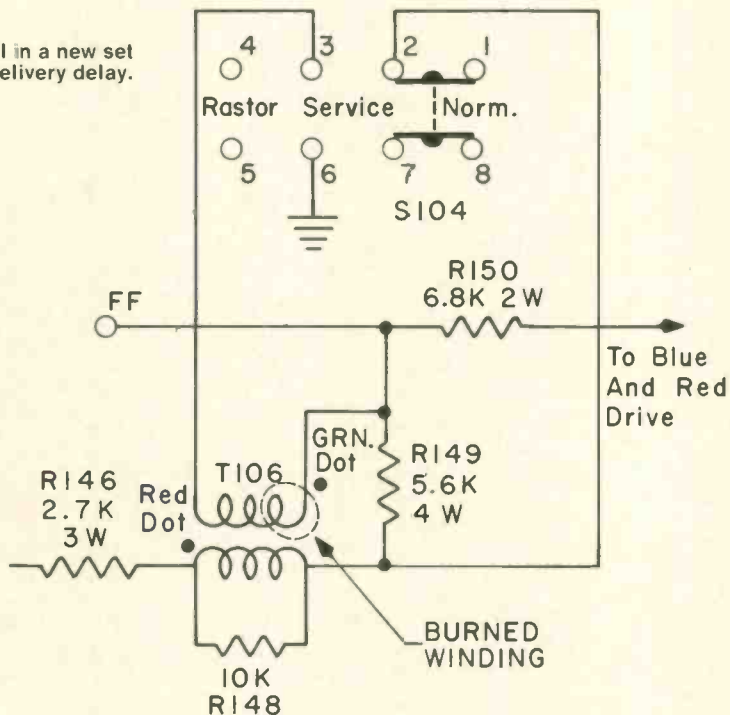


Fig. 12 — 'Rosin joint' caused a poor color picture.

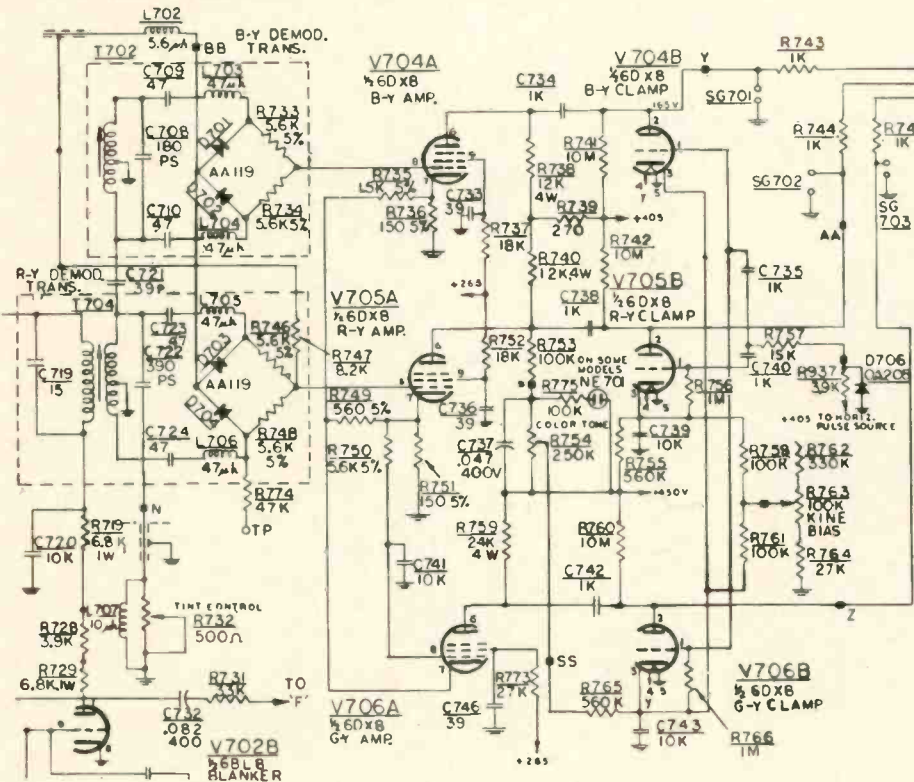
Fig. 13 — Bad peaking coil in a new set caused a delivery delay.



WHAT'S NEW IN 1968 TV SETS

Transistor circuits will soon eliminate 'tube snatchers'

Fig. 1 — Schematic of the chroma circuitry using low-level chroma demodulators and keyed triode clamps for color temperature stability in Electrohome Model C4.



■ After taking a sharp dip in June, color TV sales bounced back to a new high. According to the Electronic Industries Assn. (EIA) color TV sales to distributors by manufacturers reached 155,737 units for a period beginning Aug. 26 and ending Sept. 1. This is the highest figure ever recorded in color TV marketing.

New B/W TV sets for 1968 are getting smaller and employing more solid-state or hybrid chassis — using both tubes and transistors. Most sets today feature “instant play” allowing the sound and picture to come on instantly.

The fully transistorized portable which operates from ac line or a rechargeable pack is becoming popular. Some portable models will feature sun shields making the sets viewable in direct sunlight.

ADMIRAL

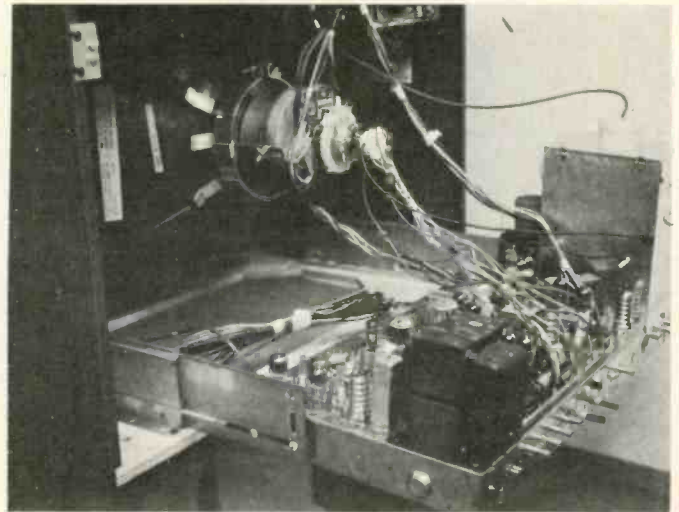
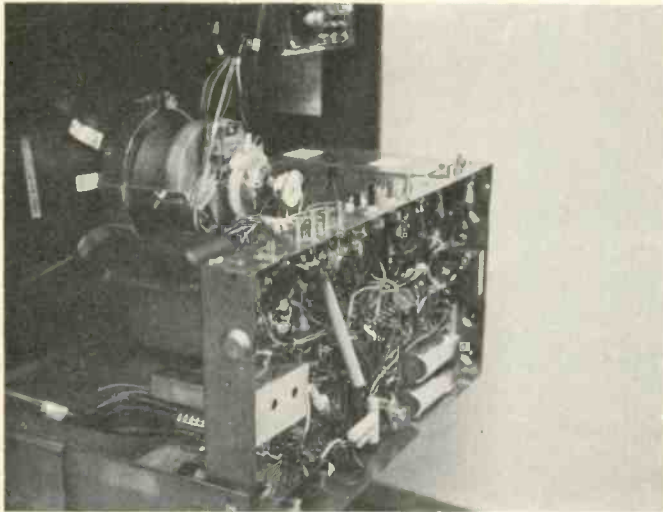
The 1968 B/W hybrid line will include the new H5 and 1H5 TV chassis employing 5 tubes (plus CRT) and 13 transistors. Tubes are used for audio output, vertical and horizontal sections. Other circuits, including the tuners, will employ transistors and diodes.

These chassis have the “instant play” feature allowing audio and picture to come on instantly without waiting for the normal warm-up. This is very practical with a hybrid receiver.

Some portable models will feature a plastic sun shield giving the set additional versatility because TV can now be enjoyed outdoors in bright sunlight. The sun shield snaps on the front of the cabinet and provides improved contrast.

ELECTROHOME

Sixteen color models are offered in 20 and 23in. screen sizes. Features include “insta-vu,” automatic fine tuning which uses integrated circuitry, automatic chroma control and a switched sepia control “Color-tone” that provides customer control of color temperature on color reception, but switches automatically on B/W to a preferred blue/white screen. An interesting circuit feature (shown in partial schematic Fig. 1) employed in the color chassis is the chroma circuitry on the C4



Electrohome's Pivot-Track chassis in different service positions.

model which uses low-level chroma demodulators and keyed triode clamps for color temperature stability.

The B/W receivers employ a patented pivot construction chassis. This pivot construction, first used five years ago, is also used in one of the color chassis (shown here). The "pivot-track" chassis allows complete service access to all tubes and components while the set is operating in its cabinet.

The B/W chassis line consists of an 11 in. all-transistor ac and battery-operated personal portable, a large screen all-transistor B/W receiver, a tube-type large screen B/W receiver and several special purpose units for closed circuit educational and monitor uses.

The B/W tube chassis is hand wired, transformer operated and employs a feedback stabilized horizontal deflection system. The receiver uses a 3-stage frame-grid IF amplifier, keyed AGC and pivot-type chassis. The all-transistor B/W chassis is also transformer powered and both models have regulated power supplies.

MAGNAVOX

The new T924 series color TV chassis has a 90deg deflection color CRT. The chassis features printed wiring construction with "road mapping" on both the top and bottom of the circuit board to aid in identifying components and test points in servicing. The chassis employs 22 tubes.

The filament circuit (shown in Fig. 2) has 18 of the tubes connected in series across the ac line. In addition to the series filament circuit, a separate filament transformer is used for the vertical output, horizontal damper and CRT. To eliminate possible arc-over between filament and cathode of the CRT, this winding is elevated to 140v from a voltage divider connected between the 280v source.

The HV circuit uses a 22KM6 as the output stage, a 6CM3 as a damper and a 3A3 as the HV rectifier. A selenium diode is used as the focus rectifier.

RCA VICTOR

The 1968 B/W TV line will employ several "continuing" chassis including the KCS155, 157, 159, 160, 161, 163, 164 and 165.

A variety of CRT sizes will be employed in various combinations. Diagonal CRT sizes employed will include 8, 15, 18, 19, 20 and 21 in.

The new chassis are the KCS158 and KCS168. These chassis will use a 15 and 19 in. CRT.

A recently introduced chassis, the KCS157, is used in the "Minikin Jr" portable models AJ005 and AJ009 with a viewable picture area of 38sq in. The portable is fully transistorized and operates from a 117vac line or a 12v rechargeable battery pack. The set is small and lightweight (approx. 15 lb) and measures approximately 8½ x 9½ x 10¼ in.

The speaker, ON/OFF VOLUME,

BRIGHTNESS control, UHF and VHF channel selectors and tuning are located on a "pop up" hidden panel. The panel is released by a push button and when closed, a microswitch is actuated by the panel which removes dc power. On ac operation primary power remains on unless the receiver is first switched off by the ON/OFF switch.

Another recently introduced, compact tube-type chassis, the KCS165, is used in models AJ024 and AJ025. This chassis employs 11 tubes, 4 diodes and an 11 in. diagonal picture (71sq in.). The HV supply is 13kv. The filaments are series connected.

This chassis will use two 12-pin dual function tubes, a 33GY7 as horizontal output and damper. The other, a 17BF11, is employed in the sound demodulator and audio output stage.

The composite signal is amplified by a two stage IF section consisting of a 4JD6 1st IF and a 4JC6 2nd IF amplifier. AGC voltage is applied through the 1st IF stage grid circuit.

Picture detection and sound mixing are performed by diode CR201.

The detected picture information from diode CR201 is amplified by the pentode section of an 11KV8. The output from this video stage drives the cathode of the 12CNP4 CRT.

The plate of the video output stage supplies video information for the AGC and sync separator stages. The triode section of the

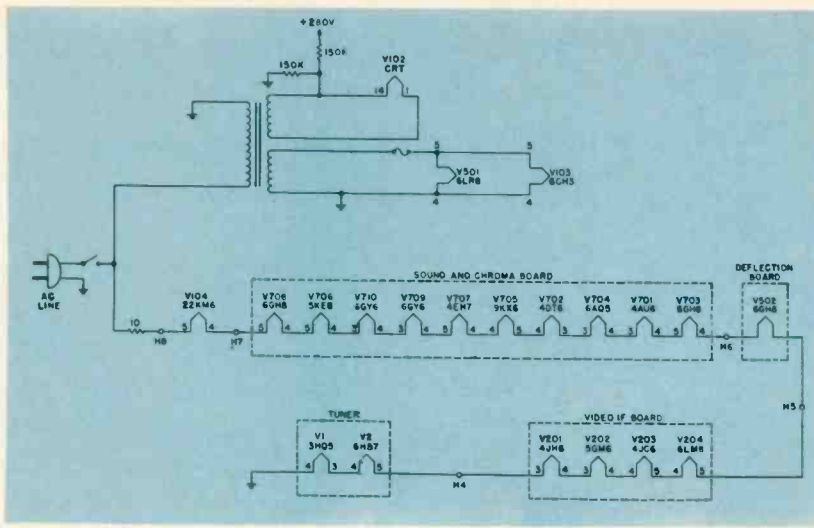


Fig. 2 — Diagram of the filament circuit employed in Magnavox T924 series color chassis.

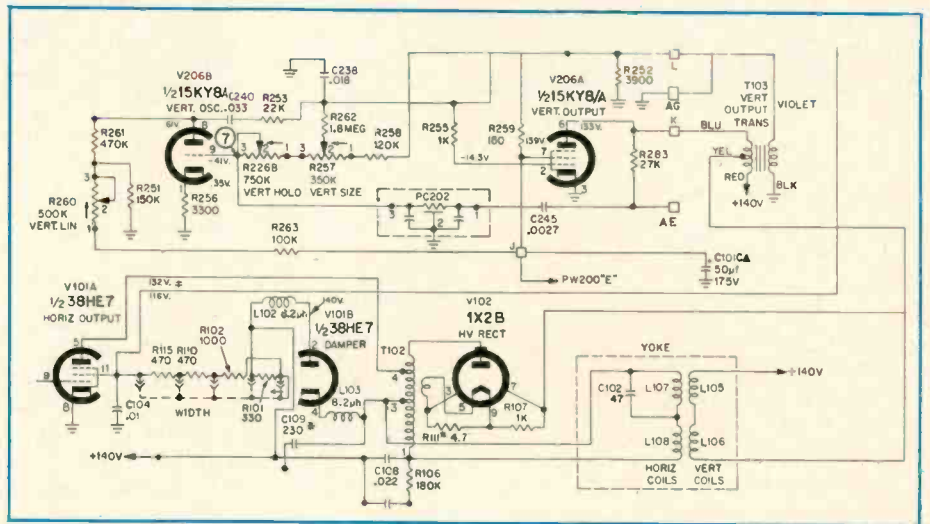


Fig. 3 — Deflection stages and CRT supply networks of RCA Victor KCS168 chassis.

11KV8 is employed as a keyed AGC amplifier, feeding AGC dc voltage to the control grids of the RF amplifier and the 1st IF amplifier.

A 6GH8A triode section acts as a sync separator amplifier stage, supplying sync information to the horizontal and vertical deflection stages.

A 15KY8 is employed as a vertical oscillator/output stage supplying vertical scanning current to the vertical yoke windings.

Horizontal oscillator AFC is performed by the horizontal phase comparator diodes, SR201. The horizontal oscillator is an 8FQ7 duo-triode, operating as a cathode-coupled multivibrator. The output of the phase comparator diodes (coupled to the multivibrator) provides the desired automatic frequency/phase control.

The output of the horizontal oscillator drives the pentode section of a 33GY7 operating as the

horizontal output stage. The diode section of the 33GY7 operates as the damper. A B+ boost supply of 300v provides screen potential for the CRT.

The low voltage supply consists of a half-wave rectifier, CR101, and associated filtering circuitry which provides 145v B+.

The KCS168 chassis is very similar in electrical and physical characteristics to the KCS165. A larger CRT is employed (16CHP4). Electrical differences are found primarily in the deflection stages and CRT supply networks (shown in Fig. 3). Tube differences include a 38HE7, a 12-element tube, employed as a combination horizontal output-damper stage and an 8JV8 serving as a video output/AGC amplifier. The vertical yoke windings are supplied from a tap on the primary of the vertical output transformer. These yoke windings are supplied from the secondary winding in the KCS165.

The KCS158 chassis is similar to the KCS159, but does not employ a power transformer. The two-stage IF circuit employs a 4EH7 and a 4JC6. A 6GH8 pentode section serves as a sync and sound amplifier.

Models using the KCS158 include the AJ153 and AJ157. These models will employ the "Instant Pic" feature as shown in Fig. 4.

ZENITH

The new hybrid 20in. chassis, 8Y4B36, employs 8 tubes and 4 transistors. Three transistors and the detector diode are part of a new solid-state IF strip or module (shown in Fig. 5) that is enclosed in a metal case (sub-chassis) and mounted upright on top of the main chassis. The other parts of the main chassis and VHF tuner have tubes. The tube circuits are quite similar to those of the 14Y26 chassis.

By enclosing the IF section in a

Fig. 4 — Simplified schematic of "instant pic" circuit employed in RCA Victor models AJ153 and AJ157 TV sets.

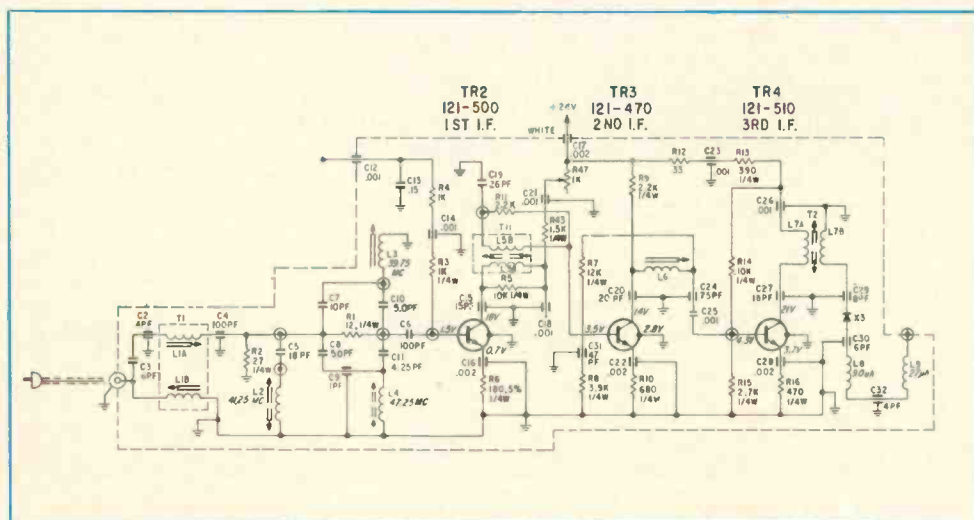
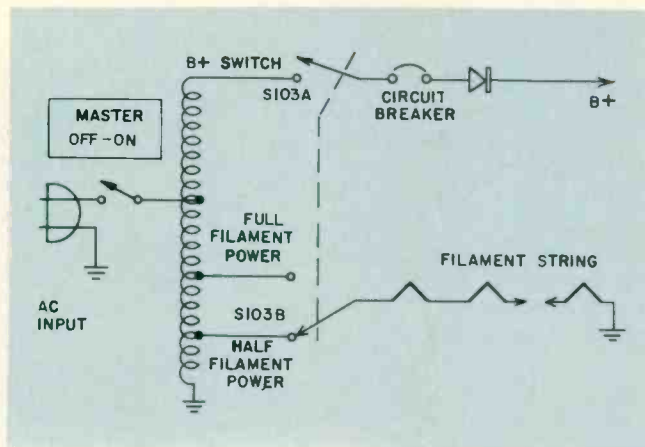


Fig. 5 — Zenith's new solid-state IF strip or module which is enclosed in a metal case.

separate sub-chassis, plus the use of two metal partitions inside, it is said that practically all radiation effects are eliminated.

The electrical connections to the "strip" are made with plug-on leads. The dc supply to the strip is 24v and is taken from the 280v line by using a dropping resistor. The voltage is regulated by a zener diode connected from the 24v line to chassis ground.

The IF strip is designed with an unusual feed-through capacitor-type lead terminal construction providing uniform wiring, parts placement, and also keeps stray wiring capacity to a minimum.

A full set of wave traps is included. Note the 41.25MHz and 47.25-MHz traps have two cores allowing a closer adjustment to the trap frequency, resulting in maximum rejection.

The 1st stage employs "forward" AGC bias. The fixed bias of the 1st IF transistor is set for maximum

gain. Under AGC action, the minimum gain point is held to a particular level to prevent distortion. After this minimum gain point is reached, the VHF tuner is then gain controlled.

A separate IF AGC control, located in the collector circuit of the 1st transistor, is set at the factory to compensate for variations in transistor and circuit gain characteristics.

The 1st IF stage is coupled to the 2nd IF stage by a double-tuned transformer. The 2nd IF stage has been designed for better than average gain for the sound carrier frequencies of weak signals. The 3rd IF stage operates unneutralized to give a maximum, but quite stable gain. The output IF circuit is operated over-coupled by a double-tuned transformer. The over-all gain of the IF module is said to be higher than comparable tube circuitry.

The 1Y21B55 chassis is completely solid-state except for the HV

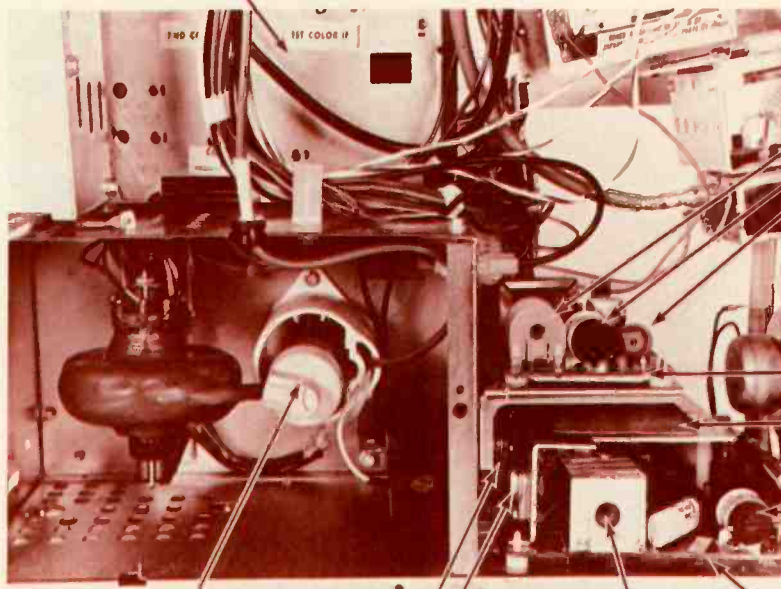
rectifier. The chassis employs 21 transistors and 17 diodes. The HV rectifier tube is type 3BM2. The CRT is a 19in. "squared corner" 20UP4 rimbond type. The deflection angle is 114deg with 20kv being applied to the 2nd anode.

The chassis has a new "molded" sweep transformer designed for use without the usual HV cage. The models using this chassis employ completely transistorized UHF and VHF tuners.

There are two separate sub-chassis, one contains the IF amplifier, detector and video driver. The other includes the 4.5MHz sound IF, the limiter and ratio detector.

This chassis has the "instant on" feature. When the volume control knob is pushed inward then rotated fully to the left, the receiver is completely off. When the knob is turned to the right, the receiver is on stand-by and the CRT (and the pilot light on some models) has a low filament voltage applied.

COLOR PANEL



The color and horizontal deflection sections of Motorola's TS915 chassis.

