SEPTEMBER 1970 A HARCOURT BRACE JOVANOVICH PUBLICATION

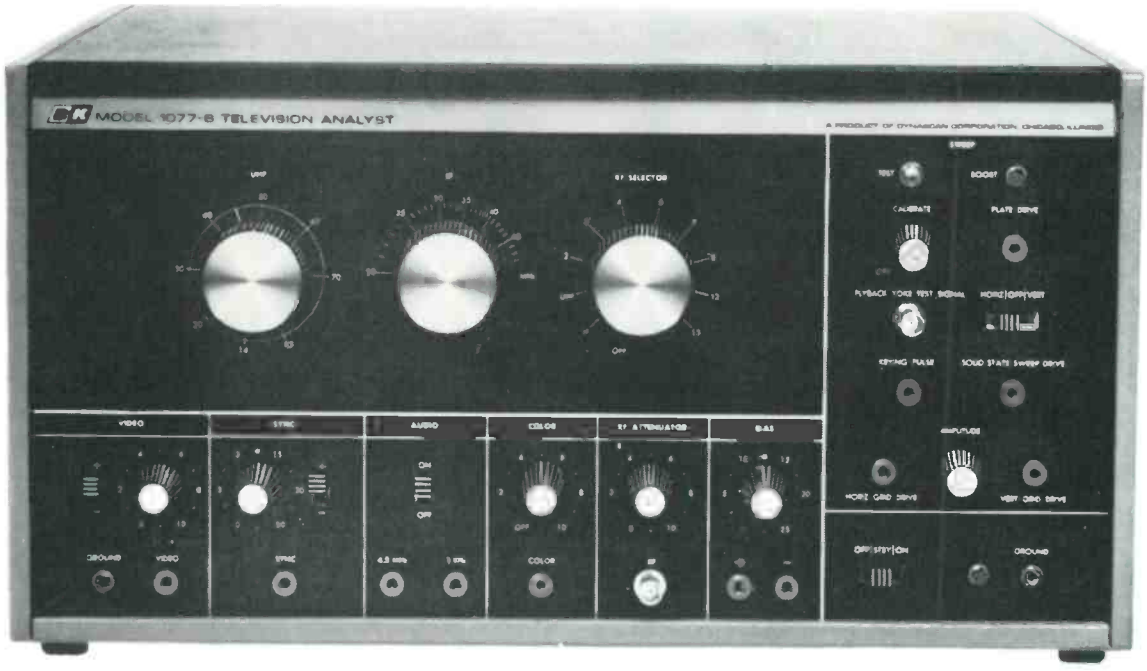
ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

Why a Trigger-Sweep Scope

Curtis Mathes CMC33 Chassis

Servicing CCTV Systems



Who said B & K couldn't improve the only complete Television Analyst?

Now there is a new model... the 1077-B, with solid state sweep drive.

The B & K Television Analyst has become standard equipment in repair shops everywhere. And for good reason. It's the quickest, simplest way to test every stage of any TV.

But even classic instruments have to keep up with the times.

That's why we've added a solid state sweep drive in our latest model. It can check any new transistorized color set on the market today.

It's so easy, too. Because the unique B & K signal substitution technique eliminates the need for external scopes or wave-form interpretation.

Whether it's tubes or transistors, VHF or UHF, simply inject the appropriate test pattern or any other known signal. The new Model 1077-B, with its exclusive flying spot scanner, checks everything from the antenna terminals to the input of the picture tube.

Ask your distributor about the new Television Analyst. Only B & K makes it. And now B & K makes it even better.

Model 1077-B $389.95

B&K

Product of DYNASCAN CORPORATION
1801 W. Belle Plaine, Chicago, Illinois 60613

. . . for more details circle 102 on Reader Service Card

ELECTRONIC TECHNICIAN / DEALER

TEKFAX

COMPLETE MANUFACTURER S' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 5 NEW SETS

GROUP 217

	SCHEMATIC NO.		SCHEMATIC NO.
ADMIRAL Color TV Chassis 19H10	1317	J. C. PENNEY TV Model 1315	1320
ADMIRAL TV Chassis TL2	1316	RCA VICTOR Color TV Chassis CTC39XAA	1319
GENERAL ELECTRIC Color TV Chassis H-3	1318		

CHASSIS VOLTAGES WITH SIGNAL

17BF11 Pin #	Volts	8BM11 Pin #	Volts	8FQ7 Pin #	Volts	33GY7A Pin #	Volts
1	Fil	1	Fil	1	84	1	Fil
2	2.1	2	106	2	.55	2	138
3	0	3	106	3	3.5	3	
4	0	4	0	4	Fil	4	Do Not Measure
5	0	5	1.35	5	Fil	5	Do Not Measure
6	70	6	0	6	94	6	
7	130	7	107	7	-9	7	
8	0	8	0	8	3.5	8	0
9	7.6	9	107	9	0	9	-14
10	120	10	.6			10	0
11	145	11	.03			11	82
12	Fil	12	Fil			12	Fil

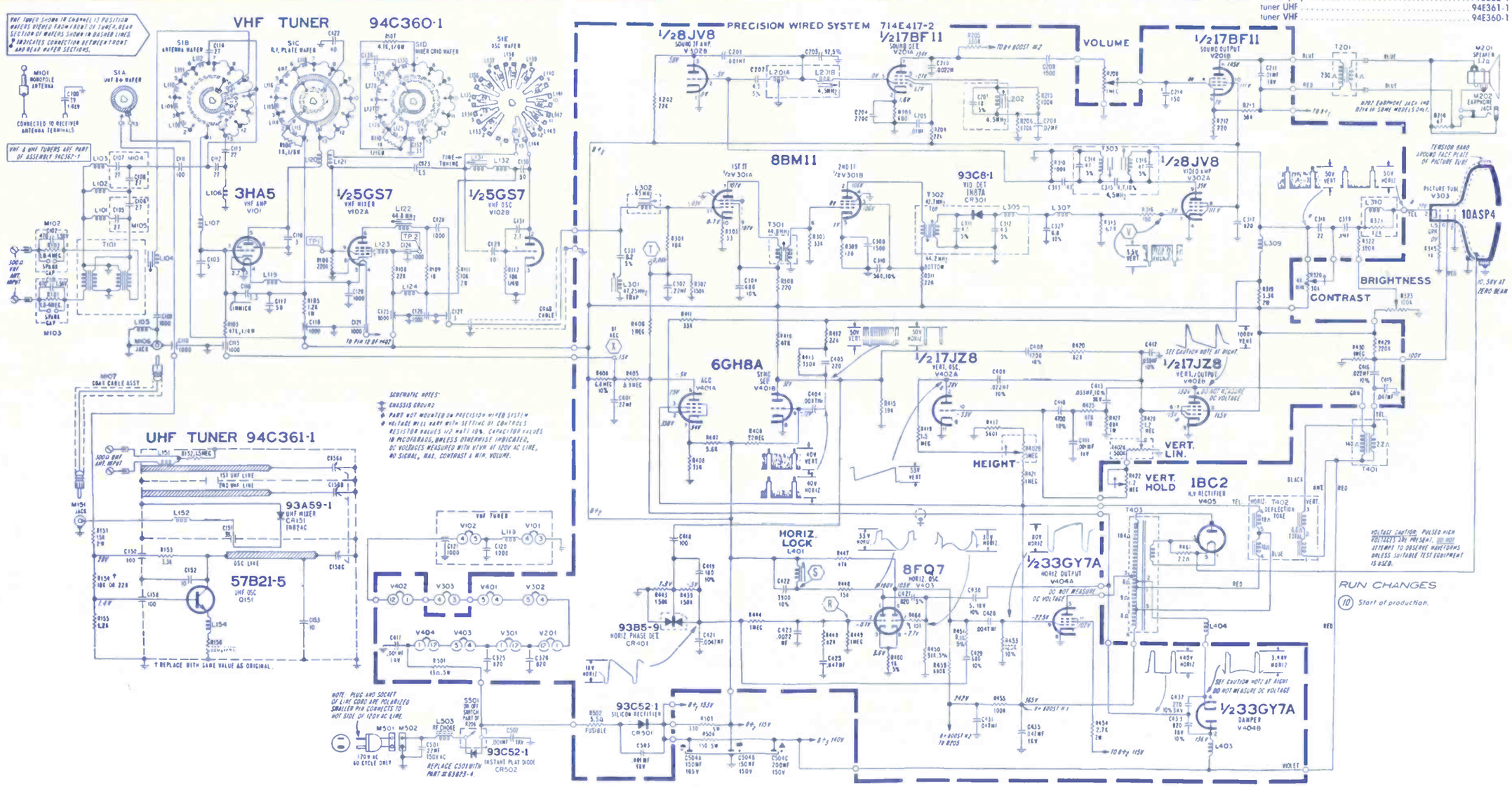
8JV8 Pin #	Volts	17JZ8 Pin #	Volts	6GH8A Pin #	Volts
1	0	1	Fil	1	52
2	-1.2	2	28	2	80
3	66	3	0	3	350
4	Fil	4	Do Not Measure	4	Fil
5	Fil	5		5	Fil
6	0	6	-16	6	-68
7	-2.5	7	-16	7	104
8	124	8	110	8	0
9	80	9	0	9	-21
		10	-64		
		11	0		
		12	Fil		

IF AGC TP "I" -11V
RF AGC TP "R" -2.6

1316
ADMIRAL
TV Chassis TL2

SEPTEMBER • 1970

SYMBOL	DESCRIPTION	ADMIRAL PART NO.
R208	1M, vol control with switch	75C120-1
R320	30K, contrast control	75C121-3
R322	100K bright control	75C121-2
R402A	vert lin control	75C95-6
R402B	height control	75C95-6
R422	1.2M, vert hold control	75C121-1
R501	13Ω, 5w	61C20-56
R502	5.5Ω, fuse type	61C48-1
R504	150Ω, 5w	61C20-44
C432	270pf, 3Kv, cer disc	65A10-434
C504A	150μf, 165v elect	67D15-393
C504B	150μf, 150v elect	67D15-393
C504C	200μf, 150v elect	67D15-393
L202	quad coil	72C132-77
L301	47.25MHz trap	72C296-4
L307	resonant choke	73C45-243
L309	video peaking coil	73C5-20
L401	horiz lock coil	94D17-17
L503	ac line choke	73C31-1
T201	audio output xformer	79C81-23
T301	1st IF xformer	72C132-76
T303	sound takeoff xformer	72C185-5
T401	vert output xformer	79A139-3
T402	deflection yoke assembly	94A372-1
T403	horiz output xformer	79A138-5
CR301	diode, video detector	93C8-1
CR401	horiz phase detector	93B5-9
CR501	silicon rectifier	93A52-1
CR502	instant play	93B52-1
	tuner UHF	94E361-1
	tuner VHF	94E360-1



1317
ADMIRAL
Color TV
Chassis 19H10

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SEPTEMBER • 1970

RUN CHANGES

(20) Start of production.

(21) To standardize PWS systems with other current chassis, different part No. PWS 400 is used. R471 (9.1K, 4W) was transferred from early PWS 400 to chassis as R754.

(22) To reduce line radiated interference, R717 & C705 were removed from ground side of AC line & connected to hot side of AC line. C704 (.047MF) was removed from across M702. C735 was added across output of L709.

(23) To stabilize brightness range. R460 & C455 were removed from between pin 2 of V404 & term. of brightness control. R778 added from term. HH of PWS500 to term. of brightness control. R456 changed from 180K to 120K.

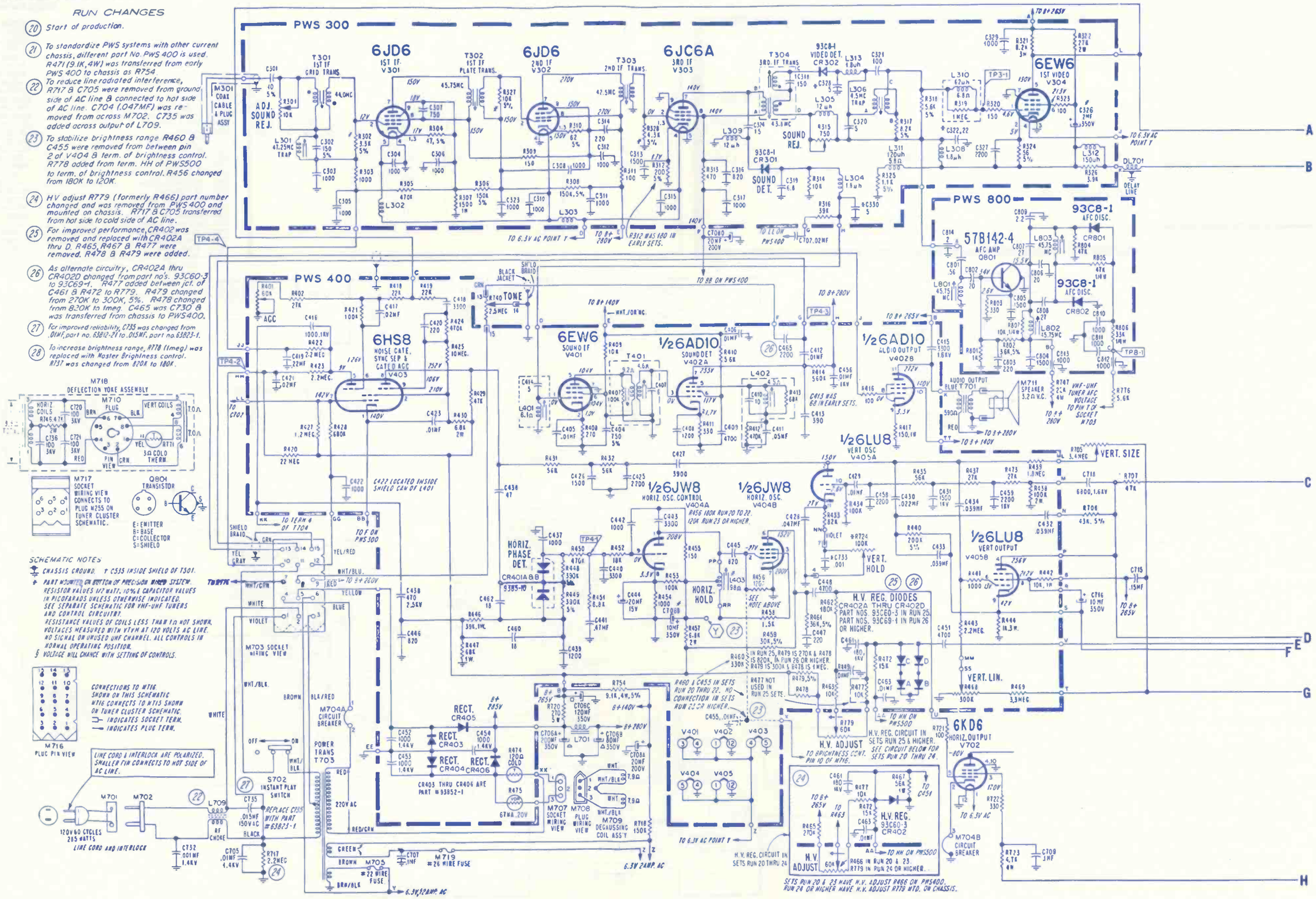
(24) HV adjust R779 (formerly R466) part number changed and was removed from PWS 400 and mounted on chassis. R717 & C705 transferred from hot side to cold side of AC line.

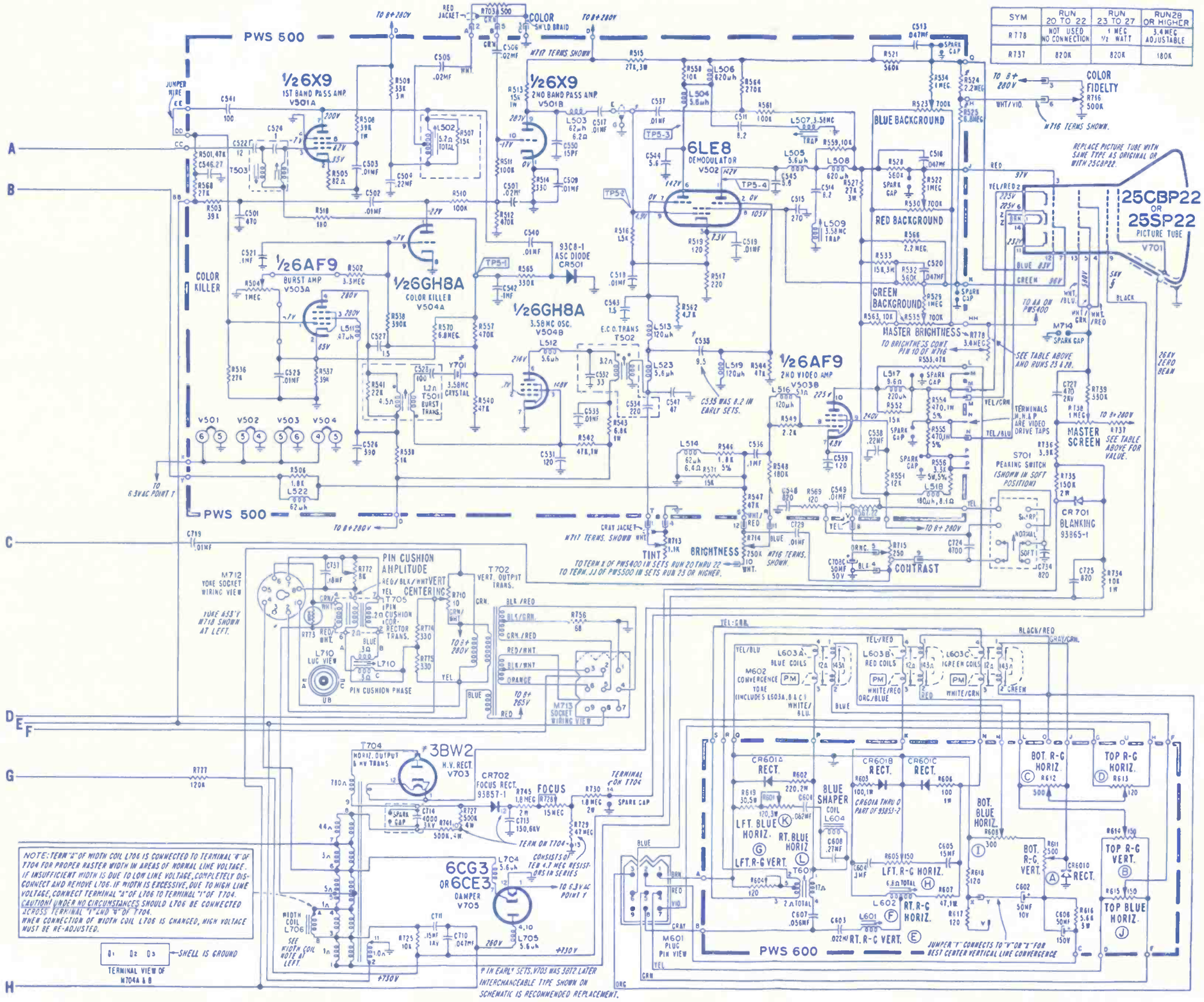
(25) For improved performance, CR402 was removed and replaced with CR402A thru D. R465, R467 & R477 were removed. R478 & R479 were added.

(26) As alternate circuitry, CR402A thru CR402D changed from part no's. 93C60-3 to 93C69-1. R477 added between jct. of C461 & R472 to R779. R479 changed from 270K to 300K, 5%. R478 changed from 8.2OK to 1meg. C465 was C730 & was transferred from chassis to PWS400.

(27) For improved reliability, C735 was changed from .01MF, part no. 63812-21 to .015MF, part no. 63823-1.

(28) To increase brightness range, R778 (1meg) was replaced with Master Brightness control. R737 was changed from 820K to 180K.





SYM	RUN 20 TO 22	RUN 23 TO 27	RUN28 OR HIGHER
R778	NOT USED NO CONNECTION	1 MEG 1/2 WATT	3.4MEG ADJUSTABLE
R737	820K	820K	180K

NOTE: TERM "2" OF WIDTH COIL L706 IS CONNECTED TO TERMINAL "4" OF T704 FOR PROPER RASTER WIDTH IN AREAS OF NORMAL LINE VOLTAGE. IF INSUFFICIENT WIDTH IS DUE TO LOW LINE VOLTAGE, COMPLETELY DISCONNECT AND REMOVE L706. IF WIDTH IS EXCESSIVE, DUE TO HIGH LINE VOLTAGE, CONNECT TERMINAL "2" OF L706 TO TERMINAL "1" OF T704. CAUTION! UNDER NO CIRCUMSTANCES SHOULD L706 BE CONNECTED ACROSS TERMINAL "1" AND "4" OF T704. WHEN CONNECTION OF WIDTH COIL L706 IS CHANGED, HIGH VOLTAGE MUST BE RE-ADJUSTED.

* IN EARLY SETS, V703 WAS 3BT2 LATER INTERCHANGEABLE TYPE SHOWN ON SCHEMATIC IS RECOMMENDED REPLACEMENT.

SYMBOL	DESCRIPTION	ADMIRAL PART NO.
R301	adj sound rej control	75B101-8
R315	750Ω, sound rej control	75C101-3
R401	60K, AGC control	75C101-9
R466	60K, HV adj control	75C101-12
R468	300K, vert lin control	75C101-10
R474	therm	61C50-5
R475	varistor	61C51-4
R504	1M, color killer control	75C101-11
R523	background triple control	75C95-9
R530	background triple control	75C95-9
R535	background triple control	75C95-9
R705	3.4M, vert size control	75C96-20
R710	10Ω, vert centering control	75D64-17
R728	15M, focus control	75C108-5
R729	47M, 10% (order 10-4.7M)	60B67-475
R738	1M, master screen control	75C136-1
R771	3Ω therm in yoke	61C27-1
R773	voltage dependent	61B46-2
R779	HV reg control	75A101-12
C706A	200µf, 350v elect	67D15-392
C706B	80µf, 350v elect	67D15-392
C706C	120µf, 350v elect	67D15-392
C708A	20µf, 200v elect	67D15-394
C708B	10µf, 350v elect	67D15-394
C708C	50µf, 50v	67D15-394
C708D	20µf, 200v elect	67D15-394
L401	sound takeoff coil	72C287-4
L402	quad coil	72C287-3
L403	horiz osc coil	94D268-4
L502	bandpass coil	72C269-4
DL701	delay line	72C217-3

1318
GENERAL ELECTRIC
Color TV
Chassis H-3

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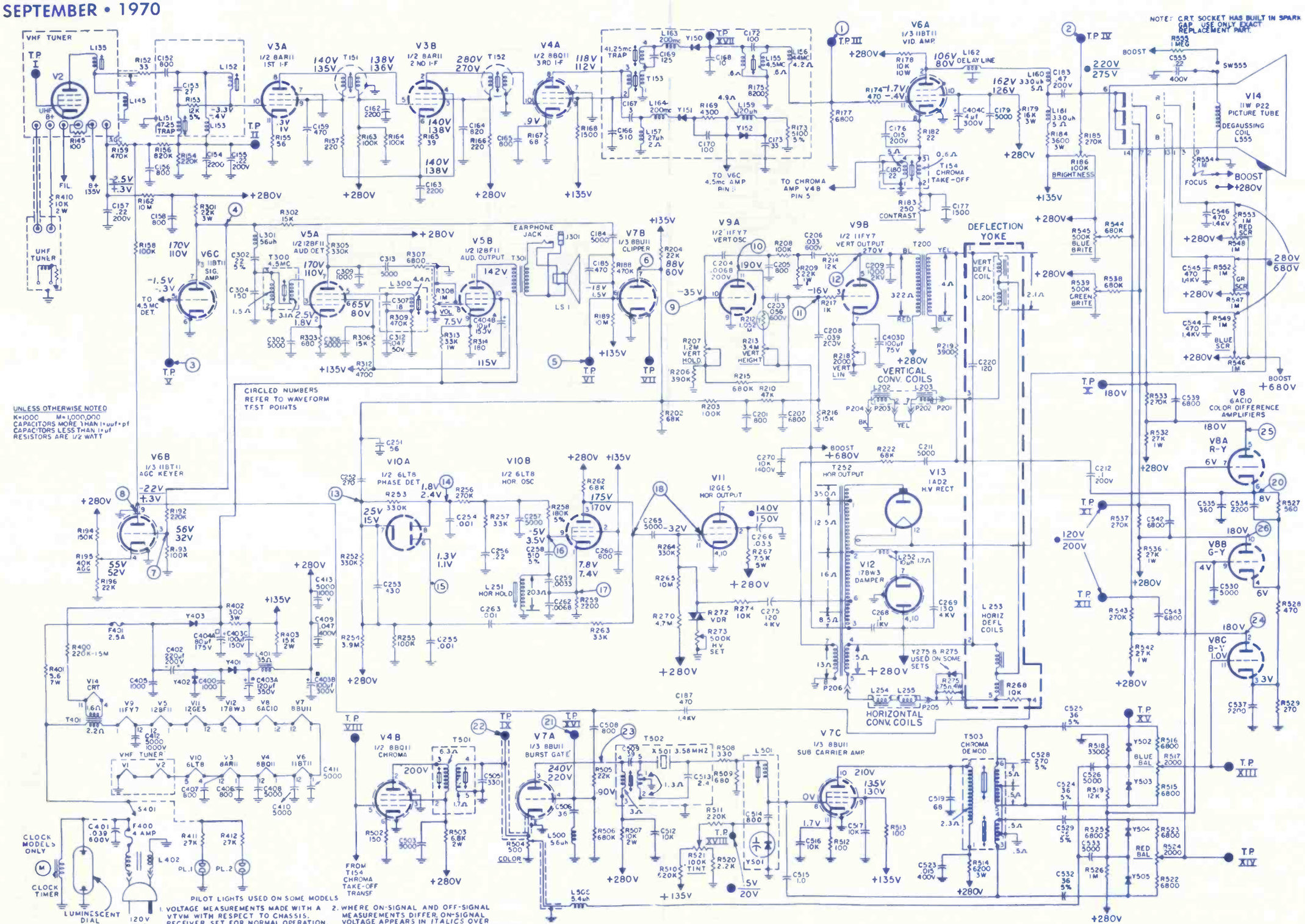

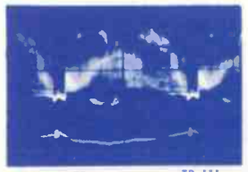
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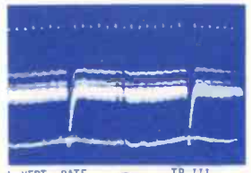
4 VOLTS PEAK FROM GROUND
(1)
TP III BROADCAST SIGNAL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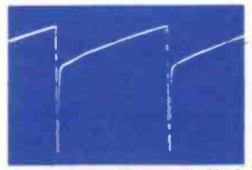
4 VOLTS PEAK FROM GROUND
(1)
TP III CROSSHATCH GEN. SIGNAL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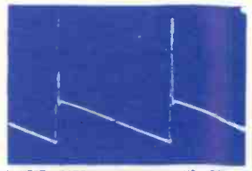
200 VPP
(11)
V9, PIN 3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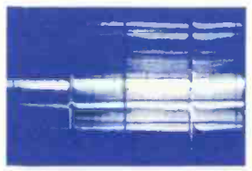
880 VPP
(12)
V9, PIN 5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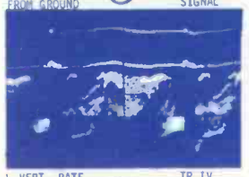
2 VPP
(20)
V8, PIN 6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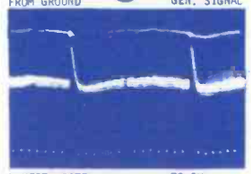
95 VPP
(2)
TP IV BROADCAST SIGNAL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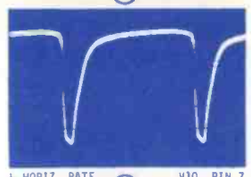
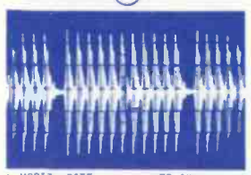
TP IV CROSSHATCH GEN. SIGNAL


½ HORIZ. RATE
28 VPP
(13)
V10, PIN 7


½ HORIZ. RATE
3 VPP
(14)
V10, PIN 8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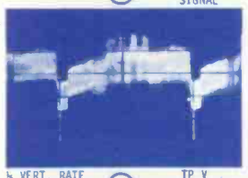
TP IX KEYED RAINBOW GENERATOR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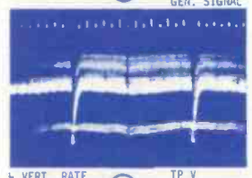
(3)
TP V BROADCAST SIGNAL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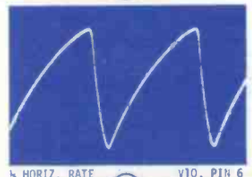
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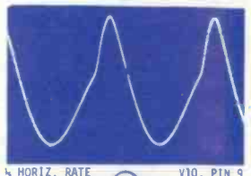
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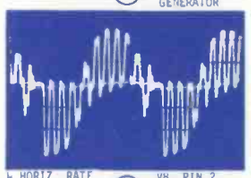
45 VPP
(16)
V10, PIN 9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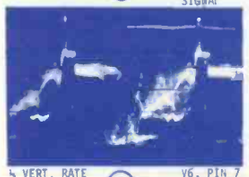
180 VPP
(24)
V8, PIN 2 KEYED RAINBOW GENERATOR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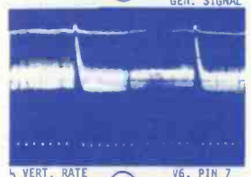
65 VPP
(4)
V6, PIN 7 BROADCAST SIGNAL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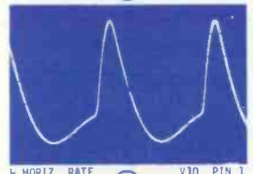
(4)
V6, PIN 7 CROSSHATCH GEN. SIGNAL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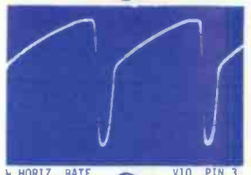
30 VPP
(17)
V10, PIN 1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150 VPP
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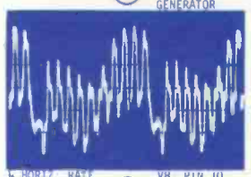
V10, PIN 3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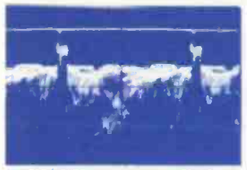
(26)
V8, PIN 10 KEYED RAINBOW GENERATOR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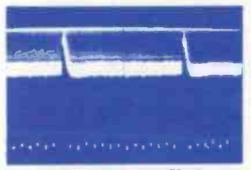
50 VPP
(5)
TP VI BROADCAST SIGNAL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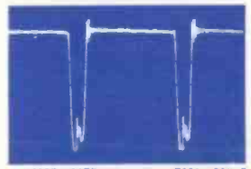
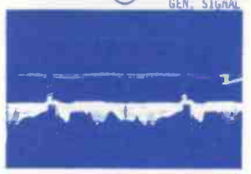
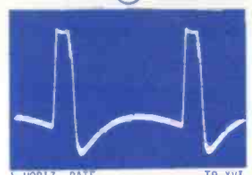
50 VPP
(5)
TP VI CROSSHATCH GEN. SIGNAL