3BN2
HV RECTIFIER

HORIZONTAL OUTPUT
TRANSISTORS

HORIZ
HOLD

HORIZONTAL
PANEL

HORIZONTAL
PINCUSHION
CORRECTION

TOP
BOTTOM
SIDES

PINCUSHION CORRECTION
PANEL

+80vdc
HORIZ OUTPUT
COLLECTORS

HORIZ
CENTERING

Understand how this solid-state color receiver works

TEKLAB REPORT

A Technician Looks at

■ The first part of this article appeared in the September 1967 issue of *ELECTRONIC TECHNICIAN*. That article covered this set's tuner, video IF amplifier and the video output section.

Some of the important features to be covered here are as follows:

Hue is adjustable independently without altering the color signal, shifting the color oscillator frequency or manipulating color sync — which is said to produce excellent fidelity and stability.

The automatic color control makes color tuning easy and holds color gain constant.

Quick acting solid-state switches provide horizontal and vertical retrace blanking, color killer action and fine tuning indication.

Direct demodulation of the composite color signal provides true color video voltages including brightness information.

The horizontal output panel and the chroma panel, shown here, are two of the ten easy-to-remove panels

contained in this one-of-a-kind color TV set.

The Color IF System

The complete color section is shown in Fig. 1. Two NPN transistor stages represent the color IF amplifier which accepts the color signal, amplifies and presents it to the demodulators where synchronous detection takes place. These two stages are typical bandpass amplifiers tuned to pass only the color signal (3.58MHz) and its sidebands up to ± 500 kHz.

Forward bias for the 2nd color IF amplifier is supplied by the color killer circuit. Absence of forward bias will allow the stage to cut off, prohibiting passage of spurious noise through the system during B/W transmission. Forward bias is manually adjustable by the customer's intensity control enabling individual control of color intensity (saturation).

The automatic color control supplies a reverse bias proportional

to received color signal strength, to control conduction of the 1st IF amplifier stage. A delay diode similar to that used at the tuner allows the color IF to operate at maximum sensitivity for weak signals.

Gated Color Sync and Crystal Amplifier

Color sync is gated through the gated color sync amplifier shown in schematic diagram by the application of a gating pulse applied to the emitter which is timed to arrive coincident with the color sync interval at the base. All other signals are excluded from passing through the gate by insufficient forward bias. The color sync intervals cause a 3.58-MHz crystal to ring, creating a continuous wave color sync signal which is amplified by the NPN crystal output amplifier.

Automatic Color Control (ACC) and Color Killer

A portion of the crystal output amplifier signal (color sync) is

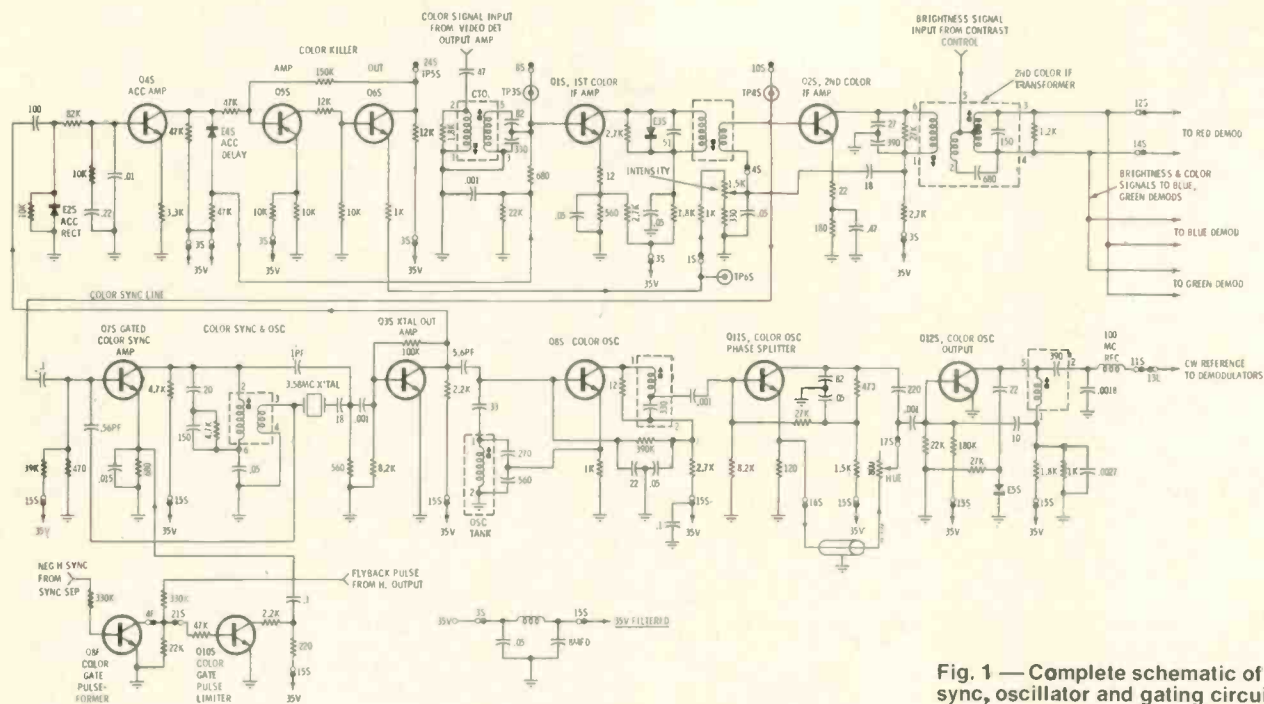


Fig. 1 — Complete schematic of color IF, sync, oscillator and gating circuits.

and you'll be prepared for future developments

Motorola's TS915 Chassis

coupled to the base of an NPN automatic color control amplifier after rectification by a diode. Converted to a positive dc proportional to color sync amplitude, the voltage causes the ACC amplifier to conduct. Also, the negative going collector voltage is applied as an ACC voltage to control the 1st color IF amplifier conduction. Conduction of the color killer amplifier causes its collector voltage to rise. The direct coupled NPN color killer output sees this rise at the preceding collector as an "on" signal and goes into conduction. A feedback resistor couples the drop in color killer output collector voltage back to the color killer amplifier base, causing saturating. This, in turn, is reflected in a high collector voltage which saturates the color killer output unit. This monostable multivibrator arrangement is "on" with color sync or "off" with no color sync. The emitter of the color killer output stage is the forward bias source for the 2nd color IF am-

plifier. Unless the color killer switch conducts, there can be no color demodulation.

Color Oscillator, Phase Splitter and Output Amplifier

Demodulation of color signals requires reinsertion of the carrier which is suppressed at the transmitter. This carrier is generated by a Colpitts oscillator which free-runs during B/W programing.

The oscillator signal is split at the subsequent phase splitter stage to permit adjustment of oscillator signal phase without disturbing the oscillator, color sync or color signal. This adjustment is the familiar hue control which permits proper flesh tone values to be obtained.

The resultant signal is presented to each of three demodulators by an output amplifier which provides isolation, amplification and amplitude limiting of the reinserted carrier.

This portion of the color circuits seems especially interesting.

Q1S and Q2S comprise the color IF amplifier system which is basically a tuned amplifier optimized to handle frequencies 500kHz above and below the color signal of 3.58 MHz accommodating all the sidebands essential to color definition. The amplified color signal is coupled to three demodulators by the 2nd color IF transformer.

A reinserted 3.58MHz CW carrier required to achieve color demodulation is generated by the color oscillator, Q8S. The signal created here is applied to the demodulators after amplification by Q11S and Q12S, the phase splitter and output stages respectively. The phase splitter permits customer control of reference phase while the output amplifier provides isolation between demodulators and the phase splitter. Reference carrier amplitude limiting is provided by diode, E5S.

Synchronization of the locally generated carrier is established by gating a sample of the original suppressed carrier transmitted during

horizontal blanking time after horizontal sync.

A continuous signal is created from these bursts of color sync by a crystal which vibrates continually under the influence of 3.58MHz color sync. The resultant sync signal is applied to the color oscillator as a reference to assure that the oscillator signal is in phase and frequency-locked with the transmitted color sync.

The color IF system is turned on by a "one shot" multivibrator, Q5S and Q6S, which make up the color killer switch.

The ACC amplifier, Q4S, receives rectified color sync, conducting accordingly to provide ACC control of the color IF system gain. The color killer switch is also activated by the ACC amplifier.

Gating signals for Q7S, the gated color sync amplifier, are derived from transmitted horizontal sync pulses. Timing and shaping are provided by Q8F, the color gate pulse-former; and Q11S, the color gate pulse limiter.

Color Demodulators

Three demodulators detect primary red, blue and green color video signals employing a simple dual diode phase comparer circuit for each of the three colors shown in Fig. 2. Two signals are compared in phase at each demodulator. One is the color signal which constantly changes in phase with hues, the other is a reinserted reference carrier. An in-phase condition between these two signals at any given demodulator produces a maximum output voltage in such a polarity as to turn the related CRT gun "on."

An out-of-phase condition of 180deg between the two signals at any given demodulator produces a maximum output voltage of such polarity as to turn the related CRT gun "off." A quadrature condition between the two signals at any given demodulator produces no output which is typical of any phase comparer circuit. Differences that are

not fully "on" or "off" at the related CRT gun are a result of intermediate phase angles between the two signals.

The reinserted carrier phase is established by design and intent directly to demodulate red, blue and green video signals by comparing the phase relationship of the reinserted carrier with the total color signal rather than the individual R-Y, B-Y, G-Y components which make up the color signal. This allows a number of advantages. There is no need for color difference signal amplifiers, no loss of the dc component in color difference channels since these don't exist; and uniform demodulation of composite color video voltages, including brightness information, solves nonlinear matrixing at the CRT.

Horizontal Deflection

Transistorized horizontal sweep circuits are interesting. Compared to tube type circuits, the solid-state version is quite simple (see Fig. 3).

An NPN horizontal oscillator is started from the 35vdc source. The tank coil is adjustable as a hold control. A train of negative rectangular pulses occurs at the oscillator col-

lector and is applied to the PNP predriver base. These pulses are amplified and inverted for presentation to the NPN driver base, causing conduction here also. The driver transformer is arranged so there is no phase inversion of the driving signal. Therefore, when the driver conducts, the output pair does not. Cutting off the driver causes its collector to rise to source voltage. This rise is seen at the output pair as an "on" signal.

Conduction of the output pair causes beam deflection from center screen to right side. At this point, retrace commences and the beams snap back to the left side, the damper starts conducting to provide deflection from the left side of the screen to center, at which time the output pair is turned on again.

Switching transients are suppressed in the output circuit by appropriate filter networks. A pulse limiter diode prevents the output collector pulse from rising beyond a safe value. The retrace pulse is applied to a typical flyback transformer HV rectifier circuit.

High voltage regulation is not required because the solid-state sys-

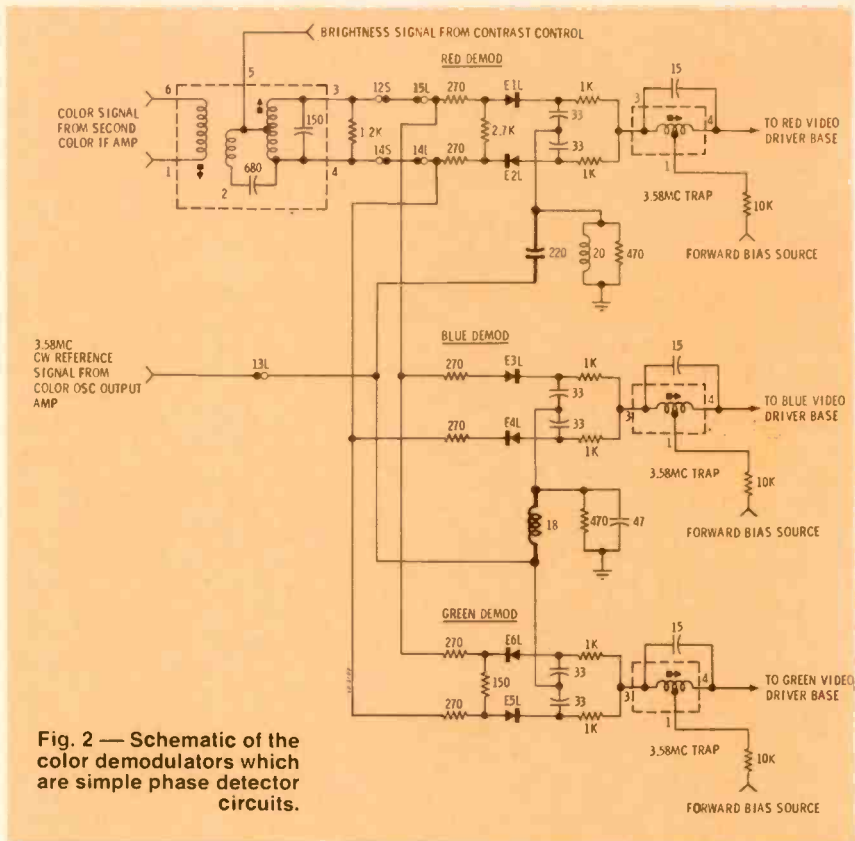


Fig. 2 — Schematic of the color demodulators which are simple phase detector circuits.

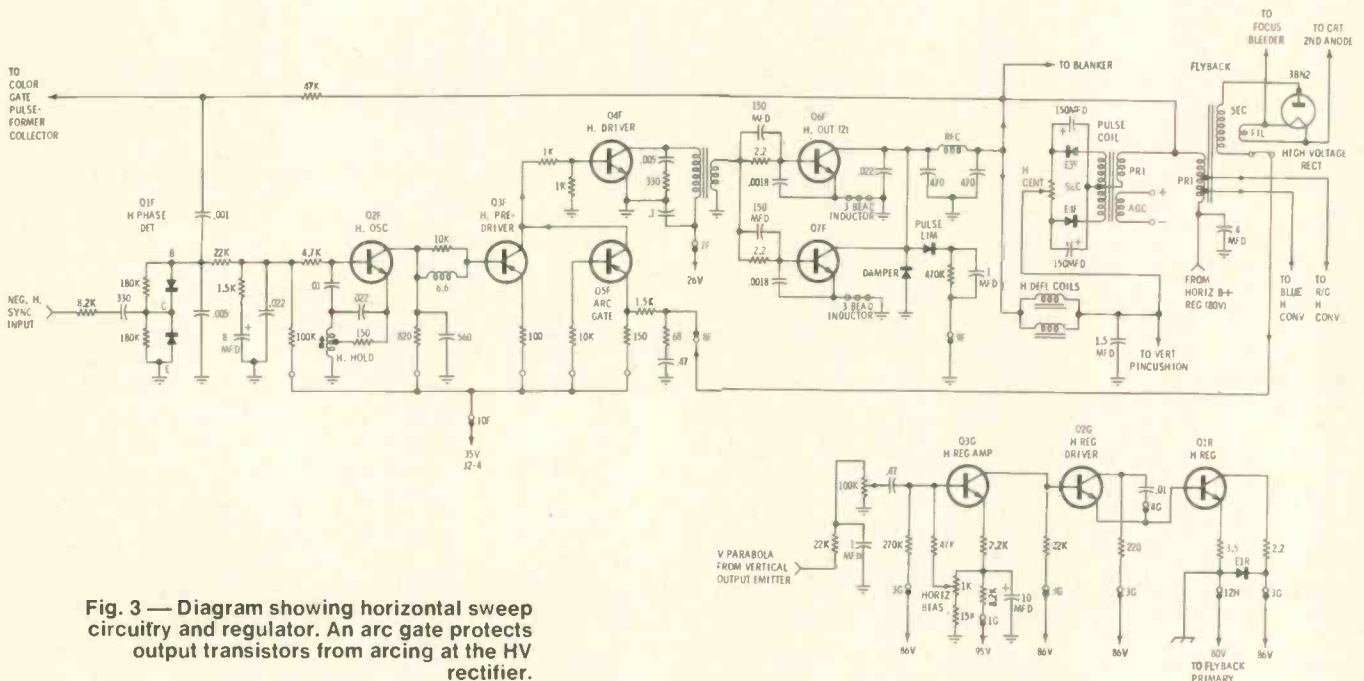


Fig. 3 — Diagram showing horizontal sweep circuitry and regulator. An arc gate protects output transistors from arcing at the HV rectifier.

tem is basically better than the tube system in this regard. Careful design of the flyback transformer permits a decrease in inductance under load. Regulation of the B+ source to the output pair holds high voltage constant.

A combination horizontal pincushion and B+ regulator performs two functions. Horizontal B+ is modulated by a vertical parabola to increase raster width at a vertical rate for side pincushion error correction. Also, while being modulated, B+ is held at an average 80vdc. Any difference between a stiff 95vdc and a variable 86vdc is sensed by the regulator circuit. The horizontal sweep regulator is caused to conduct more with a drop of the 86vdc supply and less with an increase. Consequently, the regulator holds the B+ to the horizontal output pair at 80vdc regardless of the load imposed by the high voltage system.

A phase comparer is used in the AFC system, employing a symmetrical transistor which looks like two diodes connected cathode-to-cathode. Here two signals are compared in phase. One is the negative

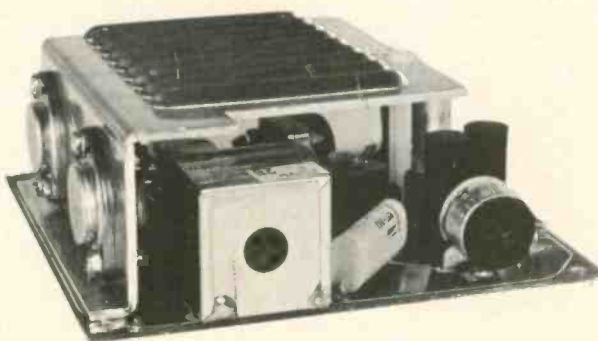
horizontal sync pulse, the other is a reference sawtooth developed at the horizontal output stage. If the reference sawtooth should drift forward or back in time as compared to the fixed sync pulse, correction voltage is developed by the AFC diodes to adjust the oscillator until the reference signal is brought back in phase with sync.

The horizontal output transistors are protected against accidental arc which may occur at the HV rectifier. An arc gate stage conducts only during an arc. As a consequence, the horizontal driver is caused to con-

duct by the arc gate. The output pair is cut-off when this happens.

A horizontal blanking pulse is taken from the collector circuit of the horizontal output pair. The AFC reference signal is also taken from this point.

Horizontal parabolic signals are delivered to the convergence coils from the primary of the flyback transformer. AGC gate pulses come from a pulse coil related to the flyback. Vertical pincushion circuitry receives a horizontal parabola from the low side of the deflection yoke. ■



The plug-in type horizontal panel removed from chassis.

Solid - State Audio

Know your bias and stabilizing circuits and your troubleshooting

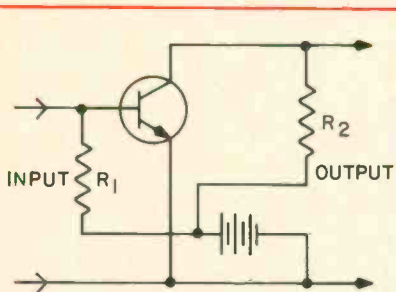


Fig. 1 — Simplified grounded-emitter amplifier circuit with fixed bias.

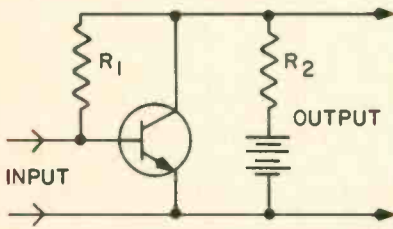


Fig. 2 — Grounded-emitter amplifier circuit with self-bias.

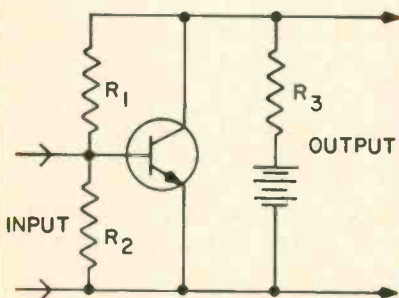


Fig. 3 — Voltage-divider bias network in a grounded-emitter amplifier circuit.

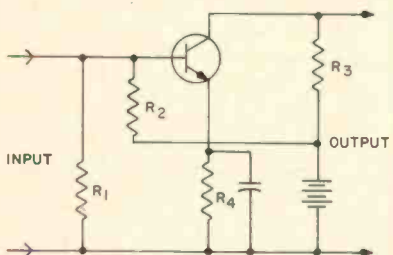


Fig. 4 — This grounded-emitter amplifier has a stabilizing resistor (R4) in the emitter circuit.

■ The first article in this series touched briefly on the three basic transistorized circuits, various audio amplifier operating modes and coupling methods.

Before we can intelligently approach solid-state audio amplifier troubleshooting procedures, however, it is necessary to understand a little more about these circuits — their circuit characteristics and how they function. As previously mentioned, we do not intend to go into this from the designer's viewpoint.

From the troubleshooting viewpoint much time can be saved if we know the basic circuit types, what their biasing arrangements are and how they function when operating properly. We will find out later how they act when circuit faults develop.

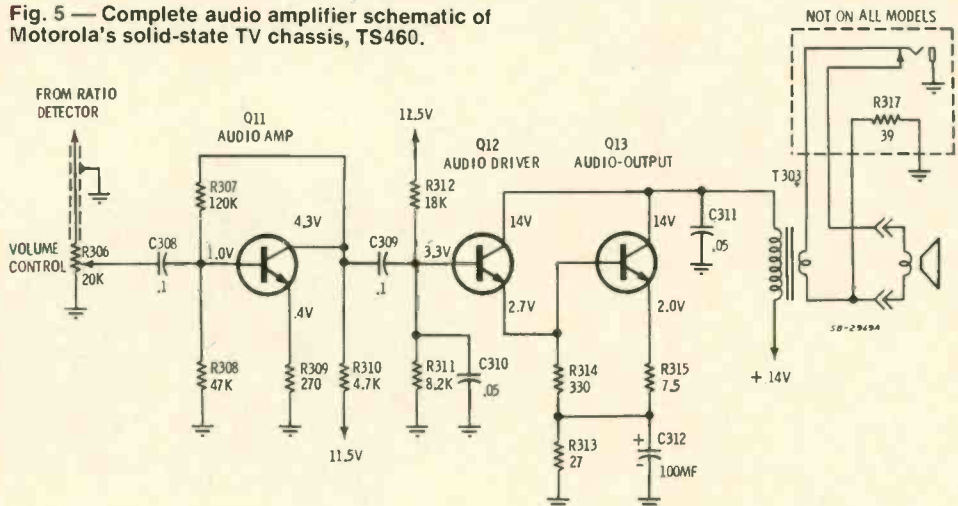
If you observe an experienced bench technician at work with solid-state equipment you will frequently see him make one or two voltage measurements, probably short two elements of a transistor together, check a few bias resistors and quickly isolate the defective

stage — even the defective part or parts — within a matter of minutes. He can do this only because he knows basic solid-state theory, how each basic transistor circuit works, the individual circuit characteristics and how each circuit functions under normal circumstances. Let's review these three circuits briefly.

We are concerned primarily with three basic transistorized circuits as shown in the previous article of this series: the grounded-base, the grounded-emitter and the grounded-collector (emitter-follower or collector-follower) circuits.

We have already learned that the grounded-emitter is the only transistor circuit which inverts the input signal 180deg from input to output. The grounded-base and grounded-collector circuits do not invert the input signal. But we should also be aware of at least a few more distinguishing characteristics of these circuits. This becomes relatively easy because we can, as far as this article is concerned, forget about the grounded-base circuit since it is presently very little used

Fig. 5 — Complete audio amplifier schematic of Motorola's solid-state TV chassis, TS460.



Amplifiers

battles are easily won

except perhaps in special circuits including TV turners and low-frequency audio amplifier applications. We will be concerned here with only the grounded-emitter and grounded-collector circuits. The former is widely used in various types of audio amplifiers. The latter is used essentially in audio amplifier chains as a unity-gain impedance-matching arrangement.

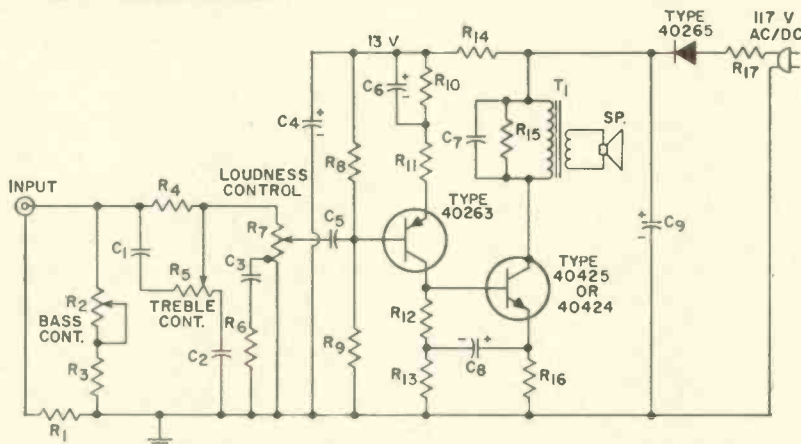
So the experienced technician knows that the grounded-emitter circuit inverts the signal phase 180 deg from input to output. He also remembers that the emitter element of the grounded-emitter circuit is "common" to both the input and output circuits. And it is easy for him to recall that the input (emitter/base) circuit has an input impedance ranging generally from 20 Ω to 5K in audio amplifier circuits and that the output (emitter/collector) circuit has an impedance ranging generally from 50 Ω to 50K. The power gain may be as high as 10k — or up to 40db.

Because he knows that the current flowing in the emitter/base

circuit always controls the current flowing in the collector circuit, our experienced technician knows the meaning of biasing, bias stability — and hence his troubleshooting instincts are sensitive to abnormal bias variations.

He knows at a glance (see Fig. 1) what a "fixed bias" arrangement is in a grounded-emitter circuit. Because of variations in transistors, however, he is aware that critical base-current characteristics and the sensitivity of transistors to temperature changes make this arrangement undesirable. The "self-biasing" arrangement (Fig. 2) is better — except that amplifier gain is reduced somewhat in this case. So, in most well-designed transistor grounded-emitter circuits the two arrangements shown in Fig. 3 and Fig. 4 are better and more often seen in high quality equipment circuits. But our technician is also thoroughly familiar with other bias stabilizing methods used in modern audio amplifiers — including the "split" voltage divider, thermistor and diode stabilizing networks.

Fig. 6 — Phono amplifier uses collector-follower transistor circuit.



Practical Circuits

Although we will "flash back" later and go somewhat deeper into this subject (which will shed considerable light on efficient troubleshooting techniques), it seems appropriate here to move quickly into the practical area of modern solid-state audio amplifier circuits.

A schematic of the complete audio amplifier circuit used in Motorola's solid-state TV chassis, TS460, is shown in Fig. 5. Let's explore the circuit briefly.

We see that the audio signal from the ratio detector output is fed to the volume control and hence, through the 0.1 μ f coupling capacitor, to the base of the 1st audio amplifier, Q11. As we can also see, this is a grounded-emitter circuit. We note that R307 and R308 provide forward bias to the NPN transistor. The emitter resistor, R309, aids in providing bias stability. The output from Q11 is coupled through another 0.1 μ f capacitor to the base of Q12, the second audio amplifier, or audio driver. We also observe that Q12 is connected in a grounded-collector (emitter-follower) circuit. This arrangement provides an impedance match between the high collector impedance of Q11 and the low base-to-emitter impedance of Q13 — the audio output stage.

The audio output from Q12 is taken from the emitter and coupled directly to the base of Q13. Note also that the collector of Q12 is returned to B+ through the audio output transformer, T303. This provides higher gain from the output. Forward bias for Q13 is supplied by the emitter voltage of Q12. Emitter resistors R313 and R315 provide stabilization for Q13.

Troubleshooting problems which may confront you in this circuit will be reviewed in a forthcoming article.

It would seem advisable at this point to pause momentarily for a "change-up." But you should be warned that the change-up is a deliberate attempt to communicate a particular type of information that (1) cautions you not to get "cocky" regarding your knowledge of transistor circuitry and (2) informs you

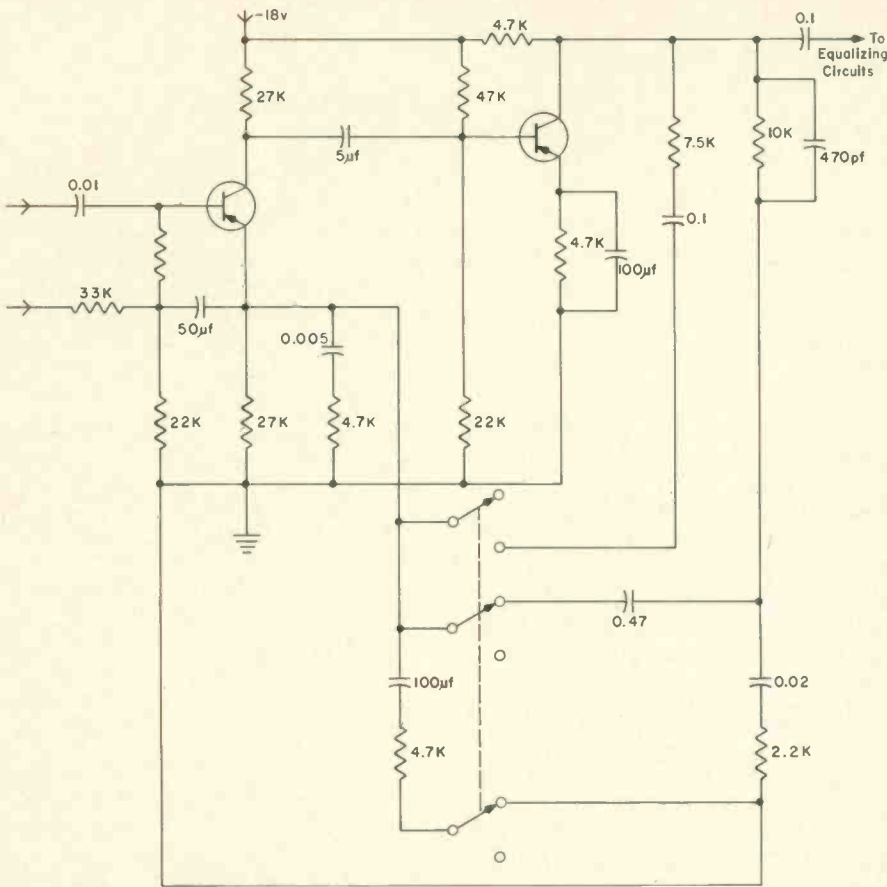


Fig. 7 — Preamplifier employs a "bootstrap" circuit to provide high impedance input.

(contrary to the opinions of some persons) that the design engineers are not all "stark-raving-mad."

And it should also be mentioned here once again that we work and live in a fast-changing world. This pause, in effect, is a "circuit-breaker" designed to prevent your "brain-gain" from approaching the "avalanche breakdown" point.

The circuit shown in Fig. 6 is by courtesy of RCA Electronic Components and Devices. It appears on page 479 of the latest RCA Transistor Manual. We have not had time to breadboard it and check it out. The specifications say that it is useful up to about 1w with approximately 10 percent harmonic distortion. Also, it is said, when running at 50mw output, the harmonic distortion is around 1 percent or less. Note that a PNP and NPN transistor are used. And the driver transistor, a grounded-collector, is operating, not as an emitter-follower, but as a collector-follower!

This is not, admittedly, an amplifier that you will find in \$500 components, but, let's face it, you'll probably be asked to repair one of

them, in a variety of monophonic phono brands, by the middle of next summer — or sooner.

Now, as we promised, let's flash back and pick up a couple of temporarily abandoned threads — biasing and bias stability. A little more attention focused on these two factors is essential if you are to maintain an efficient diagnosing, troubleshooting and repairing stance in the solid-state audio amplifier equipment area.

As previously pointed out, in reference to the fixed bias arrangement shown in Fig. 1, this is not a very desirable grounded-emitter circuit for audio amplifiers and we probably won't be bumping into the arrangement often. And the self-bias circuit shown in Fig. 2 can also be ignored.

Although the circuit shown in Fig. 3 is seldom used except in low-level, inexpensive audio amplifier circuits, we will look at it briefly because it is suitable for the points we need to stress.

Observe that we have a voltage divider composed of R1 and R2. The values of these resistors are critical. Current through the R1/

R2 network establishes base bias. And any change in collector voltage caused by a change in emitter current will alter the base bias. R3, representing the load, is also important in relation to circuit stability.

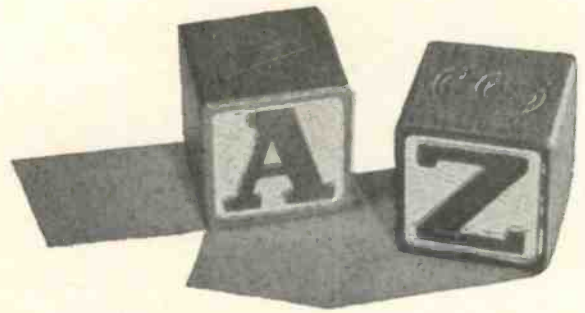
When equipment designers want to avoid low gain, or a reduction in gain caused by the type of circuits shown in Fig. 2 and 3, they turn to the circuit shown in Fig. 4 — or a variation of this circuit. A proper-value resistor (R4) is inserted in the emitter circuit. To avoid emitter degeneration, the resistor is bypassed. And the value of this capacitor (electrolytic) is usually rather large — depending on where the circuit is used in the audio amplifier chain. The value of R2 will usually be from five to ten times greater than the emitter resistor, R4 — depending again on the amplifier type.

Now, let's take a look at one more circuit (see Fig. 6). This arrangement is frequently used as a pre-amplifier stage.

Look first at the 50μf electrolytic capacitor in the grounded-emitter input stage. This is connected in a "bootstrap" circuit. Note the switches also. The over-all frequency response of the preamplifier is shaped by two negative feedback paths and audio amplitudes are equalized between functions. One feedback path is switched into the circuit when the amplifier is being used with a phono input and another is switched in when the amplifier is being used for other purposes.

From the troubleshooting viewpoint, the important thing to consider here is the "bootstrap" concept which uses the 50μf capacitor. We will not go into details regarding the operation of this circuit. It is sufficient to know that the capacitor is used to "boost" the impedance at the input of the first transistor stage by coupling the signal which appears at the emitter back to the junction of the two 22K resistors — effectively reducing the current through the upper resistor. This, in effect, as can be proven by Ohms Law, increases the impedance of the upper resistor from 10 to 25 times.

A forthcoming article will cover a few more specialized circuits and then we will go into various trouble symptoms and circuit faults. ■



Semiconductors from A to Z

New AM, FM and TV tuners require an understanding of varicap diode tuning circuits

The 16th article in a continuing series

■ For several years varicaps have been used in FM tuners to compensate for frequency drift. Until fairly recently the diode's restricted tuning range has limited its general consumer applications to these automatic frequency control (AFC) circuits, although it has had important microwave applications.

In the past some technicians have been able to repair FM receivers without understanding the function of this diode. Their luck, however, is now beginning to run out, and an understanding of this semiconductor is essential if they are to service new electronic circuits effectively.

A thorough understanding of capacitors and coils is required before varicap functions can be comprehended, and to help the reader review or develop these fundamentals last month's article explained the voltage-current relationships that occur in these components. As indicated in Fig. 1, the phase angle of current flowing through capacitor leads (represented by dashed lines) is 90deg ahead of the applied voltage (shown as solid lines).

When a capacitor is connected to a regulated-voltage signal generator (Fig. 2), the current (I) flowing through the capacitor leads is dependent on the capacitor's reactance (X_C),

$$I = \frac{E}{X_C},$$

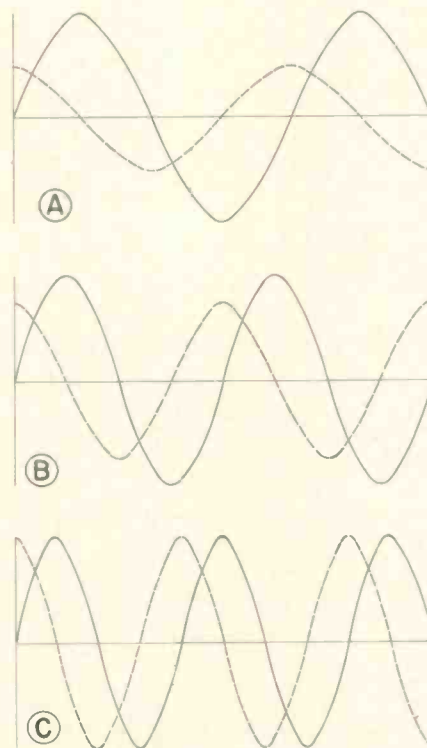


Fig. 1 — The phase angle of current flowing through a capacitor's leads (dashed curves) is 90deg ahead of the applied voltage (solid curves). The current increases as the frequency of the applied voltage increases from a lower (A) to an intermediate (B) to a higher (C) frequency.

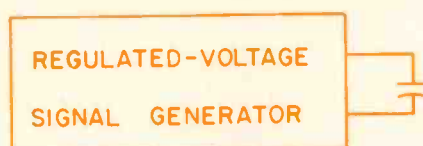


Fig. 2 — A capacitor is connected to the output of a regulated-voltage signal generator.

which in turn is dependent on the frequency (f) of the applied voltage

$$X_C = \frac{1}{2\pi fC}.$$

In Fig. 1 we see that as the frequency (f) of the applied voltage increases, the capacitor's reactance decreases and more current flows through its leads. (The upper pair of curves (A) in Fig. 1, 4, 5 and 8 represent a lower frequency than the center pair of curves (B), while the lower pair of curves (C) represent a higher frequency.)

The voltage (E) across a capacitor connected to a regulated-current signal generator (Fig. 3) is depend-

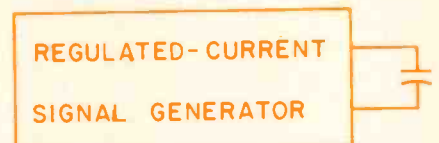


Fig. 3 — A capacitor is connected to the output of a regulated-current signal generator.

ent on the capacitor's reactance (X_C), ($E = IX_C$). As the frequency of the applied current (Fig. 4) increases, the voltage drop across the capacitor decreases.

Last month's article showed that the voltage-current relationship in a capacitor differed from the relationship in a coil. As indicated in Fig. 5, the phase angle of current flowing through a coil (represented by dashed lines) is 90deg behind the

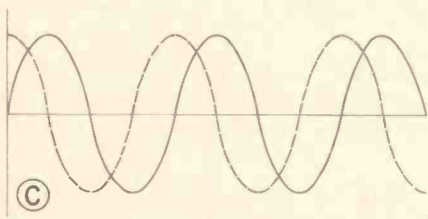
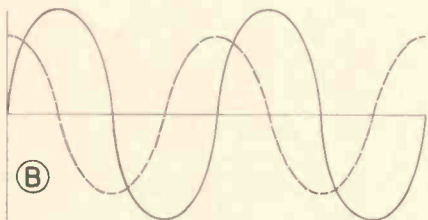
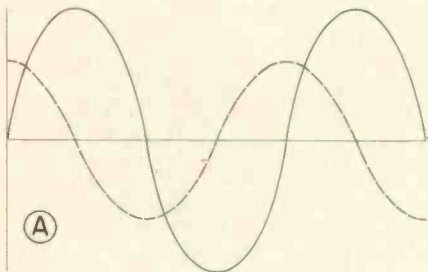


Fig. 4 — The voltage drop across a capacitor (solid curves) decreases as the frequency of the applied current (dashed curves) increases from a lower (A) to an intermediate (B) to a higher (C) frequency.

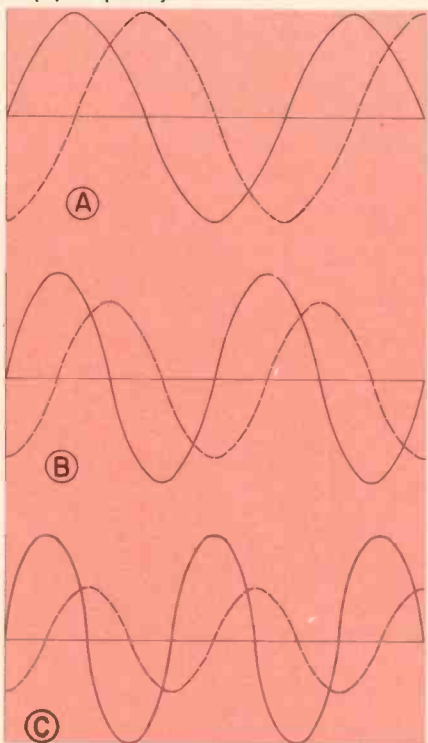


Fig. 5 — The phase angle of current flowing through the coil (dashed curves) is 90deg behind the applied voltage (solid curves). The current decreases as the frequency of the applied voltage increases from a lower (A) to an intermediate (B) to a higher (C) frequency.

applied voltage (shown as solid lines).

When a coil is connected to a regulated-voltage signal generator (Fig. 6), the current (I) flowing

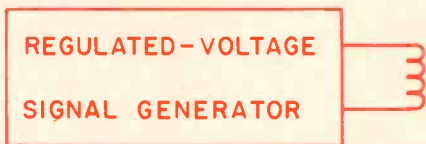


Fig. 6 — A coil is connected to the output of a regulated-voltage signal generator.

through the coil is dependent on the coil's reactance (X_L),

$$I = \frac{E}{X_L}$$

which in turn is dependent on the frequency (f) of the applied voltage ($X_C = 2\pi fL$). In Fig. 5 we see that as the frequency (f) of the applied voltage increases, the coil's reactance also increases and less current flows through the coil.

The voltage (E) across a coil connected to a regulated-current signal

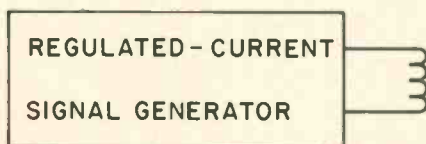


Fig. 7 — A coil is connected to the output of a regulated-current signal generator.

generator (Fig. 7) is dependent on the coil's reactance (X_L), ($E = IX_L$). As the frequency of the applied current (Fig. 8) increases, the voltage drop across the coil also increases.

Both series and parallel capacitor-coil tuned circuits depend on the capacitor and coil voltage-current relationships.

Series-Resonant Circuits

The capacitor and coil in Fig. 9 are connected in series to a regulated-current signal generator, and the same amount of current must flow through both the capacitor leads and coil. When the frequency (f) of the current from the signal generator is below the circuit's resonant frequency (f_r), the coil's reactance (X_L) is smaller than the capacitor's reactance (X_C). (When

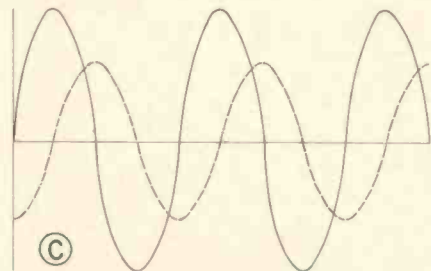
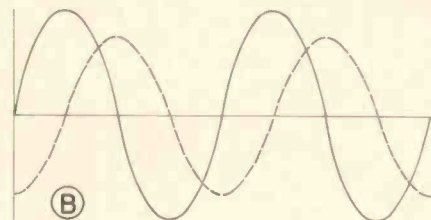
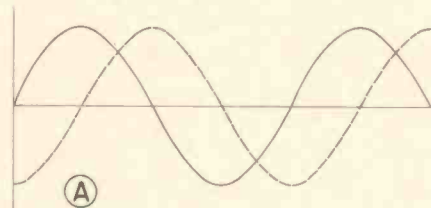


Fig. 8 — The voltage drop across a coil (solid curves) increases as the frequency of the applied current (dashed curves) increases from a lower (A) to an intermediate (B) to a higher (C) frequency.

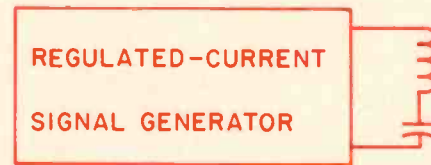


Fig. 9 — A capacitor and coil are connected in series to a regulated-current signal generator.

$f < f_r$, $X_L < X_C$.) Under these conditions (Fig. 10), a smaller voltage drop occurs across the coil (solid curve A) than across the capacitor (solid curve B).

Since the coil and capacitor are connected in series and the same current must flow through both, the phase angle of the current in both components (dashed curves A and B) must be the same. The phase angle of the voltage across the coil (solid curve A) leads the coil current (dashed curve A) 90deg, while the phase angle of the voltage across the capacitor (solid curve B) lags behind the capacitor lead current (dashed curve B) 90deg. The voltages across the two components are therefore 180deg out of phase with

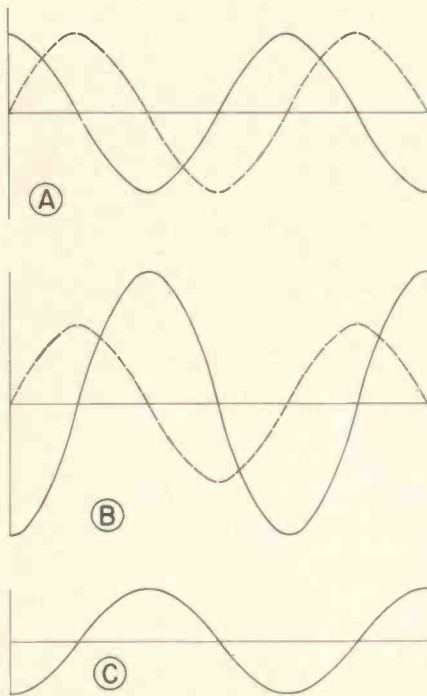


Fig. 10 — When the ac current applied to a series-resonant circuit is below resonant frequency (dashed curves A and B), there is a greater voltage drop across the capacitor (solid curve B) than across the coil (solid curve A). The curve that results (curve C) when adding the amplitudes of these two curves (solid curves A and B) represents the voltage at the signal generator. The signal generator voltage is in phase with the capacitor voltage.

each other, or of opposite polarity. When the voltage across the coil (solid curve A) is positive, the voltage across the capacitor (solid curve B) is negative.

The voltage at the regulated-current signal generator is equal to the total voltage across the coil and capacitor. If the voltage across the coil is +8v and the voltage across the capacitor is -16v, the total voltage at the signal generator is -8v.

From these calculations it is apparent that at this frequency, with the components used, an ac voltmeter would indicate a voltage across the coil greater than the voltage at the signal generator and a voltage across the capacitor equal to the voltage at the signal generator. Since the same amount of current flows from the regulated-current signal generator through the coil and capacitor, the apparent power supplied by the signal generator ($P_s = IE_s$) is less than the apparent power at the coil ($P_L =$

IE_L) and equal to the apparent power at the capacitor ($P_C = IE_C$). We know, however, that the parts of a circuit cannot absorb more power than is supplied the circuit and, therefore, the apparent power at the coil and capacitor cannot be the actual power consumed.

Measurements with a wattmeter indicate that the apparent power ($P = IE$) is the true power only in ac or dc resistance circuits. If the circuit contained a capacitor that could have a perfect insulator separating its two segments, no electrons could pass between the two segments, and current entering one capacitor lead would return out the same lead without ever passing through the capacitor. Under these conditions the capacitor would not consume any power.