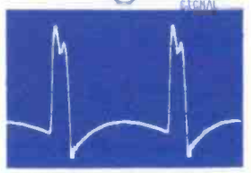

½ HORIZ. RATE
200 VPP
(19)
T252, PIN 7

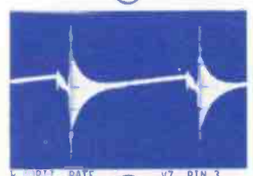

½ VERT. RATE
70 VPP
(6)
V7, PIN 7


½ VERT. RATE
26 VPP
(7)
V6, PIN 3 BROADCAST SIGNAL


½ HORIZ. RATE
140 VPP
(21)
TP XVI

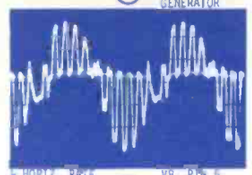

½ HORIZ. RATE
26 VPP
(7)
V6, PIN 6 KEYED RAINBOW GENERATOR

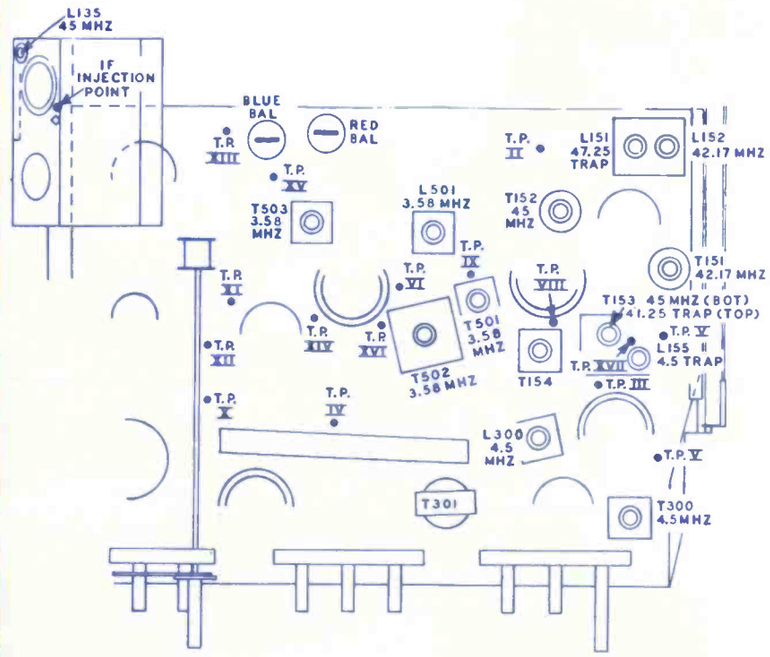

½ HORIZ. RATE
250 VPP
(8)
V6, PIN 9


½ HORIZ. RATE
200 VPP
(23)
V7, PIN 3 KEYED RAINBOW GENERATOR

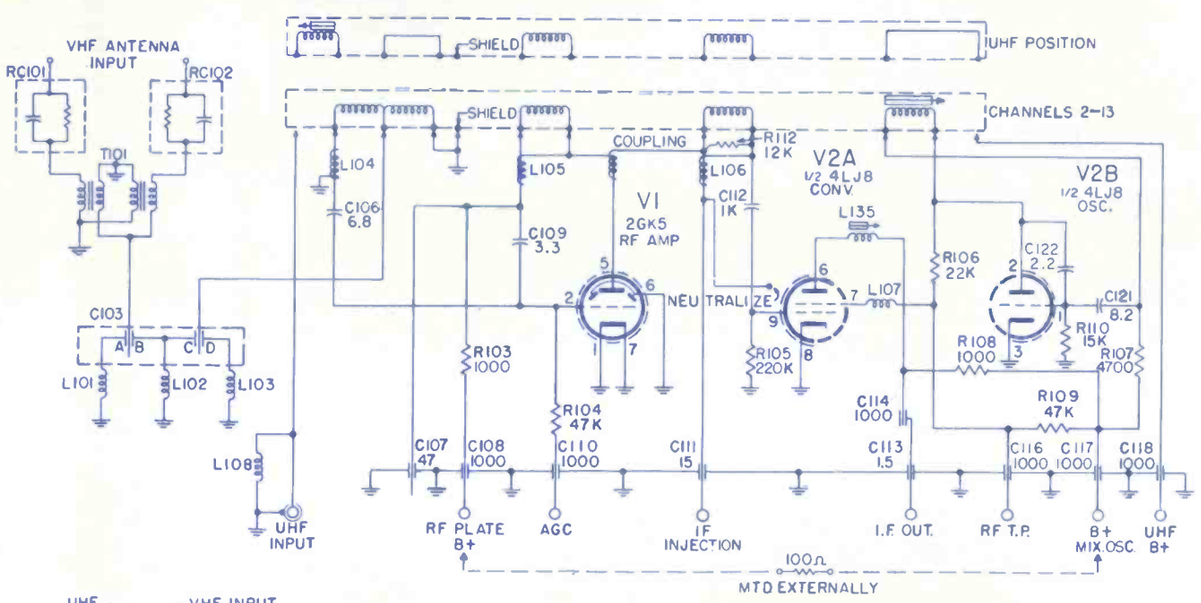

½ VERT. RATE
80 VPP
(9)
V9, PIN 10

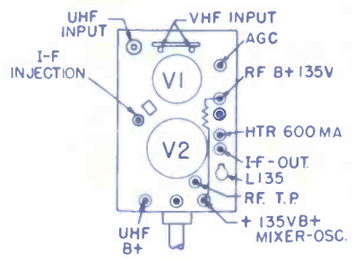

½ VERT. RATE
240 VPP
(10)
V9, PIN 11

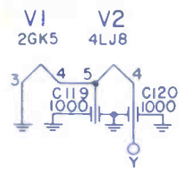

½ HORIZ. RATE
180 VPP
(25)
V8, PIN 5 KEYED RAINBOW GENERATOR



Top View
Test Points & Alignment Locations







SCHEMATIC DIAGRAM

1319

RCA VICTOR

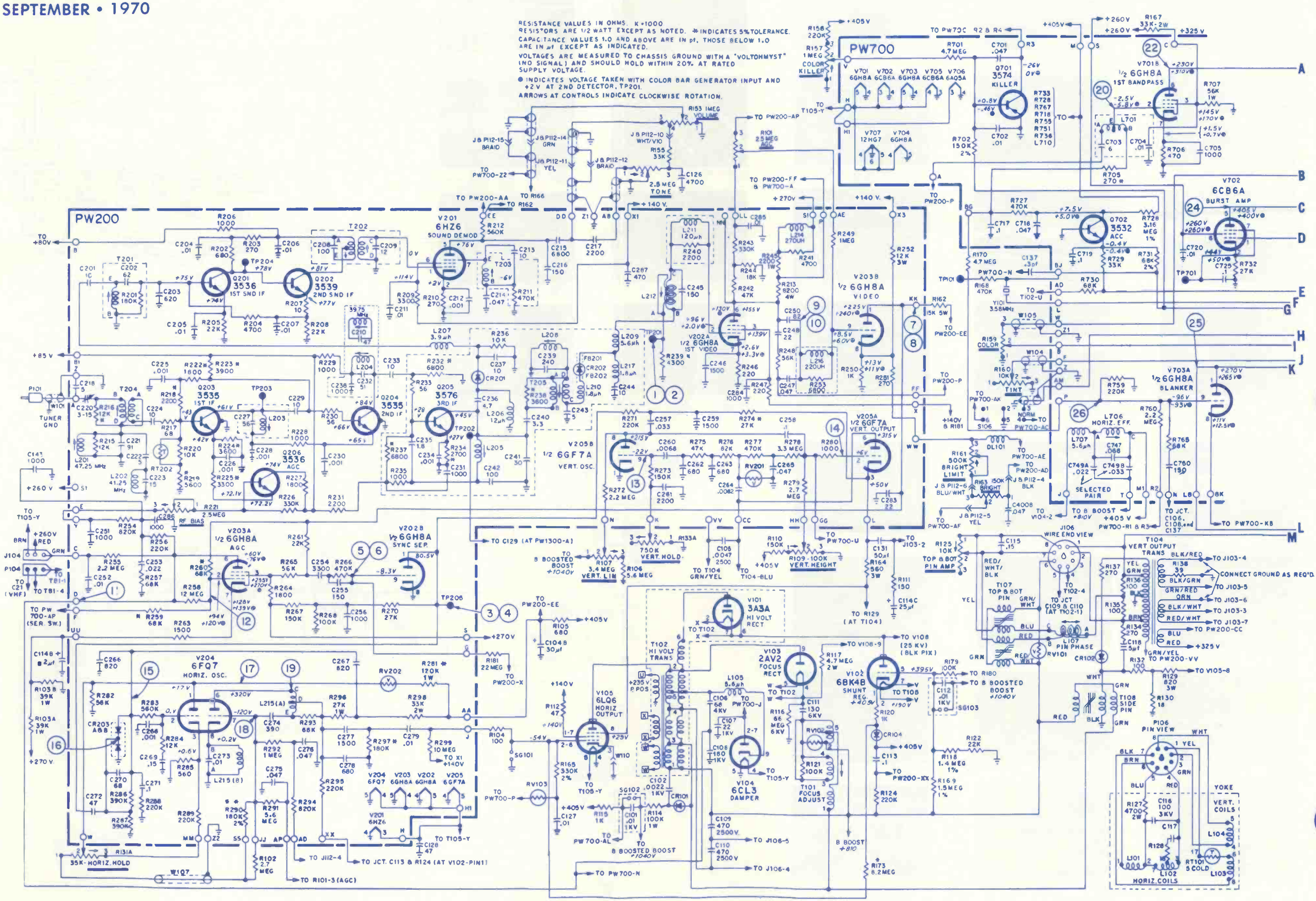
Color TV
Chassis CTC39XAA

SEPTEMBER • 1970

ELECTRONIC TECHNICIAN / DEALER TEKFAX

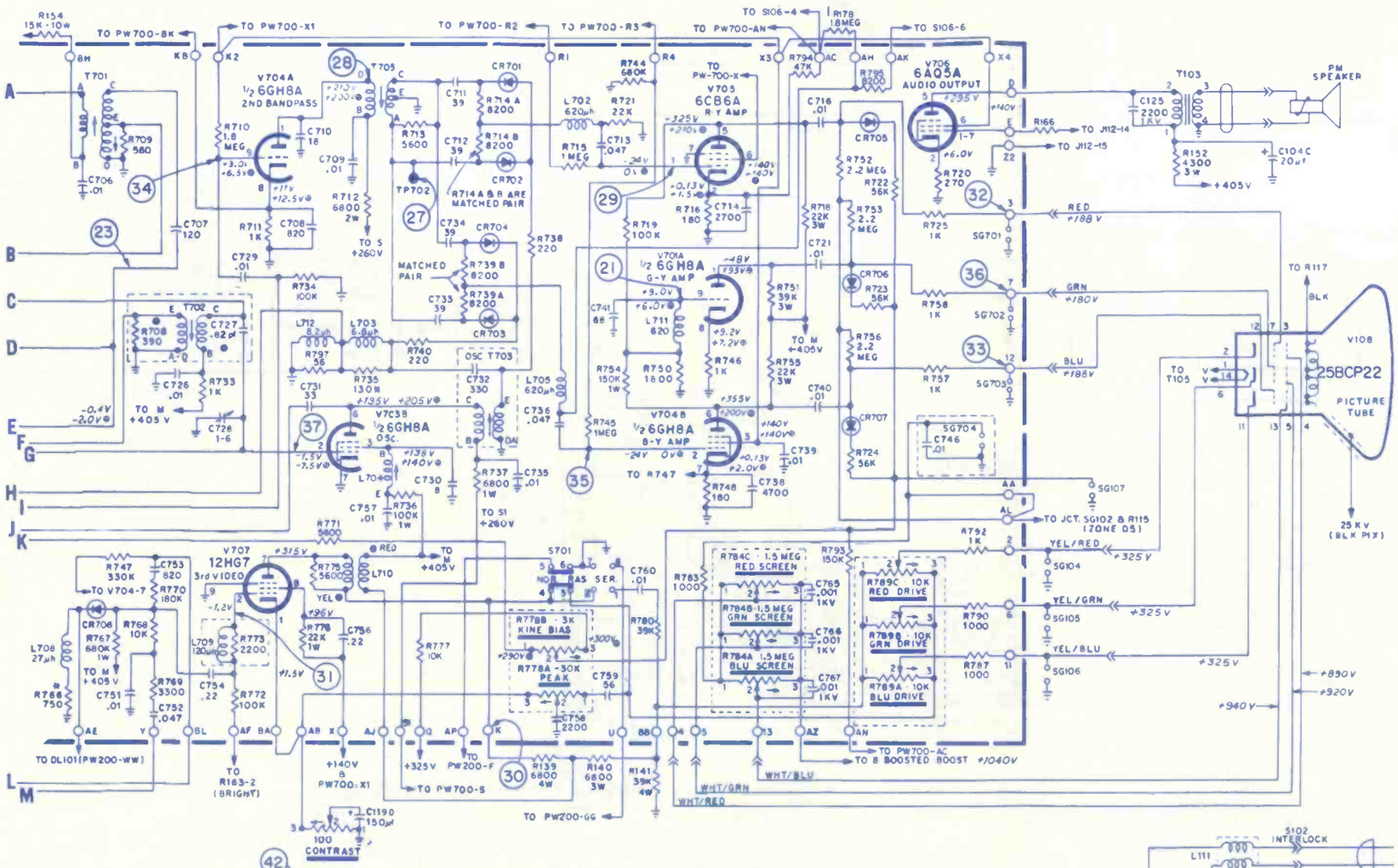
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

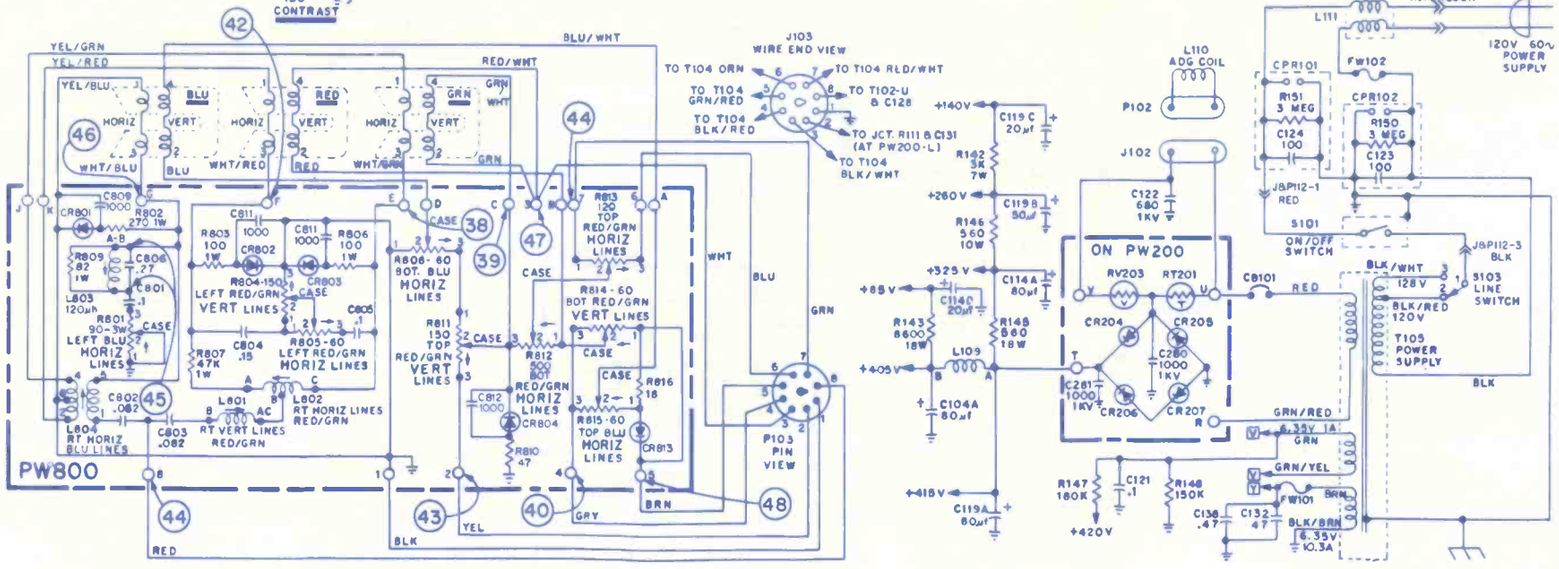
RESISTANCE VALUES IN OHMS. K=1000.
RESISTORS ARE 1/2 WATT EXCEPT AS NOTED. * INDICATES 5% TOLERANCE.
CAPACITANCE VALUES 1.0 AND ABOVE ARE IN pf. THOSE BELOW 1.0 ARE IN µf EXCEPT AS INDICATED.
VOLTAGES ARE MEASURED TO CHASSIS GROUND WITH A "VOLTOHMYST" (NO SIGNAL) AND SHOULD HOLD WITHIN 20% AT RATED SUPPLY VOLTAGE.
● INDICATES VOLTAGE TAKEN WITH COLOR BAR GENERATOR INPUT AND +2 V AT 2ND DETECTOR, TP201.
ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.

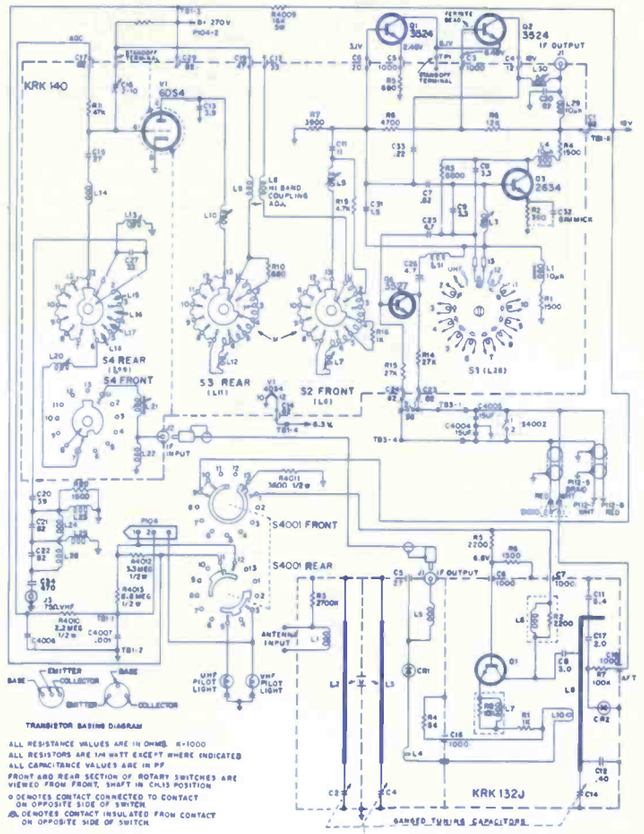


RCA VICTOR
Color TV Chassis CTC39XAA

SYMBOL	DESCRIPTION	RCA PART NO.
C104	3 section elect	116503
C104A	80µf, 450v	116503
C104B	20µf, 450v	116503
C104C	30µf, 150v	116503
C114	4 section elect	124665
C114A	80µf, 450v	124665
C114B	25µf, 25v	124665
C114C	2µf, 25v	124665
C114D	20µf, 20v	124665
C119	4 section elect	123491
C119A	80µf, 450v	123491
C119B	50µf, 450v	123491
C119C	20µf, 250v	123491
C119D	150µf, 25v	123491
CB101	brkr — cir 1.75a	122207
DL101	line — delay	128258
FW101	fuse — No. 26 wire	102792
IC1301	cir — integrated	126604
L208	41.25MHz trap	124804
L212	4.5MHz trap	124810
L215	horiz sine wave	116506
L704	osc screen	121591
L706	horiz eff	122918
L710	xformer — 3rd video output	121589
L1303	AFTC disc pri	122213
L1304	AFTC disc sec	122203
PW200	cir — printed pix	131045
PW700	cir-printed, chroma	131007
PW800	cir — printed convergence	127031
Q201	1st sound	124753
Q202	2nd sound	124756
Q203	1st IF	124757
Q204	2nd IF	124757
Q205	3rd IF	124754
Q206	AGC	124753
Q701	killer	124755
Q702	ACC	123941
R101	control AGC	124669
R103	39K matched pair	127039
R107	control, vert lin	114020
R109	control, vert height	122176
R131	control, horiz/tone	131059
R133	control vert/contrast	131058
R157	control, color killer	112841
R159	control color	131060
R160	control tint	131057
R161	control, brightness limit	112842
R221	control, RF bias	126667
R766	750Ω 5%, 1/2w, film	229700
R778	control, kinescope bias, peaking	121588
RT201	therm — 120Ω cold	107191
RT202	therm — 4300Ω at 25° C	124813
RV101	175v, at 6ma	114707
RV102	870v, at 6ma	112876
RV103	250v, at 6ma	124811
RV201	870v, at 6ma	112876
RV202	110v, at 6ma	114862
RV203	8v, at 15ma	126424
T101	coil — focus adj	113999
T102	high-voltage	131567
T103	audio	130620
T104	vert output	119828
R105	power	126489
T203	quad	124709
T701	1st band pass	124761
T702	burst	124764
T703	3.58MHz osc	121559
T705	2nd bandpass	124760
Y101	crystal — 3.58MHz	105330
RT101	therm — temp comp	114742
	yoke — deflection	114741







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1320

J C PENNEY

TV Model 1315

SEPTEMBER • 1970

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

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

SYMBOL	DESCRIPTION	PENNEY PART NO.
VR11	500Ω, IF AGC control	EVL-S2AA00B52
VR12	500Ω, RF AGC control	EVL-S2AA00B52
VR31	2K, vert hold	EVH-30AL18823
VR32	5K, vert height	EVL-S0AA00B53
VR33	5K, vert lin	EVL-S0AA00B53
VR41	1K, horiz hold	EVH-30AL18B13
VR42	500Ω, horiz frequency	EVL-S0AA00B52
VR43	2M, focus control	EVD-26AS10B26
VR61	10Ω, off/on vol control	EVC-B0ML20A14
VR62	1K, contrast	EVH-F0AL17E13
VR63	500K, bright	EVH-B0AL17B55
VR64	1K, APF control	EVL-S3AA00B13
CR103	0.01μf-470Ω ±5%	EXA-T103Z471J
CR106	0.01μf-2.2KΩ ±10%	EXA-P103P222
L102	adjacent channel trap coil 47.25MHz	TLI-33051
L103	interstage coupling coil	TLI-38403
L104	adjacent channel trap coil 39.75MHz	TLI-33051
L105	interstage coupling coil	TLI-38403
L108	peaking coil, 25μh	TLD-02501-5
L110	peaking coil, 125μh	TLD-12501-5
L111	sound trap coil, 41.25MHz	TLI-33758M
L113	peaking coil, 150μh	TLD-15001-5
L203	discriminator, primary	TLS-33205
L204	discriminator, secondary	TLS-33206
L402	horiz osc xformer	TLH-3109
L403	horiz drive xformer	TLH-3412
L404	horiz width control coil	TLH-3703
L601	deflection yoke	TLY-3361-3D
L602	balun	TLR-39311-1
T301	vert choke	TLV-3308-3
T401	flyback xformer	TLF-3901-2
T601	power xformer	TLP-3231-4
	VHF tuner	TNT-4651-5
		TNT-4651-5
	UHF tuner	TNT-86521-T
		TNT-86521-H
	fuse ac 0.4a	TSF-5401-1
	fuse dc 2a	TSF-5202-6
	ac power cord	TSX-155

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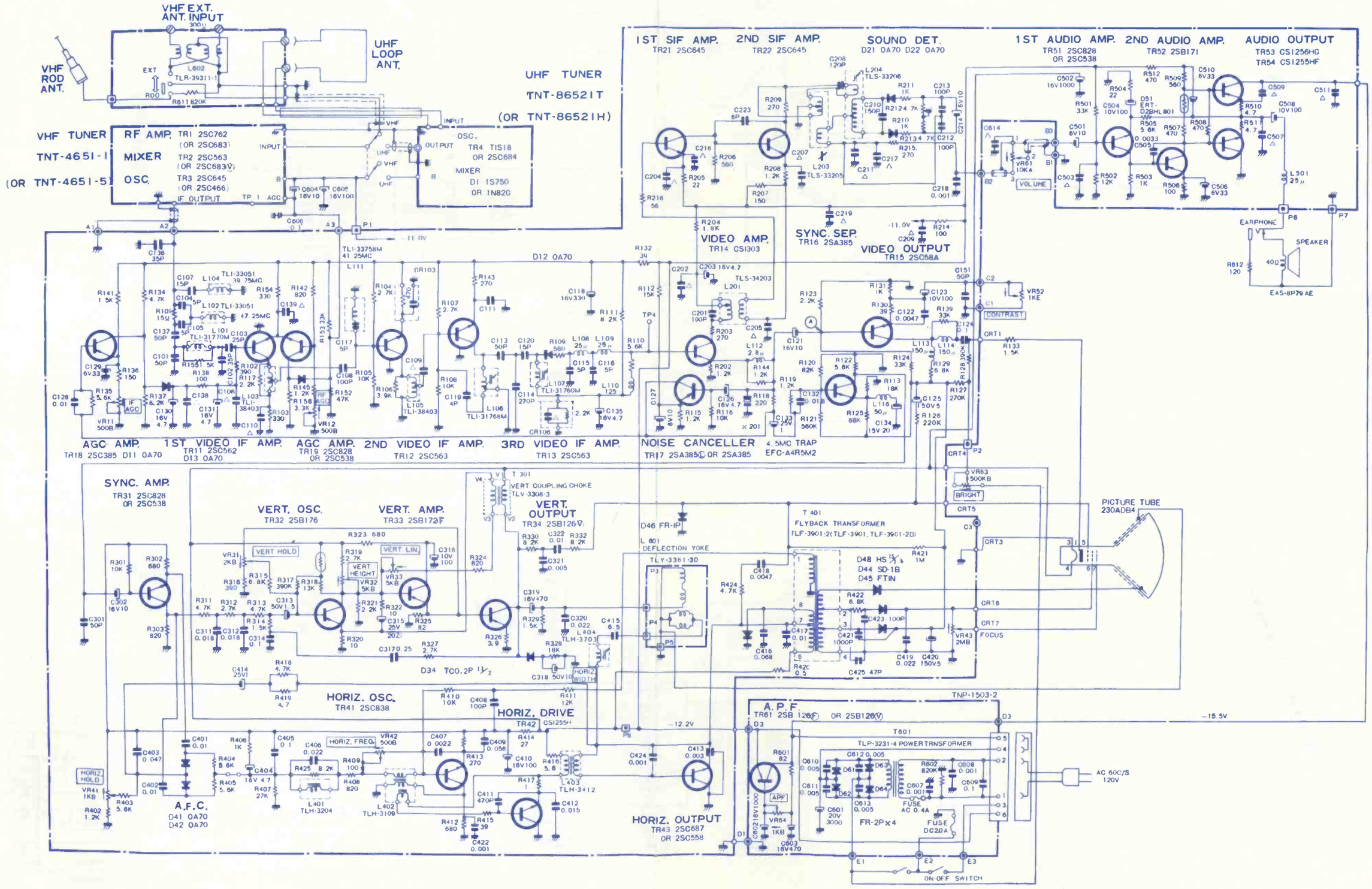

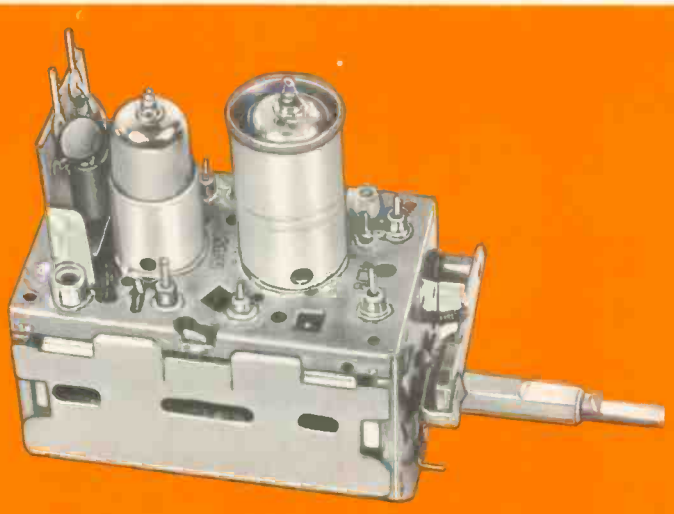

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SOUTH-EAST . . 938 GORDON ST., S. W., Atlanta, Georgia . . . . . TEL: 404-758-2232
WEST . . . . . SARKES TARZIAN, Inc. *TUNER SERVICE DIVISION* 10654 MAGNOLIA BLVD., North Hollywood, California . . . TEL: 213-769-2720

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Our cover photo shows the Editor taking one of the 106 Polaroid photographs that are incorporated in the article, "Why a Trigger-Sweep Scope."

FEATURES

A HARCOURT BRACE JOVANOVICH PUBLICATION

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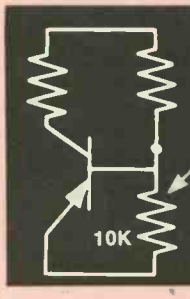
WITH THE NEW HI-LO FIELD EFFECT MULTIMETERS

USES ONLY .08 VOLTS TO POWER OHMMETER TO PREVENT TRANSISTORS FROM CONDUCTING AND UPSETTING READINGS

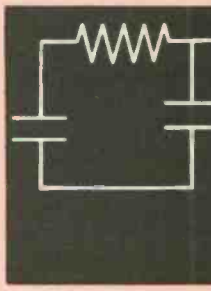
Look at these extra features to see why the Hi-Lo meter belongs on your want list:

- Unbelievable specifications of 15 megohm input impedance on DC and 12 megohms on AC
- Laboratory accuracy of 1.5 percent on DC and 3 percent on AC
- 9 DC voltage ranges from as low as .1 volts full scale to 1000 volts
- 3 hi-voltage ranges of 3 KV, 10 KV and 30 KV
- 9 DC zero center ranges from .05 volts to 500 volts . . . a must for delicate transistor bias measurements
- 7 resistance ranges from 1000 ohms full scale to 1000 megohms
- 9 DC current ranges from 100 microamps to 1 amp
- Automatic built-in battery test . . . never a worry about rundown batteries, just push the switches under the meter and read.
- Standard .6 amp fuse to protect the ohms and milliamps scales if voltage or overload is accidentally applied. No more need to return the meter to factory for repair . . . just replace the fuse.
- Special probe with 100K isolation resistor in probe to prevent AC pickup or to prevent loading oscillator circuits. Leave in normal position for most tests.



Low voltage of .08 volts prevents transistors from conducting and misreading circuit. Resistor will now read 10K as it should. Also prevents any damage to transistor.

Here is why you should have both Hi and Lo battery voltages for correct in-circuit resistance measurements in solid state circuits:



Higher voltage of 1.5 volts causes semiconductors to conduct to read proper front-to-back ratio or conductivity of transistors. Meter would not be complete without hi-ohms reading.

SENCORE INC. 3200 Sencore Drive • Sioux Falls, South Dakota 57107

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EDITORIAL

What Kind of Work Do You Do?

Since ELECTRONIC TECHNICIAN/DEALER is not a newsstand publication and the only people that can subscribe to it must be technicians gainfully employed in the electronics industry or students in trade school preparing for such a profession; and any long-term subscriber must be competent enough to have survived in this industry; we can make the following ridiculously obvious conclusion: **You work with electronic circuits. You do good work.**

Yes, but do you make money at it?

I was told by one manufacturer of electronic supplies that electronic technicians represent the second largest group of business men that go bankrupt. This is an appalling statement, but he had the statistics to back up his position.

What's the problem? A greater assortment of electronic products is being developed and placed on the market every year—these products requiring maintenance. And, within reason, you are in a position where you are even able to determine your own rates for servicing these products. So, again, what's the problem?

Unfortunately, too many technicians are merely skilled in electronics. Although this knowledge is a must for effective servicing, it does not cover such matters as the proper psychology for good customer relations, effective cost accounting for realistic billing, short cuts for streamlining bench work, factors to consider when selecting a shop site, what to look for when considering a lease and how to effectively display merchandise.

How many technicians, while out on a house call, offer to look at and service other defective consumer electronic products—phonographs, radios, other TV sets, tape recorders, etc? These may be just simple jobs that improve customer relations while increasing your income from each service call. Too many technicians would rather be out in their truck fighting traffic to the next customer's home (you don't make money between house calls) rather than spending a few extra minutes earning the customer's respect by displaying a genuine interest in your work and collecting a fee for the few other extra jobs that the customer just happens to think of.

Do your customers know that you sell TV sets? Even if the set you are servicing does not warrant replacement, frequently customers prefer purchasing their TV sets from the electronic technician that has provided them with satisfactory service, knowing that he will stand behind the purchase. Why bypass a possible commission (they add up fast) just because the customer didn't realize you sold such merchandise.

Too many technicians hold up a repair job waiting for an exact capacitor replacement when a substitute will work just as well. Do you know the range of capacitor values permitted for certain type circuits or how to combine capacitors to obtain the desired value? A future article will cover this subject in detail.

Have you taken inventory of the replacement parts you use? Is your shop and tool kit stocked properly for handling the major portion of your jobs . . . or do you have an unnecessary amount of capital invested in your stock (this excess investment may offer a greater return in the bank) . . . or, worse yet, do you go traipsing to your distributor once a day for parts? Your distributor may be a very nice fellow to visit, but he isn't paying you for your time.

These and many other non-electronic aspects of servicing make the difference between good profits and bankruptcy. And out of concern for your pocket book, this month we are beginning a series of very helpful articles on this subject, starting with Al Friedman's article, "Budget Time to Maximize Profits."