The current used to produce a magnetic field in a coil is returned to the circuit when the field dissipates, the energy absorbed to produce the field being returned to the circuit. Since the power used by the reactance in the circuit is always

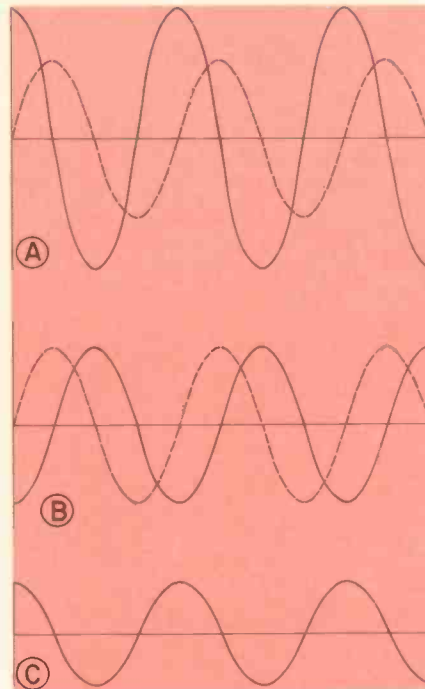


Fig. 11 — When the ac current applied to a series-resonant circuit is above resonant frequency (dashed curves A and B), there is a greater voltage drop across the coil (solid curve A) than across the capacitor (solid curve B). The curve that results (curve C) when adding the amplitudes of these two curves (solid curves A and B) represents the voltage at the signal generator. The signal generator voltage is in phase with the coil voltage.

returned to the circuit, no actual power is dissipated by it.

When the capacitor and coil (Fig. 9) are connected in series to the signal generator and the frequency (f) of the resulting current is above the circuit's resonant frequency (f_r), the coil's reactance (X_L) is greater than the capacitor's reactance (X_C). (When $f > f_r$, $X_L > X_C$.) Under these conditions (Fig. 11), a larger voltage drop occurs across the coil (solid curve A) than across the capacitor (solid curve B). If the voltage across the coil is +16v and the voltage across the capacitor is -8v, the total voltage at the signal generator is +8v.

When the frequency (f) of the current from the signal generator is the same as the circuit's resonant frequency (f_r), the coil's reactance (X_L) is equal to the capacitor's reactance (X_C) (When $f = f_r$, $X_L = X_C$.) The voltage drop across the coil (Fig. 12) is then

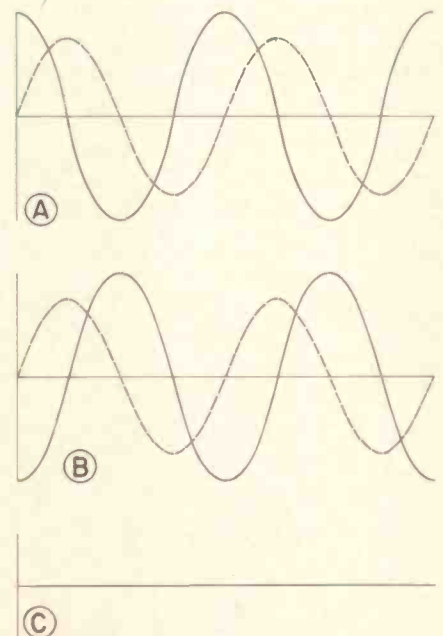


Fig. 12 — When the ac current applied to a series-resonant circuit is at resonant frequency (dashed curves A and B), the voltage drop across the capacitor (solid curve B) is as large as that across the coil (solid curve A). No curve results (line C) when adding the amplitudes of these two curves (solid curves A and B), and virtually no voltage is present at the signal generator.

equal to the voltage drop across the capacitor. Since the two equal voltages are 180deg out of phase, of opposite polarity, no voltage drop

occurs across the signal generator ($+12v - 12v = 0v$).

When the frequency of the signal generator current (Fig. 9) is either above or below the resonant frequency, the capacitor and coil impedances result in a signal generator voltage that does not occur at the resonant frequency.

Parallel-Resonant Circuits

The capacitor and coil in Fig. 13

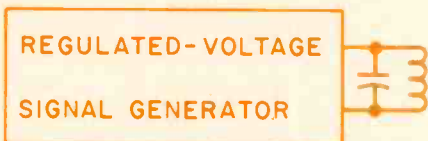


Fig. 13 — A capacitor and coil are connected in parallel to a regulated-voltage signal generator.

are connected in parallel to a regulated-voltage signal generator, and the same amount of voltage is present across both the capacitor and coil. When the frequency of the signal generator voltage is below the

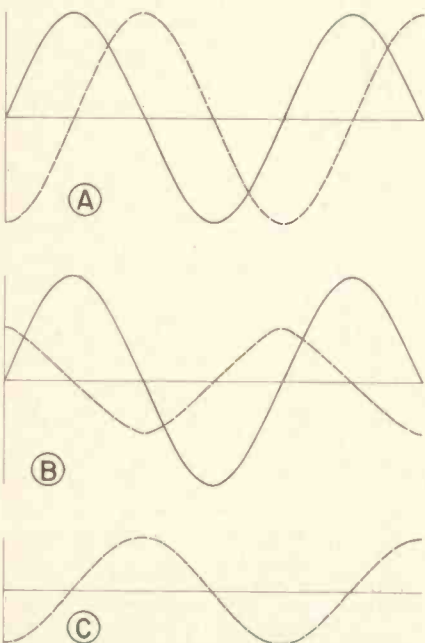


Fig. 14 — When the ac voltage applied to a parallel-resonant circuit is below resonant frequency (solid curves A and B), more current flows through the coil (dashed curve A) than through the capacitor leads (dashed curve B). The curve that results (curve C) when adding the amplitudes of these two curves (dashed curves A and B) represents the current from the signal generator. The signal generator current is in phase with the coil current.

circuit's resonant frequency (Fig. 14), the coil's reactance is smaller than the capacitor's reactance and more current flows through the coil (dashed curve A) than through the capacitor leads (dashed curve B).

Since the coil and capacitor are connected in parallel and the same voltage is applied to both, the phase angle of the voltage drop across both components (solid curves A and B) must be the same. The phase angle of the current through the coil (dashed curve A) lags behind the coil voltage (solid curve A) 90deg, while the phase angle of the current through the capacitor leads (dashed curve B) is 90deg ahead of the capacitor voltage (solid curve B). The currents through the leads of the two components are therefore 180deg out of phase with each other, or of opposite polarity. When the current through the coil (dashed curve A) is negative, the current through the capacitor leads (dashed curve B) is positive.

The current from the regulated-voltage signal generator is equal to the total current through both the

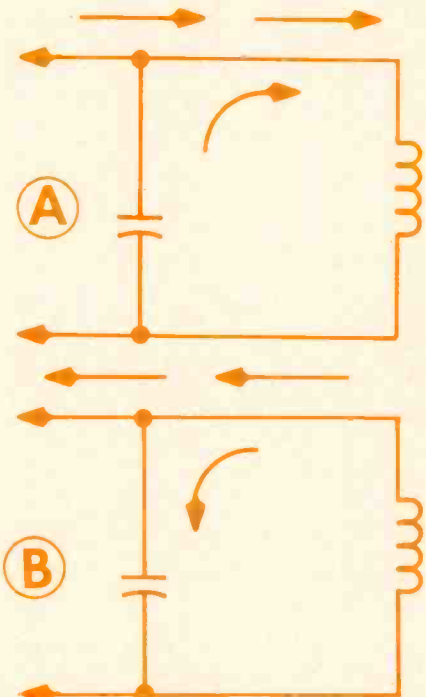


Fig. 15 — When the ac voltage is below resonant frequency, electrons flow from the signal generator and capacitor through the coil during half a cycle (A) and flow through the coil, entering the capacitor and signal generator, during the other half cycle (B).

coil and capacitor leads. If the current through the coil is $-16ma$ and the current through the capacitor leads is $+8ma$, the total current at the signal generator is $-8ma$.

At the below resonance frequency (Fig. 15), more current flows through the coil than through the capacitor leads or signal generator. During half a cycle electrons flow from the signal generator and capacitor through the coil, while during the other half cycle electrons flowing through the coil enter the capacitor and signal generator.

When the frequency of the signal generator voltage is above the circuit's resonant frequency (Fig. 16),

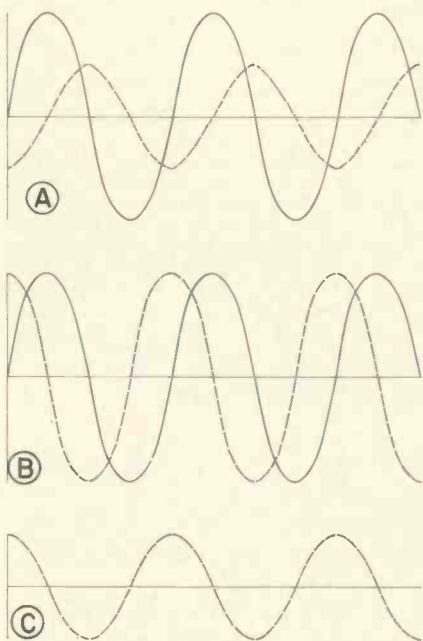


Fig. 16 — When the ac voltage applied to a parallel-resonant circuit is above resonant frequency (solid curves A and B), more current flows through the capacitor leads (dashed curve B) than through the coil (dashed curve A). The curve that results (curve C) when adding the amplitudes of these two curves (dashed curves A and B) represents the current from the signal generator. The signal generator current is in phase with the capacitor lead current.

the coil's reactance is larger than the capacitor's reactance and less current flows through the coil (dashed curve A) than through the capacitor leads (dashed curve B). The current from the regulated-voltage signal generator is equal to the total current through both the coil and capacitor leads. If the cur-

rent through the coil is -8ma and the current through the capacitor leads is $+16\text{ma}$, the total current at the signal generator is $+8\text{ma}$.

At the above resonance frequency (Fig. 17), more current flows

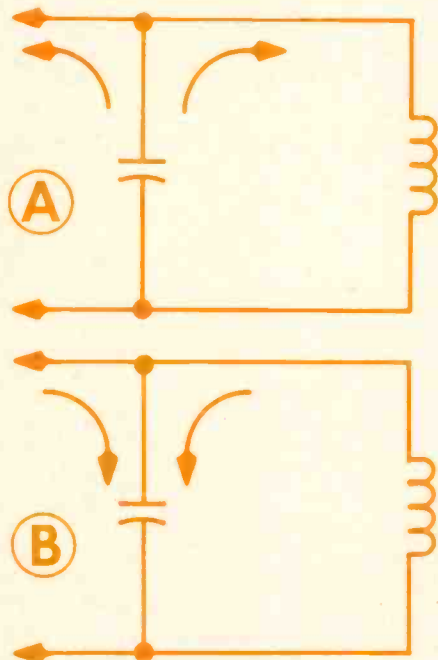


Fig. 17 — When the applied ac voltage is above resonant frequency, electrons flow from the capacitor to the coil and signal generator during half a cycle (A) and flow in the opposite direction during the other half cycle (B).

through the capacitor leads than through the coil or signal generator. During half a cycle electrons flow from the capacitor to the coil and signal generator, while they flow in the opposite direction during the other half cycle.

When the frequency of the signal generator voltage is at the circuit's resonant frequency (Fig. 18), the coil's reactance is equal to the capacitor's reactance and virtually the same amount of current passes through both of them (dashed curves A and B). If the current through the coil is -12ma and the current through the capacitor leads is $+12\text{ma}$, no current remains to flow from the signal generator and theoretically the electrons flow (Fig. 19) only between the capacitor and coil.

From the series-resonance curves (Fig. 12) we see that the signal generator voltage is a minimum at the resonant frequency, while from the

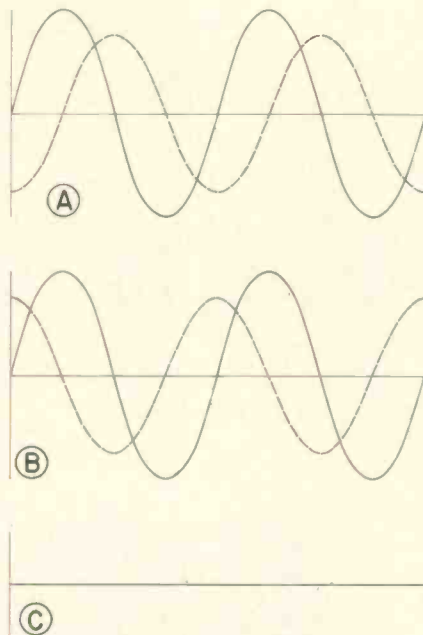


Fig. 18 — When the ac voltage applied to a parallel-resonant circuit is at resonant frequency (solid curves A and B), the current through the capacitor leads (dashed curve B) is as great as the current through the coil (dashed curve A). No curve results (line C) when adding the amplitudes of these two curves (dashed curves A and B), and virtually no current flows from the signal generator.

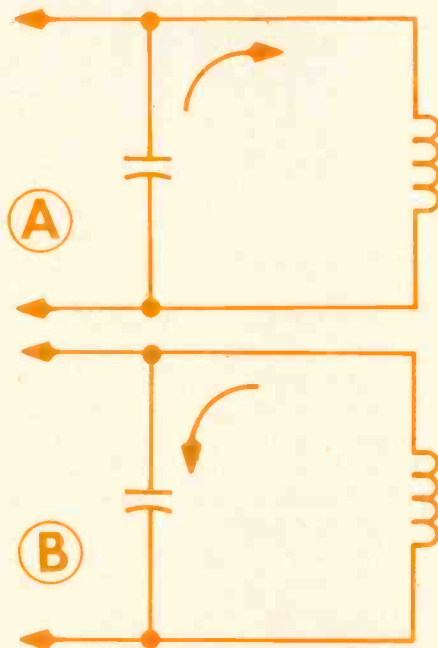


Fig. 19 — When the applied ac voltage is at resonant frequency, virtually all of the electrons flow from the capacitor through the coil during half a cycle (A) and return during the other half cycle (B) without flowing through the signal generator.

parallel-resonance curves (Fig. 18) we see that the signal generator current is a minimum at the resonant frequency. The voltage or current became greater at frequencies above and below the resonant frequency.

Varicap Tuning Circuits

Although future articles in this series will describe the use of series-resonant circuits for filtering out undesired signals in semiconductor circuits, we are now more concerned with the parallel-resonant circuits used to tune receivers. The parallel-resonant circuit shown in Fig. 20 is

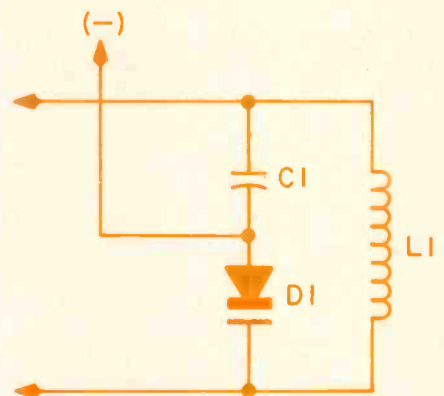


Fig. 20 — The parallel-resonant circuit is tuned with a varicap.

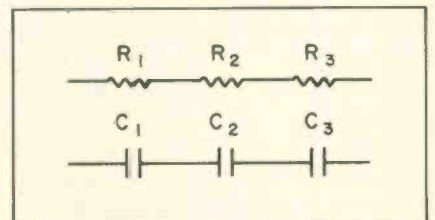


Fig. 21 — These resistors and capacitors are connected in series.

tuned with a varicap. The negative voltage applied to the anode of this diode (D1) is isolated from the balance of the tuned circuit by a capacitor (C1), and this capacitor (C1) and diode (D1) are connected in series, parallel to the coil (L1).

Just as series resistances can be added (Fig. 21) to determine the total resistance in a circuit ($R_T = R_1 + R_2 + R_3$), series capacitor reactances can be added to determine the total capacitive reactance in a circuit ($X_{CT} = X_{C1} + X_{C2}$

continued on page 99

How To Upgrade Your

Stop being a 'lone wolf' and put the heat

■ Anthropologists tell us that the last true "rugged individualist" disappeared thousands of years ago when two cavemen pooled their clubs and began chasing edible meat together.

And a year ago, Vern Green, owner of Green's TV & Appliances, Antioch, Calif., was bogged down to his neck in problems and running out of steam.

"At least on paper," Mr. Green says, "we were losing money on service. And as far as sales were concerned, I was losing efficiency and the personal touch with the result that my control over this end of the business wasn't what it should have been."

Then Vern Green got an idea. He called in his service manager, Al Norwood, an employee for eight years.

"How would you like to go into the service business on a partnership deal?" he asked Norwood.

"I'd like it," Al Norwood said.

So Vern Green set up an entirely separate company called Green's TV Service in which he and Al Norwood are partners.

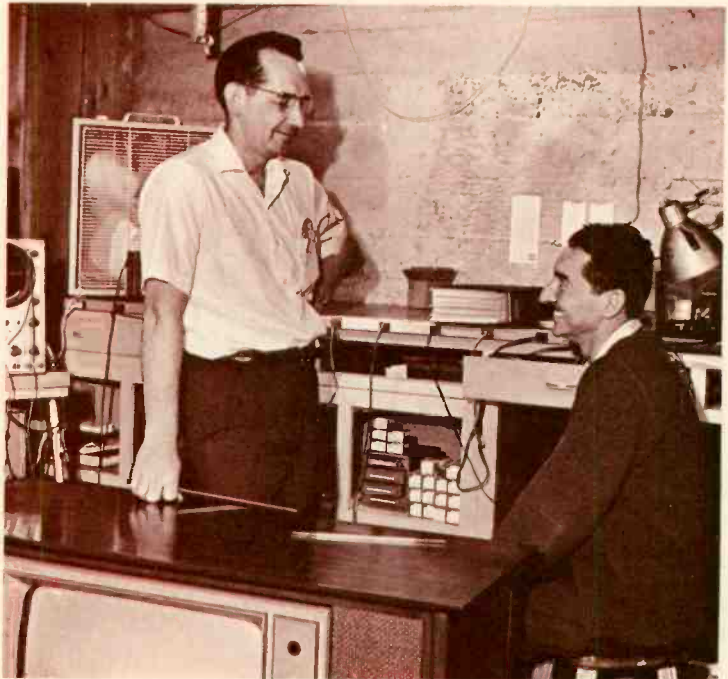
Since that time service volume has doubled. And sales have increased substantially.

So, if you're having service problems as sales grow, or not making enough money on service, perhaps you can improve your own business by a little reorganization and pooling of brain resources.

But let's hear more of Al Green's story.

Service Supports Sales

Mr. Green has been selling TV in



Happy partnership. Al Norwood (left) and Vern Green are both pleased with a more efficient operation.

Antioch for 16 years and has built a thriving business. Although he sells and services some white goods and air conditioners, the bulk of the business is TV. The service shop employs six full-time service technicians and two part-timers. One technician services white goods, record players and miscellaneous items — the rest service TV.

One of Mr. Green's customer-winning slogans has always been "Call in by 10 a.m. for same-day service." Same-day service builds the repeat business. But Vern Green found it difficult to carry out this slogan as business grew.

"Like many other dealers, we were finding it harder and harder to keep up with the growing service volume as our sales volume increased," Mr. Green declares.

"We were running into some problems in living up to our same-day service slogan and still maintaining an efficient operation.

"TV sales and service is a very personal business — at least ours is," Mr. Green smiles.

"I've always considered service so important to our sales program that I personally handled the phone calls that came in for service. Giving good service underlies business

Business in One Easy Step

on the 'no service' operators in our industry



Al Norwood runs an efficient shop. Service technicians average 15 calls a day during busy season.

growth in this field. I used to come into the store and be snowed taking service calls and getting them out to the men so they'd be handled the same day."

Often Mr. Green would have to handle some problem on the sales floor before getting all the service calls out to the shop, and then some of the service technicians might have to wait around the shop for as long as an hour. On busy days, this could mean that the inside technician might have to be pulled off the bench to meet the same-day demand.

"Now Al is on top of service,"

Mr. Green smiles. "He has the incentive and the responsibility — it's his business as well as mine. Everyone knows Al is the service boss and our customers are learning he gives them the same personal attention that I used to give them."

Green's service shop is really humming and its volume is expanding rapidly.

There has been a small population increase in Antioch during the past year and this has been a contributing factor in doubling the service business. But the reorganization, Mr. Green emphasizes, has increased shop efficiency and put it in a

position to win this new business.

"The separation of service from sales gives us better supervision and control over both sides of the operation," he points out. "I'm now able to concentrate my efforts on the sales program while Al has the authority to develop a shop program that fully meets our needs."

The sales firm pays the service branch a fixed amount for installation, delivery and warranty work on new goods. This gives the partnership the ability to develop a service program that guarantees the profitability of the operation.

Service Charges

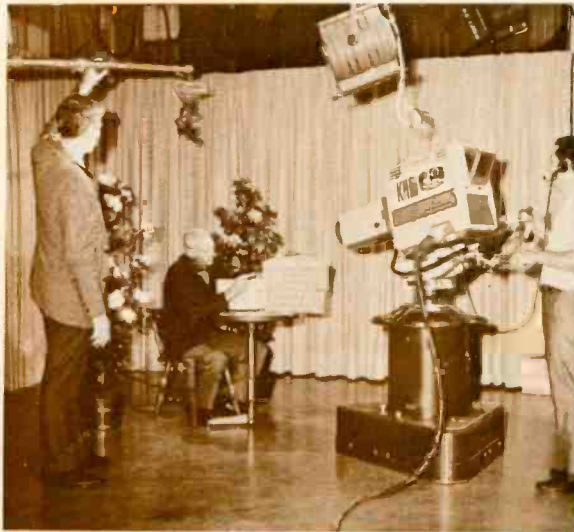
Sixty percent of the service business is on Green's sales and 40 percent on sales by other dealers. Service calls are \$9 when the set is "not our sale," \$7.50 if the set was purchased from Green's and is out of warranty.

The area covered is roughly a 20- to 25-mile radius of Antioch on same-day service. Careful scheduling and control over work performed in the home underlies the ability to give good service from the standpoint of the customer and profitable service from the standpoint of the shop.

"Although we're fortunate in having good men," Al Norwood says, "it's the scheduling and control that make for shop profitability."

"As a matter of fact, with proper scheduling a service technician can handle more calls today than in the old days of B/W because on color calls it's mostly tubes. In a busy period we can expect a service technician to handle 15 calls a day." ■

**DEALER
FAX**



Mr. Kocurek delivers his own commercials at TV station KHFI. The two artificial planters behind Willie Kocurek were give-aways in one promotional event.

MONEY

But Willie Kocurek's



Willie Kocurek's wife is his working partner. Here she is in action with a customer.



A lot of merchandise is displayed on the sidewalk in front of the store. It is protected by an overhead canopy. Kocurek is seen here placing a price tag on a TV.

■ Willie Kocurek Co. is a Space Age "mama and papa" operation in Austin, Tex. And its slogan is "you don't need money — just a little bit a month." This slogan ends all of Mr. Kocurek's TV and radio station promotion spots which he records on tape himself. This slogan also dominates the six billboards he has scattered around Austin.

Vic Mathias, manager of the Austin, Tex., Chamber of Commerce says, "Willie Kocurek is the most talked about business man in Austin. Everyone here is not only repeating his slogan but they sound like mocking birds."

Big Ad Budget

Grossing more than \$400,000 last year — the larger portion in home - entertainment electronic equipment sales — Willie Kocurek has produced a 35 percent increase in sales during the past three years by an intensified advertising campaign. And he spends 10 percent of gross on advertising.

"The merchandising experts tell me that you should never spend more than 6 percent of your gross sales on advertising," Mr. Kocurek smiles. "But we are not located in a shopping center. For that reason, we must work harder and spend more to draw business in our direction," he explains.

Mr. Kocurek elaborated on his advertising campaign.

"You might say that bad luck



Kocurek's personalized radio and TV spots bring in the potential customers as seen here.

IS FOR ADVERTISING

slogan is 'you don't need money — just a little bit a month'

brought us good luck," he smiles. "We were located in a building across the street — where we had been since 1936 originally selling appliances and tires. Then we got a 30-day notice to move because the building was going to be torn down. To advise our customers of our new location, we had to start advertising."

And Willie Kocurek's most recent and highly original, personalized advertising campaign has brought outstanding sales results. His advertising budget is co-op — equipment manufacturers paying up to 50 percent of the costs because of the excellent job he is doing.

Willie Kocurek is no fly-by-nighter. He started selling TVs, radios and other electronic equipment back in 1948.

Mr. Kocurek uses three Austin radio stations, KOKE, KVET and KNOW, where he broadcasts both 1-minute and 20-second spots. He sends out the 20-second spots 12 times a day — usually over the weekend.

TV commercials are used by Mr. Kocurek four days each month on station KHFI. He has a bank of commercials already video-taped.

The firm has five electronic equipment franchises: Motorola, Zenith, Sylvania, Westinghouse and Emerson.

His intensified advertising campaign has created considerable cus-



At the beginning of each season the radio, TV and outdoor advertising men get together with Mr. Kocurek to discuss his ad program. Left to right, standing, are Bill Dye, Rawlings Outdoor Advertising; Ron Chandler, KVET; Ken Moyer, KOKE; and Ed Nicklaus, Motorola rep from Central Distributing Co. of San Antonio. Seated are Mrs. Kocurek, Mr. Kocurek and "Pappy" Coleman from station KNOW.



Mr. Kocurek tapes his radio commercials in his store. Here a radio man times his commercial.



Willie Kocurek works hard out on the floor, meeting and selling customers. He is at ease with all of them.



Mr. Kocurek's distributors are very helpful. Here is Don Martin of Sylvania helping the two partners arrange a display.



And here is Ed Nicklaus, the Motorola representative, showing Mr. Kocurek some new merchandise.



Taking the time to explain everything a customer wants to know is one of the reasons the firm sells so much home entertainment equipment.



Willie Kocurek demonstrating a stereo phono for two young women prospects.

to appeal and has gone a long way in preselling prospective customers.

"They know our location and they know what brands of merchandise we have in stock because our message is presented over and over again. And they know they do not have to make a deposit on any merchandise they buy here simply by listening to our slogan," Mr. Kocurek says.

So strong has this impression become that 50 percent of sales are now being made on the phone. Kocurek's customers buy their TV set or radio sight unseen.

"Maybe," Mr. Kocurek smiles, "it's because my wife is such a good saleswoman."

Active in Civic Affairs

Mr. Kocurek is an active member

of the Lions Club and its former president. He is also active in the South Austin Civic Club and was also its former president. He is likewise active in a number of other community, civic and religious organizations.

"All small businessmen should become active in civic work," Mr. Kocurek says. "In fact," he concludes, "I would say that it is a must with small businessmen, especially TV-radio service-dealers."

When asked how he managed to do all this, he replied, "You just have to 'splice' the civic work in. You must also have a family who will work with you."

Willie Kocurek is a hard worker and a dynamic personality, warm and friendly and never too busy to devote time to everyone he comes in contact with. ■

"King of the hill"

Keep on top of your solid-state replacements... with RCA "Top-Of-The-Line" SK-Series. They make up just a handful of types—17 transistors, 2 rectifiers, and 2 integrated circuits. Together these 21 RCA SK-Series types can keep you ahead of 9,000 solid-state replacements in entertainment-type equipment. Designed especially for this purpose, you'll find these devices useful in line-operated and battery-operated radios, phonographs, tape recorders, TV receivers, AF amplifiers, and automobile radios.

RCA SK-Series transistors and rectifiers and the 9,000 types they replace are cross-referenced in the RCA Solid-State Replacement Guide. It's a handy booklet listing comparably-rated types including industry standard EIA types, foreign types, and those identified only by device manufacturers' or equipment manufacturers' parts numbers.

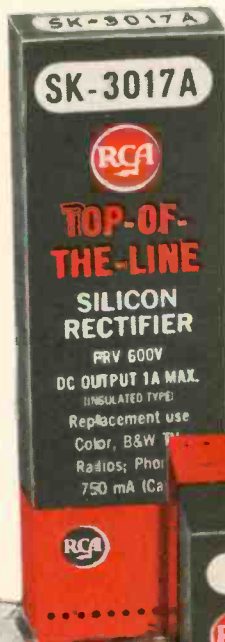
Check with your RCA Distributor. He stocks the complete line in either cartons or see-through display packs. Also, pick-up your copy of the RCA Replacement Guide SFD-202-E available through your RCA Distributor.





















RCA Electronic Components and Devices, Harrison, N. J. 07029



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 CAPACITOR	 CAPACITOR	 CAPACITOR	 CAPACITOR
XCI-21	XC2-1.1	XC2-26	XC2-36.1
 CAPACITOR	 CAPACITOR	 CAPACITOR	 CAPACITOR
XC3-45	XC4-4.2	XC4-5.1	XC4-6.1
 CAPACITOR	 CAPACITOR	 CAPACITOR	 CAPACITOR
XC4-9.1	XC4-10.2	XC4-55.1	XC4-63.1
 CAPACITOR	 CAPACITOR	 CAPACITOR	 CAPACITOR
XC4-68.1	XC4-68.2	XC4-70.1	XC4-80

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Stock only 20 General Electric Service-Designed replacement capacitors and meet over 70% of your replacement needs.

Use General Electric extended-range replacement capacitors. Just 20 General Electric Service-Designed replacement units will meet over 70% of all TV can style needs!

"Extended-range" means that fewer General Electric types are needed to meet your requirements. Every GE aluminum capacitor meets not just one, but a range of capacitance and voltage requirements. And, to make selection easier, the application range of every General Electric capacitor is shown clearly on the unit, and on the carton.

You can quickly see, for example, that the GE capacitor rated 50-60 mfd up to 450 VDC will replace any unit between

50 and 60 mfd at any voltage up to 450 VDC. You save time and money in making replacements because General Electric capacitors are Service-Designed with you in mind!

Your local GE electronics distributor carries a complete line of replacement capacitors from General Electric, a leader in supplying capacitors to the radio and television industry. Call him today for full details.

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GENERAL ELECTRIC

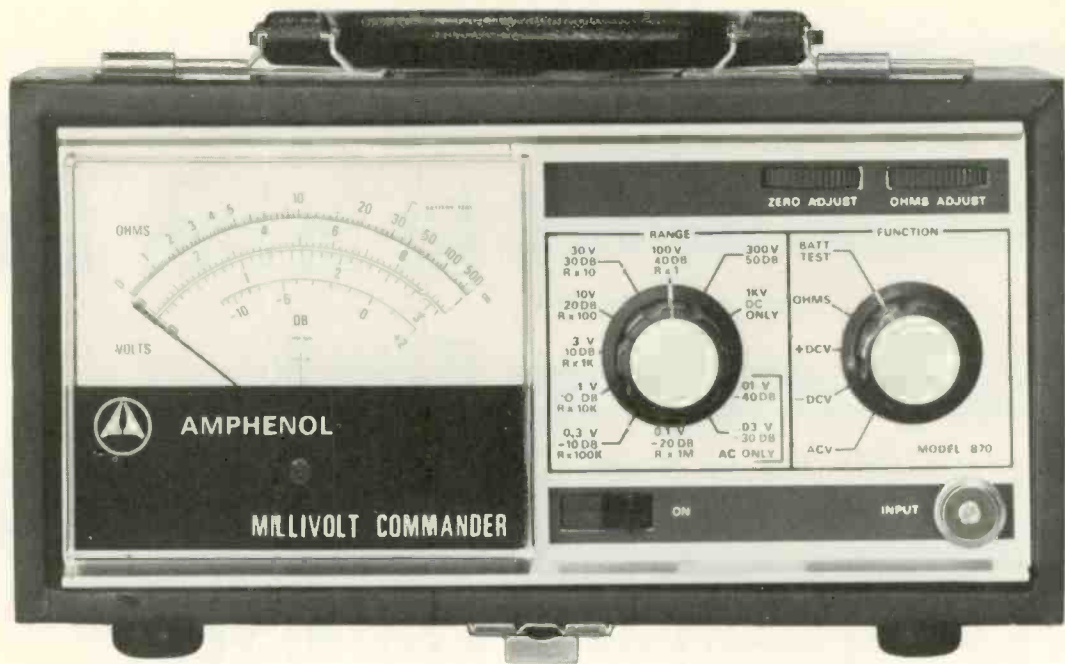


Call your GE distributor now for a special offer on replacement capacitors for COLOR TV!

It's a Treasure Chest loaded with 12 of the most popular General Electric replacement capacitors for COLOR TV! Your distributor's offering it at a special low, low price. And to make it more appealing, you get an Xcelite® nut driver set with each Treasure Chest. Don't delay, call today! Offer is limited.



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This is the most trouble shooter transistorized

Five bucks says you'll agree.

We're so sure you'll like Amphenol's 870 Millivolt Commander that we'll pay five dollars for the time it takes you to find out. Buy the Millivolt Commander, and you'll get a five-dollar certificate redeemable at your participating Amphenol distributor. If the 870 Millivolt doesn't do everything we say it will do, return the unit to your dealer in seven days. Get your money back, and keep the five bucks.

What makes us so sure that you'll like the 870? To begin with you'll be the keyman in your area, because you'll have the prime tool for servicing transistorized equipment. It has the needed low ranges for servicing all transistorized equipment. It measures down to one-tenth of a volt d-c full scale and one-one hundredth of a volt a-c full scale. That means you'll find trouble faster. More calls. Increased profits.

sensitive for servicing equipment.

Take advantage of this limited offer. Buy a Millivolt Commander today. Same \$5 test offer applies to the Color Commander, CRT Commander, Stereo Commander and Signal Commander, too.



CRT



Color



Stereo



Signal



A Keyman Tool



AMPHENOL

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COLORFAX

Automatic Frequency Control for Admiral 4H12 Color-TV Chassis

The Admiral 4H12 color-TV chassis features an automatic frequency control system which completes the fine tuning once the customer has 'roughed it in.' Its operation is similar to the AFC used on FM tuners.

The discriminator section samples the IF signal through a 0.47pf capaci-

tor, C704. Capacitor C801 couples the signal to input coil L801. All of the capacity relating to L801 forms the resonant circuit. Capacitor divider C802/C803 delivers a low input impedance to transistor Q801 while at the same time decoupling the transistor input resistance and capacitance from L801.

After amplification in Q801, the signal is driven into the FM discriminator primary coil, L802. The output of Q801 is also sent to the junction of C807 and C808; these capacitors perform essentially the same function as the ratio detector tertiary coil.

Each detector diode is detecting the ac sum of two signals. The first signal is coupled from the output of transistor Q801 through C807 and C808 to their respective diodes. The second is derived by magnetic coupling between L802 and L803. Notice the coils are not wound on the same form and are lightly coupled. At 45.75MHz both diodes are detecting equal signals. The diode load resistors are connected adding their outputs; therefore, the AFC correction voltage will be zero at correct fine tuning, 45.75MHz.

If the channel is not tuned in carefully or if the tuner drifts, a phase shift change at L803 would occur. If the picture carrier changed to 45.25MHz, diode CR801 would conduct more and CR802 would conduct less, resulting in a negative voltage appearing on the AFC line. If the carrier shifted upward, diode action would be opposite, resulting in a positive voltage on the AFC line.

Because separate VHF and UHF tuners are used, each must have its own AFC components. In the VHF tuner, AFC voltage is applied to the base of an NPN transistor. The emitter is left disconnected and the collector is connected to the oscillator tank. This collector-to-base function serves as the AFC diode. As the AFC voltage varies, the transistor acts as a capacitor. The correction voltage changes the capacity of the junction and thus corrects the oscillator error. In the UHF tuner the AFC diode performs a similar function. As with FM AFC, the correct way to tune in a TV channel is with the AFC switch on the control panel in the OFF position, then switch it to ON for drift free, correctly tuned color programs.

Major Breakthrough in TV Accessories... NEW from Mosley!

In response to your requests, Mosley introduces a completely NEW 'profit building' line of TV accessories for use with shielded and other types of twin lead cables on the market!

These solderless receptacles, line splicers, 2 and 4 set couplers, clamp the line securely so it can't pull out! Assure peak performance, especially for color. Eliminate call backs. Help simplify the cable lead-in job... for a compact, time saving installation.

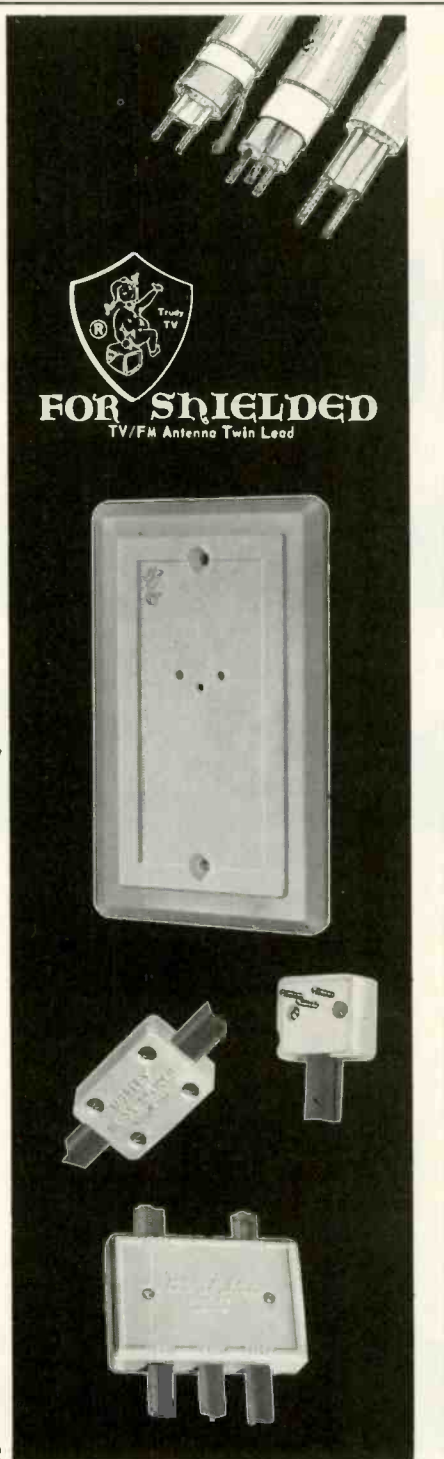
Stock up now and watch your sales climb! Send for complete details.

Write: Dept. 145

Mosley Electronics, Inc.

4610 N. Lindbergh Blvd., Bridgeton, Mo. 63042

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Admiral Color TV Service Information

To increase reliability in the HV section of the G13 and early H10 color chassis, it is suggested that you use Admiral 6KD6 tubes bearing EIA Code 312 as replacement horizontal output tubes. Tubes coded either 188 or 312 may be used to replace the 6KD6 in H12 series chassis.

If a condition is encountered where the VERTICAL CENTERING control acts like a VERTICAL LINEARITY control on the G13 and H12 chassis, look for a cold solder connection at the pin in the B+ foil pattern on PW500 (chroma board). There is a red lead connected from this pin to one end of the vertical centering control. The B+ voltages will check normal but a resistance check from the control end of the red wire to B+ will not measure zero ohms as it should. Resoldering the connection will correct this condition.

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Now you can have at your fingertips, this brand-new book, especially written for service technicians, outlining simple troubleshooting procedures that can be applied to any type of electronic circuit.

Without delving into involved theoretical discussions, this practical new handbook describes how trouble in any piece of electronic equipment may be pinpointed quickly and easily. Especially written for practicing technicians by an accomplished and well known author, the book approaches circuit troubleshooting from a new and unique slant—that every circuit is basically either an amplifier or a rectifier which can be easily tested and analyzed using simple servicing procedures.

Step-by-step techniques are outlined for pinpointing troubles to a specific improper stage, and then to the defective component itself, using the minimum amount of test equipment. Profusely illustrated, the content describes several specific troubleshooting methods which can be used to analyze the performance of various types of circuits—tube or transistor—in any kind of equipment. Contains just the kind of practical, down-to-earth information you can immediately put to use in your everyday service work! Many invaluable "Time and Temper Savers" are included, offering shortcuts and practical hints which will increase your servicing efficiency and cut down on troubleshooting time.

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ELECTRONIC TECHNICIAN'S BOOK CLUB, Thurmont, Maryland 21788

Please open my Trial Membership in the Electronic Technician's Book Club and send me a copy of your 176-page *Ten-Minute Test Techniques* billing me for only \$1.29 plus a few cents postage and mailing expense. If not delighted, I may return the book within 10 days and owe nothing. Otherwise, to complete my Trial Membership, I agree to purchase at least 4 additional monthly selections or alternates during the next 12 months. I have the right to cancel my membership anytime after purchasing these four books.

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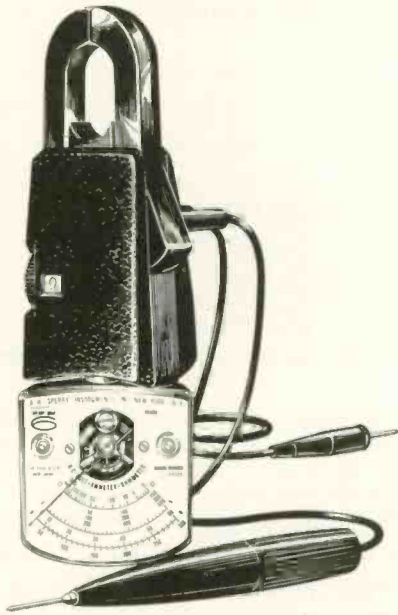
(The Club assumes postage on all prepaid orders. Foreign and Canadian prices 10% higher.) T67

NEW PRODUCTS

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly

Volt Ohm Ammeter 700

A pocket-sized snap-around volt ohm ammeter is announced that reportedly features a dust-proof meter compartment that snaps into five positions so that the meter scale always



faces the technician even when he is reading currents in crowded switch boxes. Specifications indicate that the meter has 3% accuracy and comes with two current, three voltage and one ohmmeter scale, for readings up to 300a, 600v or 25 Ω mid-scale. Sperry.

Adhesive Tape Primer

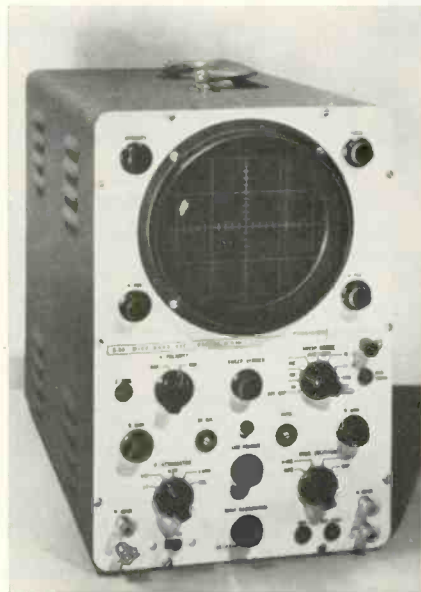
Announced is a surface primer that has been developed for use as an accessory item for a line of adhesive flat cable systems. Specifications indi-



cate that it insures a good adhesive contact between the cables and certain types of wall or ceiling materials. Typical "easy-clean" materials that reportedly require this primer include: vinyl wallpapers, acrylic esters, alkyd enamels, urethan varnishes and epoxy paints. 3M Co.

Oscilloscope 702

Announced is a wide-band ac-dc scope that reportedly features an automatic sync to simplify sweep frequen-



cy adjustment. Specifications indicate that it also has a built-in regulated calibration voltage, 70mv/in. dc sensitivity, 25 mv/in. ac sensitivity and a variable illuminated screen graticule. Price \$169.95. Precision.

VOM 703

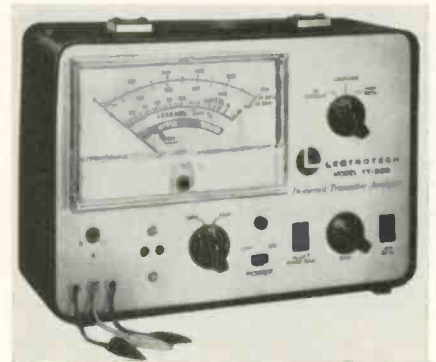
Announced is a VOM with a 0 to 10v, 50v, 250v, 500v, 1kVdc; 0 to 100 μ a, 2.5ma, 100ma dc current; 0 to 10, 50, 250, 500vac; and R x 1, R x 10, R x 100, 0 to 10K scales controlled with one knob. Specifications indicate that the instrument has a 10K/vac sensitivity and a 5kVdc sensitivity. The instrument reportedly has a magnetic cover for securing it to any iron-based metal surface. The manufacturer indicates that the instrument comes with a fully illuminated dial, and an optional probe is also illuminated.



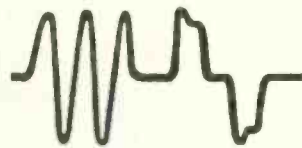
Dealer net price \$21.95, an illuminated probe is reportedly available for \$2.69 extra.

Transistor Analyzer 704

A transistor analyzer for checking transistors in or out of the circuit is announced. Specifications indicate that transistor leads do not have to be unsoldered or clipped for in-circuit tests, which measure ac gain—a posi-



tive indication of transistor condition. Out-of-circuit tests reportedly measure Beta on 0 to 250 and 0 to 500 scales. The instrument is designed to measure transistor leakage directly in micro-amperes, plus reverse leakage and forward conduction of diodes and rectifiers to determine their front-to-back ratio. The instrument's dimensions are reportedly 10½ x 7 x 4in.;



Which miniature electrolytics for transistorized AM-FM radios?

**COMPARATIVE SIZES
OF CAPACITORS ALL RATED
10 MFD., @ 25 WVDC
(shown actual size)**



TT aluminum electrolytic



MTA aluminum electrolytic



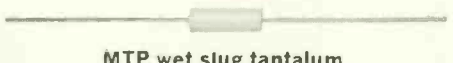
TAS solid tantalum



TAP wet slug tantalum



TLS wet slug tantalum



MTP wet slug tantalum

The new portable AM-FM radios are so compact you wonder how they get all those components into that little box. You wonder even more when you have to replace some of the parts.

Electrolytic capacitors, for example. The original electrolytic usually turns out to be a tiny thing jammed in among a dozen other midget gadgets. Getting it out is a trick in itself. Getting a suitable replacement is even tougher! And unfortunately, you're apt to need replacements, because many of these tiny capacitors just aren't much good. They don't meet the quality specs of good domestic capacitor makers. But high quality domestic capacitors are often just a bit too big to fit in the space available.

What's the answer? Search the town for another "little-bitty" original capacitor? Tell your customer you can't finish the job?

Don't give up. We have a few suggestions.

First, try a Mallory TT aluminum electrolytic. This is a real quality capacitor, rated 85°C, and it's pretty doggone small. Or a Mallory MTA, a revolutionary molded case aluminum electrolytic with excellent quality at low-low price.

If neither of these will fit, try a Mallory tantalum capacitor. The TAS solid tantalum is about the same size as the TT, but it's rated 125°C. Need still smaller size? Take a look at the Mallory "wet slug" tantalum types TAP and TLS—and the super-miniature MTP, which gives you the most microfarads in the smallest size of anything on the market. The pictures at the left show you comparative sizes, all for a 10 mfd, 25 WVDC rating.

Sure, you'll pay a little more for the tantalum capacitor. But not as much as you might think. The TAP only costs 42c more than the TT, in the rating shown. And you get the utmost in reliability.