Phillip Dahlen

LETTERS

Readers' Aid

I have found the articles published in ELECTRONIC TECHNICIAN/DEALER very interesting and informative. I enjoy the magazine very much.

I would like to know whether you or any of the readers could tell me where I might purchase a schematic for an Imperial Stereo which I have. I believe it is a German make since the plate on the back is marked as follows: IMPERIAL, Rundfunk-Und Fernsehwerk Gmbh, Fabrik Nr. 18493.

I would greatly appreciate any information on this item.

H. W. HITCHCOCK
803 AURORA
HOUSTON, TEX. 77009

We understand Webcor is out of business. Can anyone tell us how to get a replacement transformer for the Webcor power transformer No. 68P-050-1, used in Webcor audio amplifier Model No. EP4820, serial No. 562168. Primary 117v. High voltage 240v to CT. Secondary two: 5v at 2a. Secondary three: 12.6v CT.

JOHN W. LEWIS
THE HOUSTON COUNTY COURIER
BOX 551
CROCKETT, TEXAS

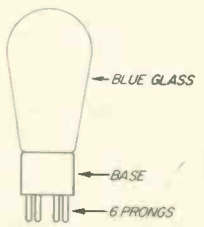
My son is refixing the inside of the '61 Buick he purchased. At the present he wants to install a tape recorder in the car. He wants to put it up front under the dashboard. The radio and glove compartment have been removed already.

He fixed up the recorder to fit into the glove compartment or radio compartment. Our problem is that there is a hose under the dashboard that won't allow the case to go in far enough.

Perhaps some reader has an idea that can help us.

FRANCES BATZER
3015 FARRAGUE RD.
BROOKLYN, N.Y. 11210

As a hobby, I renovate old radios and attempt to get them into first class condition. I am presently working on a Stewart-Warner Model No. 40. I have one old tube for which I am unable to find a replacement or a substitution. I was wondering if perhaps your readers' column might help me. I am enclosing a rough sketch of this tube. Thank you.



LEROY GSCHWIND
Whitney Electric
2105 Monroe St.
Toledo, Ohio 43624

I have a DeWald amplifier for repair, Model M-1200. I have to replace the power transformer Part No. PT-164A-3. Can you locate DeWald for me? It is a division of United Scientific Labs.

SMITTY'S TV
258 Wurz Street
Brentwood, New York 11717

We have a Jackson picture tube checker, Model 825, Serial No. TT 1353, and we need the latest roll check. So far we are unable to locate the Jackson Electrical Instrument Co. The latest address we have is: 124 McDonough St., Dayton, Ohio. Our letter to them was returned and stamped

continued on page 26

Do you want the same things Dick DeVroeg wants in capacitors?

Then you'll ask for Sprague Twist-Lok® Capacitors when you need twist-prong electrolytics.

As manager of S&R TV in Lake Forest, Illinois, Dick DeVroeg knows the importance of using quality components. The 8-man S&R organization has built a name for itself in northern Chicago suburbs over the past 18 years. "To maintain our reputation in servicing everything in electronics," Dick says, "we just can't compromise on dependability. That's why we prefer Sprague Twist-Lok Capacitors."

Ask your Sprague distributor for a copy of Sprague's Electrolytic Capacitor Replacement Manual K-109 or write to: Sprague Products Company, 65 Marshall St., North Adams, Mass. 01247.

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P.S. **You can increase your business 7½% by participating in EIA's "What else needs fixing?" program. Ask your distributor or write to us for details.**

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LETTERS

continued from page 24

"Moved not Forwardable."

If they are out of business, maybe someone will have an extra chart which is newer than ours. Our latest chart is M825, No. 32-250/3-64. Please send C.O.D. Thank you very much.

JOE D. MARLOWE
EPSCO
24 Valley St.
Lewistown, Pa.

I need an out-of-production cathode ray tube (2EP4) originally used in a Philco Safari transistorized portable TV receiver.

I would greatly appreciate your including this request in your column.

WILLARD B. ANKER
6706 Lenclair Street
Alexandria, Va. 22306

I have an Atwater-Kent Model 10 radio that I would like to restore to operating condition. Not being too familiar with this type of radio, I would like to know if any readers could supply me with a schematic for this or other early battery radio. I would also like to pick up a scanning disc-type TV set, and was wondering if any readers have one they would be willing to part with.

ALVIN HECKARD
Rt. 1, Box 88
Lewistown, Pa. 17044

Could you or any of your readers help me locate a power transformer for a Superior Instruments Genometer TV-50A. I have written to Superior only to find out that they have gone out of business.

I enjoy your magazine and find it helpful.

PAUL H. DAVIS
Davis Radio-TV
Hallieford, Va. 23068

A Concerned Manufacturer

In your June issue, you reprint a letter in which a reader complains about not receiving the literature he requested through your inquiry cards. I know how frustrating that could be because I have had the same experience in other publications.

We, at Dynascan, receive hundreds of inquiries for our test equipment and two-way radio products.

continued on page 72

COMMON SENSE APPROACH TO CLEANING TUNERS

This article is intended to clear up some of the mysteries involved in cleaning tuners. Since it is also an advertisement it briefly mentions a few products we manufacture and recommend but most of the article is just a good solid approach to caring for the most sensitive unit in the TV set, the tuner. We hope that it helps you.

Dick Pavek

Basically there are only two reasons to clean a tuner. Sometimes only one of these reasons is present but often both are. The first and most common, is when the contacts are dirty and making poor connection. The second is when the tuner drifts or oscillates. Each of these conditions needs to be understood in order to know the best way to correct them.

DIRTY TUNER CONTACTS

When the contacts become dirty the tuner is hard to keep on channel, the picture may be snowy, streaked, flashing or have poor color response. This condition is usually easy to correct by one of two methods.

THE ONE-SHOT METHOD

The oldest method used is to clean the contacts with a dirt and grease dissolving solvent and then protect the contacts against future contamination by applying a protective lubricant coating. Usually this is done with a combination cleaner/lubricant in an aerosol form. All that is necessary is to spray the contacts and let the solvent evaporate. The tuner contacts are cleaned and protected in one simple operation that can usually be done without removing the tuner from the cabinet.

Unfortunately there are disadvantages to this method as well as the advantages. Neither the cleaning or lubrication are as effective as they could be. The cleaning action can only take place one time, when first sprayed into the tuner and the light lubricant used is not as efficient as other lubricants. In addition drifting and oscillation can be caused when using this type because spray may get into the neutralizing capacitor. Remember, any tuner cleaner that contains a lubricant can cause detuning if not properly applied. There are no exceptions to this.

We are not saying that you should never use this type of product as there are many times when this method will do all the cleaning and protecting necessary and do it quickly and easily as well.

When using a cleaner/lubricant of this type remember these points:

1. Products with more lubricant will protect better but will more easily detune.
2. Products containing lubricants made only from silicones will last much longer than those containing lubricants made only from petroleum.
3. Never spray into neutralizing capacitors or other capacitive sensitive devices because detuning can result.

TECH SPRAY manufactures an excellent combination cleaner/lubricant that minimizes detuning problems as much as possible. It is COLOR RID OX.' We recommend it highly when you wish to clean the tuner without removing it from the cabinet.

THE CONTINUOUS CLEANING METHOD

There is a much more effective way to clean and lubricate TV tuner contacts. Several products on the market clean contacts with an entirely different approach. Instead of using a solvent type cleaner they use a soft grease like material with a polishing agent to clean the contacts. Often an abrasive of some sort is included to aid in cleaning the contacts. The polishing is not done with a cloth but by the normal wiping action of the contacts as the channel selector is rotated. This type does a much better job for the simple reason that it does not evaporate and will continue to clean over and over again, every time the channel selector is rotated for months. This is obviously much better than a cleaner that only cleans once, at the time it is applied.

Besides the better cleaning action, the thick permanent lubricant gives far better protection against future corrosion than a product with an oil type lubricant.

There is one major disadvantage to this type. Capacitive sensitive devices, such as neutralizing capacitors can be badly detuned if sprayed with this type of material. *And they will not gradually return to normal.* This is because the material will not evaporate. (If this ever happens to you there is a simple way to cure it and we'll tell you how in the next section.) It is very often difficult to use this type on tuners when they are installed in the cabinet. When the tuner is out of the cabinet it is much easier to apply the material to just the contacts, with no overspray getting into any detunable component.

When using a product of this type remember that:

1. The thicker the product the more stable, and less likely to run into sensitive components.
2. If too harsh a polishing agent is used damage to the contacts could result.
3. Spray only on contacts, never spray into neutralizing capacitors, or coils on other capacitor sensitive devices.
4. Never overload a tuner with cleaner of any type.
5. If the cleaner contains an abrasive, be sure the contact surface plating will not be harmed by it.

TECH SPRAY introduced this type of product to the industry with ***BLUE STUFF FOR TUNERS***. It is entirely safe and effective. We recommend it unhesitantly for cleaning and lubricating all tuner contacts. It contains polishing agents but has no harsh abrasives. It will last and last. It will not dry up either in the can or on the tuner. But please, don't spray it blindly into the tuner, just on the contacts and not capacitive sensitive devices.

DETUNED TUNERS

The cleaners mentioned before are designed to clean contacts only and cannot effectively clean the rest of the tuner. The rest of tuner can have troubles just as contacts can. The troubles are different, however. Tuner contacts don't become detuned. Other parts of the tuner do. Detuning will result in everything from herringbone patterns and drifting oscillators down to poor quality reception.

How does a tuner become detuned? The tuner is filled with devices that can be detuned. Air wound coils and air capacitors are in many parts of the circuit. Both coils and capacitors have an air dielectric. (There is capacitance between the coil windings just as there is between the plates of an air capacitor.) As long as these components are clean they have air as the dielectric. However just as soon as the surfaces get contaminated the contamination becomes part or all of the dielectric. Of course, no contamination will have the same dielectric constant as air. When the dielectric constant changes so does the frequency response of its portion of the circuit. The most sensitive part of a tuner is the neutralizing capacitor. This component can be very easily upset by contamination.

Contamination comes from two major sources. One is air born contamination, such as vaporized cooking grease from a kitchen, greasy factory smoke, or gas heater fumes. The other source is lubricants from misdirected tuner sprays. There is no difference between the two sources as to what happens to the tuner, just as there is no difference as to how the contamination should be removed.

First, it is impossible to remove contamination from detuned parts of the tuner with either a cleaner/lubricant product or with a polishing lubricant product. Obviously both products leave a contact protecting film that will get into the detuned device and keep it detuned. The only way to clean a detuned tuner and restore it to normal operation is with a lubricant free cleaner, one that will not leave a residue of any type. The procedure is simple. Simply drench the tuner with the spray letting it drain dry. When it is dry it is ready to run. Be sure to clean the tube sockets also.

When using a product of this type remember these points:

1. Be sure the cleaner is safe on all plastics, as many types of plastics used in a tuner can be harmed by some residue free cleaners.
2. Be sure the cleaner has a forceful spray. This is necessary to penetrate tiny crevices in components.

TECH SPRAY makes a product of this type called ***BLUE SHOWER FOR TUNERS***. It is completely residue-free, has great force (it comes with two sizes of spray heads and extensions so that you may select the force you need) and is safe on all plastics. We recommend it for all detuned, dirty tuners.

WARNING: Remember that while this is the best way to thoroughly clean all tuner parts it provides no protection for the tuner contacts against future corrosion. We recommend that after restoring a dirty detuned tuner with ***BLUE SHOWER*** that you treat the contacts with ***BLUE STUFF*** for future protection and lubrication. This will assure a good job for your customers and fewer call backs for you.

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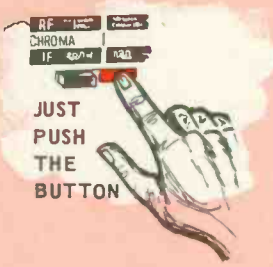
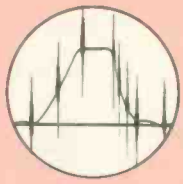
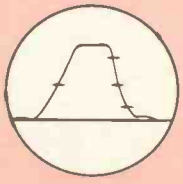
Here are 7 Reasons why we call the SM158 the Speed Aligner

AUTOMATIC ALL CRYSTAL CONTROLLED MARKERS: You will never spend any more time looking up marker frequencies or interpreting them when you own an SM158; they are automatic. For example, want the chroma carrier on any RF curve, IF curve, or chroma curve, simply push the chroma carrier marker button. Want the sound, video, adjacent carrier markers or any other marker on any curve, just push the button as directed on the panel. The SM158 is fast and saves you time . . . that's why we call it the speed aligner.



UNLIMITED MARKER AMPLITUDE: The marker height control is like a powerhouse; crank it up as far as you want, even to the point where the markers are larger than the scope screen, without upsetting the response curve. Each marker is crystal controlled on fundamental frequencies and post-injected so that you may place all markers on the curve at unbelievable heights without affecting the curve in the least. That's why we call the SM158 the speed aligner.





EASY TO CONNECT: Just four connecting cables clearly marked TO TV and TO SCOPE. It takes just seconds to connect . . . that's why we call the SM158 the speed aligner.

TWO EXTRA VHF CHANNELS: Competition has only two VHF channels; the SM158 has an extra high channel and an extra low frequency channel to prevent any co-channel interference. The SM158 is interference-free . . . that's why we call it the speed aligner.

PLENTY OF SWEEP WIDTH: A full 15 megahertz sweep signal, constant on all IF, chroma and RF curves, provides adequate sweep width to cover new solid state IF amplifiers. Competition covers only 12 megahertz. The SM158 gives you the full picture the first time . . . that's why we call it the speed aligner.

GENERATES A ZERO REFERENCE BASE LINE: You know where zero is with the SM158. All alignment instructions show a base line, yet some competitors do not generate a base line. You can follow TV manufacturers' instructions to the "T", easier and faster with the SM158 . . . that's why we call it the speed aligner.

SWITCHABLE HORIZONTAL OR VERTICAL MARKERS: want to tilt markers 90 degrees so you can view markers better in traps or for leveling? Merely pull the MARKER HEIGHT control out and markers appear horizontally — a real plus feature.

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NEWS OF THE INDUSTRY

CATV Revenue $4.4 Billion in 1980

Quantum Science Corp.'s latest study predicts that in 1980 almost 4400 CATV systems will yield a revenue of $4.4 billion. The forecast also calls for over 28 million CATV subscribers in 1980, compared to 4.4 million subscribers and 2400 systems in the industry today.

Today's systems and programming methods will be obsolete by 1980, according to the study, just as the community antenna systems serving isolated rural areas in the 50's are expected to become complex communications media serving major metropolitan areas.

The study offers CATV systems operators and equipment suppliers a comprehensive appraisal of the diverse techniques, programming and services expected in the 70's. Some of the trends foreseen are two-way systems, local programming, interactive educational programming and the "wired city."

Admiral's New Cartrivision Unit and Video Camera

In its first demonstration, the Admiral Cartrivision VTR recording and playback system played pre-recorded cartridges containing full-length color movie features and also recorded programs directly off the air in color. An 18-in. Admiral color TV in a 43½-in.-wide cabinet was used in conjunction with the Cartrivision unit.

A portable video camera accessory has been designed to tape scenes in the home or office for immediate playback through the tape deck without processing.

By setting a timer on the Cartrivision unit, an absent TV set owner will be able to record automatically a TV program for future playback.

The Cartrivision system, which will be priced under $1000, is expected to be ready for marketing in the spring of 1971.

RCA's 18-in. Color TV Set

RCA has developed an 18-in. color TV set, the Argosy, which makes use of a slim, 110° picture tube and a chassis featuring plug-in component modules. The plug-in modules are designed to maintain the original manufacturing performance standards through the life of the color set.

The solid-state chassis of the portable color model will have 11 separate "AccuCircuit" modules, including five integrated circuits, which will constitute approximately 75 percent of the receiver's circuitry. No adjustment is said to be necessary when substituting modules.

The picture tube used in the TV set has enabled RCA to develop a more compact portable receiver that is 4 in. slimmer than previous 18-in. models. According to RCA, the Argosy represents the first use in this country of the 110° deflection picture tube. The TV set is expected to sell at a retail price below $450 and to carry RCA's one-year service labor warranty.

First Diploma Awarded For CIE College-Level Course

The first diploma for the college-level "Electronics Engineering" course of the Cleveland Institute of Electronics was awarded in April, 1970, to John W. Watts, Master Chief Electronics Technician, U.S. Naval Air Station, Norfolk, Va.

The presentation was made by Anthony Gibilaro, the regional manager of CIE. Also attending the event was Capt. William A. Kiernan, Watts' Commanding Officer in the Atlantic Fleet Airborne Electronics Training Unit.

The advanced course for senior technicians, junior and associate engineers was introduced by CIE in January, 1969. It is comprised of 100 lessons covering solid-state

physics and circuitry, magnetics, pulse techniques, computer logic, and steady-state and transient network theory. The course can be completed in approximately 36 months.

IR Changes Location of Boston Field Office

The Boston office of International Rectifier's Semiconductor Div. has moved to an expanded field office facility at 2 Militia Dr., Lexington, Mass. The new phone number is (617) 861-1820.

The new facility is expected to increase IR's customer service capability.

Tube Sales Off 9.9% During First Quarter

EIA reports that U.S. factory sales of high vacuum, gas and vapor and all other tubes totaled $19 million during the first three months of 1970, down 9.9% from $21.1 million during the same period in 1969.

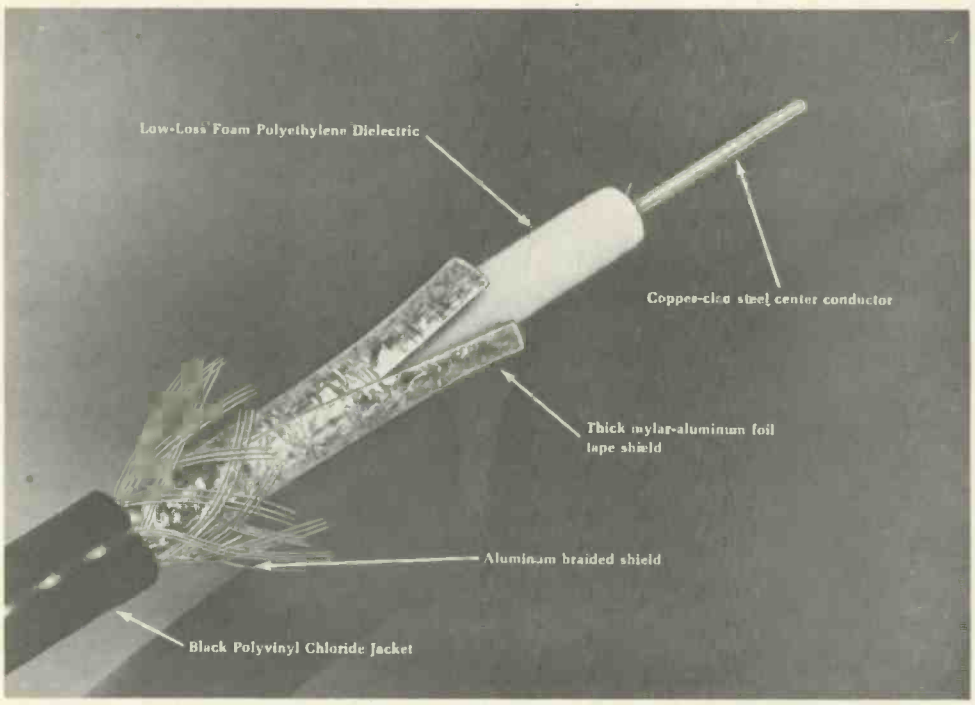
According to data received from manufacturers, high vacuum tubes were down 9.5%. Gas and vapor tube sales slipped 16.4%, while all other tubes climbed 15.9% in dollar sales.

Unit sales reflected decreases in high-vacuum types, down 18.8%, and gas and vapor types, down 16.3%. All other types, however, were up 4.3% in unit sales. Total unit sales reached 959,000 during the first quarter, which represents a decline of 18.1% from 1.2 million tubes sold during the first quarter of 1969.

Research and development funds for high vacuum, gas and vapor and all other tubes amounted to $283,637 during the first quarter of 1970 as compared to $538,548 in 1969. This represents a 47.3% decrease.

NEW AND NOTEWORTHY

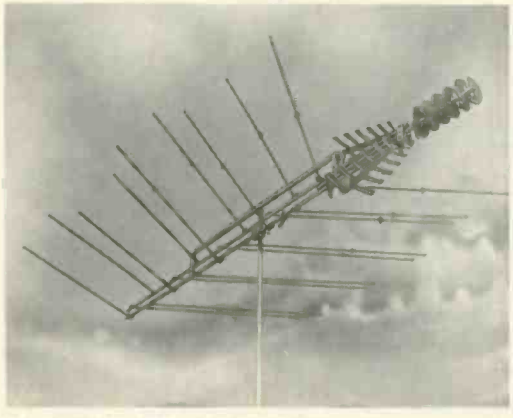
For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.



COAXIAL CABLES 722

Meet the requirements for 82-channel color MATV systems

Two 82-channel coaxial cables—CAC-6 and CAC-11—have been designed to meet the requirements of 82-channel color MATV systems. Specifications indicate that the cables have 80dB shielding and are able to withstand bending and pulling because of the aluminum braided shield covering a thick mylar-aluminum foil tape. The additional braided shield reportedly provides mechanical protection to the foil and also allows easier connector installation in the field. These cables are said to feature lowest loss and flat match through and beyond VHF. The black polyvinyl chloride jacket reportedly remains flexible in cold weather. Jerrold.



VHF/UHF/FM ANTENNAS 723

Eight models for a wide variety of uses

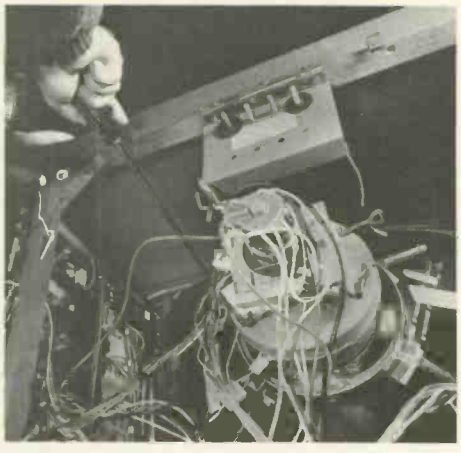
A line of antennas features a color tuned capacitor-coupled VHF dipole design as well as wide-aperture tapered disc directors for UHF. JFD.

FOR MORE NEW PRODUCTS SEE PAGE 61

CONVERGENCE CONTROLS 724

Cross reference and exact color replacement for knobs

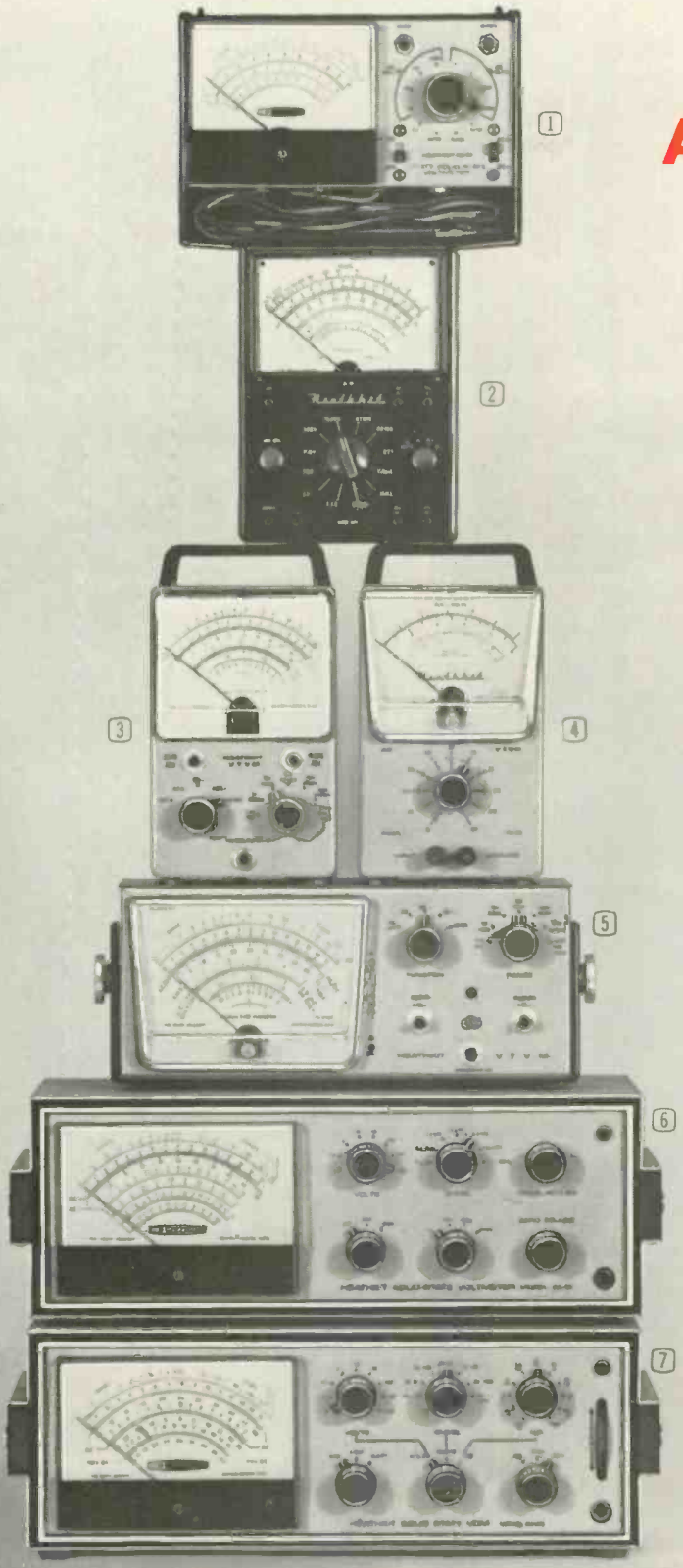
A line of color TV convergence controls is now being manufactured for exact replacement. The standard package consists of six controls on a tear-off display card, with a cross reference on the back. The knobs on the controls are exact color replacements. Workman.



NUTDRIVERS 725

Ideal for hard-to-reach areas inside the TV set

A pair of super long (20⅞-in.) fixed handle, hollow shaft nutdrivers with hex openings of ¼ in. and 5/16 in. have been designed for use on up-front components where the only access is through the back of the set. Xcelite.



Stack These Up Against The Others

your best buys in meters come from Heath

For over 20 years, Heath has been the first choice in meters for tens of thousands of service technicians, schools and home labs. There's a reason for this continued popularity — Heath meters are designed to have that balance of versatility, needed features and low cost that make them your best buy. For the price of just a couple of meters from others, you can buy every meter Heath makes. We believe that you should still be able to get a stack of meters without spending a pile of money. When you need a meter, look to Heath. For performance, versatility and top dollar value, the others just don't stack up.

1 **$21.95* Buys A Portable Solid-State Volt-Ohm-Meter.** Four ranges on AC & DC volts measure 1-1000 volts full scale. Four resistance ranges measure 0.1 ohm to 1000 megohms. Features convenient battery operation . . . zero & ohms adj. controls . . . DC polarity reversing switch . . . spare jack for HV & RF probes . . . rugged polypropylene carrying case. IM-17, 4 lbs.

2 **$34.95* Buys A Portable Volt-Ohm Milliammeter.** Measures AC & DC volts 1.5-5000 full scale. DC current from 150 uA to 15A. Resistance midscale from 15-150,000 ohms. Large 4½" 50 uA movement meter for extra accuracy. MM-1, 5 lbs.

3 **$29.95* Buys An Accurate VTVM.** 7 AC & DC ranges measure RMS volts from 1.5-15000 full scale . . . AC P-P from 4.0-4000 . . . 7 resistance ranges from 0.1 ohms to 1000 megohms. 25 Hz — 1 MHz response. Single probe makes all measurements. IM-18, 5 lbs. Assembled IMW-18, 5 lbs. . . . $54.95*

4 **$41.95* Buys A Laboratory AC VTVM.** Especially useful for low-level AC & audio work. Ten RMS ranges from 0.01—300 V full scale . . . measures dB from −52 to +58. ±1 dB response from 10 Hz—500 kHz. 10 megs. input impedance. IM-38, 4 lbs. Assembled IMW-38, 5 lbs. . . $57.95*

5 **$39.95* Buys A Big Service Bench VTVM.** Has the same high performance as the IM-18 above, plus added features to make it more useful for service work . . . separate 1.5 & 5 VAC scales . . . calibration controls that are adjustable from the front panel . . . versatile gimbal mounting . . . large 7" meter. IM-28, 7 lbs. Assembled IMW-28, 7 lbs. . . . $59.95*

6 **$46.95* Buys A Big Solid-State Volt-Ohm Meter.** Battery-powered portability plus built-in AC supply. 8 AC & DC ranges 0.5-1500 full scale . . . 7 resistance ranges (10 ohm center scale) x1-x1 meg. High input impedance & 6" meter for greater accuracy. IM-16, 10 lbs. Assembled IMW-16, 11 lbs. . . . $69.95*

7 **$85.00* Buys A Deluxe Solid-State Volt-Ohm Milliammeter.** 9 AC & DC ranges from 150 mV-1500 V full scale . . . 7 resistance ranges measure from 1 ohm to 1000 megohms . . . 11 current ranges from 15 uA-1.5 A full scale. 100 kHz response . . . high input impedance . . . large 6" meter with zero center. IM-25, 10 lbs. Assembled IMW-25, 10 lbs. . . . $120.00*

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Our hot ones are the last to go.

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Take our 6JE6C/6LQ6, for example. It's the horizontal deflection tube that takes such a beating when the set gets hot.

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Now it runs cooler and lasts longer.

Same for our 6JS6C.

Or take our 6BK4C/6EL4A. That's the shunt regulator that eliminates runaway high voltage. We gave this one a whole new anode and shield design to improve heat transfer and stability.

Now it also runs cooler and lasts longer.

Or take our 3A3B high voltage rectifier. This one's got leaded glass for added protection. And it lasts longer too.

So next time you have to replace any of the hot ones, just cool it. You'll both last longer.

SYLVANIA

GENERAL TELEPHONE & ELECTRONICS

TEKLAB REPORT

When total shop service is required, the module keeps the cabinet in the home

Curtis Mathes Modular Total Color TV

by JOSEPH ZAUHAR

■ Each year, as new TV sets appear on the market, we find a number of them that contain new circuits and unique features. We hear of various types of modules, printed circuit boards, plug-in transistor and component units, etc. But, the module that we encountered this time consisted of the entire color TV set encased in a steel housing, which can be inserted on nylon runners into a large assortment of cabinets.

The line includes five types of modules from a basic color TV set, the two star, to the six star deluxe module shown in the photo.

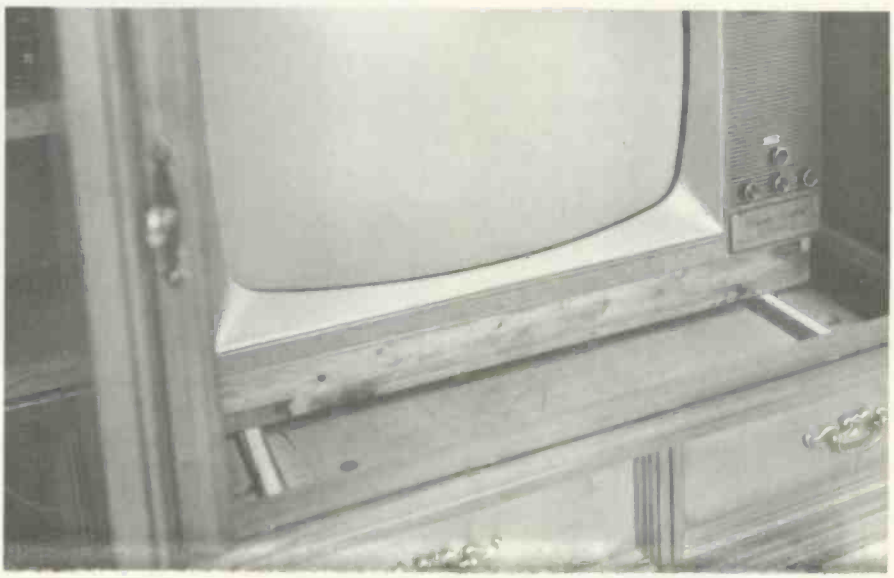
The module we received for this report is the six star chassis CMC33, which is the deluxe model featuring total automatic color.