We certainly don't expect you to use a tantalum capacitor to replace every aluminum electrolytic. But they come in mighty handy sometimes. And you can get them when you need them from your Mallory Distributor. Ask him for our latest catalog, or write to Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

DON'T FORGET TO ASK 'EM—*What else needs fixing?*



**NEW
HOLLOW
SHAFT**

nutdriver set
with Locknut/Screw
adjusting feature

Speeds, simplifies setting of combination locknut/slotted screw adjustments on rheostats and similar controls used in a wide variety of electrical and electronic equipment.

Handle is drilled so you can run an 8" screwdriver blade right through its center and down through the hollow nutdriver shaft.



Ideal for all-around production, maintenance, and service work, this new HSC-1 Set contains eight interchangeable hollow nutdriver shafts in the most popular hex opening sizes from 3/16" thru 9/16"



Really compact! Set is small enough, light enough to carry in your hip pocket. Sturdy, see-thru, plastic carrying case doubles as a bench stand.

WRITE FOR BULLETIN N867

XCELITE

XCELITE, INC., 14 Bank St., Orchard Park, N.Y. 14127
In Canada contact Charles W. Pointon, Ltd.

... for more details circle 148 on postcard

NEW PRODUCTS

VOM 705

A VOM is announced that reportedly contains a mirrored scale for accurate reading. Specifications indicate that it has 20v/ohm sensitivity and the following scales: 0 to 3, 12, 60,



120, 300, 600 and 1200vdc; 0 to 6, 30, 120, 300, 600, and 1200vac; 0 to 2K, 200K, 2M and 200M; and 0 to 12madc, 6madc, 60madc, 300madc and 12adc. Its dimensions are 5 1/2 x 7 1/2 x 2 3/8 in. Price \$29.98. Olson.

Ohmmeter 706

A portable ohmmeter designed to provide 0.5% accuracy at center scale can be used to determine the resistance of leads, grounds, resistors, coils and similar electrical components. The instrument is reportedly calibrated



ed in four ranges: 0 to 50 Ω , 500 Ω , 5K and 50K. The manufacturer indicates that accuracy is assured by a built-in precision wirewound calibration standard which permits corrections for battery condition and the resistance of lead and clip. Price \$139. Associated Research.

Oscilloscope 707

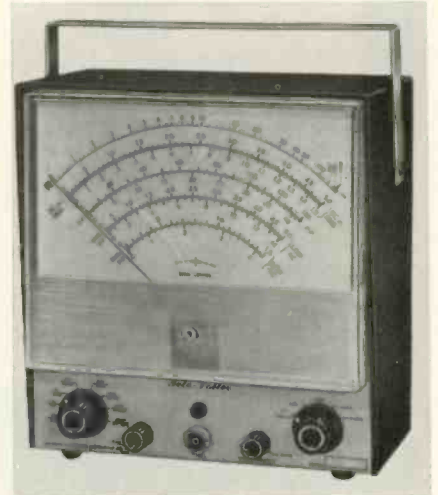
A portable solid-state scope reportedly combines a 20MHz bandwidth with a 10mv/cm sensitivity. Specifications indicate that it provides a choice



of single-trace, dual-trace and high-gain differential amplifiers, plus standard or delayed-sweep time bases. Price of single-trace unit \$765, dual-trace unit \$895. Xetex.

VTVM 708

Announced is a VTVM, with 7-in. meter. Specifications indicate full-scale ac voltages from 0.1 to 1.5kv in 7 overlapping ranges while dc voltages



are from 0.01 to 1.5kv on 2 scales in 8 overlapping ranges—both with 3 percent full-scale accuracy. The meter also has 7 overlapping resistance ranges. Price \$84.95. Jackson.

EXTRA POWER

with

FINCO

AMPLIFIERS

*For perfect color TV and
FM Stereo Reception*

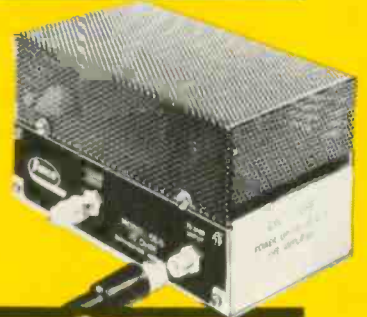
FINCO MODEL #65-4
Antenna Amplifier
\$47.95 list VHF-TV
Two-transistor Antenna
Amplifier for 75 OHM
Downlead, and power
supply with built-in
single or dual 300 ohm
outputs. Provides 12
dB gain in the low band
and 14 dB gain in the
high band.



FINCO MODEL #65-1
Distribution Amplifier
\$29.95 list 2-tube 4-
output VHF-TV or FM
Distribution Amplifier
for 300 OHM Opera-
tion, providing 8 dB
gain at each 300 ohm
output to feed home or
commercial systems.



FINCO MODEL #65-5
Distribution Amplifier
\$44.95 list VHF-TV 75
OHM Single Outlet Dis-
tribution Amplifier for
deluxe home or com-
mercial use to feed
multiple sets through
line tap offs or split-
ters. Delivers 17 dB
Low Band and 14 dB
High Band.



FINCO MODEL #65-2
Distribution Amplifier
\$39.95 list 2-tube 4-
output VHF-TV or FM
Distribution Amplifier
for 75 OHM CO-AX
Operation, providing 6
dB gain at each 75 ohm
output to feed deluxe
home or commercial
systems.



FINCO MODEL #65-6
Amplifiers \$79.95 list.
VHF-TV Antenna Moun-
ted two-transistor pre-
amplifier with 75 OHM
two-tube Single Output
Distribution Post-am-
plifier up to 30 dB gain
for improved reception.
Used in home or com-
mercial installations to
feed multiple sets.



FINCO MODEL #65-3
Antenna Amplifier
\$44.95 list New VHF-
TV Antenna Amplifier
and Power Supply with
built in single or dual
outputs to improve re-
ception of weak signals
in fringe areas. Pro-
vides 12 dB gain in the
low band and 14 dB
gain in the high band.



FINCO MODEL #65-7
FM Signal Amplifier
\$24.95 list. One tran-
sistor Indoor Behind-
the-set FM amplifier
with a passive filter in-
put circuit to reject sig-
nals outside the FM
band which cause in-
terference. Delivers 20
dB Gain.



Sets "COME ALIVE" with Brilliant Sound and Color

A Finco high-gain, low-noise amplifier
will bring in the sharpest **COLOR** or
B & W TV picture and the finest sound!

**All FINCO Products are Engineered
For Color!**

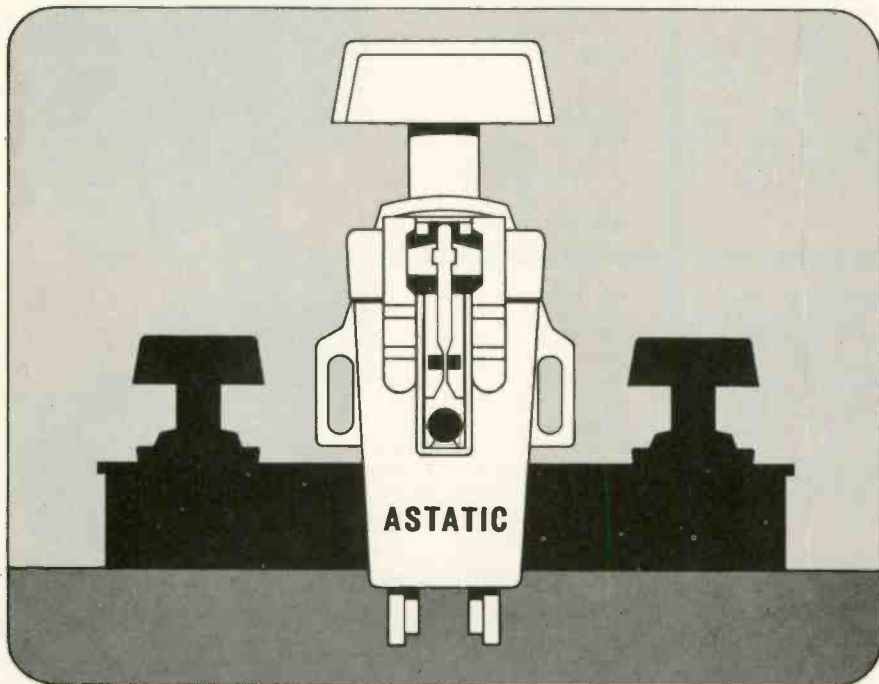
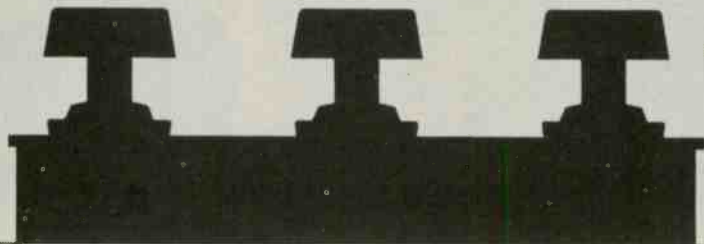


Write for Color Brochure #20-411.

THE FINNEY COMPANY

34 W. Interstate Street • Dept. 110 • Bedford, Ohio 44146

WILL THE REAL NO. 1 In Replacement Phono Cartridges Please Stand Up!!



So many pretenders have been laying claim to No. 1 position that they've turned the situation into a game.

Having held the No. 1 position for more than 30 years, Astatic is naturally reluctant to play around about it. But, in case you're interested in how to spot the leader, ask questions like these: Is your line really the most COMPLETE, or will I run into complications of needing several sources of supply? Do you follow RESPONSIBLE practices such as visual Date Coding and Shelf Life Control? Are you really the largest OEM supplier creating a replacement demand for your cartridges? There are many similar questions, but this is enough. ONLY ASTATIC CAN SAY YES. There can be only one No. 1—and its STILL ASTATIC.



THE ASTATIC CORPORATION
Conneaut, Ohio 44030 U.S.A.

In Canada: Canadian Astatic Ltd., Toronto, Ontario
Export Sales: Roburn Agencies, Inc.
431 Greenwich Street, New York, New York 10013, U.S.A.

THE PIONEERS AND THE PACESETTERS OF QUALITY SOUND REPRODUCTION

... for more details circle 106 on postcard

NEW PRODUCTS

FM Receivers 709

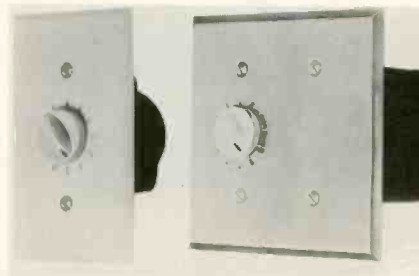
Two crystal controlled or tuneable solid-state FM receivers for 30 to 50MHz or 152 to 174MHz coverage



are announced. Specifications indicate that integrated circuits are used in the IF stages along with 13 transistors for superheterodyne receiver operation. The receivers reportedly measure 13¼ x 7½ x 6in. Lafayette.

Audio Level Controls 710

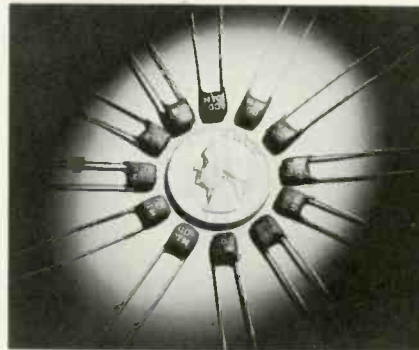
Audio level controls for commercial audio installations have been designed for 75, 35 and 10w rated capacities. Specifications indicate that they can



be mounted in standard shallow wall boxes and feature an exterior protective shell that minimizes the chance of damage during installation. Jensen Mfg.

Ceramic Capacitors 711

A line of ceramic capacitors has been designed for conventional or printed wiring assemblies in tuned circuits, delay lines and filter circuits.



Specifications indicate that they are phenolic-coated with radial lead construction and have values ranging from 10pf to 0.1pf. Cornell-Dubilier.

Getting a hernia and not getting paid for it?

Let Arcolytic® capacitors lift the load off your mind. Or anywhere else it happens to be.

These aluminum electrolytics are built to last: wound with computer-grade 99.99% pure aluminum foil so they'll keep operating in your customers' sets even at continuous temperatures of 85°C.

You'll find they take the worry right out of premature failure, lost customer confidence and costly call-backs.

There's no premium cost, either. Arcolytics are priced along with other home entertainment capacitors.

Ask your Authorized Arco Distributor for Arcolytic electrolytic capacitors in single-section tubular, multiple-section tubular, or twist-mount designs. It may be the best break you get this year.

Arco Electronics

A DIVISION OF LORAL CORPORATION
Community Drive, Great Neck, N. Y. /
Arlington, Texas / Elk Grove Village,
Illinois / Pasadena, Menlo Park,
California. Write for our free catalog.



... for more details circle 104 on postcard



NEW PRODUCTS

Six-Band Radio 712

A table radio is announced that reportedly has a "spread" tuning system that expands normally crowded short-wave channels until they appear about three times more widely spaced than local broadcast stations seem on a conventional table radio. Specifications indicate that the receiver's ac-

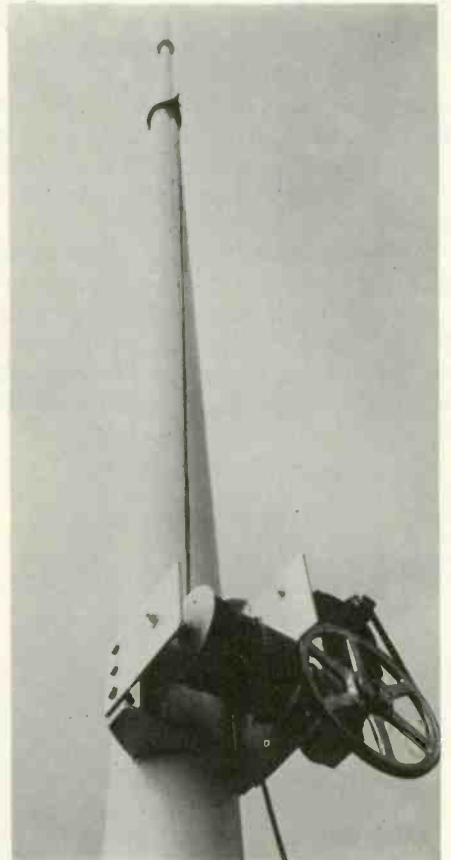


tual tuning range is 550 to 1600kHz, 5.9 to 6.25MHz, 11.5 to 12.0MHz,

15.05 to 15.55MHz and for FM 88 to 108MHz. The receiver only has five controls which handle ON/OFF VOLUME, TONE, band selection, AFC and tuning. Hallicrafters.

Telescoping Mast 713

Announced is a 70ft free-standing tower reportedly capable of holding a 30-sq-ft antenna in a 60mph wind. Specifications indicate that the tele-



scoping tubular mast, nesting at 27ft, can be run up to its full height by one man using the worm-gearred, self-locking winch and galvanized cable. The manufacturer indicates that no crane is needed to erect the mast because of its tilting hinged base. Tri-Ex.



JEWELRY for your best gal— STUNNING PINS

from
Perma-Power

you get them **FREE** with either
of these **BRITENER PACKS**

Whether it's a special occasion or an unexpected surprise—the gals all love to receive jewelry. Give your best gal one of these unusual Gold-Fashioned pins (they'd cost as much as \$4.95 in an exclusive shop). Watch her face brighten up!

Brightening up is a Perma-Power specialty, although it's usually directed at faded picture tubes. Vu-Brite and Tu-Brite boost picture tube brightness, and boost your popularity with your customer. Always keep both kinds on hand!



The pin is free (many unusual designs)—when you buy 12 Vu-Brites, Series or Parallel, at the special \$9.95 price.



You also get one of these "Gold-Fashioned" beauties with a pack of 4 Tu-Brites. If the base is right, the boost is right. Only \$8.95.

NEW! 110° Button Base Vu-Brite/Jewelry Pack . . . \$8.95

6 model C-411 Parallel or 5 model C-412 Series

SEE YOUR DISTRIBUTOR NOW FOR BOTH THESE SPECIALS.

PERMA-POWER COMPANY

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Phone (312) 539-7171

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Service Tool Kit 714

A kit has been designed to fit in an electronic technician's pocket and



contains a long-nose plier, wire stripper, injection oiler, fine-nose tweezers, industrial burnisher, pin vise and combination screw and 1/4in. nut driver. Price \$9.90. Jonard.

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*Performance-Matched
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at the Right Price*

ELECTRO has the practical cost saving answer to your power supply needs. Why buy more than you need? ELECTRO's line includes a wide range of DC outputs up to 125 volts and from 0.002% ripple for critical transistor circuitry to applications permitting up to 5% ripple.

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NEW MODEL PS-1000-32
1000 watt Power Supply

**CHOOSE FROM OVER 20 MODELS
REGULATED • INDUSTRIAL
GENERAL PURPOSE**



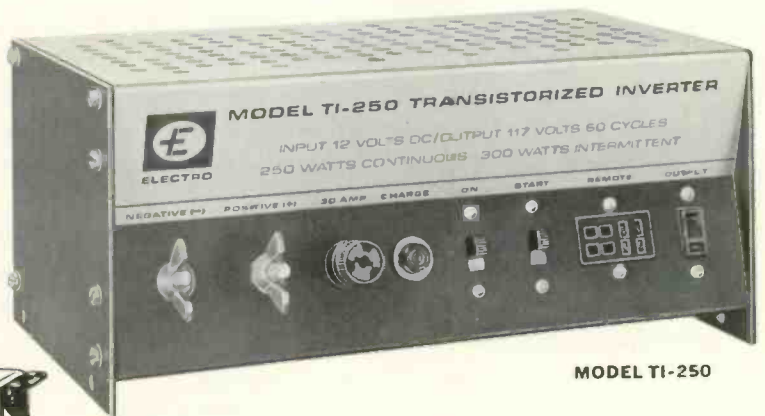
Send for complete catalog and detailed specifications on the ELECTRO line.

**ALL ELECTRO POWER SUPPLIES ARE
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INVERTERS, TOO

Supply 117 volt alternating current from a 12 volt battery

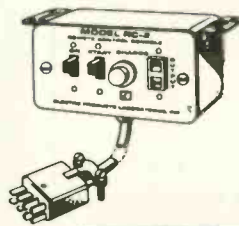
Three models to choose from: TI-100A, a low cost model adequate for most applications; TI-100TR, especially designed to assure correct frequency for tape recorders; Model TI-250, a larger model having a 250/300 watt output for a wider range of applications.



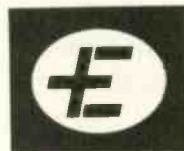
MODEL TI-250

RC-2 REMOTE CONTROL CONSOLE

Duplicates inverter front panel controls. Permits operation of inverter from any convenient location up to 8 feet away. Size: 4¼ w, 2¼ h, 2¼ d. Weight: 1½ lbs.



Send for complete data or contact your local Electronic Parts Distributor.



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Reward

for the recovery of each of these shunt regulator tubes



General Electric has discovered that certain of its large screen color TV sets containing these high voltage regulator tubes could emit soft X-radiation in excess of desirable levels.

Almost all of the sets which might have this potential X-ray emission have been found and modified with a new regulator tube specially designed for the purpose. We are now conducting a nationwide search for the remaining obsolete regulator tubes.

We are looking for these tubes in two ways. **Those in use** in any model General Electric color television set. **And new tubes in cartons**, on shop shelves, in trucks and kits.

Now here's how you can help us and pick up your reward.

First, look for the above tube types of any brand in every large screen GE color set you service. If you find one, remove it and return it to this address:

General Electric Product Service Section
Northern Concourse Building
North Syracuse, New York 13212

For every one you turn in, you will receive a check for \$5.00 plus a new replacement tube at no extra charge. To qualify, you need only to provide the customer's name and address and the model and serial number of the TV set serviced.

Second, should you have unused tubes bearing these numbers in your shop or truck, send them to the following address, and you will receive a check in the amount of 50% of list price (plus transportation expense) for each and every tube returned:

General Electric Company
Building #12, Old Hartford Road
P.O. Box 1008
Owensboro, Kentucky 42301

Remember, every used tube will get you \$5.00 when mailed to Syracuse. And every new, cartoned tube when mailed to Owensboro will bring you a check worth 50% of the list price.

If you haven't seen it, we recommend you ask your GE Distributor for a copy of GE's recent "Service Talk" on X-ray precautions in servicing color TV receivers.

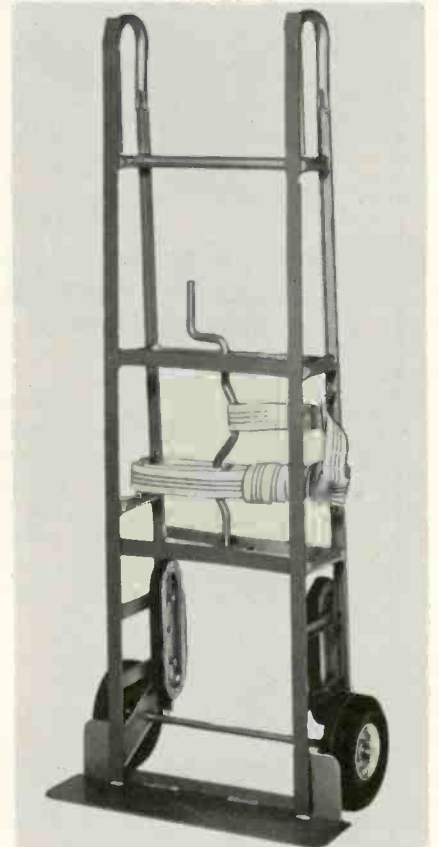
GENERAL  **ELECTRIC**

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NEW PRODUCTS

Appliance Hand Trucks 715

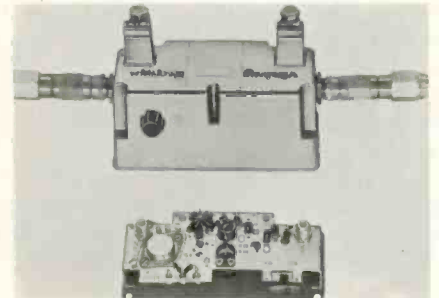
Announced is an appliance hand truck that reportedly has 8in. semi-pneumatic roller bearing wheels for rough unpaved surfaces. Specifica-



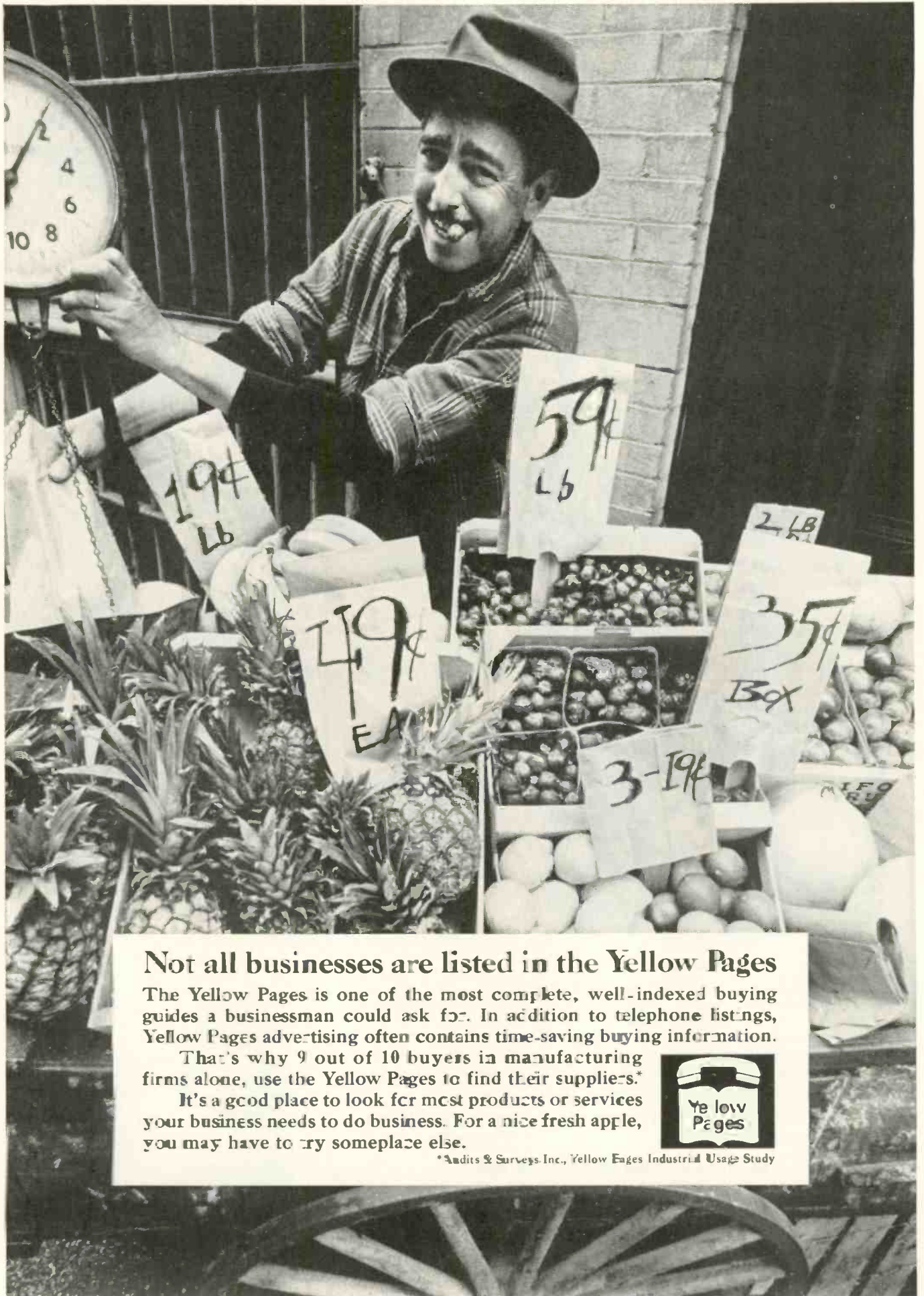
tions indicate that the 60in. high truck has an 800-lb load capacity. Other features reportedly include V-belt roller bearing stair climbers and geared belt tighteners. ElKay.