If shop service is required, only the module leaves the home, thus avoiding damage to the cabinet. The complete set can be checked as a unit. Much of the service on the module can be performed in the chassis by removing a panel providing access to chassis components.

We found the module easy to pull by removing four bolts. The unit then slides out smoothly. However, we felt the nylon runners should be

Curtis Mathes Belmont Model 54M424 employing the CMC33 chassis.

The module is shown being pulled from the back, exposing the nylon runners that guide it smoothly out of the cabinet.



placed on the module to keep the chassis bolts from scratching the service bench, as we experienced.

Some of the features found in this total color chassis includes: a chassis featuring three stages of IF, keyed AGC, preset fine tuning and a combination of hand-wired and etched circuitry; Automatic Fine Tuning (AFT); Instant-On; Automatic degaussing, Automatic Chroma Control (ACC); and Automatic Tint Control (ATC).

As can be seen in Fig. 1, the CMC33 chassis employed in this TV receiver incorporates circuits and layouts similar to a previous RCA chassis. Since most of these are familiar field proven circuits, we will review only one of the more current additions.

AUTOMATIC TINT CONTROL (ATC)

The Automatic Tint Control (ATC) senses flesh tone errors—such as station-to-station variations in transmission, as well as change in program material—automatically changing them to the hue desired. It is located in a metal box attached to the control assembly as shown in Fig. 2.

By pulling the ATC control, located on the front panel, the circuit is inactivated. It should be OFF when tuning color TV programs or adjusting controls for a normal picture.

After this has been done, push the ATC knob in and then rotate the control for proper flesh tones. A slight readjustment of the color control may be desired, but then the circuit will automatically correct for a wide variation in transmission—the ATC circuit sensing phase errors and correcting them in the following manner:

The phase correction added to the chroma signal is developed by two transistors called the red and the yellow gate (shown in Fig. 3) which sample chroma information coupled to the base of each. Each gate is sensitive only to certain chroma phases on either side of the correct fleshtone phase. A transistor, Q401, is used as a switch to complete the emitter circuit of the gates. This 3.58MHz switch is turned ON

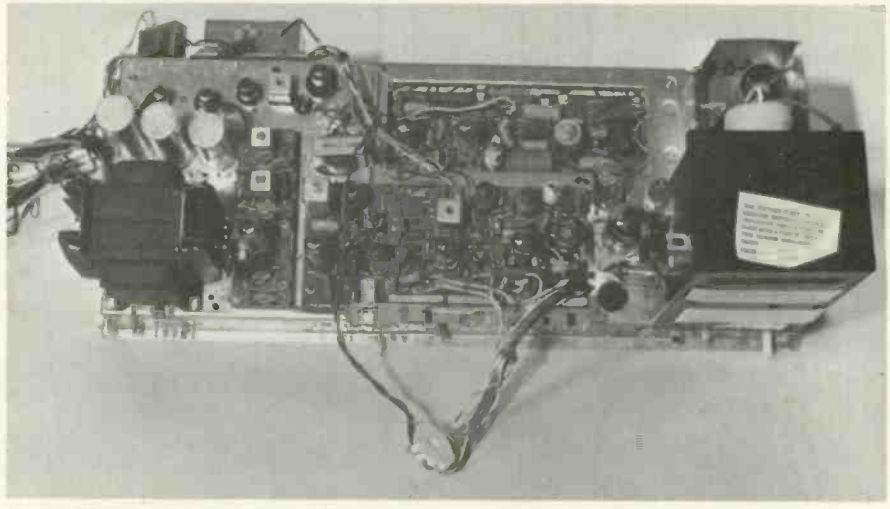


Fig. 1—The Curtis Mathes CMC33 chassis is similar in circuits and physical appearance to a previous RCA chassis.

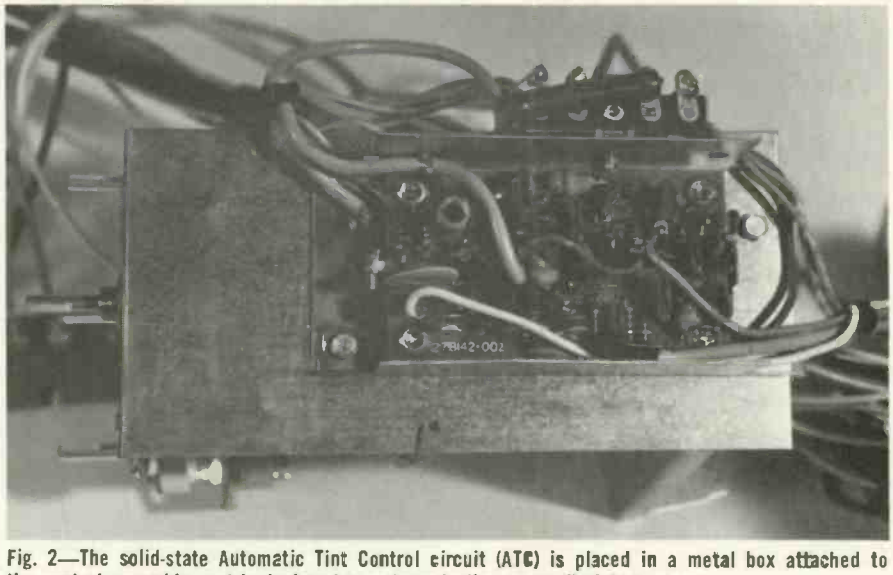
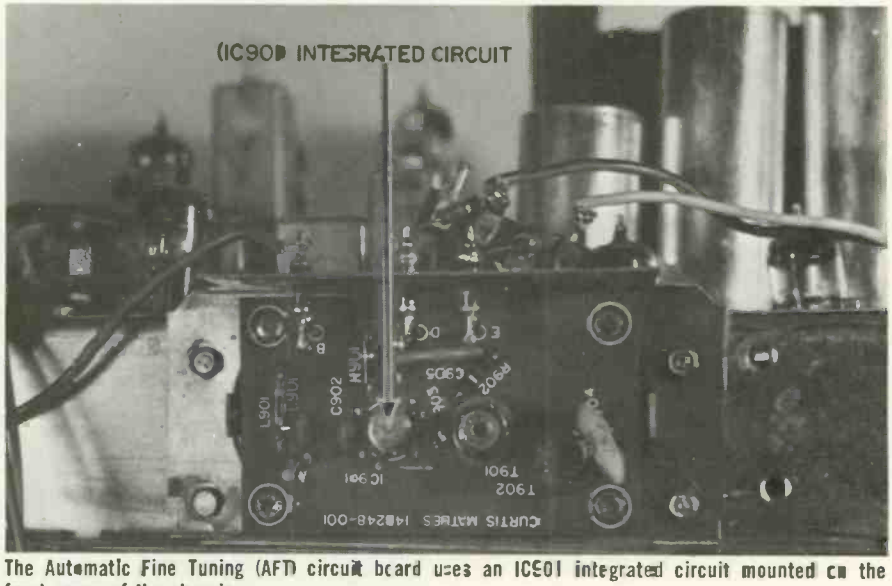


Fig. 2—The solid-state Automatic Tint Control circuit (ATC) is placed in a metal box attached to the control assembly, and is designed to automatically correct flesh-tone errors.



The Automatic Fine Tuning (AFT) circuit board uses an IC901 integrated circuit mounted on the front apron of the chassis.

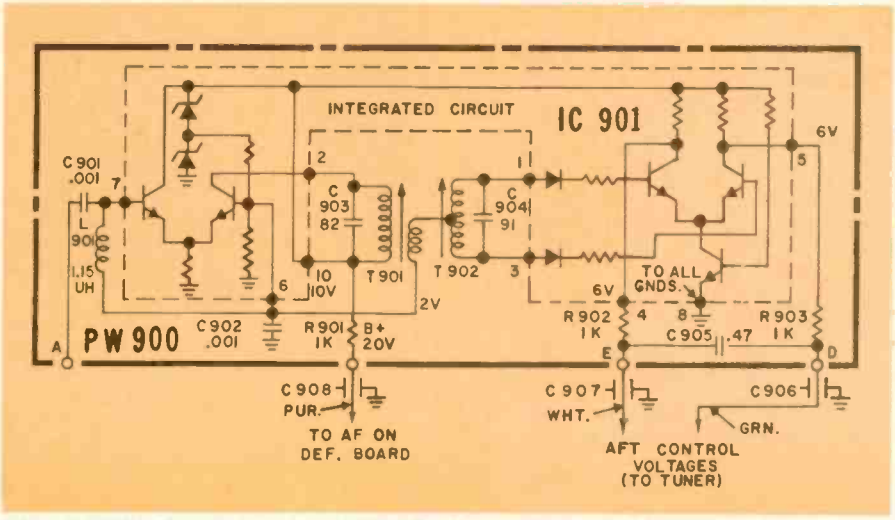
by a continuous wave (CW) signal from the 3.58MHz oscillator, which is near the phase angle of the yellow chroma signal.

The switch bias is such that conduction occurs during the interval that the CW sine wave is passing through its positive peak. The gates are biased to conduct only when the chroma signal applied to the base of each is positive. (i.e., The yellow gate will conduct heavily when a yellow chroma signal is present on the base of the stage at the same time the switch is completing the emitter circuit.) The applied chroma signal to the red gate is phase shifted so that the red chroma information is also near peak positive during the switch conduction interval.

If it were possible to transmit both yellow and red chroma phases simultaneously, the switch conduction time would be equidistant from the peak of each chroma sine wave when correct fleshtones are transmitted. A deviation in chroma phase would cause one or the other of the gates to conduct more heavily, while conduction of the alternate gate is reduced. The gates are now able to correct an error in fleshtones, with the red gate conducting more heavily when red errors are transmitted and the yellow gate conducting more when yellow errors are transmitted.

The corrected signal from both gates is added to the original chroma signal by the chroma-amplified transistor. This stage is emitter driven by the same chroma information that is applied to the base of both gates. The base bias of the chroma amplifier is developed by the individual phase-shift network in the collector circuit of each gate. These phase-shift networks will add the phase correction necessary to cause an output from the red gate to develop a correction toward yellow, and the yellow gate to develop a correction towards red.

The combined output of both gates will mix with the chroma signal fed to the chroma-amplifier emitter to produce a signal at the chroma amplifier collector of the



Schematic of the Automatic Fine Tuning (AFT) circuit employing the IC901 Integrated Circuit.

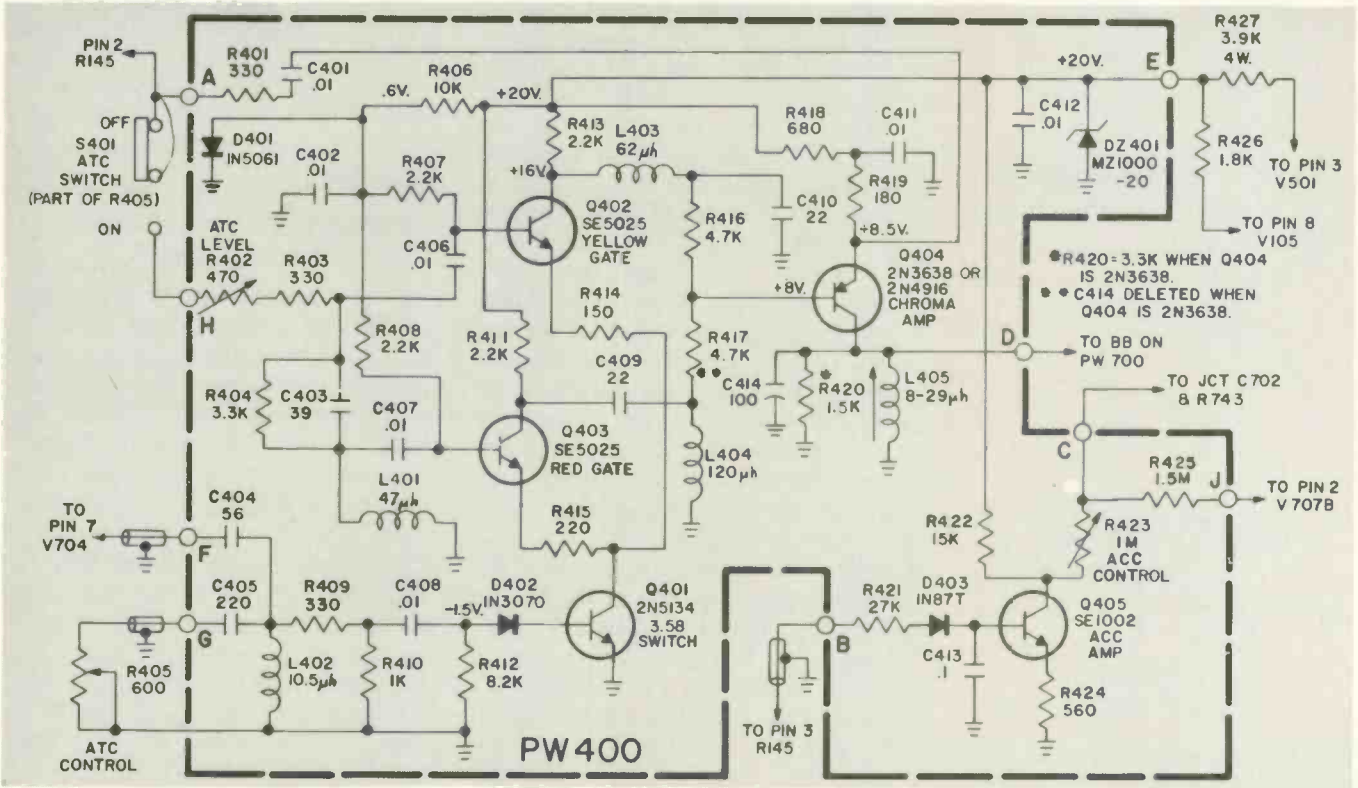


Fig. 3—Schematic diagram of the Automatic Tint Control (ATC) circuit. This circuit is designed to sense phase errors and correct them for proper hue.

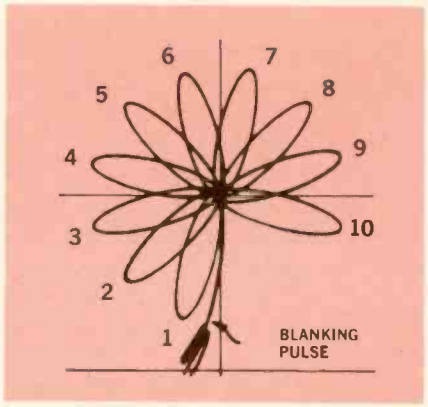


Fig. 4—Color bars in vector form with the ATC switch in its OFF position.

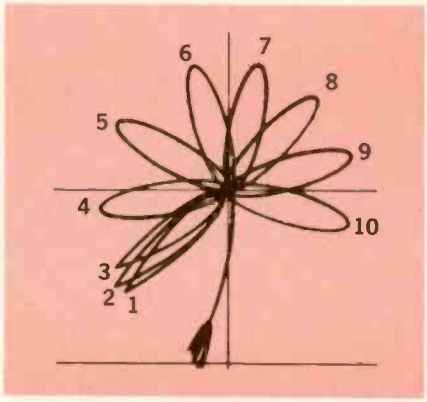


Fig. 5—Corrected color bar vectors with the ATC level adjusted for proper correction.

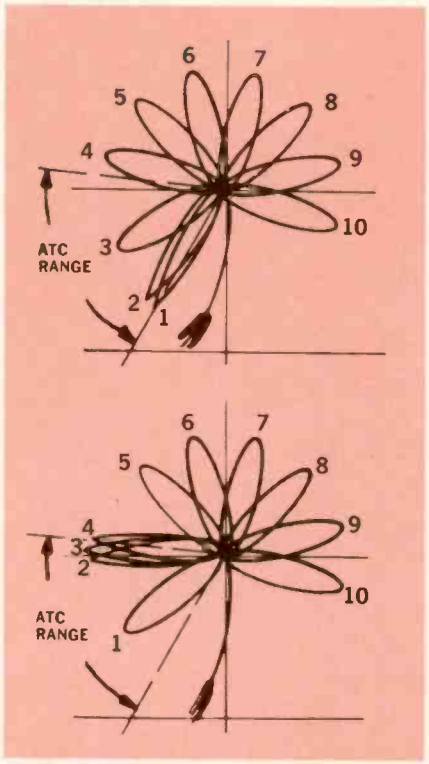
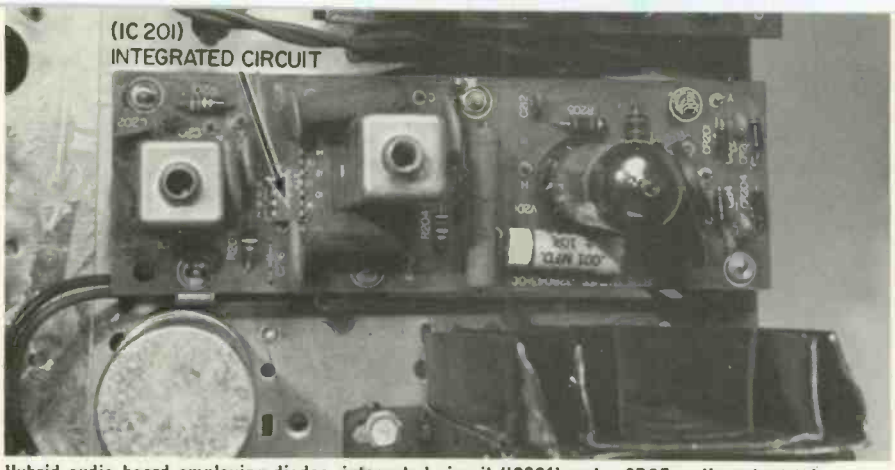


Fig. 6—Color bar vectors with (A) the ATC control fully CCW and (B) with the ATC control fully CW.



Hybrid audio board employing diodes, integrated circuit (IC201) and a 6BQ5 audio output tube.

proper phase for producing correct fleshtones.

Chroma phases other than those capable of producing yellow through red are negative during the time the 3.58MHz switch is turned ON. The gates are sensitive only to fleshtone hues and the remainder of the color spectrum is unaffected by the correction circuit.

ATC ALIGNMENT

The chroma alignment must be correct before attempting to align the ATC. Then proceed with the following set-up: (1) Adjust the TV set to view rainbow color bars, fine tune properly and switch the AFT ON, the ATC OFF. (2) Set the color killer control counterclockwise. (3) Connect a scope to terminal point "EE." (4) Adjust potentiometer R425 (the ACC control on the ATC) for 12v P-P of signal. (5) Connect the scope to the (R-Y) pad and check for the proper tint range. See the manual if touch-up is required. (6) Connect the scope's vertical input to the (B-Y) pad ("12") and the scope's horizontal input to pin 2 of V706, using a 0.05μf capacitor for the latter. (7) Set the scope for external sweep and adjust the scope's vertical and horizontal gain to obtain a symmetrical vector display as shown in Fig. 4. (8) Adjust the color control for a vector display with ½ to ¾ bars of blanking (Fig. 4). (9) Adjust the tint control to place the first bar nearly on top of the blanking (Fig. 4). (10) Push the ATC control ON and turn it to approximately mid-range. (11) Adjust potentiometer R402 (the ATC level) to pull 3 bars together without crossover (Fig. 5). (12) Check the ATC control range—the minimum swing of the corrected bars should be from the 1½ bar position to the 3½ bar position (Fig. 6A and 6B). If necessary, adjust coil L405 on the ATC unit to center the ATC range. Maximum touch-up allowable is a ¾ turn. The tint range *must* be realigned if coil L405 is adjusted. (13) Set color killer to complete the procedure.

This module, the six star deluxe model, is the complete TV set encased in a steel cabinet.

CONCLUSION

We learned a number of interesting facts concerning the production of this set. The company indicates that it builds most of its own components including cabinets, speakers, transformers, coils, chassis, flyback transformers, circuit boards, face masks, plus many other components. According to the manufacturer, this allows more control over the overall quality of the finished product, with parts built to complement each other.

The set is reportedly converged twice and run 24 hours under elevated voltages and in 10° to 15°F higher temperatures, which is said to be equal to the first 30 days of the set's use. ■

Servicing CCTV Systems

Preventative maintenance with a running card file precludes trouble and system downtime

by C. A. TUTHILL

■ CCTV systems consist basically of equipment for pick up, generation, distribution and display of video signals and reproduction of synchronized sound to specific areas, sometimes local, sometimes remote. Each unit or group of units in a basic CCTV system (Fig. 1) requires service. Each unit has its weaknesses, and some components have a predetermined life expectancy. There may be one camera or many, and this is also true of receivers and monitors. Thus, for their most economical operation, time and money can be saved when the preventative and corrective maintenance dictates of Fig. 2 are studied and implemented, as described later in the article.

While the best possible resolution for the system at hand should always be maintained, CCTV quality may be ample even when less than that dictated for broadcast TV standards. For example: Detroit uses sequential and animated line drawings to illustrate proper assembly or disassembly procedures. But, to sell their cars, they use the best available equipment for the best possible sales picture.

Actual values of horizontal resolution may be 600, 450 or 300 lines for high, medium or low performance systems, respectively.

Since CCTV systems have been in use for several years, this article will deal primarily with equipment already in use.

PREVENTATIVE MAINTENANCE

If the equipment manufacturer does not supply waveforms for the various test points, use a scope and camera adapter to record those waveforms during normal operation. Record, date and file the resultant waveforms for periodic comparison. Always allow a 15 minute warmup period before sampling, using the same model scope for comparing waveforms.

In the same dated performance file, record the normal voltage and resistance values at strategic points in major components or units. Such recorded data will, when compared to subsequent periodic checks, detect and localize a decrease in reliability of internal components due to aging, and indicate the need for replacements before failure occurs. Periodic checks will reduce or even prevent downtime, and thus avoid refunds to contractual customers.

Watch the dated files for progressive changes or drifts, even though slight. These can indicate tube or other replacement needs before marginal limits or breakdown are reached. Use a clean dry cloth or carbon tetrachloride sparingly to keep all units clean. Inspect for corrosion, loose connections and loose, worn or unlubricated mechanisms. Always maintain an ample supply of spare parts, both of electronic and mechanical components.

WAVEFORM ANALYSIS

A true analysis of waveforms is gained from experience and the proper interpretation of patterns seen on the test scope. For the less experienced, a careful study of the scope manual and controls is a must. Remember that the unknown, or

Fig. 1—Basic CCTV system.

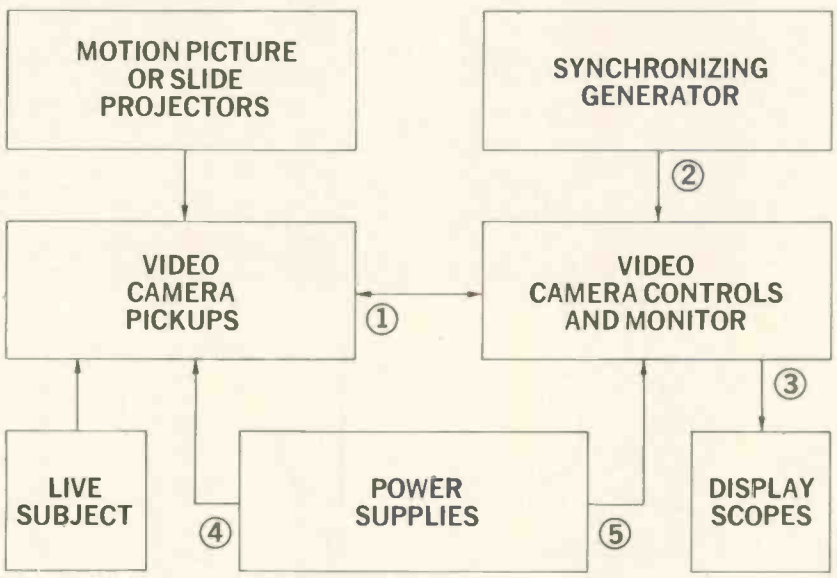


Fig. 2—Basic CCTV maintenance chart.

PERIODIC PREVENTIVE MAINTENANCE	STEP	A PERIODIC CORRECTIVE MAINTENANCE
GENERAL INSPECTION	I	TROUBLE SHOOTING
CLEANING	II	SIGNAL TRACING
LUBRICATION	III	PICTURE SHAPE DISTORTION
WAVE FORM ANALYSIS	IV	TUBE AND V&R CHECKS
CAMERAS AND CONTROLS	V	REPAIR OR REPLACEMENT
MARGINAL V&R CHECKS	VI	FINAL OPERATIONAL TESTS

signal under test, is plotted on the scope as a function of another reference or test signal whose characteristics are known.

Do not waste time over relatively minor differences observed. These may result from differences in control settings on the scope. However, severe differences can rapidly localize a fault.

One should be familiar enough with his CCTV system to know approximately the frequency and type of waveshape expected at the test point probed. This is why a systematic file of previously recorded waveshapes is indispensable. To check frequency, it is a good practice to apply a sawtooth waveform of known frequency on the horizontal axis and synchronize this signal with the fundamental or a submultiple of the frequency under test. A plot of that signal versus time is easily derived since the sawtooth reference signal provides a horizontal deflection linearly proportional to time.

Several types of probes are provided for proper scope applications. A typical test setup using a low-capacitance probe is shown in Fig. 3. Switch "S" permits producing a pattern from the squarewave generator directly on the scope before making a comparison with the output of the amplifier. Thus any distortion contributed by the scope is considered during an analysis of the amplifier output. Scope test leads should be shielded against unwanted stray signals.

Typical samples of distorted squarewaves from another source are shown in Fig. 4 together with the reason for each distortion.

CAMERAS

A test chart and a "live" or studio camera can be used to provide a quick overall system checkout. If the test pattern appears faulty on only one of the several monitors, the malfunction is generally localized in that monitor. But, if the test pattern is poor on all monitors, refer to your dated files and make scope comparisons to previously recorded patterns. Scanning circuits in the camera can cause distortion. Check internal amplifier tubes and, if necessary, run voltage and resistance checks. Other faults may be localized to the camera control section.

When the system checks out normally, and a film pickup was in use during a failure, either the film pickup camera or the projector is at fault. Substitution of either is the fastest isolation rundown and should restore the service while repairs are made.

Studio cameras for live pickup are carefully designed for high-quality image transmission to the system's video input. The wide range of camera types that may be operated or maintained is shown by the simple comparison of two picture tubes (Table I).

These camera tubes may incorporate one of three basic scanning principles—instantaneous scanning, storage scanning or slow-speed scanning. All three camera tubes function well when properly applied.

Instantaneous Scanning—The image dissector, actually a two-section tube, is one example. Output from the photocathode section is focused through an aperture to the multiplier section. Corrective adjustments are made with the usual exterior focus and deflection coils. One disadvantage is that a high output light source of about 1000 ft candles is required.

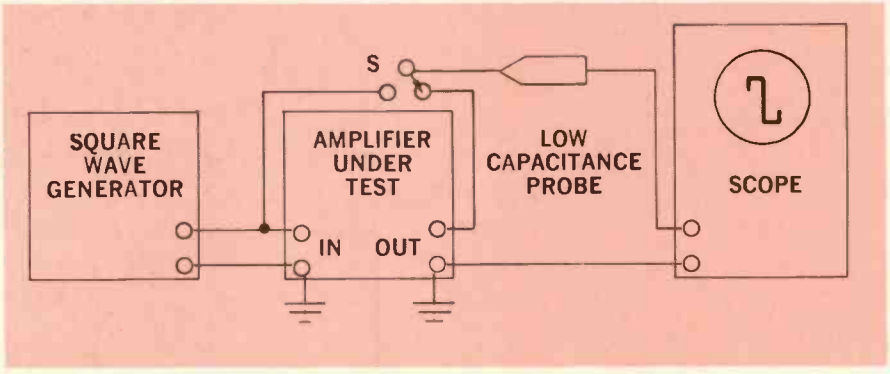
Storage Scanning—Three examples of this type tube are the iconoscope, image orthicon and vidicon. The well known iconoscope is an older development but still serves well. However, its weaknesses include a poor signal-to-noise ratio, black level instability and edge flare.

The image orthicon is a more costly tube to operate, but it is highly sensitive and pays off for more exacting and lucrative operations (see Table I).

The vidicon functions similarly but is less sensitive than the orthicon. It is also less expensive to operate.

Slow-Speed Scan—For the greatest economy and minimum picture quality, a slow-speed scan technique is available. Such a camera may be used to scan a newspaper or other printed matter where time is avail-

Fig. 3—Test connections for determining squarewave response of video amplifier.



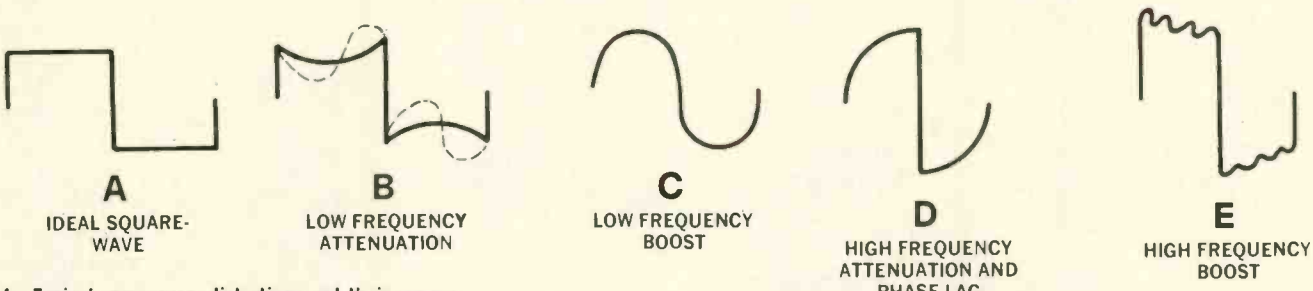


Fig. 4—Typical squarewave distortions and their causes.

able. Limitations are such that a five minute TV commercial might consume several hours for transmission. The video bandwidth for slow scan ranges from 250kHz downward to 500Hz.

CONTROLS

The camera control unit provides several electrical functions including: adjustment of focus, beam current, signal level, dc restoration, blanking, shading and signals for monitors. In addition to the controls just mentioned, stabilized power sources of specified voltages are a must.

Many of the less exacting CCTV systems used for simple industrial assignments, security service and such, do not use a special blanking pulse, such as in video broadcasting. Instead, the same pulse that triggers scanning and blanks the picture tube during retrace is also used to close the camera scanning aperture. The resultant lack of interlace, or lock-in between vertical and horizontal frequencies, results in poor resolution. In these simpler systems good interlace is impossible. But the system may serve satisfactorily where no great distances separate the camera and final display tube.

SYNC GENERATORS

Synchronizing, blanking, horizontal and vertical drive pulses are obtained from the heart of the system, the sync generator. In higher grade systems, both the camera tube and monitor tube must simultaneously scan exactly the same element of a particular line of the picture. When even slightly out of step, distortion results.

If a picture is to be obtained, the electron beam of the tube must sweep across the screen. This is accomplished by applying sawtooth waves to the deflecting coils of the camera picture tube, or to the deflecting plates if electrostatic deflection is used. These sawtooth waves are controlled by sync signals from the sync generator.

To avoid inadequate picture resolution, the sync signals (pulses) must be injected during the scanning retrace period. Thus the scanning functions of both camera and display tubes are locked in sync.

Use a scope to check the outputs from the sync generator. Two of these outputs are the sync and blanking pulses in the video signal. The other two provide the vertical and horizontal drive pulses. Refer to the manufacturer's literature, the standardized RETMA waveform charts showing video pulses or to your own waveforms previously recorded while the sync generator was performing normally.

COAXIAL CABLES

Coaxial cables distribute the video signals to various system units. These cables are often long and produce high frequency attenuation and phase distortion. To compensate for such distortion, booster amplifiers and corrective equalizers are often used. The boosters drive the picture and sync pulses through the coaxial cables. Impedance matching transformers are usually used to feed signals to these lines or obtain signals from the lines. The attenuation loss per 100 ft of cable, as shown in Table II, is alone ample reason for using booster amplifiers at the start and termination of a coaxial cable.

Table II—Typical Coaxial Cable Attenuation

MHz Cable	100 (Approximate	500 loss in	1000 dB per	3000 100 ft)
RG19A/U	0.7	2.0	3.5	8.0
RG8A/U	2.0	5.0	8.0	15.0
RG59A/U	4.0	10.0	15.0	25.0
RG55/U or RG58C/U	4.8	12.0	18.0	32.0

Table I—Comparison of Typical Camera Tubes

Vidicon	Image Orthicon (Fig. 5)
Costs $0.10 per hour to operate.	Costs $2.00 per hour to operate.
Simpler circuitry permits use of more cameras per dollar.	Greater sensitivity and larger contrast range. Will reproduce scene with only 10 ft candles of incident light.
Simplified adequately for many applications.	Insensitive to lag or smear due to moving objects.
Responds well to film pickup.	Output more stable, less sensitive to light intensity changes.
Reasonable signal-to-noise ratio.	Alignment coil external to tube neck corrects for misalignment.

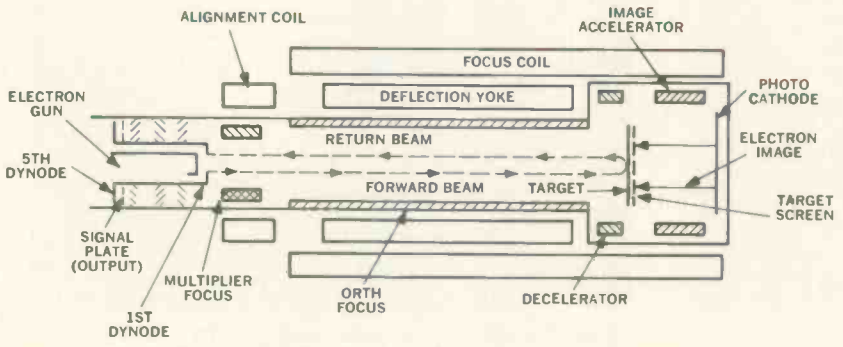


Fig. 5—Components of an image orthicon camera tube.

VIDEO DISPLAYS (MONITORS)

Some form of cathode ray tube (CRT) is used in a video display, often called a monitor, which converts the scene viewed by the camera from electrical signals to an optical image or display. Signal input may be taken directly from the video line, or the monitor may receive a demodulated signal. In the latter case, RF and IF stages are added, thus permitting the monitor to function as a receiver. (Refer to Fig. 1 in the next article for methods of checking monitor performance.) When remote monitors must be located at some considerable distance from the camera, an RF generator is required to supply an adequate signal for getting the required pulses through the long coaxial line. ■

Why a Trigger-Sweep Scope

by PHILLIP DAHLEN

Effective TV servicing requires that the technician know the capabilities and limitations of his oscilloscope

■ Each month the TEKFAX portion of ELECTRONIC TECHNICIAN/DEALER provides many helpful schematic diagrams of TV circuits that the technician may encounter when servicing. Although we have received excellent readership response to this service and the many helpful diagrams that it has provided, one type of information usually provided with these schematics is too frequently ignored—the small photographs showing the signals present in various stages of the TV set.

When a TV set ceases to function properly, the trouble can frequently be localized according to the symptom observed. Checking tubes, transistors or voltages can generally result in the final pinpointing of the defective component—but what if it doesn't? What about the too frequent occasions when the technician either fails to use a scope or doesn't use it effectively? This results in the time-consuming task of prodding all accessible components and making component substitutions until finally "hitting upon" a solution that brings the TV set back to near normal operation. And too frequently these wasted hours of searching are charged to the customer as exorbitant fees, resulting in bad customer relations and the loss of future business. Failure to charge for the time wasted, on the other hand, can result in eventual bankruptcy.

What was the basic problem? It was the technician's failure to initially pinpoint the problem with his scope, comparing scope traces with those considered normal by the TV set manufacturer.

There is too great an assortment of scopes on the market to describe the capabilities and limitations of each when signal tracing a defective TV set. Instead, this article compares the traces of two scopes with the waveforms supplied by Zenith for its 14A9C50 chassis. One set of waveforms was obtained from a 5-in. Lectrotech oscilloscope/vectorscope advertised at $339.50. The second set of waveforms was obtained from a less expensive scope, costing in the neighborhood of $100 in kit form. The first is a triggered-sweep scope, while the second is a sync-sweep scope.

As we photographed scope waveforms in the ELECTRONIC TECHNICIAN/DEALER laboratory (Fig. 1), we concluded that both scopes were of excellent quality—for the price charged. With the first scope, we had very little difficulty duplicating all waveforms provided for the TV set; while some waveforms could not be duplicated on the second scope. In addition to the apparent differences in frequency response, sync stability and probe background hum, as noted in the many comparative photographs, there was also a significant difference in waveform brightness. We compensated for the latter by making different camera settings while photographing the waveforms viewed on the two scopes.

This article shows how the technician's efforts to duplicate the waveforms provided by TV set manufacturers will differ with the capabilities of the scope used. It also shows that these waveforms can differ somewhat with the program signal present when waveforms are observed. Most of the photographs were taken using a signal source produced by our own test pattern (note Fig. 1 & 2), while others represent responses to a color-bar generator.

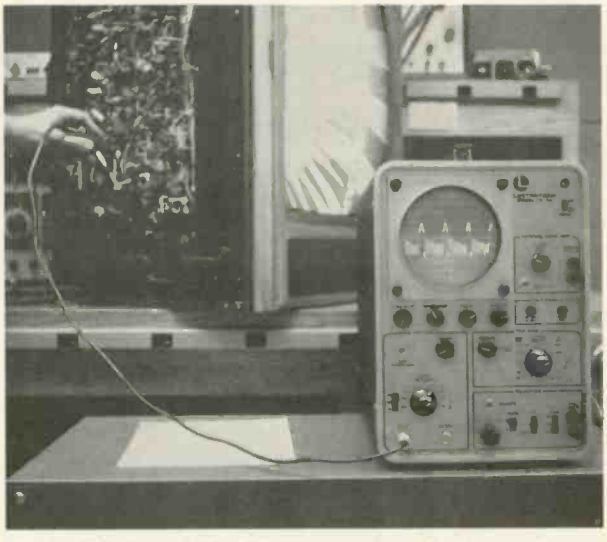


Fig. 1—Waveform obtained from test-pattern signal on Lectrotech oscilloscope/vectorscope.

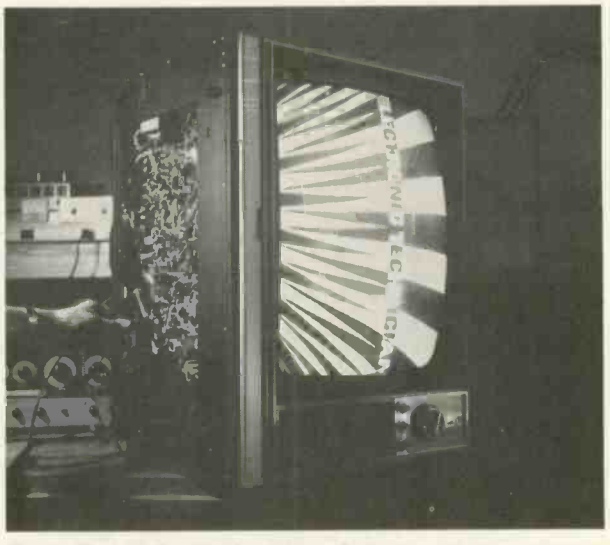


Fig. 2—Most of the signals photographed represent those required for producing the test pattern shown.

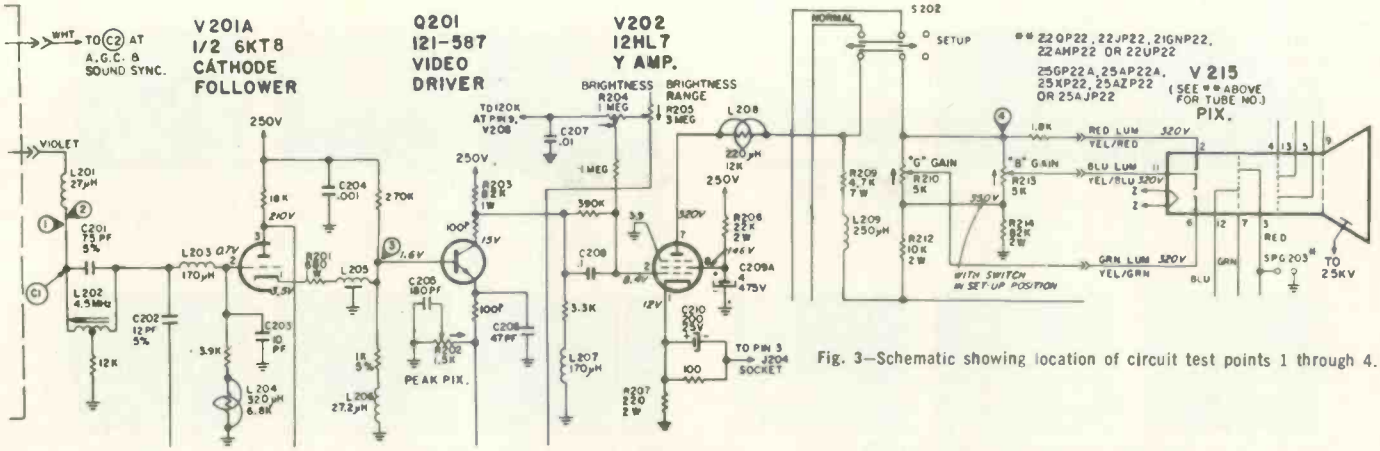


Fig. 3—Schematic showing location of circuit test points 1 through 4.

We suggest that technicians not adequately familiar with their own scope duplicate our efforts on a TV set that is functioning properly, comparing their results with those provided in TEKFAX. Then they will know what to expect from their scope when servicing a defective TV set. It could be that a missing waveform is due to the limitations of the scope used rather than a TV set defect. Such limitations must be known if scope signal tracing is to be effective.

The complete schematic of this TV set will be shown in next month's TEKFAX Schematic No. 1324. Future articles will show how TV circuit defects will affect signals observed on a scope.

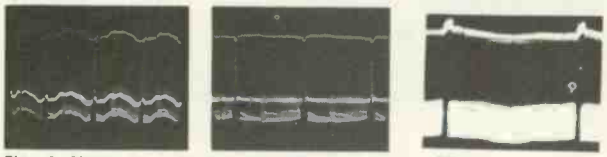


Fig. 4—Signal from IF assembly (terminal 1) as indicated by manufacturer (right), as seen on the trigger-sweep scope (center), and as seen on the sync-sweep scope (left). The white lower portion of the two photos that we took differed from that supplied by Zenith due to the presence of a different video signal (they probably used a live TV program instead of a test pattern). The extra waves imposed on the waveforms in the left photo are the result of 60Hz hum present at the unshielded scope input terminals. The trigger-sweep scope has shielded input terminals.

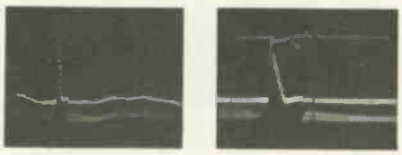


Fig. 5 — The same waveform as shown in Fig. 4, but with the trigger-sweep scope switched to ×5 magnification and the sync-sweep scope adjusted for maximum magnification. With this degree of magnification, the IF signal generating the waveform becomes apparent on the trigger-sweep scope (right), while it cannot be seen on the sync-sweep scope (left).

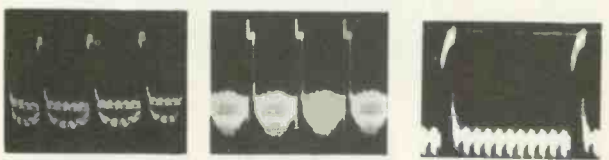


Fig. 6—The manufacturer has labeled No. 2 the same waveform as had been previously obtained from terminal 1. Although of the same signal, the two waveforms appear different since the first shows the signal's 60Hz harmonic waveform (TV vertical sync) while this set of photos show its 15.76kHz harmonic waveform (TV horizontal sync). The manufacturer's illustration of the resulting waveform (right) again differs slightly from those seen on the trigger-sweep (center) and the sync-sweep (left) scopes due to the nature of the video signal present.

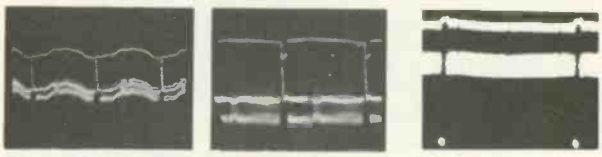


Fig. 7—Signal present at the input of the video drive circuit, as indicated by the manufacturer (right), and seen on the trigger-sweep (center) and sync-sweep (left) scopes. In this instance the manufacturer's waveform is of the wrong polarity, while a different video signal accounts for any other apparent waveform differences.

Fig. 8—Trigger-sweep scope still connected to Terminal 3 but with a live TV program applied to the TV set rather than the test pattern. Note how a change in TV pictures changes the video signal.

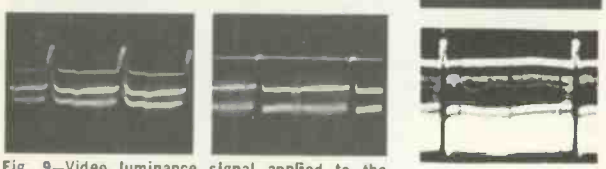


Fig. 9—Video luminance signal applied to the cathodes of the three picture-tube guns. (This signal is equivalent to the signal used to produce pictures on B/W TV sets.) The signal pictured by the manufacturer (right) again differs slightly from that seen on the trigger-sweep scope (center) and sync-sweep scope (left) due to the fact that it represents a different TV image.

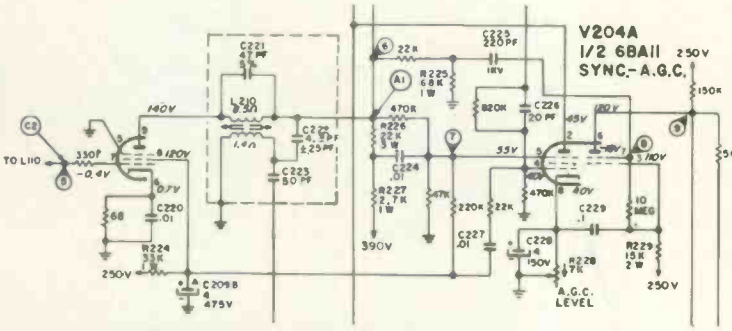


Fig. 10—Schematic showing location of circuit test points 5 through 9.

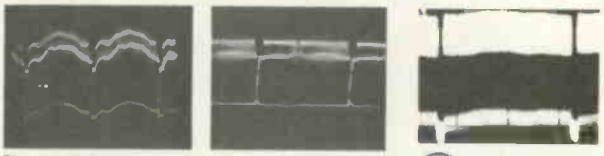


Fig. 11—Input signal to the sound, synchronization and automatic-gain-control circuit amplifier, as indicated by manufacturer (right), as seen on the trigger-sweep scope (center), and as seen on the sync-sweep scope (left). Again note the 60Hz hum present on the left scope trace.

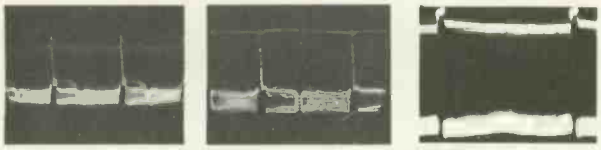


Fig. 12—Amplified signal remaining after sound has been removed, as indicated by the manufacturer (right), and seen on the trigger-sweep (center) and sync-sweep (left) scopes.

6 — 44V P-P, 60 Hz

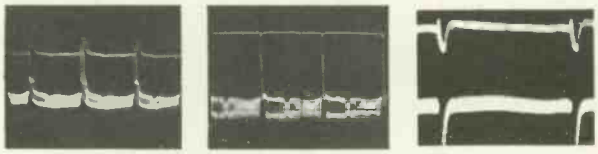
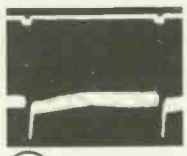


Fig. 13—Signal applied for further amplification and use in the AGC control circuit. The possible absence of a video signal on the manufacturer's waveform (right) probably accounts for the difference between it and the waveforms observed on the trigger-sweep (center) and sync-sweep (left) scopes.

7 — 7.3V P-P, 60 Hz

Fig. 14—The manufacturer indicates that this waveform represents the signal fed to the tube grid for further amplification. This was the only signal that we were unable to observe on either scope.



8 — 37V P-P, 60 Hz

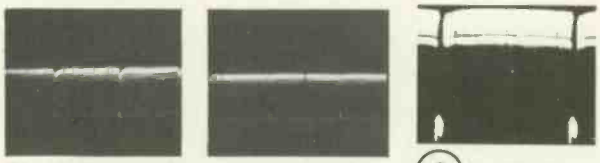


Fig. 15—The amplified sync signal used for synchronizing the vertical and horizontal oscillator circuits, as indicated by the manufacturer (right), and seen on the trigger-sweep (center) and sync-sweep (left) scopes.

9 — 70V P-P, 60 Hz

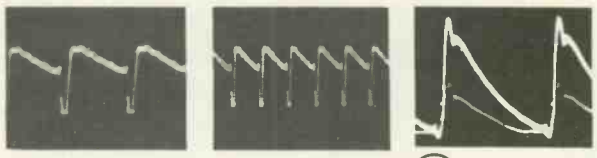


Fig. 18—Signal obtained from sync amplifier circuit, as indicated by manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

11 — 30 V P-P, 15.75 KHz

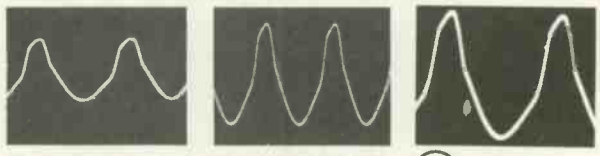


Fig. 19—Signal present at the grid of the horizontal oscillator tube, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

12 — 420V P-P, 15.75 KHz

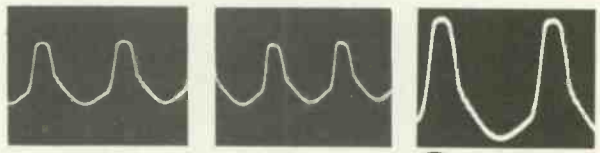


Fig. 20—Signal present at the cathode of the horizontal oscillator tube, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

13 — 260V P-P, 15.75 KHz

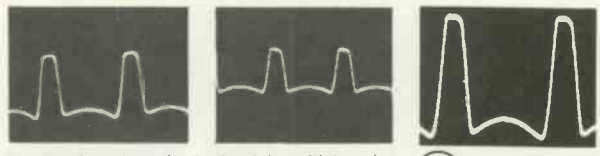


Fig. 21—Output of the horizontal oscillator circuit, applied to grid of horizontal discharge circuit, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

14 — 150V P-P, 15.75 KHz

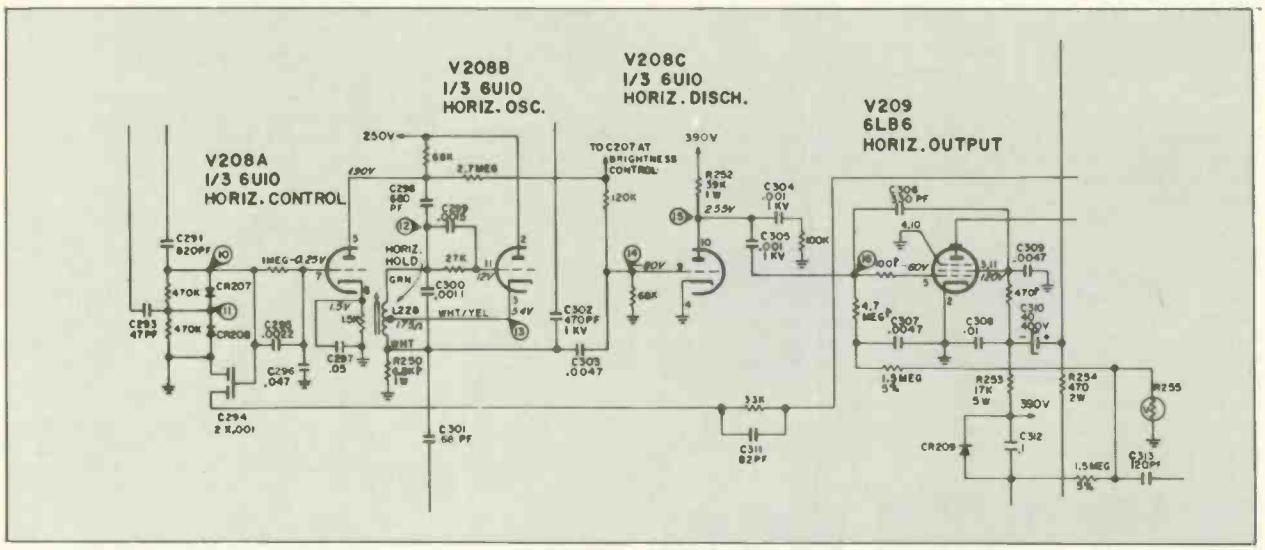


Fig. 16—Schematic showing location of circuit test points 10 through 16.

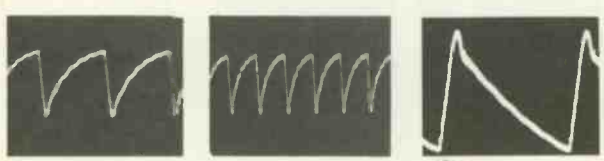


Fig. 17—Signal obtained from vertical oscillator circuit, as indicated in inverted form by manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

10 — 21V P-P, 15.75 KHz

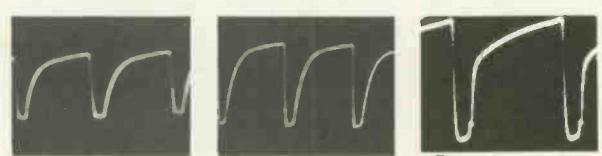


Fig. 22—Signal present at the plate of the horizontal discharge tube, as indicated by the manufacturer (right), and seen on the trigger-sweep (center) and sync-sweep (left) scopes.

15 — 250V P-P, 15.75 KHz

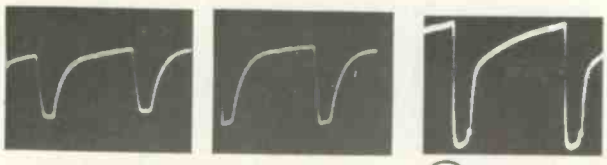


Fig. 23—Signal applied to the horizontal output circuit, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

16 230V P-P 15.75 KHz

Fig. 24—Schematic showing location of circuit test points 17 through 19.

Fig. 25—First of three horizontal convergence signals, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

17 19V P-P 15.75 KHz

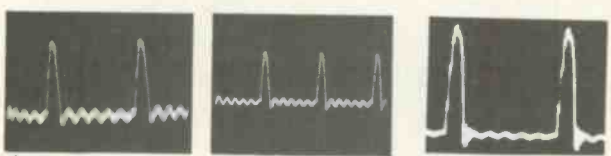


Fig. 26—Second of three horizontal convergence signals, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

18 6V P-P 15.75 KHz

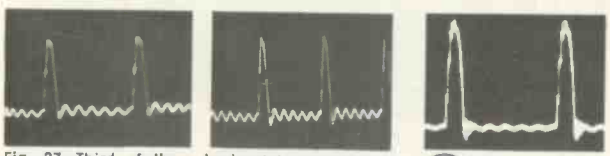
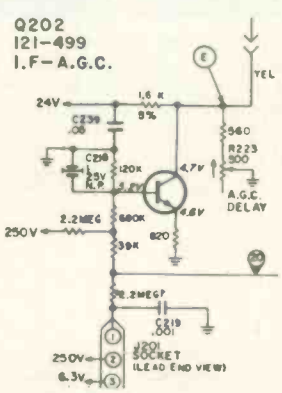


Fig. 27—Third of three horizontal convergence signals, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

19 240V P-P 15.75 KHz

Fig. 28—Schematic showing location of circuit test point 20.



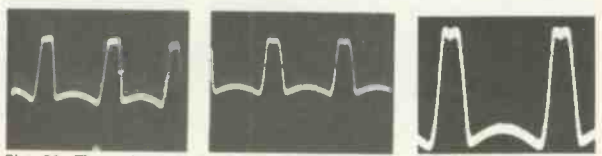


Fig. 29—The output of the horizontal oscillator circuit and the AGC circuit are connected together and their combined signal affects the base bias in the IF-AGC circuit. The corresponding waveforms provided by the manufacturer, trigger-sweep and sync-sweep scopes are shown from right to left in sequence.

20 145V P-P 15.75 KHz

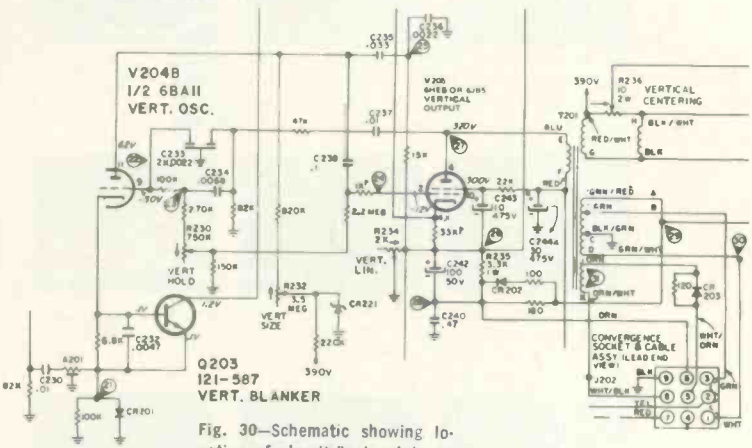


Fig. 30—Schematic showing location of circuit test points 21 through 31.

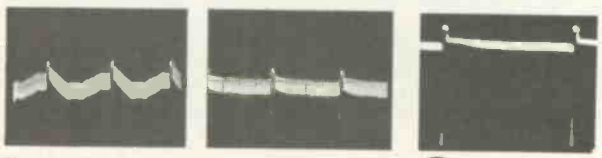


Fig. 31—Waveform of sync signal applied to vertical blanking circuit, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

21 10V P-P 60 Hz

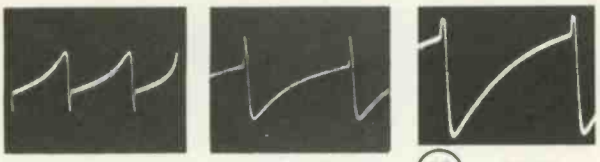


Fig. 32—These waveforms provided by the manufacturer (right) and seen on the trigger-sweep (center) and sync-sweep (left) scopes represent the signal present at the grid of the vertical oscillator tube.

22 84V P-P 60 Hz

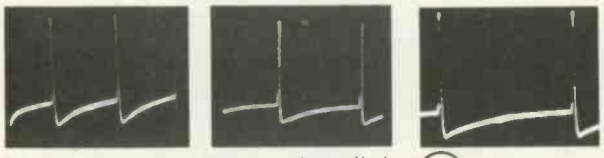


Fig. 33—Differentiated signal near the vertical hold control, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

23 420V P-P 60 Hz

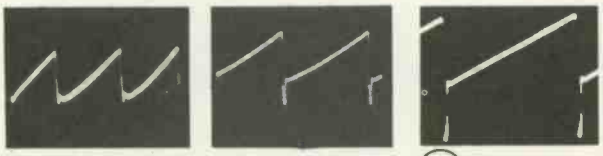


Fig. 34—Waveforms indicated by the manufacturer (right), and the trigger-sweep (center) and sync-sweep (left) scopes, for the signal at the grid of the vertical output tube.

24 70 V P-P 60 Hz

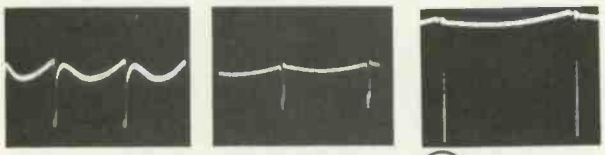


Fig. 35—Differential signal near the vertical linearity control, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

25 60V P-P 60 Hz

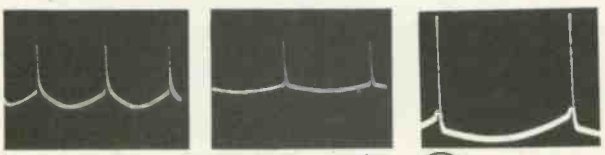


Fig. 36—Waveforms indicated by the manufacturer (right), and the trigger-sweep (center) and sync-sweep (left) scopes, for the signal fed from the cathode to the grid of the vertical-output tube.

26 26V P-P 60 Hz

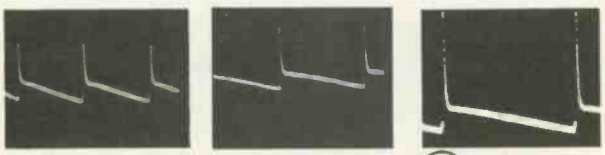


Fig. 37—Signal at the plate of the vertical output tube, as indicated by the manufacturer (right), and as shown on the trigger-sweep (center) and sync-sweep (left) scopes.

27 1350V P-P 60 Hz

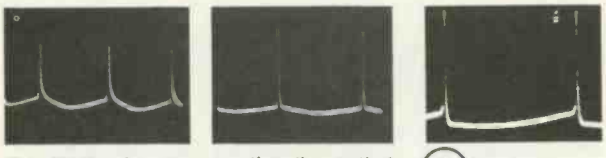


Fig. 38—Waveforms representing the vertical output signal applied to the convergence circuit, as indicated by the manufacturer, trigger-sweep and sync-sweep scopes, and shown from right to left in sequence.

28 24V P-P 60 Hz

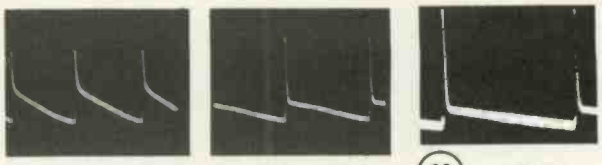


Fig. 39—Waveforms indicated by the manufacturer (right), and the trigger-sweep (center) and sync-sweep (left) scopes, for the vertical-output-circuit signal later applied to the pincushion-correction circuit.

29 95V P-P 60 Hz

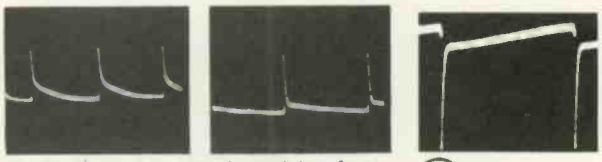


Fig. 40—Signal from vertical-output transformer that is applied to the convergence circuit. Note that the polarity of the signal, as indicated by the manufacturer (right), is opposite that shown on the trigger-sweep (center) and sync-sweep (left) scopes.

30 11V P-P 60 Hz

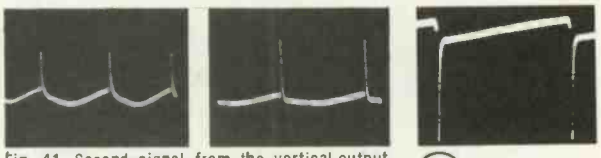
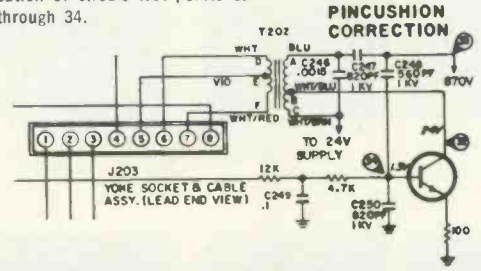


Fig. 41—Second signal from the vertical-output transformer that is applied to the convergence circuit. Note that again the polarity of the signal indicated by the manufacturer (right) is opposite that shown on the trigger-sweep (center) and sync-sweep (left) scopes.

31 44V P-P 60 Hz

Fig. 42—Schematic showing location of circuit test points 32 through 34.



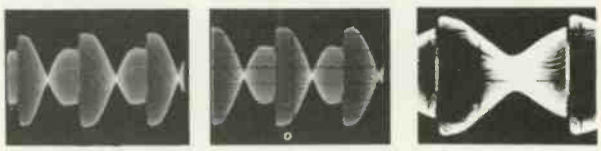
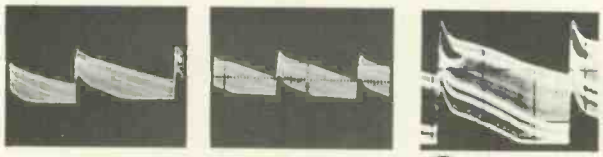


Fig. 43—Signal present at the transistor collector in the pincushion-correction circuit. The waveform seen on the trigger-sweep scope (center) clearly resembled that indicated by the manufacturer (right), while the full detail of the waveform produced on the screen of the sync-sweep scope (left) was not bright enough to be clearly seen until a time exposure photo was taken.