CATV Line Extender 716

A solid-state CATV amplifier has been designed in modular form for quick servicing. Specifications indicate that it has a 50 to 220MHz band-



width, 22db minimum gain at Channel 13 and requires 5w of power. It can reportedly operate through a temperature range of -40°F to $+140^{\circ}\text{F}$ and measures $5\frac{7}{8} \times 2\frac{3}{8} \times 4$ in. Vokoa, Inc.



Not all businesses are listed in the Yellow Pages

The Yellow Pages is one of the most complete, well-indexed buying guides a businessman could ask for. In addition to telephone listings, Yellow Pages advertising often contains time-saving buying information.

That's why 9 out of 10 buyers in manufacturing firms alone, use the Yellow Pages to find their suppliers.*

It's a good place to look for most products or services your business needs to do business. For a nice fresh apple, you may have to try someplace else.

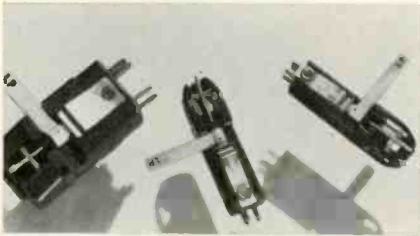


*Audits & Surveys Inc., Yellow Pages Industrial Usage Study

NEW PRODUCTS

Stereo Cartridges 717

Announced are three ceramic stereo



cartridges designed for replacement in transistorized record-playing equipment. The cartridges reportedly feature easy replacement with clip-in and clip-out mounting brackets. The brackets are designed to fit all two-boss-mount type tonearms. The needles come in 0.7-mil sapphire and 3-mil sapphire, dual 0.7-mil sapphire, 0.7-mil diamond and 3-mil sapphire. Sonotone.

TV Camera 718

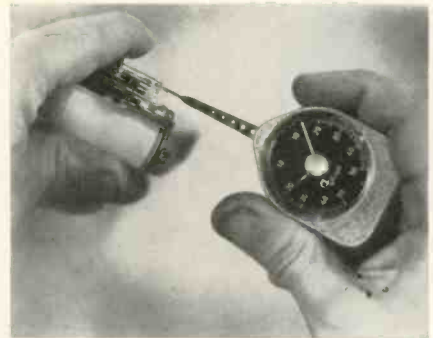
A solid-state TV camera is announced that features a built-in monitor with a 6in. CRT screen designed



to allow the operator to view the exact picture being recorded while operating the camera. A control panel below the monitor screen reportedly permits the operator to make immediate adjustments for vertical and horizontal hold, brightness and contrast. A focus control knob is also located on the rear of the camera. The manufacturer indicates that the camera provides totally automatic light correction for use under varying light conditions. Specifications indicate that the camera requires a 40 lux minimum light intensity with an f/1.8 lens, has 500 line resolution, random interlacing, 75 Ω output impedance, 1.4v output voltage. 7½ x 10 x 15in. external dimensions, weighs 20 lb and consumes 30w or 120v, 60Hz power. Price with lens under \$900. Concord.

Tension Gage 719

Announced is a gage that is reportedly designed for measuring the pressure needed to actuate relays and switches. The manufacturer indi-



cates that all gages are equipped with a maximum reading pointer. The three models have 0 to 50g, 5 to 150g or 100 to 1kg scales. Jonard.

50,000 users can't be wrong!

TECHNICIANS EVERYWHERE RELY ON FAMOUS SENCORE MIGHTY MITES. HERE'S WHY.

- Grid Leakage Test with ultra-high sensitivity of 100 megohms
- Emission Test at full rated cathode current
- Shorts Test picks out interelement shorts of 180K ohms or less
- Mighty Mite accurately checks over 3,000 tubes, including foreign



NEW MIGHTY MITE V

TC142

Now, Sencore's new Mighty Mite V gives you the same reliability and accuracy, plus new features that make the "V" the most up-to-date tester of all.

NEW—Magnoval socket so you check many more tubes.

NEW—Horizontal in-line switch layout saves setup time.

NEW—Rugged vinyl-clad steel case stays new longer.

NEW—Brushed chrome panel; detachable cover.

The new TC142 is truly Sencore's mightiest Mighty Mite and it's only

\$79.50

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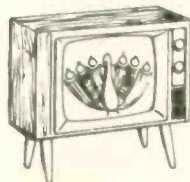
426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

... for more details circle 140 on postcard

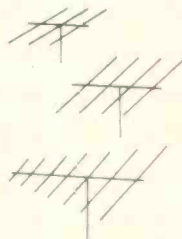
FS134 UHF-VHF-FM Solid State Field Strength Meter



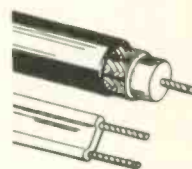
CHECK DISTRIBUTION SYSTEMS



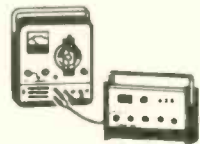
COLOR INSURANCE



MAKE ANTENNA COMPARISON



MEASURE DROP IN TRANSMISSION LINES



CHECK SIGNAL GENERATORS

Get in on the lucrative business in distribution systems, UHF, FM, and VHF antenna jobs with the all new FS134 completely solid state portable field strength meter. Calibrated in true microvolts on all bands: $\pm 3\text{DB}$ on VHF-FM/ $\pm 6\text{DB}$ on UHF.

FS134 Field Strength Meter—The FS134 uses Jerrold coax connectors so you can correct problems on existing systems, as well as install, balance, and check new distribution systems. Built-in attenuators of 0, 20, and 40 db (X1, X10, and X100) enable you to measure signal strength from the amplifier to the last tap-off in the system. The FS134 is portable and requires no AC cord; you can take it to the top of the tower to orient the VHF TV, UHF TV, and FM antennas for best signal with minimum interaction between them. Highly sensitive: 30 Microvolts $\pm 3\text{DB}$ on VHF-FM and 30 Microvolts $\pm 6\text{DB}$ UHF. Separate built-in UHF tuner for greater accuracy in critical antenna work and translator checking. 4" 2% meter calibrated in microvolts and db. Uses industrial standard for 0 db, often called 0 DBJ or DBM.

Now check db loss in various cables and lines, compare different antennas and amplifiers for db gain, field intensity surveys, and show a critical customer why he needs a new antenna for his FM stereo or color TV set. The audio amplifier and speaker let you monitor the TV or FM sound signal and aid in tracking down noise. Besides the Jerrold connector for 75 ohm cable, the FS134 has a built-in balun to match 300 ohm twin-lead; no messy adaptors. The FS134 is powered by easy to get "C" cells or optional rechargeable battery supply (part #39G15), installed in minutes as cheater cord receptacle is already riveted to panel. 10" x 9" x 5", 9 lbs.

\$199⁵⁰

39G15 Rechargeable battery supply (less battery)\$9.95

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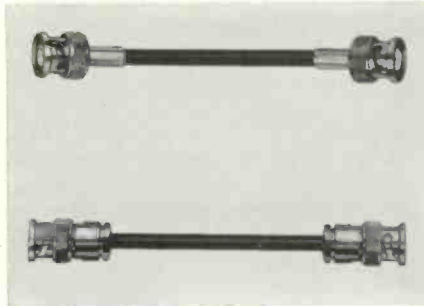


NEW PRODUCTS

Patch Cords

720

Announced are BNC connecting patch cords using type RG59B/U and RG62A/U shielded coaxial cable. Both cable types are offered in two



versions: standard UG type male BNC connectors in lengths ranging from 18 to 60in.; and crimp male BNC connectors, comparable to UG type connectors, in lengths ranging from 12 to 60in. Pomona Electronics.

Ledge-Type Shelving

721

A line of ledge-type shelving units has been designed to permit the storage of both small and large bulky items. The manufacturer indicates that it can also be used for providing a work surface. Specifications indicate that these units are available with 12-, 15-, and 24-in. deep shelves above the ledge and 18-, 24-, 30- and 36-in. deep shelves below the ledge that can be bolted for the desired storage clearance. The ledge height is reportedly



3ft 3in. on all models while the units come in 30-, 36-, 42- and 48-in. widths. Bay.

Communications Receiver

722

Announced is a solid-state receiver designed to cover all broadcast and short-wave frequencies from 535kHz through 30MHz in 4 bands. Specifications indicate that it provides regular AM plus SSB and CW reception. It can reportedly operate on 117vac, 12vdc or eight size D cells in an optional dc portable power pack. The manufacturer indicates that the receiver's illuminating lights are auto-



matically by-passed when the receiver operates on batteries, to limit battery drain. Radio Shack.

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NEW PRODUCTS

Cutting Fluid 723

Announced is an aerosol cutting fluid formulated to cool and lubricate the cutting point when drilling, cutting



or countersinking most metals. According to the manufacturer the spray eliminates scoring, oversizing and chatter marks. Sprayon Products.

AM/FM Receiver 724

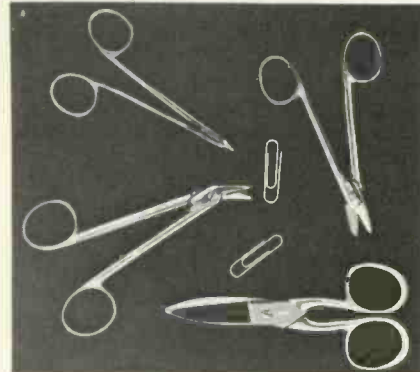
Announced is an AM/FM receiver that reportedly incorporates FETs in the FM RF and mixer stages to achieve -95db cross modulation rejection. Specifications indicate that the receiver has 2.0µv AM sensitivity, 1.8µv FM sensitivity and 80w of music



power across a 4 Ω-speaker load. The manufacturer indicates that the receiver contains 36 silicon transistors, 2 silicon FETs and 20 silicon diodes. Price \$339.50. Sherwood.

Scissors 725

Five styles of scissors have been designed for cutting fine wires,



springs, foil, insulation, gaskets, light sheet metal, etc. The manufacturer indicates that their small size lets them get into tight places. Telvac.

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LUBRICATION	Good	Fair	Fair	Poor
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FLAMMABILITY	None	None	None	None
CONDUCTIVITY	None	None	Slight	Slight
ANTI-STATIC PROTECTION	Excellent	Fair	Poor	Poor
DRIFT	None	Slight	Yes	Yes



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**Simple - Fast - Accurate • Automatic Color Tracking!
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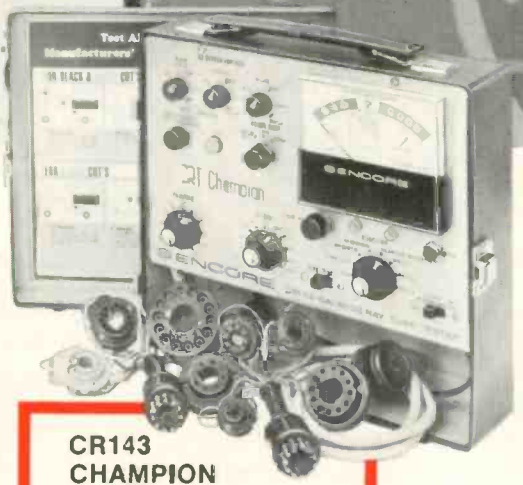
CRT manufacturers, set manufacturers, distributors, technicians — all demanded a better CRT tester than any available. This is it — the new Sencore CHAMPION — a winner on every count.

Separate G2 screen grid controls, just like the color circuit itself, enable you to set up each color gun, then automatically compare it with the others for tracking — exactly according to industry standards. This check is important when claiming credit for a defective color CRT. No time consuming logging of each color gun reading at every setting of the G2 control like competitive models. It's automatic with the CR143 Champion.

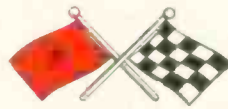
The CHAMPION also makes all the standard color and black and white CRT tests — shorts, emission, and life tests. Its Line Adjust control assures exceptional accuracy. Its exclusive three step Automatic Rejuvenation Circuit lets you save many a faulty black and white tube or equalize gun currents in color tubes.

The all-new CHAMPION is equipped with plug-in sockets for fast testing and easy updating. Rugged vinyl-clad steel case has spacious lead compartment.

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NEW PRODUCTS

Base-Station Microphone 726

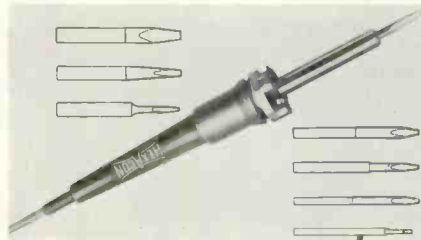
Announced is a microphone that reportedly contains a two transistor



preamplifier with volume control and 2mv to 45mv output for 1 bar input. The self-contained battery is designed for a life of over 300 hours. Specifications indicate that the microphone has an adjustable height from 9 1/2 to 12in. and includes a press-to-talk bar. List price \$49.50. Shure.

Miniature Soldering Irons 727

A line of soldering irons designed for soldering miniature electronic assemblies is announced. Specifications



indicate that they weigh less than 2oz, have 5/16in. case diameters and use tips with diameters ranging from 1/16 to 3/8in. and power ratings from 15 to 60w. Hexacon.

Portable Radio 728

Announced is a portable radio designed to receive not only regular AM and FM broadcasts but interna-



tional short wave (5 to 12MHz), local airport and airplanes (108 to 142.70MHz) and police, fire, radio-telephone, commercial and public service vehicles (143.80 to 177.38-MHz). It measures 7 3/8 x 10 1/2 x 3in. and reportedly operates from size C cells. Price with earphone, batteries and ac adapter is \$59.50. Allied Radio Corp.

Mobile Antenna 729

A fiber glass mobile antenna has been designed for the 150 to 174MHz frequencies. The radiating element and matching coil are reportedly en-

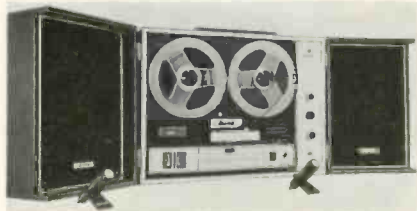


cased in fiber glass to help eliminate precipitation static, corrosion and mechanical and electrical failures caused by vibration. Specifications indicate that the 5/8 wave antenna has a 5MHz bandwidth, 50Ω impedance, 150w power rating, omnidirectional radiation and 3db gain. C/P Corp.

NEW PRODUCTS

Tape Recorder 730

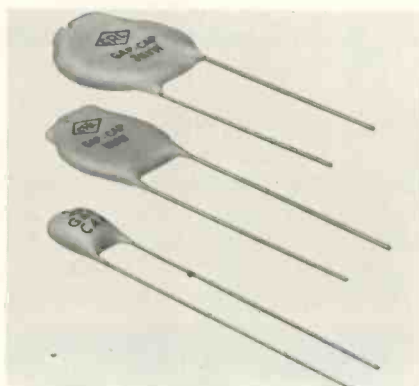
A solid-state tape recorder designed to record and play 4-track stereo and mono at speeds of 7½, 3¾ and 1⅞ ips is announced. Specifications indicate 10w peak output, 30Hz to 18kHz



frequency response and less than 0.15% flutter-and-wow at 7½ips. Allied Radio.

Spark Gap Capacitors 731

Announced is a series of capacitors in which the applied voltage is reportedly prevented from exceeding a specified value, and any excess energy that could endanger sensitive components is dissipated across its spark gap. Specifications indicate that capacitances range from 0.75pf to



0.01μf and maximum working voltages range from 1kv to 3kv, while arc start voltages are 1 to 2kv, 2 to 3kv or 4 to 6kv. Centralab.

CB Transceiver 732

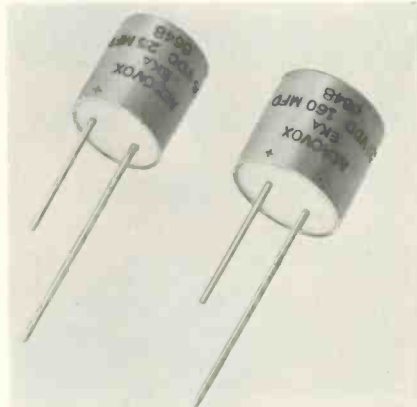
A 23-channel CB transceiver has been introduced which reportedly features a cascade front end and Nuvistor mixer. Specifications indicate that it also has dual conversion, a transistor



power supply, illuminated channel selector and "S" meter plus a modulation indicator. Price \$189. Courier.

Electrolytic Capacitors 733

A line of plastic-cased tubular capacitors is designed for printed circuit transistor circuitry and miniature electronic assemblies. They reportedly are produced with epoxy end sealing



to reduce damage caused by humidity. Specifications indicate that they are produced in 11 types with values ranging from 5 to 250μf, dc ratings of 3, 6, 10, 15, 25, 35 and 70v, and leakage current ratings between 30 and 120μa. Aerovox.

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Two full-size UHF
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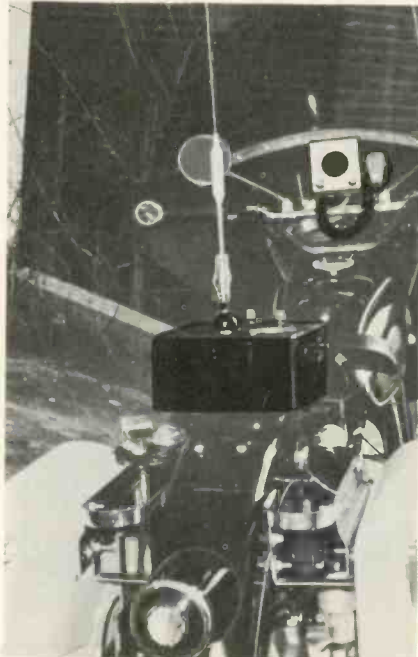
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NEW PRODUCTS

Motorcycle CB Radio 734

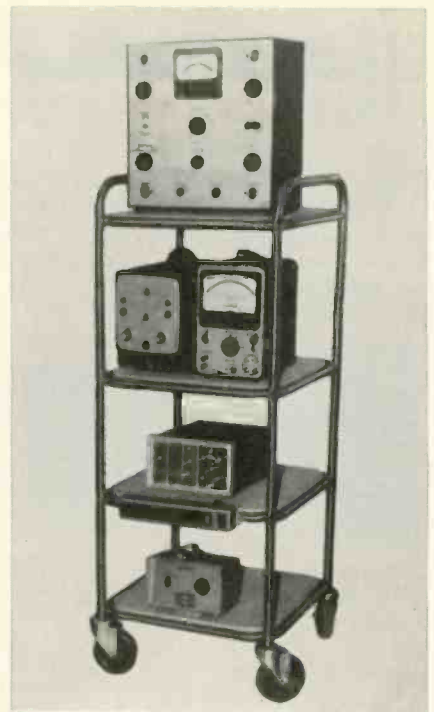
A line of two-way CB radios has been developed for mounting in the luggage carrier or saddlebag of scooters or motorcycles. Specifications



indicate that the 7-channel models are equipped with a 5w transmitter and superheterodyne receiver. A remote control head, weather-proof speaker and spring-loaded antenna are reportedly also included in the transceiver package. Price \$199.50. Polytronics.

Instrument Cart 735

A four-deck instrument cart is announced that reportedly features 4in. swivel casters for smooth mobility. The cart reportedly has 1800sq in. of shelf space capable of holding 600 lb. The manufacturer indicates that it is



made of 1-in. stainless steel with decks made of fiber-glass and plywood. The cart is 58⁵/₈ x 24⁵/₈ x 31¹/₂in. with the top deck 55in. above the floor. Cambridge Electronics.

Stereo Systems 736

An AM/FM stereo system is announced that reportedly contains an



automatic turntable driven by a four-pole induction motor. It also contains a solid-state receiver that has an 85w (IHF) rated power output. Price \$499.50 with speakers. Benjamin.

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Hugh "Scotty" Wallace Appointed ET Publisher

Marshall Reinig, president of Ojibway Press, Inc., announces the appointment of Hugh "Scotty" Wallace as publisher of ELECTRONIC TECHNICIAN Magazine, effective Oct. 2, 1967. Ojibway's president said that Mr. Wallace will be headquartered in the New York City office of the company at 71 Vanderbilt Ave. Until recently, Mr. Wallace was national advertising sales manager for PF REPORTER.



Mr. Wallace served as a radio communications specialist in the U.S. Navy during WW2 and was recalled during the Korean conflict. He also served as Chief Radio Officer aboard troop transports and after the war attended Purdue University for three years.

"Scotty" Wallace has a wide acquaintance in the home-entertainment and two-way communications equipment area of the electronics field, both among manufacturers and trade-magazine readers.

"He brings to ELECTRONIC TECHNICIAN an ability and a background that we are sure will make a very substantial contribution in connection with a new expanded program we have under way," Mr. Reinig said.

Ojibway Press publishes 27 other trade magazines in addition to ELECTRONIC TECHNICIAN, world's largest circulation electronics trade magazine, which has more than 80,000 TV-radio service-dealer and technician subscribers in the United States and Canada.

FM Radio and Phonograph Sales Continue To Climb

Distributor sales of FM radios and portable-table phonographs registered considerable gains in June, according to the Electronic Industries Assn.'s (EIA) Marketing Services Dept.

FM radios distributed to dealers numbered 414,169, a 43.4 percent rise over the June 1966 sales figure. This brought first six-month sales to 766,767, an increase of 9.1 percent over FM radio sales for the first half of 1966.