32 42V P-P 60 Hz

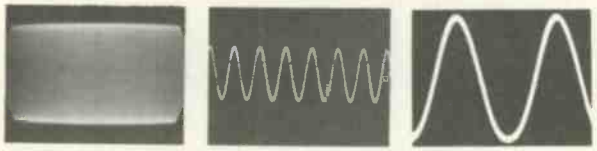
Fig. 44—Signal present on the high-voltage lead of the pincushion-correction circuit, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.

33 60V P-P 15.75 KHz



34 25V P-P 60 Hz

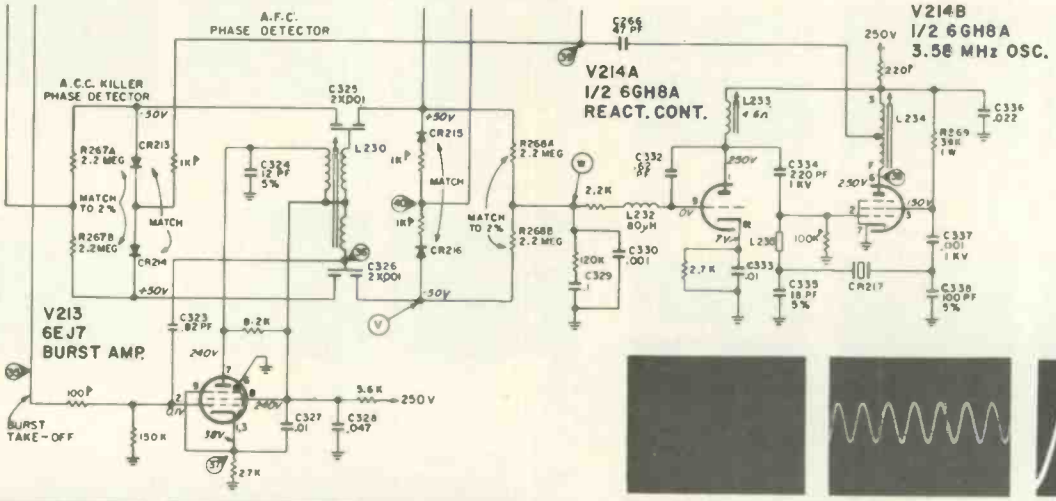
Fig. 45—Signal present at the transistor base in the pincushion-correction circuit. The waveform on the sync-sweep scope (left) was not as easily seen as that shown by the trigger-sweep scope (center).



39 40V P-P 3.58 MHz

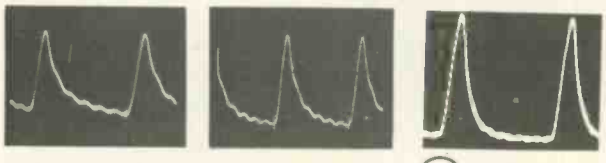
Fig. 51—AFC phase detector reference signal. A time exposure shows the image produced on the sync-sweep scope (left) as compared to that produced on the trigger-sweep scope (center) and that indicated by the manufacturer (right).

Fig. 46—Schematic showing location of circuit test points 35 through 40.



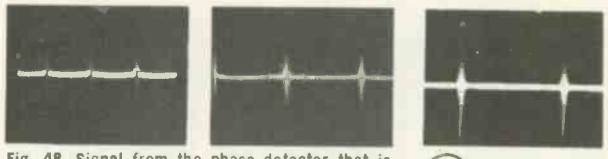
40 56V P-P 3.58 MHz

Fig. 52—Manufacturer's photo of 3.58MHz phase-shift color signal (right) as compared with waveform from trigger-sweep scope (center). No waveform was obtained from the sync-sweep scope (left).



35 54V P-P 15.75 KHz

Fig. 47—Burst take-off signal as indicated by the manufacturer (right), and seen on the trigger-sweep (center) and sync-sweep (left) scopes.



36 75V P-P 15.75 KHz

Fig. 48—Signal from the phase detector that is supplied to the burst amplifier. Although the trigger-sweep scope (center) was easily adjusted to duplicate the manufacturer's waveform (right), a direct lead (rather than the usual low-capacity probe) was required in order to obtain adequate signal voltage for the sync-sweep scope (left). We then still found it very difficult to synchronize the scope and there was some problem with background hum.

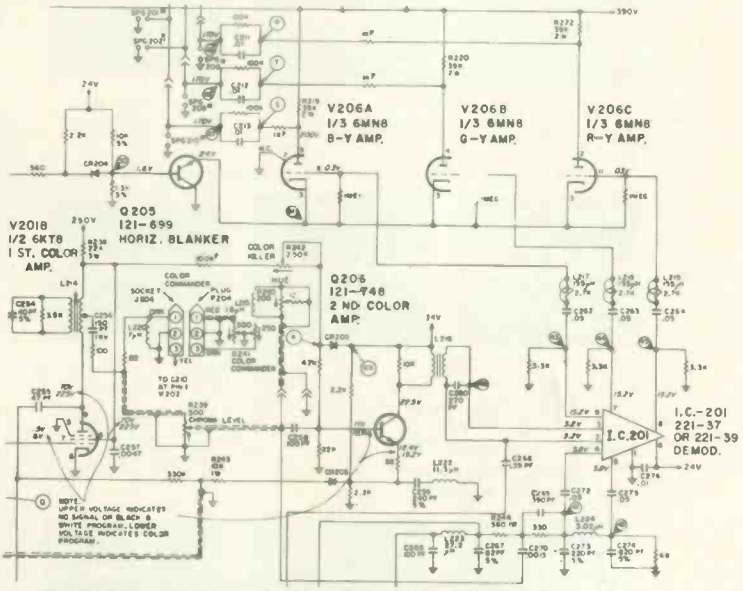
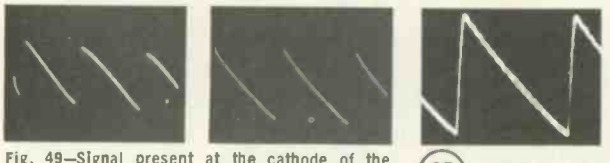
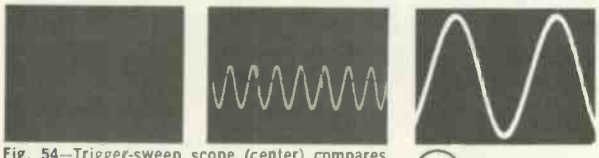


Fig. 53—Schematic showing location of circuit test points 41 through 51.



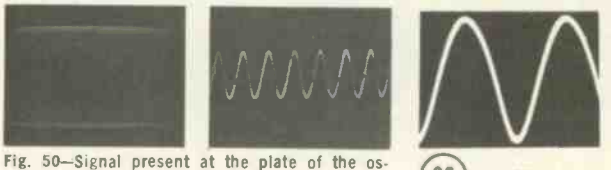
37 14V P-P 15.75 KHz

Fig. 49—Signal present at the cathode of the burst amplifier tube, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.



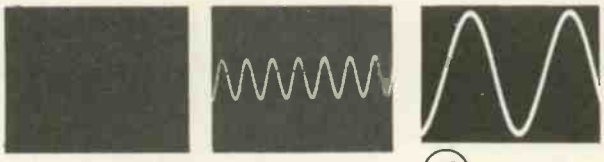
41 1.1V P-P 3.58 MHz

Fig. 54—Trigger-sweep scope (center) compares phase-shift color signal, applied through capacitor to IC terminal 4, with waveform indicated by manufacturer (right). Again the sync-sweep scope (left) is unable to produce a corresponding waveform.



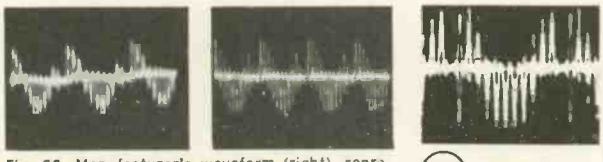
38 180V P-P 3.58 MHz

Fig. 50—Signal present at the plate of the oscillator tube. By turning the trigger-sweep scope to ×5 magnification, the resulting waveform (center) corresponded to that shown by the manufacturer (right). The sweep frequency of the other scope (left) was too slow for forming an image at that frequency.



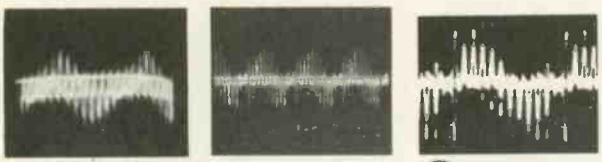
42 1.0V P-P 3.58 MHz

Fig. 55—Manufacturer's waveform (right) representing the phase-shift color signal applied through capacitor to IC terminal 5, is compared with that produced by the trigger-sweep scope (center). As before, the sync-sweep scope (left) is unable to produce a corresponding waveform.



43 6.2V P-P 15.75 KHz

Fig. 56—Manufacturer's waveform (right), representing the blue signal output from the IC color demodulator, is compared to those seen on the trigger-sweep scope (center) and sync-sweep scope (left).

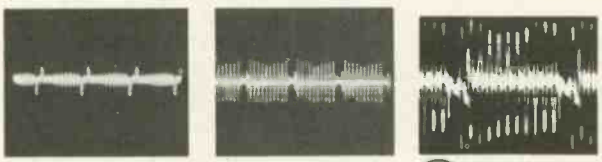


44 2.4V P-P 15.75 KHz

Fig. 57—Green signal output from IC color demodulator. The trigger-sweep scope (center) was able to reproduce the waveform indicated by the manufacturer (right), while at this low signal voltage there was too much input terminal hum for an accurate trace on the sync-sweep scope (left).

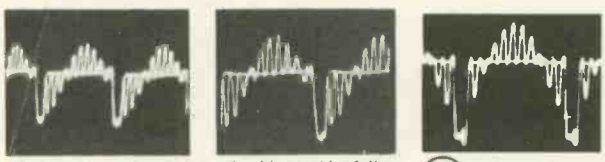
45 6.4V P-P 15.75 KHz

Fig. 58—The waveform indicated by the manufacturer (right) for the red signal output from the IC color demodulator is compared with that seen on the trigger-sweep (center) and sync-sweep (left) scopes.



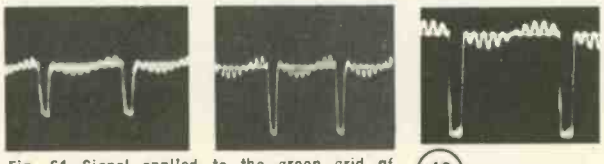
46 .2V P-P 15.75 KHz

Fig. 59—The output signal from the second color IF amplifier clearly demonstrates the superiority of the more expensive trigger-sweep scope. At maximum gain, its waveform (center) closely represents that indicated by the manufacturer (right). The sync-sweep scope did not have adequate sensitivity and the use of a direct lead resulted in waveform distortion (left).



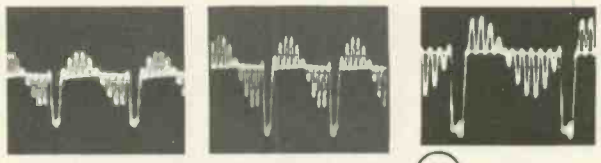
47 170V P-P 15.75 KHz

Fig. 60—Signal applied to the blue grid of the color-picture tube, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.



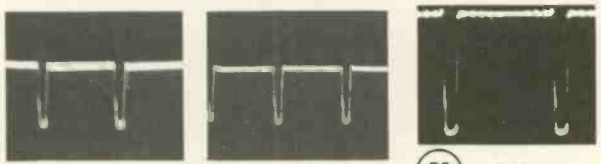
48 120V P-P 15.75 KHz

Fig. 61—Signal applied to the green grid of the color-picture tube, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.



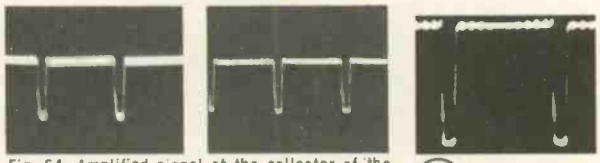
49 160V P-P 15.75 KHz

Fig. 62—Signal applied to the red grid of the color-picture tube, as indicated by the manufacturer (right), and as seen on the trigger-sweep (center) and sync-sweep (left) scopes.



50 3.4V P-P 15.75 KHz

Fig. 63—Manufacturer's waveform (right), representing the signal applied to the base of the horizontal blanker transistor, is compared to those seen on the trigger-sweep (center) and sync-sweep (left) scopes.



51 3.2V P-P 15.75 KHz

Fig. 64—Amplified signal at the collector of the horizontal-blanker transistor, as indicated by the manufacturer (right), and as shown on the trigger-sweep (center) and sync-sweep (left) scopes. With so low an input signal, background input-terminal hum has resulted in a slight sync problem with a closely paired double image on the sync-sweep scope. This same problem also occurred on the previous blanker stage.

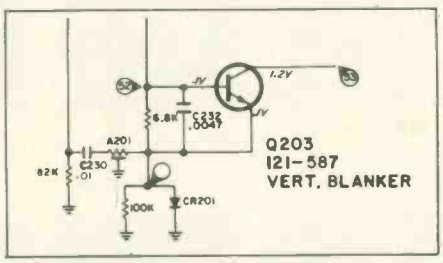
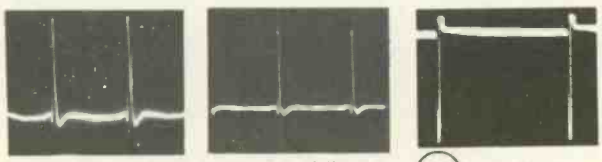
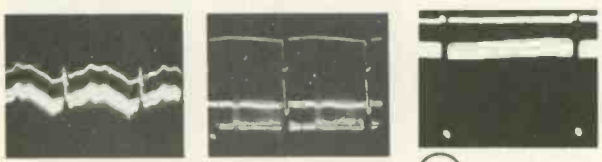


Fig. 65—Schematic showing location of circuit test points 52 and 53.



52 12V P-P 60 Hz

Fig. 66—Signal present at the base of the vertical-blanker transistor. The waveform shown by the manufacturer (right) is of the wrong polarity and should be like those seen on the trigger-sweep (center) and sync-sweep (left) scopes.



53 2.4V P-P 60 Hz

Fig. 67—Signal present at collector of the vertical-blanker transistor. Again, the waveform shown by the manufacturer (right) is of the wrong polarity and should resemble that seen on the trigger-sweep scope (center). The presence of a different video signal at the vertical driver transistor, which is connected to the blanker transistor, may have resulted in the slightly different waveform on the trigger-sweep scope; while background hum, present at the terminals of the sync-sweep scope, may have resulted in some distortion of its waveform (left).

Servicing Solid-State Stereo

Part IV—The function of various components in a passive-type equalization circuit, and the various causes of circuit failure, must be thoroughly understood if that portion of an audio system is to be effectively serviced

by NORMAN H. CROWHURST

■ FM receivers, phonograph preamplifiers and tape playback circuits all require equalization for substantially the same reason—to improve the apparent signal-to-noise ratio or dynamic range of the system. Steps are taken to reduce the effective intensity of background noise in signals recorded, transmitted, or what-have-you.

CIRCUIT FUNCTION

Noise, whether the result of radio transmission, deviations in the molecular orientation of magnetic tape, similar random "events" not related to program sound or defective phonograph record grooves, all have similar characteristics distributed on a "per Hertz" basis.

This means that there is as much noise energy between 500Hz and 1000Hz as there is between 0Hz and 500Hz, and that there is 10 times as much energy between 1kHz and 10kHz as there is below 1kHz.

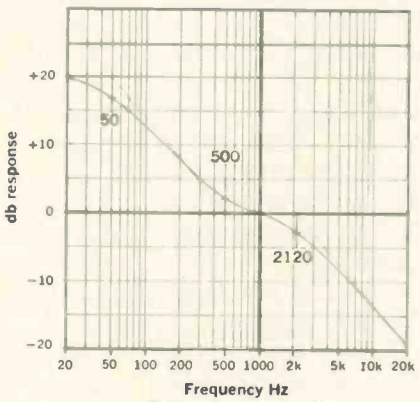
A second factor, which puts equalization in the category of a "must," is that in music or speech —the kind of program that we listen to—most of the audio energy is below 2kHz, or thereabouts.

The sensitivity of the human ear is still a third factor. Human hearing is much more sensitive to frequencies above 1kHz than it is to lower frequencies. This, combined with the first factor, means that noise can be much more readily heard, for its relative power level, than the wanted signal in its natural (unequalized) state.

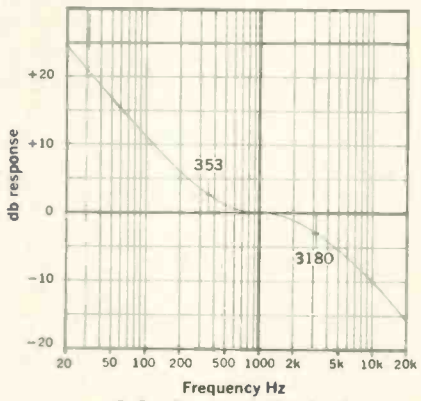
To overcome this, the engineers that developed the use of each medium resorted to emphasizing the level of signals somewhere above 1kHz so that there could be a better chance of overriding the noise—there being energy space to allow this. Although the precise formula adopted varies from medium to medium, they have always been adopted with similar intent.

Still another factor enters the picture for the recording media. There low frequencies require greater signal amplitude to get the same output response—thus making matters more difficult for the opposite end of the audio spectrum. By reducing the amplitude of low-frequency signals and boosting them back again after playback, both middle- and

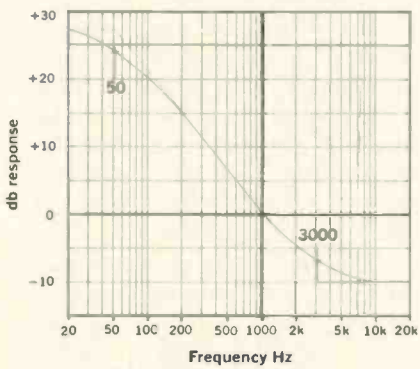
Fig. 1—Some of the more commonly used equalization curves. On each, the turnover points, used to design circuits that produce such a response, are clearly marked.



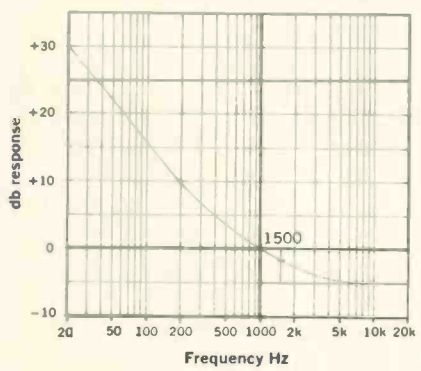
R.I.A.A. Playback



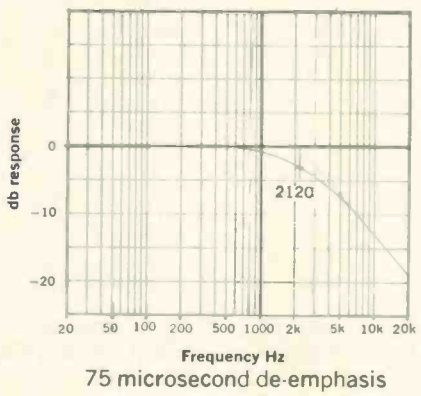
C.C.I.R. Disc Playback



N.A.R.T.B. Tape Playback



C.C.I.R. Tape Playback



75 microsecond de-emphasis

high-frequency signals can be recorded at greater amplitudes without overloading the lower frequencies.

By increasing or decreasing the amplitude of signals according to their relative frequency, equalization curves (Fig. 1) have been developed to improve the quality of the sound heard. Each of the equalization curves provides a response opposite that imposed on the signal at the recording or transmitting end—thus returning the audio signal to its original state. Each of these responses equalizes for an opposite response, used at the recording or sending end. An overall correct rendition of the recorded or transmitted program depends on correctly equalizing the playback or receiving end. For this reason, any high-fidelity control center will include some form of equalization.

Often the equalization curves are changed with the function switch so that the signal is automatically corrected for the type of program source selected—magnetic tape, phonograph record or receiver. But, like other circuits, equalization circuits can develop malfunctions. And technicians must understand how these circuits function if they are to be effectively serviced.

Although there are two basic types of equalization circuits, the passive-type circuits described this month are the most popular. Feedback equalization circuits—the other type—place the frequency correcting components in the feedback circuit through a stage of controlled amplification. With each type circuit there are variations in component arrangement so that responses will change to suit different media.

PASSIVE CIRCUIT DESIGN

It is important to know how basic passive circuits are designed to achieve each form of response before covering what can cause them to malfunction. In describing circuit design, we will ignore input and output impedances—the circuits between which the equalizer functions. Instead we will merely assume that an emitter follower circuit supplies the signal fed to the equalizer, which in turn supplies it to a high impedance circuit.

PHONOGRAPH PLAYBACK

The circuit shown in Fig. 2 will achieve either of two phonograph playback responses, depending upon appropriate changes in component values. Ignoring source and load resistances (r and R) for the moment, the turnover points of the RIAA playback response are determined as follows: The 50Hz signal by the combination of resistors R1 and R2 in series with capacitor C1; the 500Hz signal by the combination of resistor R2 in series with capacitor C1; and the 2120Hz signal by the combination of the output of the components just mentioned in parallel with capacitor C2.

[*Editor's Note*: *The author's assignment of component values can be more readily understood if we first cover the function of these components at various audio frequencies. To provide RIAS playback equalization, the value of resistor R1 is several times that of resistor R2 and the value of capacitor C1 is several times that of capacitor C2. At low audio frequencies (say 50Hz), only capacitor C1 is of a large enough value to conduct any significant signal current; and this current results in a voltage drop across both resistors R1 and R2, resulting in a reduced output signal voltage. However, once the signal frequency is so high (500Hz) that the reactance of capacitor C1 becomes comparable to the resistance of resistor R2, the resistor prevents any drastic increase in signal current through the capacitor (C1), while capacitor C2 begins to conduct greater portions of the signal current. At even higher audio frequencies (2120Hz), capacitor C2 conducts a significant portion of the audio-frequency current, further reducing the output signal.*]

For the circuit shown in Fig. 2, let us assume that resistor R2 has a value of 1K. To obtain a 10-to-1 ratio between the 50Hz and 500Hz turnovers, resistor R1 must be of a value nine times that of resistor R2, or 9K (let us just say 9.1K since that is a more standard resistance value). To produce a reactance of 1K at 500Hz, a capacitor must have a 0.318μf value, or for convenience say a 0.33μf value. [*Editor's Note*: $C = \frac{1}{2\pi f X_c}$ $= \frac{1}{2 \times 3.14 \times 500\text{Hz} \times 1000\Omega}$ $= 0.318\mu\text{f}$.] Now resistors R1 and R2 in parallel have a 900Ω total resistance. [*Editor's Note*: *At* 2120Hz, *capacitor* C1 *has a* 236Ω *reactance* ($X_c = \frac{1}{2\pi fC}$ $= \frac{1}{2 \times 3.14 \times 2120\text{Hz} \times 0.33 \times 10^{-6}\text{f}}$ $= 236\Omega$.) *Since we have assumed that there is no input impedance* ($r = 0\Omega$), *there is only a small degree of error in assuming that in effect resistor* R1 *is connected in parallel with resistor* R2 *and capacitor* C1. *Likewise, our calculations are greatly simplified if we assume that the* 236Ω *reactance of capacitor* C1 *is insignificant when compared with the* 1K *resistance of resistor* R2. *The author has therefore assumed that his calculations*

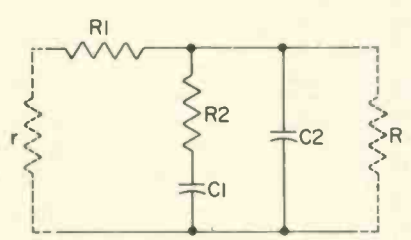


Fig. 2—Basic passive equalizer circuit used to achieve the phonograph playback equalization curves.

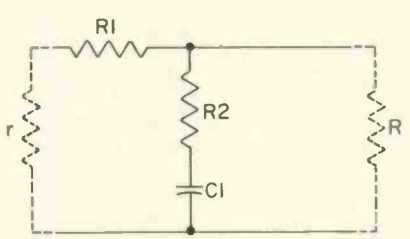


Fig. 3—Basic passive equalizer circuit used to achieve the magnetic tape playback equalization curves.

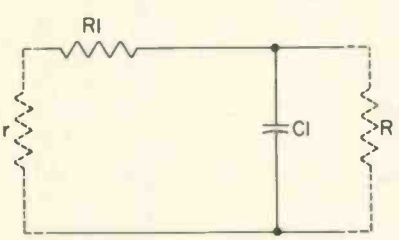


Fig. 4—Basic receiver equalization circuit.

would experience only a minor error if we ignored the reactance of capacitor C1 *and assumed that resistors* R1 *and* R2 *were connected in parallel to ground. Their combined resistance would be equal to* 900Ω. ($\frac{1}{R_T} = \frac{1}{R1} + \frac{1}{R2} = \frac{1}{9000\Omega} + \frac{1}{1000\Omega} = \frac{1}{9000\Omega} + \frac{9}{9000\Omega} = \frac{10}{9000\Omega} = \frac{1}{900\Omega}$.)] To produce a reactance of 900Ω at 2120Hz, capacitor C2 needs to have a value of 0.0862μf or say 0.082μf. [*Editor's Note*: $C = \frac{1}{2\pi f X_c} = \frac{1}{2 \times 3.14 \times 2120\text{Hz} \times 900\Omega} = 0.0862\mu\text{f}$.]

The equalization circuit used for the European (CCIR) equalization standard is basically the same except for component values. The value of resistor R1 must be increased so that a voltage drop will occur across it, as a result of signal current flowing through capacitor C1, even at frequencies below 20Hz. Generally this resistor (R1) should have at least 20 times the value of resistor R2, and in this example we have assigned it a value of 20K. For the reactance of capacitor C1 to become insignificantly small (as compared to the value of resistor R2) at around 353Hz instead of 500Hz, its value must also be increased. [*Editor's Note*: $C = \frac{1}{2\pi f X_c} = \frac{1}{2 \times 3.14 \times 353\text{Hz} \times 1000\Omega} = 0.451\mu\text{f}$.]

However, as noted in Fig. 1, further reduction in signal strength does not become apparent until the audio frequency approaches 3180Hz, meaning that capacitor C2 must be of a smaller value than before. [*Editor's Note*: *With the value of resistor R1 increased to 20K, the total effective resistance in parallel with capacitor C2 can be calculated as being approximately* 952Ω. ($\frac{1}{R_T} = \frac{1}{R1} + \frac{1}{R2} = \frac{1}{20{,}000\Omega} + \frac{1}{1{,}000\Omega} = \frac{1}{20{,}000\Omega} + \frac{20}{20{,}000\Omega} = \frac{21}{20{,}000\Omega}$. $R = \frac{20{,}000\Omega}{21} = 952\Omega$.) *For capacitor C2 to have an equivalent reactance at 3180Hz, it must have a value of* 0.05μf. ($C = \frac{1}{2\pi f X_c} = \frac{1}{2 \times 3.14 \times 3180\text{Hz} \times 952\Omega} = 0.526\mu\text{f}$.)]

MAGNETIC TAPE PLAYBACK

For tape equalization, the circuit shown in Fig. 3 functions in basically the same manner as the components containing the same labels in Fig. 2. Assigning a value of 1K to resistor R2, the NARTB curve dictates that capacitor C1 have a 1K reactance at 3000Hz, requiring that it have a 0.053μf value. ($C = \frac{1}{2\pi f X_c} = \frac{1}{2 \times 3.14 \times 3000\text{Hz} \times 1000\Omega} = 0.0531\mu\text{f}$.) And to put the other turnover at 50Hz, resistor R1 must be assigned a value of 59K to in theory correspond to the 60K reactance of capacitor C1 at that frequency. ($X_c = \frac{1}{2\pi f C} = \frac{1}{2 \times 3.14 \times 50\text{Hz} \times 0.053 \times 10^{-6}\text{f}} = 60.1\text{K}$.)

The CCIR equalization curve has no low-frequency turnover, so resistor R1 needs to be of still a larger value for the turnover to be moved off the lower end of the audio scale. However, as a practical matter, retaining a 50Hz turnover will probably not be noticed too much. The important difference is that the turnover is shifted down from 3000Hz to 1500Hz, requiring the capacitor to have twice its previous value or 0.106μf.

RECEIVER DE-EMPHASIS

The de-emphasis circuit for radio reception (Fig. 4) contains a capacitor (C1) that functions in the same manner as capacitor C2 in the circuit shown in Fig. 2, while the resistor (R1) functions in the same manner as the total effective resistance in parallel with capacitor C2. (We are again assuming a 0Ω value for the input resistance (r), so that resistor R is in effect connected in parallel with capacitor C1.) Assuming that resistor R1 has a value of 1K, then for capacitor C1 to have an equal reactance at 2120Hz, it must have a value of 0.075μf. ($C = \frac{1}{2\pi f X_c} = \frac{1}{2 \times 3.14 \times 2120\text{Hz} \times 1000\Omega} = 0.0751\mu\text{f}$.)

SWITCHING EQUALIZATION CIRCUITS

The calculations that have been shown provide component values for achieving each of the various equalization responses desired. In a practical circuit these responses must be selected according to the program source being used at the moment. Various kinds of switching circuits are used to achieve this.

In some control centers the component values are changed, eliminating components not required for some equalization curves—such as capacitor C2—but maintaining the same basic circuit throughout. This could mean that resistor R2 will always have a 1K value, but that a switch will be used to change the values of resistor R1 and capacitors C1 and C2 to vary the performance required.

In other control centers, the switching may be complete—switching in and out complete equalization circuits. The choice of switching circuits is generally more dependent on cost than other factors.

CIRCUIT FAILURE

All component value calculations were based on the assumption that the input impedance (r) is a negligibly low resistance ($r \approx 0\Omega$) and that the output impedance (R) is an extremely high resistance ($R \approx \infty$). In the past some manufacturers have occasionally overlooked this fact and, thinking that the circuit works "by itself," have included it between two stages of amplification having impedances that have completely invalidated the circuit's performance.

Should the input impedance (r) be increased, the low-frequency turnover will function at a lower frequency—probably so low a frequency that the circuit will seemingly cease to function. The effect of too low an output impedance can be even more disastrous, limiting the low frequency rise. ■

GUEST AUTHOR

Budget Time to Maximize Profits

As a TV technician, time is your stock in trade. If you can utilize your working hours more effectively, you can make more money. It's as simple as that. Therefore, it will pay you to make a serious effort to make every minute count.

by AL FRIEDMAN

Al Friedman is President of Chemtronics, Inc., a firm devoted exclusively to chemicals for the electronic industry. After getting his engineering degree in electronics from Rutgers University, he began his career as a Radio Operator in the Maritime Service. Later, he became a radio instructor in the Merchant Marine. With the advent of television, Al became a television instructor at the Radio TV Institute in New York City and at the Pierce Radio School. Prior to forming Chemtronics with his partner, Jacques Ebert, a chemist, Al was a Brooklyn electronics distributor, owning and operating AMA Electronics for some 14 years.

■ The sad fact is that TV technicians across the nation are not making their time pay off properly. We all know about the boom in consumer electronics, the shortage of trained technicians and the ever increasing need for servicing. Recent statistics indicate that there are almost 20 million color TV sets in operation in this country, with each set requiring 1.2 service calls per year. Add this to the 65 million B/W TV sets, 54 million phonographs, millions of tape recorders, high fidelity, etc., and you have a service market approaching a billion dollars in 1970.

Under these conditions, it seems almost inevitable that skilled TV technicians should be making more money. Unfortunately, this is simply not true. The average TV technician earns only about $4.00 an hour, while the average electrician is paid over $6.00 an hour, or 33 percent more.

Part of the problem is that the electronics service industry does not charge enough for its services. Recent U.S. Department of Commerce figures indicate that since 1963 the cost of living has increased by about 30 percent. This means that it costs the nation's service shops more for rent, utilities, parts, etc. Yet the price the consumer pays for electronic service has been *reduced* by more than 5 percent since 1963. In other words, it costs you more to do business, but you are charging less. Therefore, you make less money.