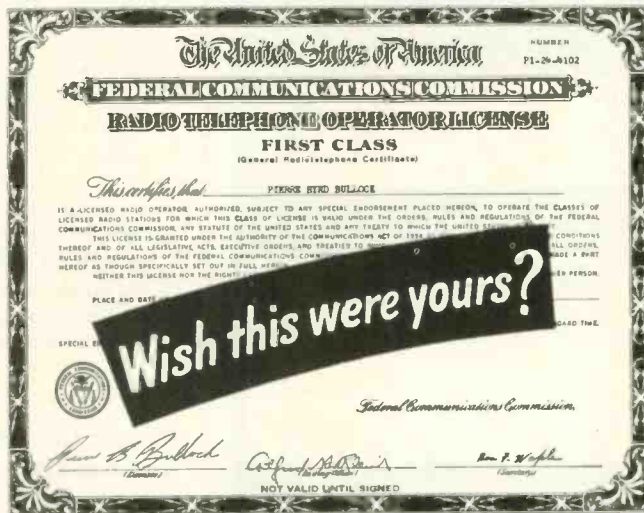
Portable-table phonographs sold to dealers climbed to 35,992, a 20.9 percent jump over June 1966. This result continued the favorable pattern established earlier in 1967. So far this year, distributor sales of portable-table phonographs have numbered 1,391,390, 18.8 percent above the first six months of 1966.

The TV picture was not quite so bright. Color TV sales in June were at 284,949 units, 14.4 percent below June 1966 sales. Comparative six-month figures for color, however, still gave 1967 an 8.6 percent edge over the first half of 1966. B/W TV sales in June numbered 385,900 units, down 29.1 percent from June 1966.

RCA Reports 30 Percent Increase In Color TV Sales

RCA reports that its factory sales of color TV sets this year are running more than 30 percent ahead of the record first eight months of 1966 despite a strike that idled production lines for five weeks. Delbert L. Mills, RCA executive vice president of consumer products, said "August factory shipments showed an 80 percent increase over the same month last year."

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NEWS OF THE INDUSTRY

Patents and Information Exchanged By Du Pont and Sony

The Du Pont Co. of Wilmington, Del., and Sony Corp. of Tokyo, Japan, have agreed to an exchange of certain technical information and patent rights in the magnetic tape field.

Under the agreement, Sony will be licensed by Du Pont to manufacture in Japan video tape based on a chromium dioxide process developed by Du Pont. The company will receive from Sony certain know-how and patent rights involving the manufacture of magnetic tape.

Merger Documents Signed By GI and Jerrold

The Boards of Directors of General Instrument Corp. and The Jerrold Corp. have approved the acquisition of Jerrold by General Instrument, and the formal documents were signed Sept. 22, 1967.

The merger is subject to the approval of stockholders of both companies and receipt of a favorable ruling from the Internal Revenue Service.

Mini-sized Records Introduced For Battery Radio-Phonos

Philco-Ford Corp. introduces a mini-sized vinyl record containing best-selling tunes in a double-barrelled promotion aimed at the growing youth market in popular music.

Beginning this fall it will manufacture and distribute hip pocket records, a special line of 3 7/8 in., wafer-thin 45rpm discs. (The standard single 45 is 7 in. in diameter.)

Armin Allen, vice president of the Consumer Electronics Div., says that only songs that have been on the best-selling lists will appear in the company's new catalog. The mini-sized records will contain hit recordings by the very artists who made them the standard songs.



Color TV Set Sales Climb To All-Time Weekly High

Color TV distribution sales set an all-time record for any single week in the period ending Sept. 1, the Electronic Industries Assn.'s Marketing Services Dept. disclosed.

Color TV sales to distributors by manufacturers reached 155,737 units for the reporting period beginning Aug. 26 and ending Sept. 1, the industry statistical service reported. This is the highest figure ever recorded in color TV marketing and represents a sharp comeback from the 1967 low point of 39,000 sets distributed in the week ending June 2.

The previous high this year for

color TV distribution sales was the 130,000 figure reached in early January. After dipping gradually to a June 2 low, distributor sales started trending upward, as steady on the positive side so far this half of 1967 as the first-half movement had been on the down side.

The previous largest distributor sales week ended Sept. 29, 1966, when 144,000 color-TV sets were recorded as shipped to distributors.

July FM radios, the star performer among the radio lines this year, kept close to the phenomenal 1966 comparable month, numbering 269,235 units. Year-to-date figures still show 1967 7.5 percent ahead of last year.

U. S. Consumer Electronics Market Statistics
For First Half of 1967

Items Purchased	Factory Sales U. S. Produced	Imports U. S. Brand	Imports Foreign Brand	Total U. S. Sales
Table Radios	801,352	112,509	560,485	1,474,346
Clock Radios	1,833,910	92,477	203,491	2,129,878
Portable Radios	797,441	1,539,311	7,357,317	9,694,069
Automobile Radios	4,288,987	—	294,607	4,583,594
Total Radios	7,721,690	1,744,297	8,415,900	17,881,887
Color & B/W TV Sets	4,448,696	319,993	359,637	5,128,326
Phonographs	1,810,921	174,722	581,930	2,567,573
Home Tape Recorders	427,564	184,126	453,000 (Est.)	1,064,690 (Est.)

The information for this table was compiled by the Electronic Industries Assn.'s Marketing Services Dept.

Hip pocket records will be sold separately and as a part of a promotional package with a portable radio-phonograph, which is listed at \$24.95. Two other models with phonograph only will sell for \$19.95 each.

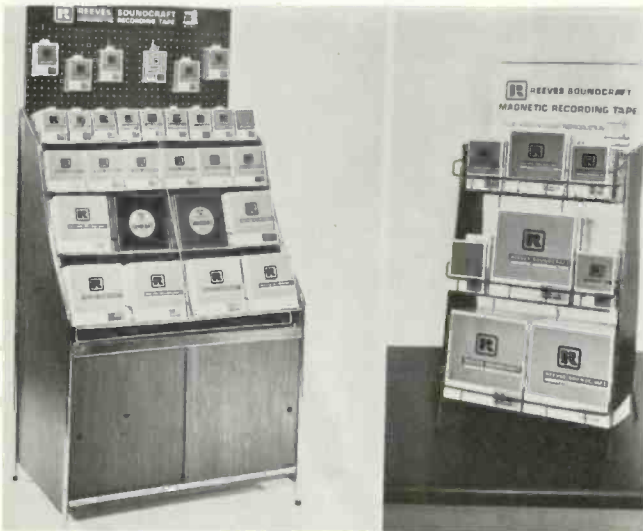
New Industrial Research Center Developed Along Hudson River

A new industrial research center for occupancy by selected industries will be developed by Stevens Institute of Technology along the Hudson River directly opposite midtown Manhattan.

"The reasoning behind the research center," said John Muller, vice chairman of the Stevens board of trustees, "is similar to that which has led to the grouping of industrial scientific communities around other science-minded colleges and universities. There is a growing realization that industry and the academic world have much to offer each other."

Free Recording Tape Displays Offered by Reeves

New walnut-paneled floor stands and counter displays for Reeves' 5- and 7-in. recording tape and mailer packages



are currently being offered free of extra charge to retailers of Reeves Soundcraft tapes.

The floor stand, which reportedly can display 276 reels of tape and provide storage for an additional 200 reels, is being offered at no charge on orders totaling \$500 or more. The chrome-plated stands are finished in walnut and measure 34½ x 22½ x 65in.

For smaller purchases amounting to at least \$100, a free counter display is provided, which is designed to accommodate 96 reels of tape. It, too, is chrome-plated and walnut-paneled. Its dimensions are 15½ x 11 x 30in.

Blonder-Tongue Announces Equipment For TV RF Signals

A battery powered, solid-state RF signal converter for signal measurements in the 5 to 54MHz range has been announced by Blonder-Tongue Laboratories. Specifications indicate that the output frequency of the converter is always 100MHz above the incoming frequency. Input signals between 5 and 54MHz will therefore fall between 105 and 154 MHz.

Also announced is the addition of four antennas to its line of 300 Ω color antennas. These new antennas have a provision for connecting both 300Ω twinlead or 75Ω coax.

Introducing the world's first 5-channel, solid state, Citizens Band Radio with a Class B push-pull amplifier, super-sensitive receiver, and full-powered transmitter, that comes with either palm microphone or telephone handset at no extra cost: The Sentry II, by Pearce-Simpson. Total weight, 3 pounds. Total price, \$99.90.

At \$99.90, Pearce-Simpson introduces a remarkable new CB Radio.

How remarkable? This remarkable:

It features no close range blocking.

A greatly improved noise limiting circuit which virtually eliminates ignition and alternator noise, plus electronic switching.

Its specifications include 4.0-watt power output, 0.5 uv to open squelch, adjacent channel 50 db down, and cross modulation 80 db down. And it carries a full one year warranty.

Conclusion:

Nobody can make a better radio for \$99.90.

Not even Pearce-Simpson.

And at \$139.90, Pearce-Simpson introduces the brand new solid state Companion IV, featuring 10 channels plus P.A.

Plus:

Both front and bottom speakers.

An innovation which guarantees unobstructed, distortion-free sound no matter where the radio is mounted.

Touch-tap tuning. Which allows you to change channels just like that. No close range blocking. A greatly improved noise limiting circuit.

Plus:

It comes with a choice of either palm microphone or telephone handset at no extra cost.

It weighs only 3¾ pounds. And it carries a full one year warranty.

Conclusion:

Dollar for dollar, there are more features in a Pearce-Simpson CB Radio than any other CB Radio in the world.

Write us. It could be the start of something small, that could easily grow into something big.



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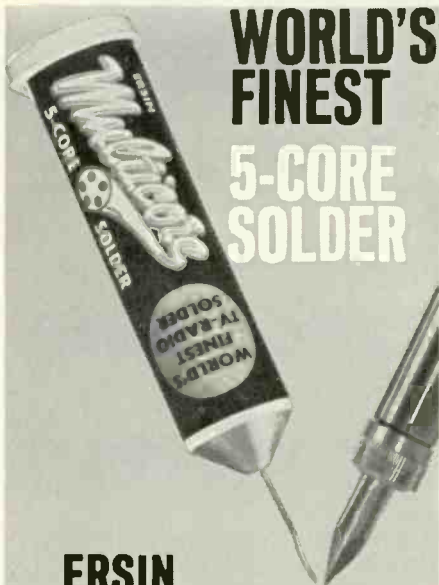
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NEWS OF THE INDUSTRY

Sony Drops Price Of B/W TV Sets

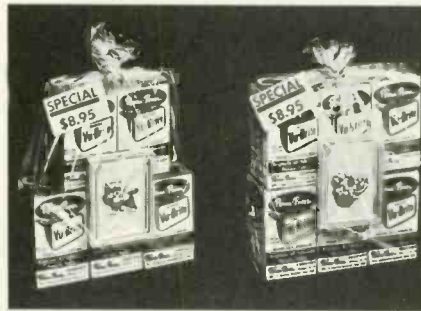
Sony Corp. has announced a reduction in the list price of its 700U Model B/W TV receivers from \$129.95 to \$115.

When making this announcement, the company indicated that the growing demand for this type of receiver had resulted in increased production, which made the price drop possible.

Sony has reportedly started delivery of its new black screen 500U model TV receivers with a list price of \$135.

Perma-Power Promotes Britener With Free Pin Set Packages

Vu-Brite and Tu-Brite TV CRT



brighteners, being packaged by Perma-Power, contain a free gold pin set with simulated pearls or stones.

Thomas Shelby Appointed Oxford Electric Sales Rep.

Oxford Transducer Co. has announced the appointment of Thomas Shelby and Co. as sales representatives for the Oxford line of speakers in Ohio, West Virginia and western Pennsylvania.

Semiconductor IC Sales Climb

U. S. Factory sales of semiconductor integrated circuits totaled \$104 million during the first half of 1967, climbing 56.6 percent above sales during the same period last year, the

Perma-Power Appoints Three More Garage-Door Opener Reps

Perma-Power Co. has appointed three new garage-door opener sales representatives. They include Northwest Sales Co. of Portland, Ore.; J.A. Gedney Co. of Denver, Colo.; and Hopkins & Co. of Lebanon, Ohio.

Audio Tape Sales Stimulated By Christmas Bonus Promotion

Audio Devices, Inc. has announced a special Christmas bonus promotion created to generate store traffic



and stimulate dealer sales of audio tape. The package deal is built around a new prerecorded tape — "The 100 Voices of Christmas" — plus five 1800ft reels of blank mylar-based audio tape. "The 100 Voices" features a 30-minute choral program of carols in 4-track stereo.

"The tape six-packs, including the prerecorded bonus tape, are available to dealers at \$13.95, the regular price for five reels of audio tape alone," Rolf Haag, marketing manager, says. "We believe there will be enthusiastic consumer response to this special offer and, at the suggested retail price of \$19.95, the dealer's profit margin will be more than 30 percent," he adds.

Electronic Industries Assn.'s Marketing Services Dept. reported.

With the 31.3 percent decline in average values, total unit sales rose 128 percent to reach 27 million during the 1967 first half.

U. S. Factory Sales of Semiconductor
Integrated Circuits
First Halves, 1966 & 1967

Circuit Type	1966			1967		
	Units	Dollars	Average Value	Units	Dollars	Average Value
Digital	11,211,000	53,839,000	4.80	24,063,000	80,385,000	3.34
Analog	708,000	12,433,000	17.56	3,116,000	23,367,000	7.50
Total	11,919,000	66,272,000	5.56	27,179,000	103,752,000	3.82

Electronic "Copy Boy" Stars At International Press Show

A fast-moving electronic "copy boy" has scored a news "beat" in a demonstration before approximately 400 press representatives by transmitting a 1400-word news story from England to Puerto Rico in less than two minutes.

The transmission, from the London bureau of the WASHINGTON POST to the Inter American Press Assn. conference in San Juan, Puerto Rico, used the Datel service of ITT World Communications which transmits at a speed of 1300 words per minute.

Internationally Renowned Scientist Receives Communications Prize

Dr. Dennis Galbor, internationally renowned scientist, received the Christopher Columbus International Communication Prize for outstanding scientific achievement in communications theory.

The Christopher Columbus prize of five million lire (\$8000) is given annually by the City of Genoa to outstanding men of science who have contributed most to the progress of navigation communications.

Dr. Gabor is known throughout the world as the "father of holography." Holography is the new technique of "lenseless photography," in which an object is imprinted in three dimensions on a photographic plate by interference patterns.

In addition to holography, Dr. Gabor has carried out considerable research during the past 20 years in communication theory, particularly on the problems of frequency compression and prediction, also in plasma theory.

Econoline Antenna Truck Won In National Electronics Week Show

Art Poma from Poma TV in Ukiah, Calif., was the grand prize winner of the Ford Econoline antenna truck in the Jerrold Distributor Sales Div.'s "Jack-in-the-Box" Sweepstakes.

Mr. Poma received his truck keys at the same time that Leonard Thrash of Basham Christensen Co., his Jerrold distributor salesman in Santa Rosa, was awarded a Mercury Cougar.

Both men received their prizes after having won a drawing held at the National Electronics Week Show.

STATEMENT REQUIRED BY THE ACT OF OCTOBER 23, 1962, (39 U.S. Code, 4369) SHOWING THE OWNERSHIP, MANAGEMENT AND CIRCULATION OF ELECTRONIC TECHNICIAN published monthly at Duluth, Minnesota for November 1967.

1. The names and addresses of the publisher, editor and managing editor are: Publisher, Ron Kipp, 71 Vanderbilt Avenue, New York, N.Y. 10017; Editor, None; Managing Editor, Jack Hobbs, 1 East First Street, Duluth, Minnesota, 55802.

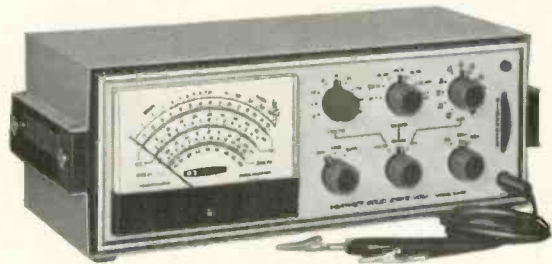
2. The owner is: ELECTRONIC TECHNICIAN, INC., 1 East First Street, Duluth, Minnesota. Stockholder owning 1 percent or more of stock: Ojibway Press, Inc., 1 East First Street, Duluth, Minnesota.

3. The known Bondholders, mortgages and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: 82,449. Free distribution by mail, carrier or other media: 551. Total distribution: 83,000.

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COLOR TV SERVICING SIMPLIFIED WITH VECTORSCOPE. By Wayne Lemmons. Published by Lectrotech, Inc., 28 pages, soft cover. \$1.25.

Ten photographs showing tracings on a vectorscope are used to help explain the scope configurations expected on color TV sets that function properly and how these configurations change when problems arise. The book contains many helpful hints on using this test instrument, manufactured by the publisher. This information should be of interest to color TV technicians interested in expanding their servicing techniques.

RCA TRANSISTOR MANUAL. Written and published by Radio Corp. of America, 544 pages, soft cover. \$2.

The material covered in this book begins with a theoretical valence electron explanation of semiconductor materials. This basic concept is developed into a study of diode, transistor, "triac" and FET characteristics. Basic circuits are used to describe the practical applications of

these components. The major portion of this 317-page book contains semiconductor component descriptions by using maximum rating and characteristic tables. Typical collector characteristic curves are also frequently used. This book should be of some value to both beginning and advanced electronic technicians who are concerned with the functions of new semiconductor components they may service.

SERVICING CLOSED-CIRCUIT TELEVISION. By Melvin Whitmer. Published by Howard W. Sams, Inc., 192 pages, soft cover. \$4.25.

The historic background of closed-circuit TV and the general specifications of a CCTV system introduce the reader to the type of work he would experience when installing and servicing CCTV systems. The book appears to be primarily concerned with the maintenance of cameras and cable transmission systems. Step-by-step testing procedures and desired waveforms are provided for this purpose. A 69-page section of the book also contains diagrams for an assortment of CCTV equipment. This book may be of interest to the experienced technician who is interested in expanding his business into a new area that promises a big future.

Business Communications 400

Guides for selecting transmitter power, antenna height and two-way business/industrial communications systems are included in a 16-page full-color booklet. The booklet defines this communications band and explains licensing requirements. E.F. Johnson.

Fault Locators 401

An eight-page bulletin describes instruments designed for locating above- and below-ground communications cable faults. Included also are pictures of the instruments while in use. Hewlett-Packard.

Audio Systems 402

Industrial amplifiers, microphones, microphone mixers, microphone stands, reflex trumpets, paging talk-back speakers, drivers and mobile audio systems are described in a six-page bulletin. American Geloso.

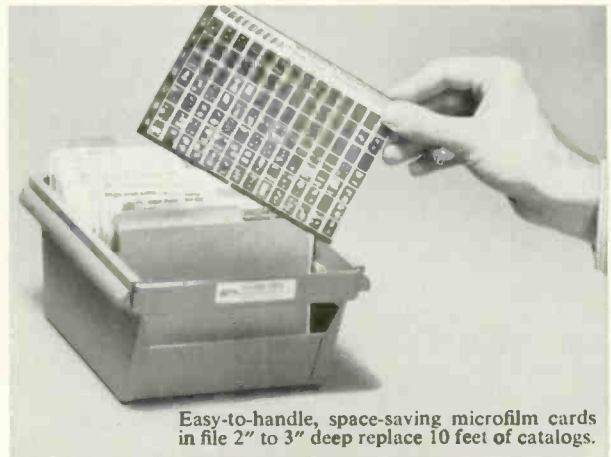
Controls 403

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lays; toggle, trigger and push-button switches; push-button control stations and reversing drum controls are described in a 26-page catalog. Relay and Control Corp.

Capacitors 404

An eight-page bulletin describes a line of molded solid electrolyte tantalum capacitors with the use of tables, graphs and drawings. Mallory.

Hi Fi Systems 405

A 12-page catalog describes a line of solid-state tuners, receivers and amplifiers, plus speaker systems and crossovers. Electro-Voice.

Potentiometers 406

Industrial and laboratory potentiometers, trimmers, dials and instrument motors are described by using cutaway photographs and drawings in a 112-page catalog. Amphenol.

Console Decorating 407

An illustrated, full-color, 24-page brochure features a line of stereo consoles in a collection of decorator-styled room settings. Reportedly included are informative articles on high fidelity, the role of music in the home, choosing the correct console to match individual room decor and explana-

tions of the more technical aspects of stereo consoles. H.H. Scott.

Capacitors 408

A six-page brochure reportedly contains a listing that includes over 250 wide range electrolytics of single, dual, triple and quadruple section type capacitors. These components are reportedly designed for over 2500 different exact replacements according to a wide range principle of broad capacitance tolerances. Cornell-Dubilier.

SEMICONDUCTORS...

continued from page 59

+ X_{C3}). By substituting the equation for determining capacitive reactance

$$(X_C = \frac{1}{2\pi f C}),$$

we can calculate the total capacitance in the series:

$$\frac{1}{2\pi f C_T} = \frac{1}{2\pi f C_1} + \frac{1}{2\pi f C_2} + \frac{1}{2\pi f C_3}$$

Both sides of the equation can be multiplied by the same quantity:

$$\frac{2\pi f}{2\pi f C_T} = \frac{2\pi f}{2\pi f C_1} + \frac{2\pi f}{2\pi f C_2} + \frac{2\pi f}{2\pi f C_3}$$

This can be simplified to the following:

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

If the varicap in Fig. 20 has the characteristics illustrated in Fig. 9 of the October 1967 article, the diode will have a 50pf capacitance when its reverse bias is 4.25vdc. When connected in series with a 200pf capacitor, the total capacitance in parallel with the coil is 40pf.

$$\left(\frac{1}{C_T} = \frac{1}{D1} + \frac{1}{C1} = \frac{1}{50\text{pf}} + \right.$$

$$\left. \frac{1}{200\text{pf}} = 0.02/\text{pf} + 0.005/\text{pf} = \right.$$

$$\left. 0.025/\text{pf}. C_T = \frac{1}{0.025/\text{pf}} = 40\text{pf}.\right)$$

By reducing the reverse bias, the total capacitance is increased, reducing the capacitive reactance and changing the resonant frequency.

The next article in this series will describe the function of varicaps in FM AFC, TV AFTC and AM tuning circuits. ■

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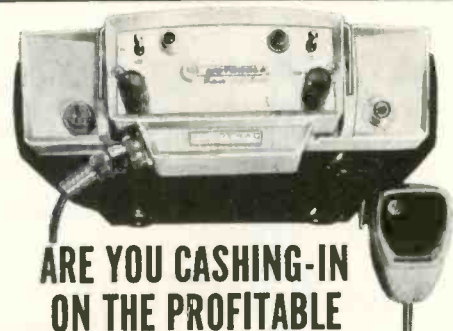
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How the Wide Ranger Protects Your Profits

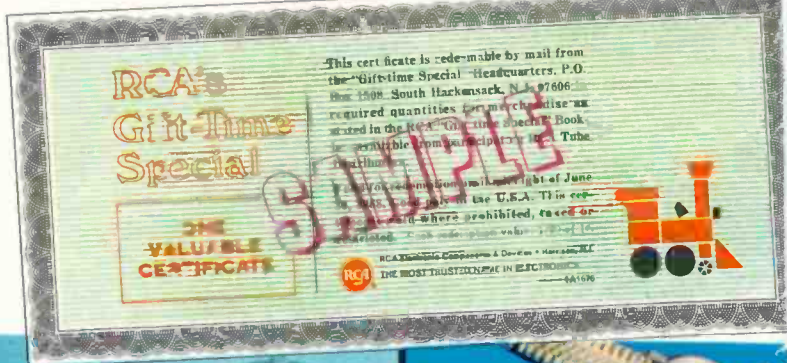
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