The problem, aside from competitive pressure, which is no more acute than in other industries, is psychological. The average TV technician loves his work. It is intriguing, demanding and satisfying. Every time you track down a really tough problem, you feel like Perry Mason when his skill and ingenuity have just won him another case. Monetary rewards seem secondary to the satisfaction of a job well done. But, as the man says, "If you're so smart, why ain't you rich?"

Every good TV technician is entitled to earn at least as much as the average electrician, because his work is more demanding. And if you run your own shop, you are also entitled to a reasonable return on your investment, plus the financial rewards that traditionally accrue to entrepreneurs.

You can achieve these goals only by valuing your time more highly. This involves both charging more and becoming more efficient.

There are two keys to making the best possible use of time: planning and proper use of tools.

PLANNING YOUR TIME

No man has more time than you. The richest man in the world still has only 60 minutes an hour and 24

hours a day to spend. One of the main reasons some people get a lot more done in a day than others is that they plan their time. Think about your typical day carefully. What percentage of your time do you really spend doing things you get paid for directly (like repairing TV sets, dealing with customers, etc.) compared with time you don't get paid for? If you call the time you get paid for productive and the time you don't get paid for unproductive, you will find that when you add up the hours, a surprising percentage of your working day is spent unproductively—talking to salesmen, coffee breaks, discussing sports, looking for schematics or parts, waiting for equipment to warm up, etc. You can improve your productive/unproductive ratio significantly if you plan your work and work your plan.

Since you're one of the vanishing breed of men whose income depends not on hours put in on the job but actual accomplishments, careful planning will definitely increase your income.

The last thing you should do before you go home each night is to *write* a "plan of the day" for tomorrow. Of course you can't adhere to this plan rigidly. But you know to a great extent how your day will shape up—how many chassis you have to be worked on, how many house calls you can expect to make, how much time you normally spend on the phone talking to customers, etc.

A big time saver is to work on two or more sets at a time. This means that you will have to have as many bench positions as possible. Of course, you can't buy too many sets of duplicate test equipment. But you can use revolving bench positions or wheel your test equipment around the shop from position to position.

This may seem like a lot of trouble, but you can't possibly be efficient working on one set at a time. If you try, you will find that you waste a lot of time just waiting. Waiting for tubes to heat up or parts to cool off. Besides, when you get stuck on a "trouble," it is always a good idea to drop it and work on something else for a while. This gives your subconscious mind a chance to work on the problem, making it easier to solve when you get back to it. Don't fall into the trap of saying, "I'm going to lick this thing no matter how long it takes!" This approach may be good for your pride, but it can cost a lot of money. You have to discipline yourself to thinking in terms of return on your investment of time.

SCHEDULE HOUSECALLS BY AREA

Planning is indispensable when making house calls. Remember that traveling time between calls is unproductive. Schedule your housecalls by grouping them in neighborhoods to minimize travel time. In some cases, this may involve making a customer wait a day or two. Customers don't like to be kept waiting, but they don't like to pay you for extra traveling time either. If you handle customer calls diplomatically, express a sincere desire to help the caller, and point out that you are already booked up for the day, your customer will usually accept some delay.

It is always wise to try to get some idea of the trouble over the telephone. For one thing, the customer usually wants to describe the symptoms. It makes him feel important. It makes him feel that you care about him, and it makes him feel that something is already being done about his set.

Besides, it helps you to bring the right tube, tools and test equipment to service his set rapidly.

For some strange reason, many technicians antagonize customers over the telephone. This can cost you money in lost business. Make the customer feel that you are an expert, on his side, and half the battle is won.

DO NOT WASTE TIME ON REPLACEMENT PARTS

Many distributor countermen express amazement at how often they see some of their customers. Some technicians just seem to like to visit distributors—sometimes two or more times a day. This is a waste of time for you as well as your distributor.

You can save a lot of time by keeping a good stock of commonly used replacement parts on hand at all times. Keep your parts neatly stored and clearly labeled, so you can find what you want rapidly. The time you invest organizing your spare parts and keeping them neat will pay off in reducing waste as well as time spent looking for things.

Of course, you can not stock everything. Chances are that you will need several specific flybacks or coils or some other odd parts every day. But this does not mean that you have to run to your distributor every day. Make lists of the parts you need and choose a distributor who can deliver orders as often as possible.

Make your customer wait if that's the only way you can avoid an extra trip. Remember, your customer will not pay you for the time you waste picking up a part. He would rather wait a day or two than have you charge even $5.00 more for the job.

Again, it is important that you maintain cordial customer relations by letting your customer know that you are doing everything that is economically feasible to get his set back to him as soon as possible. Your customers will respect you more if they think you are a good businessman as well as a good technician. ■

TEST INSTRUMENT REPORT

B & K Model 176 Solid-State FET-VOM

B & K Model 176 solid-state FET-VOM.

For more details circle 900 on Reader Service Card.

Manufacturer incorporates complementary symmetry circuit to improve instrument characteristics

by PHILLIP DAHLEN

■ When glancing at the manufacturer's schematic, we were impressed by the fact that this instrument contains three amplifiers. One, consisting of a three-transistor circuit, is designed to supply a constant voltage to the other two amplifiers for the life of the batteries, thus offering protection against erroneous meter readings should the batteries be allowed to become weak.

The other two amplifiers, each containing a FET and three transistors, form a complementary symmetry circuit—the two together operating in a push-pull manner with one containing PNP-type transistors and the other containing NPN-type transistors. This is said to provide balanced temperature compensation, protect the FET's from overvoltage transients and offer drift-free accuracy.

Since the ammeter requires no internal power, the power supply is automatically turned OFF by the range switch to conserve battery life during current measurements. However, specifications indicate that when measuring dc currents of up to 5a, the instrument still has an internal voltage drop of only 200mv or less.

One very convenient switching feature that deserves noting is a set of push buttons that permit reversing dc voltage polarities without exchanging probe leads, plus permitting the use of the same ac scale for both P-P and RMS voltage readings —thus eliminating the confusion and clutter of having two ac meter scales.

The manufacturer's list of instrument specifications is very impressive and includes the following:

DC VOLTS:
8 Ranges: 0.5, 1.5, 5, 15, 50, 150, 500 and 1500v full scale.
Accuracy: ±2% full scale.
Input Impedance: 11M.

DC VOLTS:
8 P-P and RMS Ranges: 0.5, 1.5, 5, 15, 50, 150, 500 and 1500v full scale.
Accuracy: ±3% full scale.
Input Impedance: 10M shunted by 65pf on the 0.5v range and by 37pf on the remaining ranges.
Frequency Response: ±½dB from 9Hz to 1MHz.

OHMMETER:
7 Ranges: R×1, R×10, R×100, R×1K, R×10K, R×100K and R×1M.
Midscale Reading: 10Ω (on the R×1 range).
Accuracy: ±3° scale arc.

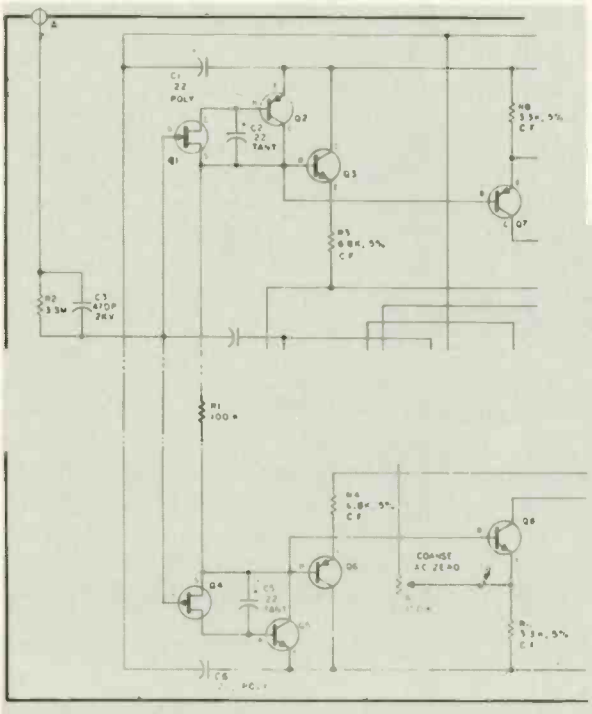
DC CURRENT:
6 Ranges: 150μa, 1.5ma, 15ma, 150ma, 1.5a and 5a full scale.
Accuracy: ±2% full scale.
Internal Voltage Drop: 200mv.

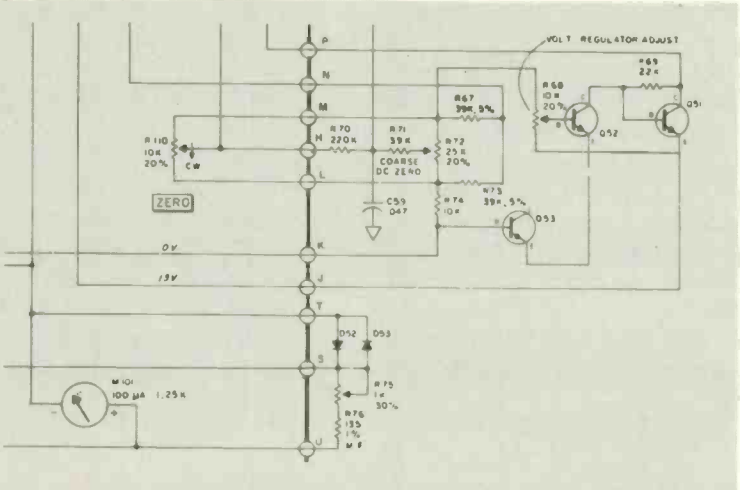
MULTIPLIERS:
1% precision type: Frequency compensated for ac.

Amplifier: Two 9v batteries in series, regulated for constant 13vdc.
Ohmmeter: One 1.5v C-cell.

DIMENSIONS:
7 in. high by 9 in. wide by 3½ in. deep.

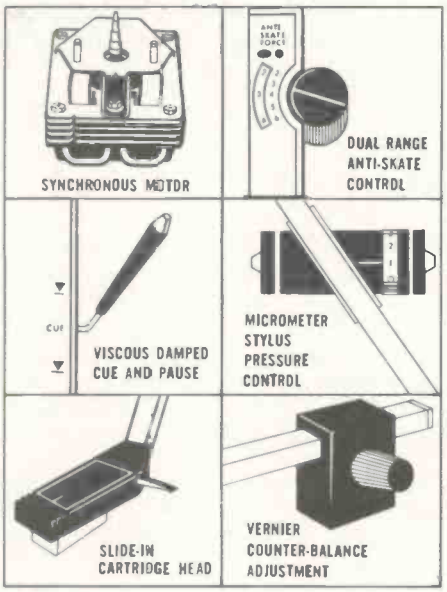
WEIGHT: (less batteries):
5 lb, 2 oz. ■





Portions of the manufacturer's FET-VOM schematic that include semiconductor circuits.

Some turntables may have our professional features.



But none has our price.

The BSR McDonald 610/X is our finest Total Turntable ever. And now we've added important new features. A synchronous motor that assures quick start and constant speed. We've viscous damped the cue and pause to gently control the stylus descent. The dual-range anti-skate control provides settings for both elliptical and conical styli.

And because the 610/X is a Total Turntable, it comes complete with a Shure M-93E elliptical magnetic cartridge, our deluxe tinted dust cover and our Decormatic base, which permits the turntable to shut off the entire system after the last record has been played.

Feature the 610/X in your better component systems. It's for customers who want the best, no matter how little it costs.

The price? Ask and be surprised.

BSR
McDONALD

BSR (USA) Ltd., Blauvelt, N.Y. 10913

. . . for more details circle 108 on Reader Service Card

TECHNICAL DIGEST

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

SYLVANIA

The MOSFET

The MOSFET is a special semiconductor having all the characteristics of a pentode vacuum tube, but manufactured in a completely different manner.

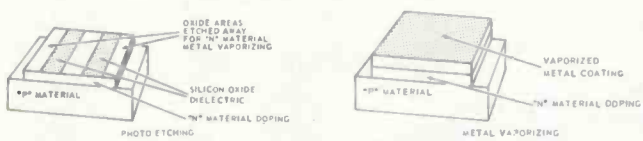
It begins as a slab of silicon "P" material lightly doped and polished, readied for the oxidation furnace. The temperature within the furnace covers the silicon bar with a coating of Sl02, silicon oxide. This coating acts as a dielectric material insulating the bar.

The completely coated bar is photoetched, opening the oxidized bar in two separate areas, one area is the source, the other, the drain.

A diffusion technique is used to form the drain and source area. "N" material is diffused into the "P" material bar forming a channel from the source to the drain.

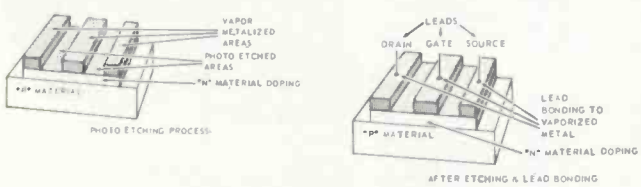
Again, the oxidation process is applied to the silicon bar of the diffused channel material, completely covering the bar again.

The etching process is applied to the oxidized bar barring the areas where the drain and source contact leads will be attached to the vaporized metal.



The vaporized metal operation covers the channel area preparing the drain source and gate area lead attachment.

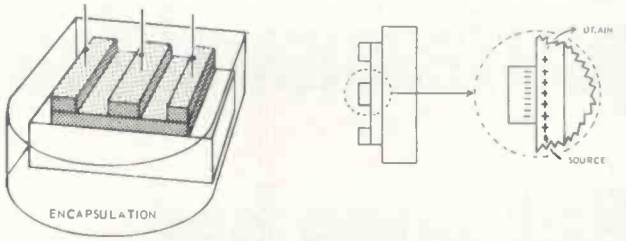
A third photo etching application is made to remove excessive metal at the three elements location. The element leads are attached to the metalized areas by bonding.



The bar is separated into the many MOSFET devices and the element wires are brought out to the leads of the capsule. The leads are welded and the unit hermetically sealed.

The MOSFET is used where high-impedance input-output isolation is required. MOSFETs come in single or dual gate configurations. A dual gate FET is electrically related to a pair of single gate FETs in cascode.

A MOSFET RF amplifier has higher Q and sharper selectivity. The selectivity consideration enables the set front end to reject unwanted signals and dramatically reduce cross-modulation.



Dual gate MOSFETs operating as Class "A" RF amplifiers are biased to operate on the linear portion of the gate voltage/drain current curve. The gate voltage applied to the device determines the method of transistor bias "B." An "N" channel device uses negative voltage to turn it ON, while a "P" channel device uses positive voltage to turn it ON.

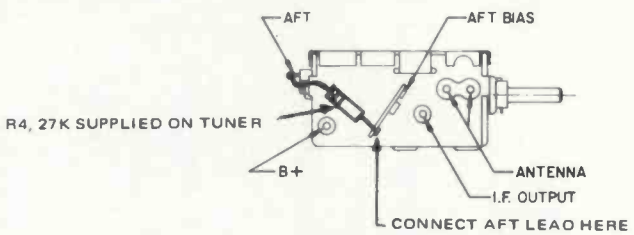
In an "N" channel MOSFET a negative voltage turns ON the device because the gate channel dielectric acts like a capacitor. The negative voltage applied to the gate pushed electrons away from the gate area causing the channel material electron to flow toward the drain. A lesser accumulation of electrons (negative charges) lowers the negative electrostatic field in the accumulation area, permitting additional electrons to flow from the source to the drain.

A positive charge placed on the gate would turn OFF electron flow from the source to the drain. The positive gate would attract all the "N" channel electrons to the gate area. This accumulation of electrons would place a large negative electric field into the channel, squeezing off electron flow. A similarity would be the space charge around the cathode of a vacuum tube. The accumulation of electrons produces a negative field, repelling electrons back to the cathode.

MAGNAVOX

Color TV Chassis T933/T939/T940 Employing 340129-2 UHF Tuner—Change in Location and Value of Resistor R4

This tuner has been produced with three possible locations for resistor R4, a resistor connected to the automatic fine tuning terminal. On the initial version, the resistor is



located inside the tuner and has a value of 150K. On later versions the resistor was moved to the outside of the tuner and changed in value to 27K. In this version, the resistor is connected directly between the AFT lead from the main chassis and the AFT terminal on the tuner. Current versions of the tuner have the 27K resistor (R4) connected between the AFT terminal of the tuner and a terminal strip mounted on the top of the tuner.

All replacement 340129-2 tuners from Magna-Par will be the current versions, with resistor R4 mounted in place between the AFT terminal and the terminal strip. When replacing either of the two earlier versions with the current

continued on page 56

TECHNICAL DIGEST

continued from page 54

version, the AFT lead must be connected directly to the terminal strip end of resistor R4 on the tuner.

Color TV Chassis T940—Elimination of Channel 2-6 Beat Interference

Kit No. 171026-1 is now available from Magna-Par Branches. This kit includes all necessary parts and instructions for modification of T940 chassis to eliminate the beat interference pattern reported in low-channel VHF signal areas. This modification includes the following: (1) Changes in the QA1 (3.58MHz switch) circuit on the ATC Board. (a) 1μh Choke (Part No. 360522-9) added, Emitter to ground. (b) 3.9K resistor (Part No. 230104-69) added in base circuit. (c) 15pf capacitor (Part No. 250546-1509) added, base to ground. (2) Eliminate ground lead between the ATC switch and ATC board, ground the ATC switch at the Tuner/Control Assembly and point G1 on the ATC board in the ATC chassis.

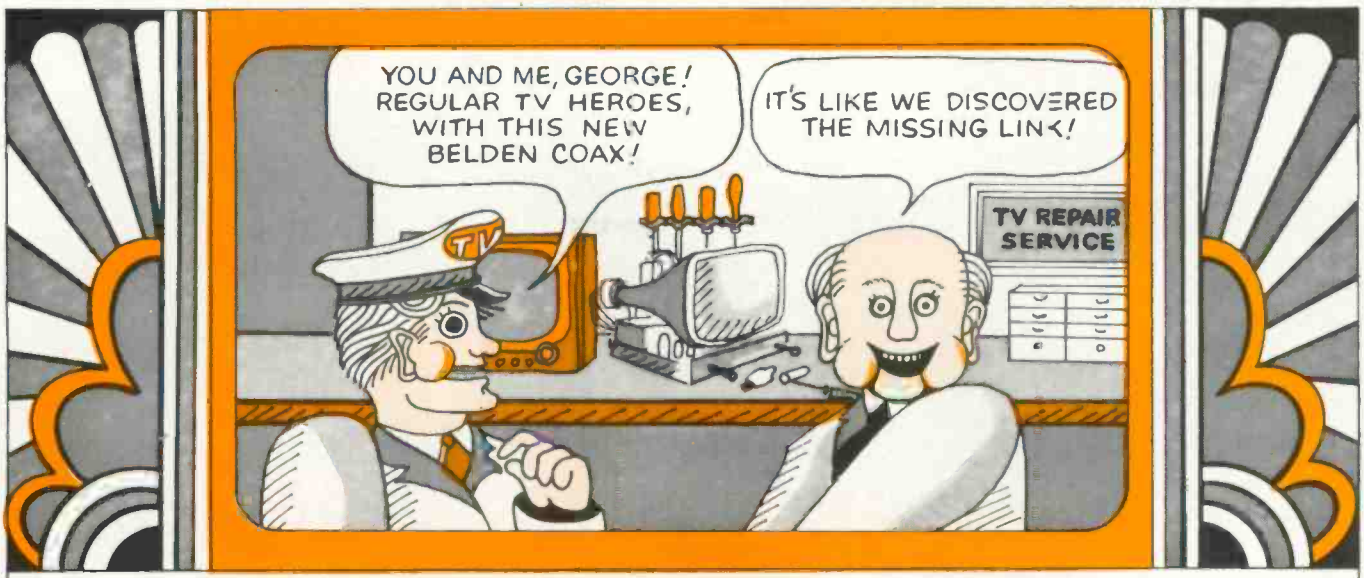
GENERAL ELECTRIC

TV Chassis C-1—Arcing in Corona Seal on High Voltage Rectifier Socket

Some problems associated with the high voltage rectifier socket in this receivers chassis have been traced to the corona seal around the socket terminals.

Excessive leakage currents in some corona seals have caused any or all of the following failures: (1) Arcing in the corona seal. (2) Deterioration of the rectifier socket. (3) Deterioration of the 2 ohm filament series resistor.

The correction is to remove all the old corona seal, replace all damaged components and install new corona seal (Cat. No. ET90X24) in any receiver which has a failure in this area.



Jacket
Black all-weather PVC .030 nominal wall with a .242" nominal O.D.

Dielectric
Low loss cellular polyethylene, .180" nominal O.D.

Conductor
18 AWG solid, annealed, bare copper.

8228 BELDEN DUOFOIL

Drain Wires
4—28 AWG solid tinned copperweld conductors applied spirally and positioned uniformly around the circumference of the shield.

Shield
Belden DUOFOIL 100% shield is a polyester film with aluminum lamination on both outside surfaces.

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BELDEN 8228 DUOFOIL®

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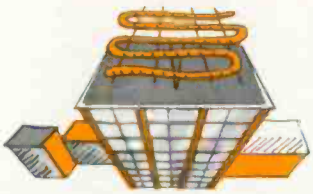

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Is CATV coming into your area? DUOFOIL is the perfect underground drop cable. Its exceptional flexibility and moisture resistance assures extra-long service life, and preserves the impedance values of the cable design.

LOW, LOW ATTENUATION

Nom. Attenuation per 100'	
mc	db
50	1.5
100	2.1
200	3.1
300	3.8
400	4.5
500	5.0
600	5.5
700	6.0
800	6.5
900	6.9

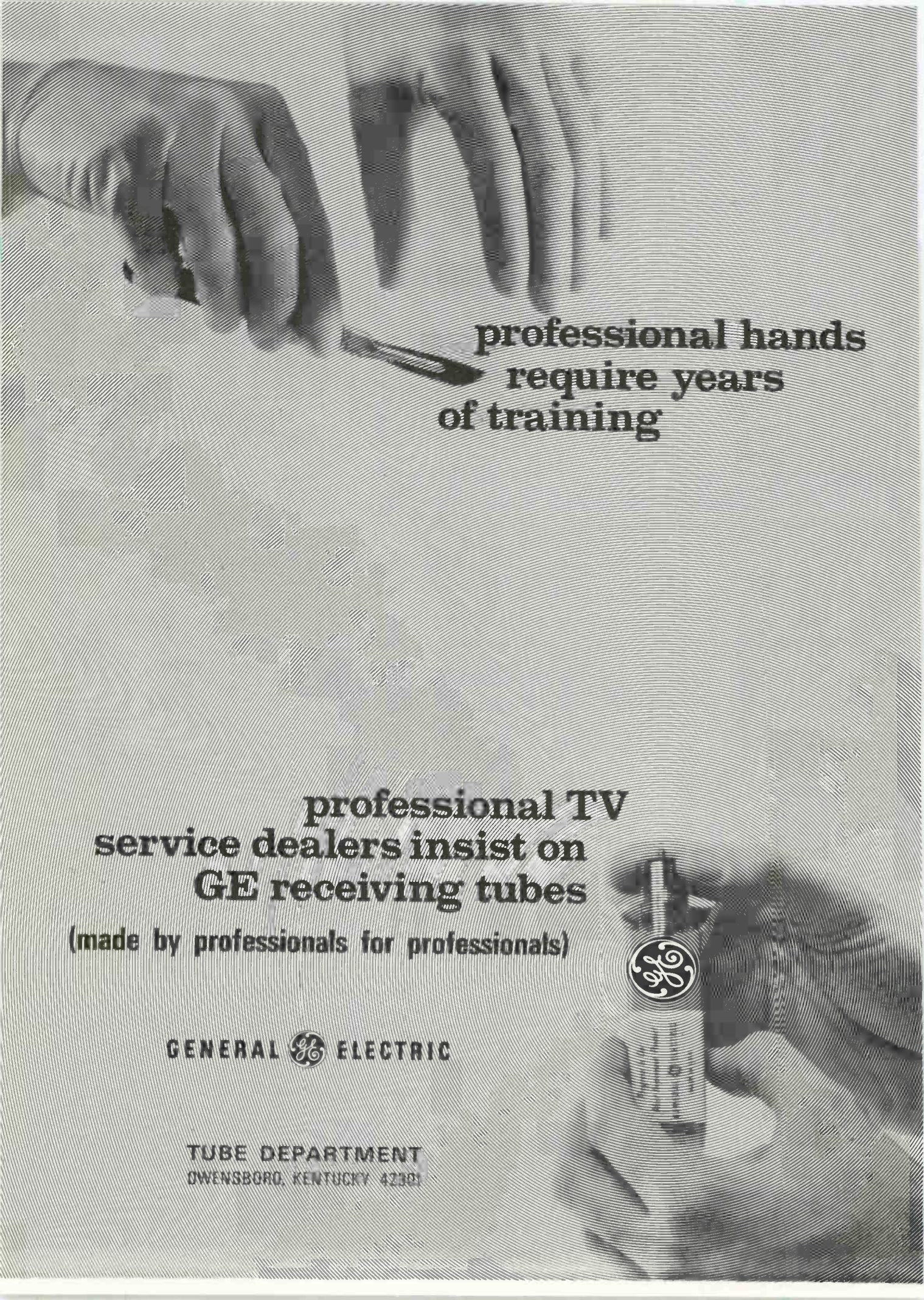
Available in 100, 500 and 1000 ft. spools. See your local Belden Distributor for full details or to order. For a copy of the reprint article, "Electronic Cable," write: Belden Corporation, P.O. Box 5070-A, Chicago, Illinois 60680.

Don't forget to ask them what else needs fixing?

BELDEN

8-5-8

. . . for more details circle 103 on Reader Service Card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require years
of training
professional TV
service dealers insist on
GE receiving tubes
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The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

ADMIRAL

Color TV Chassis K10—AGC Troubleshooting

The following service procedure can be used to isolate circuit defects related to the VHF Tuner, IF section, first Video Amplifier or AGC section used in all K10 Series color TV chassis.

From the block diagram you can see that a problem could occur in any one of nine circuits, none of which is independent of the others. Consequently, it could be difficult to identify the specific component or even the circuit causing the problem.

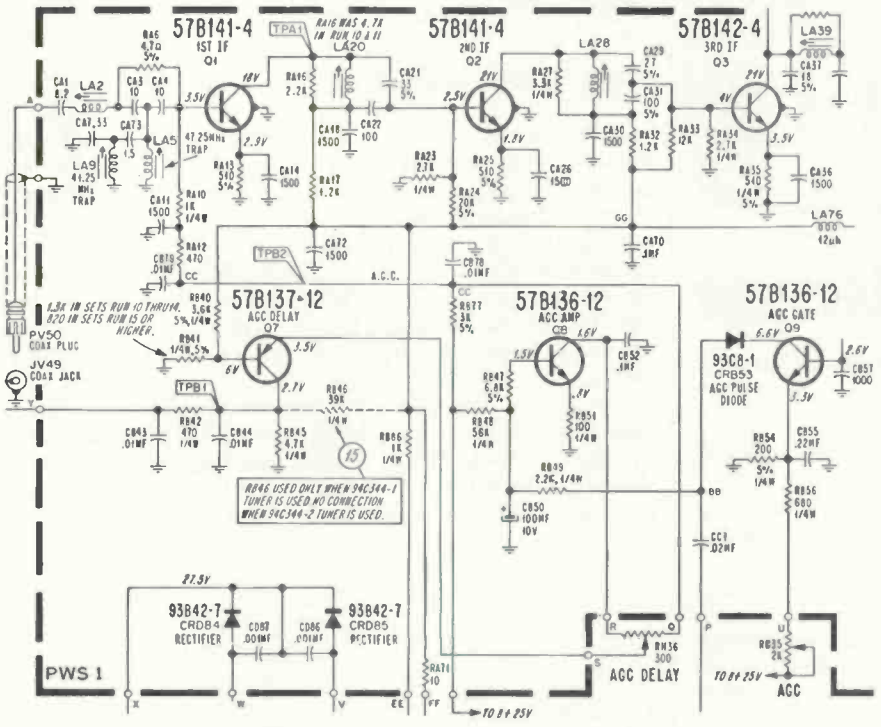
This procedure will help you quickly isolate the trouble to one circuit where further tests will help identify the specific fault. The following test equipment is required: Bias Box, VTVM, Oscilloscope and AM Signal Generator.

I Test Setup

(A) Set VHF or UHF Tuner to receive local station and power the set through an isolation transformer. (B) Apply +7.0v bias to TPB2 (IF AGC) with set on.

II Circuit Testing

Slowly vary TPB2 (IF AGC) bias between 5v and 9v.

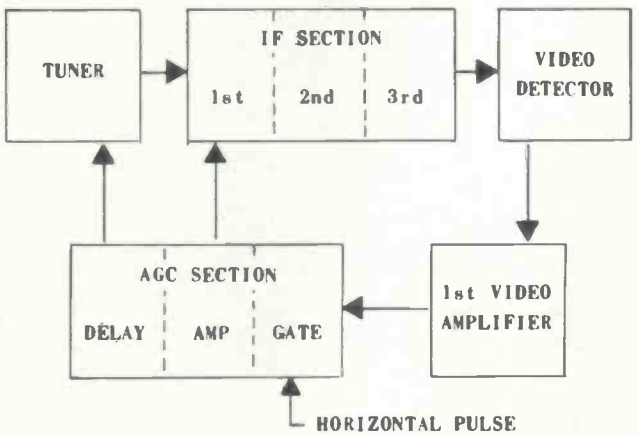


If you can get a picture, the problem is related to the AGC section—proceed to III. If you cannot get a picture, the trouble is probably in the Tuner, IF or first Video stage. Set the bias to +7.0v and proceed to IV.

III Checking AGC Circuit

(A) Remove bias connection from TPB2. Apply +1v bias to positive end of capacitor CB50. Slowly vary bias from 0v to +2v while checking for video on CRT. If video is not restored, the problem is most likely in transistor Q8 (AGC Amp) or transistor Q7 (AGC Delay). Make routine voltage and resistance checks of transistors Q7, Q8 and related components. (B) If video is restored, leave the bias connected to CB50, set for best video. The problem is most likely in the transistor Q9 AGC Gate circuit. (1) Check rectifier CRB53 and transistor Q9. With the scope sweep rate set at 60Hz, check for a composite video signal at the base of transistor Q9. With the scope sweep rate set at 15kHz, check for an AGC horizontal pulse at CC1. (2) Check CB50 for open.

BLOCK DIAGRAM
K10 AGC SYSTEM



IV Checking Tuner, IF and First Video Stages

(A) To eliminate the possibility of IF failure, disconnect the IF Input Cable at the VHF Tuner and inject a 44MHz AM signal with audio modulation at the plug of the cable. If horizontal dark bars are now visible on the CRT, the IF and first Video Amp should be okay and the VHF Tuner is probably at fault. (B) If you do not get the horizontal dark bars in A above, the problem is in the IF or first Video Amp. (1) To check the first Video Amp, inject a 400Hz to 1000Hz signal at TPB3 (Base of first Video Amp). If you do not get dark horizontal bars on the CRT, the trouble is in this section. (2) To check the IF section, inject a 44MHz signal with audio modulation at each transistor to isolate the stage. Make voltage and resistance measurements to identify the defective part.

Part Number Information

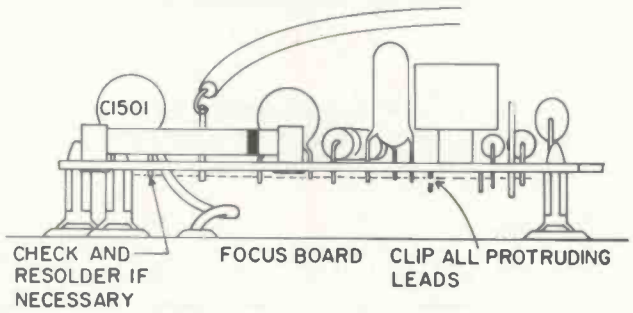
In Admiral's electronics part numbering system, the letters A, B, C, D & E within the number have no service significance. Regardless of which letter is used in the number, the parts are the same if the remainder of the number is the same. The letter identifies the engineering drawing size, which may change without affecting the parts specified.

COLORFAX

RCA SALES CORPORATION

Color TV Series "L"—Focus Board Circuitry

The color TV sets included in this series contain focus boards that could arc to ground. To provide a method of checking and eliminating any arcing in this area, the following procedure should be used: (1) Remove the plastic dust cover from the focus area by unsnapping plastic clips (if the cover is translucent, discard). (2) Unsnap the focus board from the chassis mounting standoff. Use care when unsnapping. (3) Clip off all protruding leads to within 0.1 in. of the board, as illustrated. (4) Inspect the solder connections between C-1501 and the board, resolder if needed. (5) Reinstall the board on its proper chassis standoffs. (6) Install an opaque plastic dust cover, RCA Stock No. 128661, if the original dust cover was discarded. Note: It is recommended that the RCA Stock No. 128661 opaque dust cover be carried by service technicians when making calls to service this chassis.

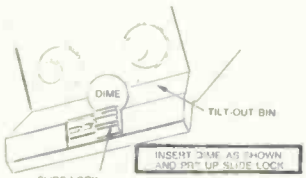


Color TV "M" Line—Tilt-Out Bin and Slide Lock Replacement

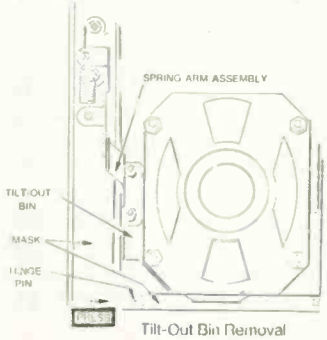
Both the tilt-out bin (crystal-control panel) and the slide lock (clip-door lock) that holds the bin closed are individually replaceable on "M" line color television instruments utilizing this feature.

To remove the lock, pry up the rear (or slide portion) of the lock with a coin or small screwdriver (as shown in the illustration) until it is released from its track on the bin. To replace, insert the lock so that the slide portion is above the track, then press down until the slide snaps into place.

To remove the bin: (1) Remove the customer controls panel from the bin and disconnect the speaker leads. (2) Remove two Phillips screws, securing the spring arm assembly to the bin. (3) While facing the rear of the cabinet, release the left hinge pin by pressing the pin into the



Slide Lock Removal



Tilt-Out Bin Removal

hole (in the bin) until it clears the edge of the mask. (4) The bin can then be rotated slightly (to disengage the other hinge pin) and removed from the front.

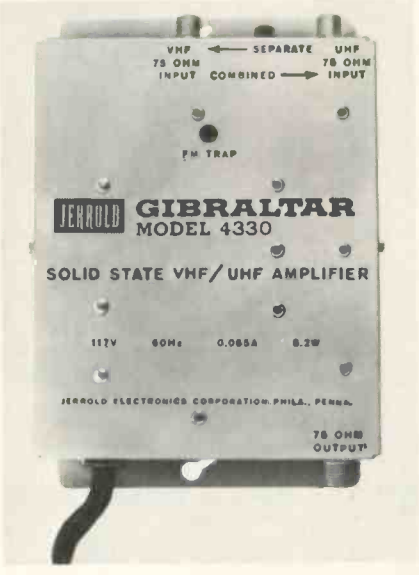
NEW PRODUCTS

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

SOLID-STATE AMPLIFIER 700

For small and medium-sized MATV systems

A solid-state amplifier has been designed for use in small and medium-sized MATV systems. The unit is said to include a switch-selected input that allows either a single all-channel input, or separate VHF and UHF inputs. Specifications indicate that the amplifier includes duodiode lightning protection, tunable FM trap, and a flat response of ±1.5dB through all 82 TV channels. Transistors in the circuit, which are said to be stripline type with low-inductance radial leads, reportedly produce optimum amplifier gain over the entire UHF band. Input impedance is said to be 75Ω. A self-contained power supply is operated from the standard 117v, 60Hz power line at 8.2w. Price $120. Jerrold.



MOBILE CABINET BENCH 701

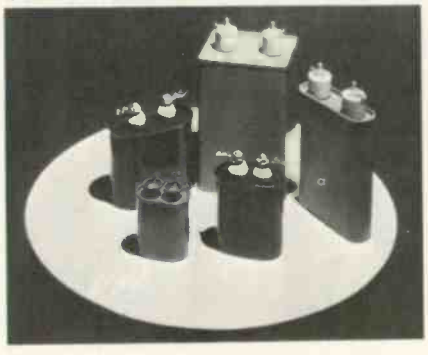
Comes in 4, 5 and 6 ft lengths with a choice of five tops

The mobile "Shop On Wheels," designed to transport maintenance equipment, features a "Disappearing Door," which can reportedly be brought out to 90° and slides on ball-bearing rollers under the bench's bottom shelf when not in use. The mobile bench is said to have four 5-in. heavy-duty swivel casters with side brakes, is 36 in. high, and comes in lengths of 4, 5 and 6 ft. The bench is designed to come in a choice of five tops: steel, pressed wood, plastic laminate, laminated maple and resinwood "Shop-Top." It is finished in gray baked-on enamel. Bay.

CAPACITORS 702

Low inductance and dissipation factor

A complete line of SCR capacitors has been designed to operate with fast rise times, high pulse repetition frequencies and large peak currents. These SCR capacitors reportedly have the lowest possible inductance and dissipation factor. Besides being used to commutate the SCR, they are said to be able to function as transient spike suppressors, filters and resonating capacitors at moderate frequencies. They can also be used in phase control circuits. Their peak voltage ratings range from 200 to 2000v, and capacitance ratings range from 0.25 to 50μf. They are said to be produced with paper, metallized paper or polycarbonate dielectrics. Unit price starts at $8.60. Cornell-Dubilier.



POWER MONITOR 703

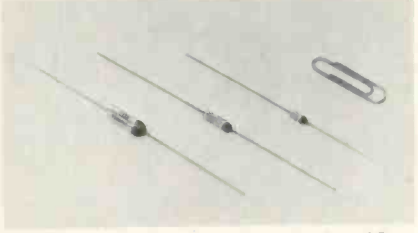
Measures ac and dc current up to 10a

A power monitor has been designed to check ac current up to 10a to determine whether the circuit breakers that are popping out are defective or the circuit itself is at fault. The unit is designed to measure wattage with the same setting of the control switches. The monitor reportedly uses a bridge circuit to measure dc current up to 10a and to read a combination of ac and dc current. The power is said to be fed through the monitor so that measurements are made under actual load. Price $69.50. Sencore.

CAPACITORS 704

Smallest size measures 0.110 by 0.280 in.

A line of miniature, non-solid electrolyte, sintered-anode tantalum capacitors has been designed. Specifications indicate that the smallest case size is 0.110 in. in diameter by 0.280 in. in length with capacitance ratings from 27μf at 6v to 2.2μf at 75v. Their operating temperature range is said to be from —55°C to +85°C without voltage derating. Sprague.



BRIGHTENER 705

Produced for red, green and blue guns

A plug-in single-gun brightener has been designed to brighten only the low emitting gun of a color CRT to re-

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WELLER SPECIALIZES IN SERVICE SOLDERING TOOLS. Today's electronic products such as computers, office equipment, instruments, radios, televisions, hi-fi sets and other sophisticated equipment are manufactured with the use of highly specialized soldering tools - to assure optimum results. But . . . what about specialized soldering tools when these products require service soldering? Whether the servicing is done in a plant, shop or right in the field, you should get the same quality solder connection that your product received on the production line. Are your servicemen equipped with soldering tools that perform as well as those in your production line? If not they should be . . . it's costing you money!

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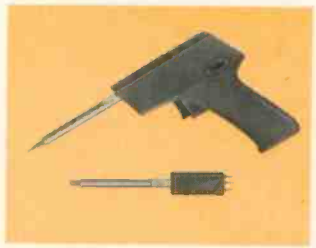

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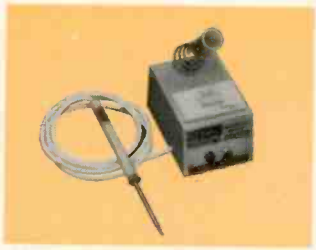
MODEL W-TCP-L

- CONTROLLED OUTPUT - provides proper temperature and capacity for any soldering job.
- EASY, QUICK CHANGE TIPS AND ACCESSORIES - maximum flexibility.
- ISOLATED LOW VOLTAGE SUPPLY - eliminates voltage damage to sensitive components.
- FAST RECOVERY - for maximum soldering efficiency.
- FLEXIBLE NON-BURNING CORD SET.
- IDEAL FOR BENCH OPERATION.



MODEL W-MCP

- SOLID STATE MINIATURE SIZED TOOL - for micro soldering and easy access to tight work areas.
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- FIXED TEMPERATURE ELEMENT - assures proper tip temperature for the job.
- ISOLATED LOW VOLTAGE SUPPLY - eliminates voltage damage to sensitive components.
- FLEXIBLE NON-BURNING CORD SET.
- FOR BENCH OR FIELD OPERATIONS.

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- IDEAL FOR SIMPLE SERVICE SOLDERING.
- SMALL, HANDY (7-⅞" long) - easy to use and store.
- USEFUL IN CROWDED WORK AREAS.
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	Stockton	Dunlap Elec.
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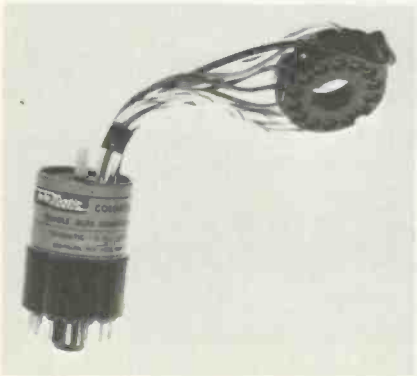
FL	Miami	Elec. Equipment Co., Inc.
	Orlando	Hammond Elec.
GA	Atlanta	Jackson Elec.
	Atlanta	Specialty Dist. Co., Inc.
IL	Chicago	Allied Radio Corp.
	Chicago	EDI Elec. Dist., Inc.
	Chicago	Newark Elec. Corp.
	Harvey	The George Co.
	Peoria	Klaus Radio
	Rockford	J & M Elec., Inc.
IN	Indianapolis	Graham Elec. Supply Co.
	Indianapolis	RA-DIS-CO, Inc.
KY	Louisville	P. I. Burks & Co., Inc.
	Louisville	Peerless Elec. Equip. Co.
LA	Baton Rouge	Davis Whsle. Elec. Sup. Co.
	New Orleans	Columbia Radio & Sup. Co.
ME	Portland	DeMambro Radio Sup. Co., Inc.
MD	Baltimore	D & H Distributing Co.
	Bethesda	Empire Elec. Supply Co.
	Rockville	Pioneer-Standard
	Rockville	Capitol Radio Whslers., Inc.
MA	Boston	DeMambro Radio Sup. Co., Inc.
	Newton	Cramer Electronics, Inc.
	Worcester	DeMambro Radio Sup. Co.
MI	Adrian	Wedemeyer Elec. Sup. Co.
	Ann Arbor	Wedemeyer Elec. Sup. Co.
	Detroit	Radio Specialties Co.
	Jackson	Wedemeyer Elec. Sup. Co.
	Lansing	Wedemeyer Elec. Sup. Co.
	Oak Park	Newark-Detroit Elec., Inc.
MN	Saint Paul	Ragon Electronics, Inc.
MS	Jackson	Risher Radio Sup. Co., Inc.
MO	Kansas City	Beaver Drill & Tool Co.
	Kansas City	Burstein-Applebee Co.
	Saint Louis	Olive Industrial Elec., Inc.
NB	Lincoln	Scott Elec. Supply Corp.
NV	Reno	Dunlap Electronics
NH	Manchester	DeMambro Radio Sup. Co., Inc.
NJ	Hillside	Raysons Supply Co.
	Paterson	Roberts Tool & Supply Co.
	Saddle Brook	Thermotronics Co.
	Springfield	Federated Purchaser, Inc.
NM	Albuquerque	Electronic Parts Co.
NY	Bronx	Electronic Tool Co.
	Farmingdale, L.I.	Arrow Electronics, Inc.
	Farmingdale, L.I.	Harrison Radio Corp.
	Farmingdale, L.I.	Claude Michael, Inc.
	Long Island City	H. L. Dalis, Inc.
	New York City	Newark Elec. Center, Inc.
	Plainview, L.I.	Morris Abrams, Inc.
	White Plains	Westchester Elec., Inc.
	Yorkville	Valley Elec. Labs, Inc.
NC	Raleigh	S'east'n Radio Sup. Co., Inc.
OH	Cincinnati	United Radio, Inc.
	Cleveland	Pioneer-Standard
	Columbus	Hughes-Peters, Inc.
	Dayton	Pioneer-Standard
OK	Oklahoma City	Trice Wholesale Elec.
	Oklahoma City	Wholesale Elec. Supply, Inc.
	Tulsa	Trice Wholesale Elec.
OR	Portland	United Radio Supply, Inc.
PA	Allentown	A. A. Peters, Inc.
	Harrisburg	Pyttronic Industries, Inc.
	Philadelphia	Philadelphia Elec., Inc.
	Philadelphia	Radio Electric Svc. Co., Inc.
	Philadelphia	Simco Electronics, Inc.
	Pittsburgh	Cameradio Company
	Pittsburgh	RPC Electronics
	Reading	The Geo. D. Barbey Co., Inc.
	Scranton	Pursell Electronics Co.
	Warrington	U. S. Equipment
RI	Providence	DeMambro Radio Sup. Co., Inc.
SC	Columbia	Dixie Radio Supply Co., Inc.
TN	Knoxville	McClung Appliances
	Memphis	Elec. Comm. Whslers.
	Nashville	Electra Distributing Co.
TX	Austin	Hargis-Austin, Inc.
	Corpus Christi	Modern-Electrotex
	Dallas	Claude Michael, Inc.
	Dallas	Wholesale Elec. Supply Co.
	El Paso	Midland Specialty Co.
	Houston	Sterling Electronics Corp.
	San Antonio	Modern-Electrotex
UT	Salt Lake City	Standard Supply Co.
VA	Arlington	Arlington Elec. Whslers., Inc.
	Norfolk	Priest Electronics, Inc.
WA	Seattle	Seattle Tool & Sup. Co., Inc.
	Seattle	Western Electronics Co.
WV	Charleston	Mountain Elec.-Chemcity
WI	Madison	Satterfield Electronics

NEW PRODUCTS

store color balance. Specifications indicate that the brightener plugs in between the CRT and the CRT socket in a manner similar to a regular brightener. The manufacturer reports that this arrangement is an improvement over splice-in type brighteners because it eliminates the need to splice into the appropriate grid lead, thus saving time and eliminating accidents due to errors. The brightener is reportedly produced for the red, green and blue guns, in both 70° and 90° socket/plug configurations. The brightener is said to feature an oversize transformer for long life and cooler operation. Telematic Div. of U.X.L.



SOLID-STATE VOM 708

Low power ohms for ICs, 5mv sensitivity

A solid-state portable, battery-operated VOM has been designed to measure dc voltages, resistance, ac-dc current and ac RMS voltages. The Model 801 reportedly has the following features: "low power ohms" circuit for IC, transistor and other solid-state components measurements; "conventional ohms" circuit with 1½ v battery power source useful for checking forward and reverse resistance of semiconductors—plus offering a polarity reversing function. The single test probe is said to have a built-in sliding switch used for all dc, ac, ma and resistance functions. Manufacturer's specifications: DC voltmeter ranges are: 0 to .05, .5, 1.5, 5, 15, 50, 150, 500, 1500v. Accuracy is said to be ±2% of full scale on all ranges. Input resistance is 11M on all ranges. AC voltmeter ranges are: 0 to .005, .015, .05, .15, .5, 1.5, 5, 15, 50, 150, 500, 1500v. Accuracy is said to be ±3%. Input resistance is 10M on all ranges. Frequency range is 50Hz to 50kHz. Decibel measurement range:

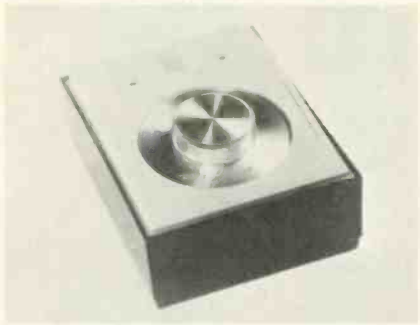
NEW PRODUCTS

—70 to +66dB. Current measurements: 12 ranges ac and dc. Full scale 5μa, 15μa, 50μa, 150μa, 500μa, 1.5 ma, 5ma, 15ma, 50ma, 150ma, 500ma, 1500ma. Accuracy is said to be ±3% dc and ±4% ac. Resistance measurements: Conventional: X1, X10, X100, X1K, X10K, X100K and X1M at 1.5v. Low power: X.1, X1, X10, X100, X1K, X10K, X100K and X1M at 35mv. Accuracy on all ranges is said to be 3° of dc arc. The tester case is reportedly constructed of black, molded phenolic and measures 8 in. by 7 in. by 5 in., not including the plastic carrying handle. The aluminum panel contains all functions etched in black lettering. Net price $200. Triplett.

ANTENNA ROTATOR 709

Permanently synchronized and lightning protected

Introduced is a permanently synchronized TV antenna rotator which



is said to be lightning-protected. The PrismMatic PM-1 Antenna Rotator features permanent synchronization and can reportedly be mounted conveniently at any point on a TV mast. The mast unit is said to weigh 4½ lb and can support all conventional TV antennas and some amateur beams. The manufacturer indicates that the unit has absolutely no wind slippage

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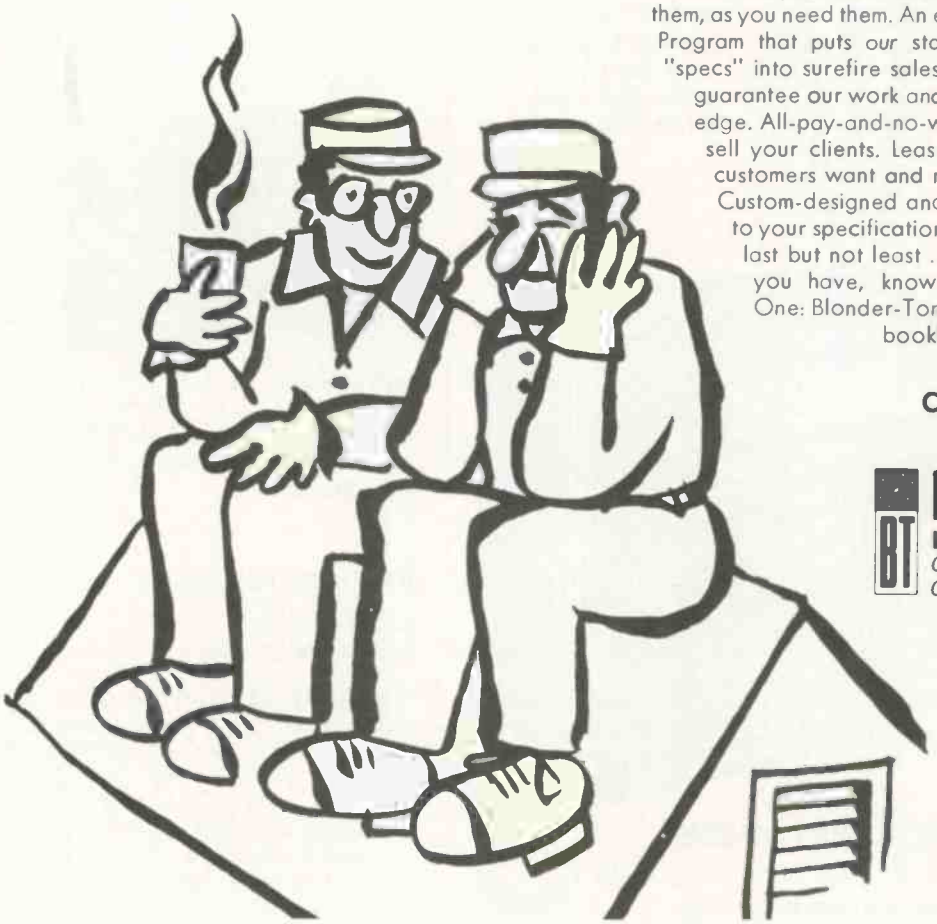


You pay for coffee breaks while your men wait for materials.

. . . for more details circle 104 on Reader Service Card

NEW PRODUCTS

and is usable in temperatures ranging from —40° to +140°F. All materials were selected for extended reliability: Naval bronze worm gear, sintered steel drive gear, nylon gear train and a one-piece die-cast aluminum housing. A solid-state control system is used to insure excellent repeatability of antenna direction. Power requirements are 117 vac. Blonder-Tongue.

WIRELESS MIKE 710

Transmits through any FM tuner or receiver

The Model WX-127 wireless microphone reportedly transmits through any FM tuner or receiver. It is said to be tunable from 88MHz to 106MHz,

fully shielded, and static-free. The unit measures 4¾ in. by 1 in. by 1 in. and weighs 3 oz. Net price $19.95, including 2 RM-625 batteries and tuning tool. Mura.

VTR/MONITOR TABLE 711

Constructed of 1-in. tubular steel and tip-proof

A heavy-duty chrome video tape recorder and CCTV monitor table has been developed. The unit, called Model TS-48, provides two shelves, one for a 1-in. or ½-in. video tape recorder, and the other for a TV monitor. It can also be used as a movable TV receiver stand. The table is said to be constructed of 1-in. chrome plated

Don't sell a color picture tube unless its been on a test ride.

Down at the bottom of the page, you have a major advance in space-age homeliness.

And a major advance in color tube testing as well.

That machine squatting down there is our beloved Iron Horse, the fully-automated, revolving carousel we use to test our color bright 85® tubes for emission, gas leakage, shorts, arcing and screen uniformity prior to shipment.

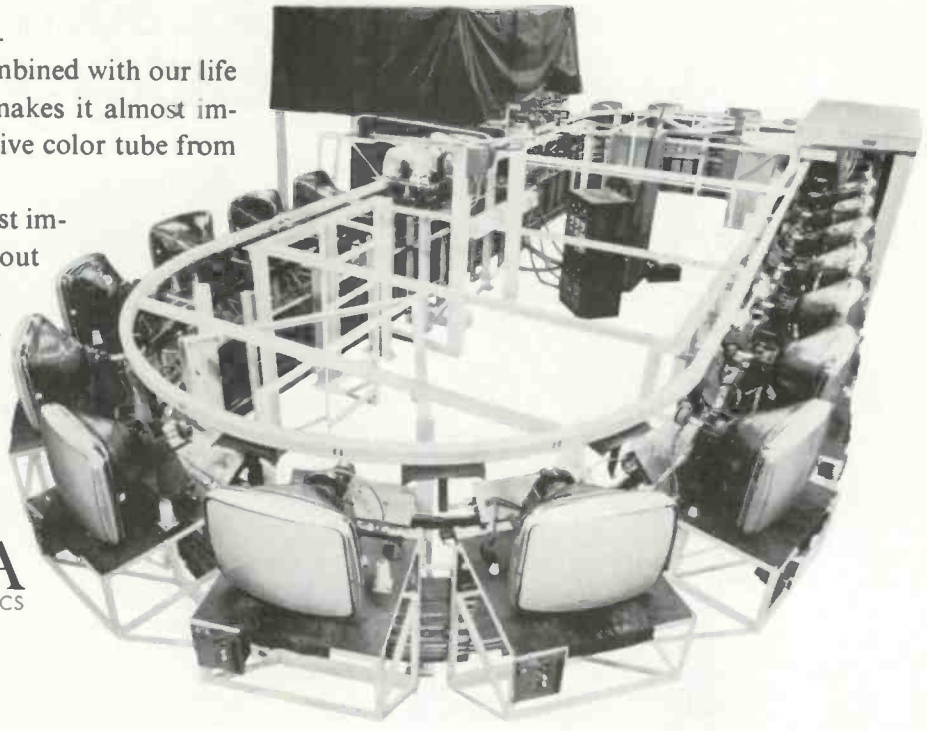
Now we don't intend to go into a song and dance on how total automation reduces testing error.

But we will tell you one thing.

Our Iron Horse test ride, combined with our life testing and 100% set testing, makes it almost impossible for you to get a defective color tube from us.

Which in turn makes it almost impossible for you to get chewed out by a customer.

Next time you need a color replacement tube, remember the great thing about the color bright 85. We don't send it to you till it's been around.



SYLVANIA
GENERAL TELEPHONE & ELECTRONICS

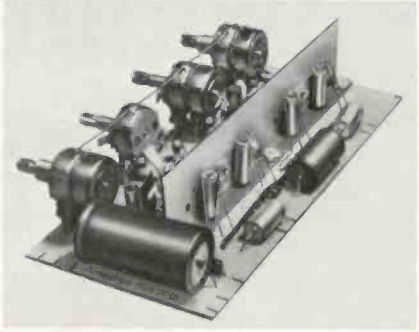
NEW PRODUCTS

tubular steel, and tip-proof. It reportedly rolls on swivel ball bearing casters with 4-in. rubber tires and shimmy-proof spring clips. Specifications indicate that the TS-48 is 48 in. high, and the shelves measure 15 in. by 29 in. List price $39.50. GBC.

STEREO AMPLIFIER 712

Rated at ±3dB from 40Hz to 30kHz

A stereo amplifier has been designed to have a 200mv sensitivity. Specifications indicate that it has an output of



4w per channel at 1kHz with 10% distortion and a frequency response of ±3dB from 40Hz to 30kHz at 1w per channel. Its circuit is said to consist of a thermistor-stabilized, three-stage, dc-coupled power amplifier with an integrated circuit preamplifier for each channel. The output can reportedly drive two 8Ω speakers capable of handling 5w at 100Hz. The amplifier is

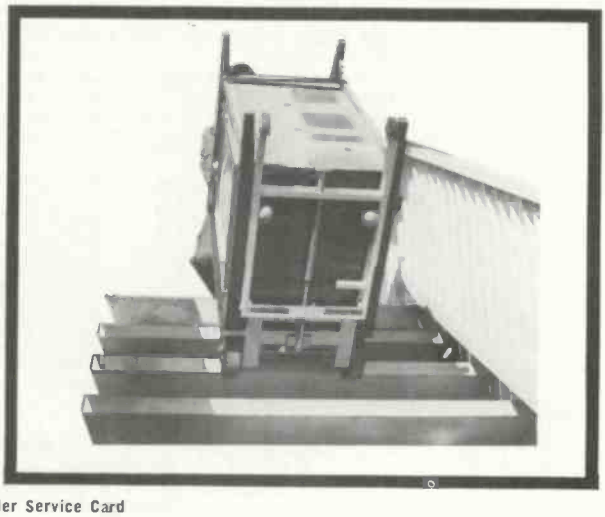
NOW...ONE man can do what TWO used to

Mighty Mover T.M. *can be the most valuable tool you own*

Remember the last time you carried a heavy TV or stereo console down a flight of stairs? One slip, and . . . disaster!

Mighty Mover was designed especially for you. It uses the principles of the hand truck and tilting cradle to not only carry the heaviest objects . . . console TVs, stereos and table models . . . even up and down steps, but to load them onto a van.

Field testing and research proves the Mighty Mover can save you time, lower your risk and raise your profits at the same time!



INTERESTED? SEE YOUR LOCAL TV DISTRIBUTOR OR WRITE FOR MORE INFORMATION.

GRIFFITHS
electronics, inc.

National Handling Equipment Sales Office
2875 Westside Blvd. /Jacksonville, Florida 32209
Phone: (904) 355-9006

. . . for more details circle 119 on Reader Service Card

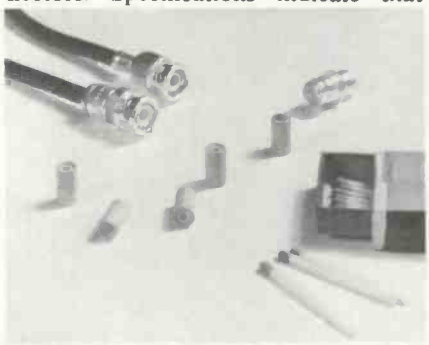
NEW PRODUCTS

contained on a 3½-in. by 7½-in. printed circuit board, and overall height of the unit is 1½ in. Price $12.80 each. Amperex.

INSULATOR 713

Improves performance of coaxial connectors

A high temperature insulator has been designed to extend the performance range of standard coaxial connectors. Specifications indicate that

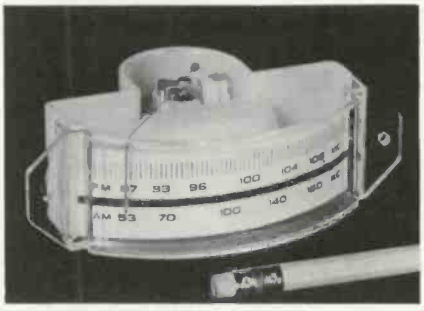


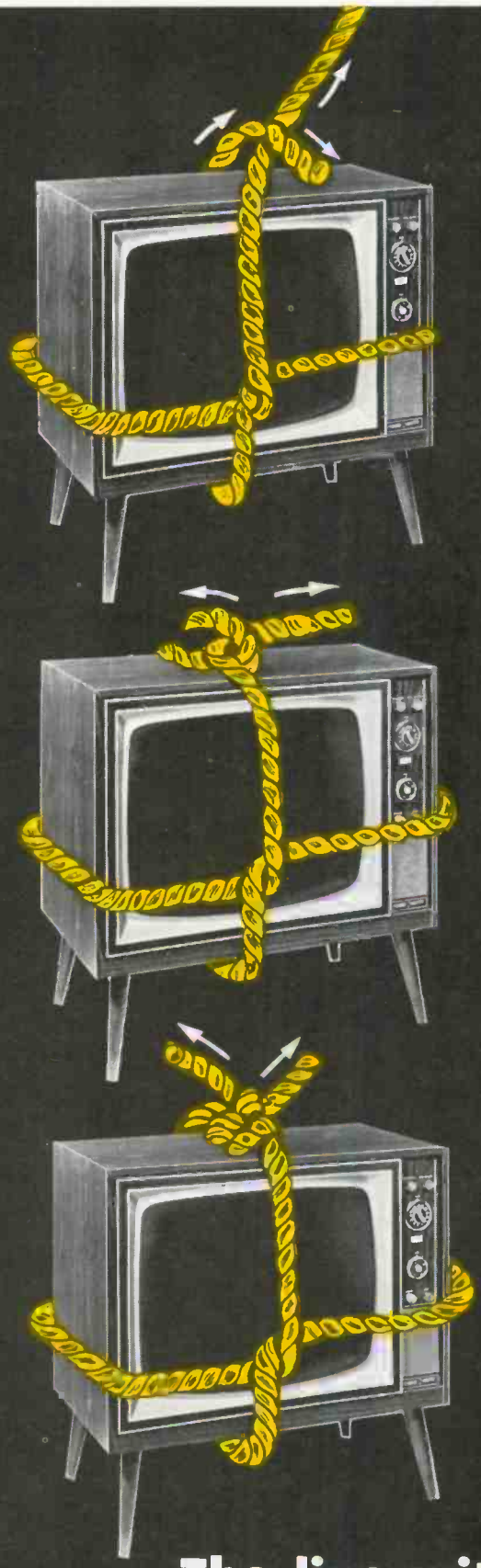
the insulating material has a slightly higher dielectric constant than standard Teflon, but is a relatively stable constant. It reportedly varies only slightly with temperature. For average applications, insulators are inserted into standard coaxial connectors. Amphenol.

INDICATOR METER 714

Can be mounted horizontally or vertically

An edgewise indicator meter has been designed for stereo and TV variactor tuners expected on the market soon. The meter is said to be constructed of clear plastic and can be mounted horizontally or vertically. Specifications indicate that it has a sensitivity of 1ma and a resistance of 410Ω. The unit measures 1½ in. by 3½ in. Price per unit under $5. International Electronics.





Want to tie up the service market?

Start with the Channel Master Opti-Vue Color CRT with the three year warranty, one TV set that needs a picture tube, and one customer.

Tell your customer how Opti-Vue guarantees the finest color he's ever seen for a full three years---not just one or two. And how, just in case something should go wrong, he gets a free replacement. So it may cost a little more, but it's worth it. And the price is right, too!

Now, you've secured the part of the set he's most worried about he's sure to call you when any other part fails. You've tied up all his service business for a full three years by taking care of his knottiest problem, and, not unimportantly, your customer's very happy with his new color vision!

So go ahead and tie one on with

OPTI-VUE

The line with 3 year warranty!

CHANNEL MASTER

Div. of Avnet, Inc., Ellenville, N.Y. 12428

. . . for more details circle 110 on Reader Service Card

LETTERS

continued from page 26

We deem it a privilege to send the literature out. We deeply appreciate it when some potential user is sufficiently interested to ask for more information about our products. We owe him a vote of thanks for his interest in us, and it is, therefore, a high priority item in our office to answer all such inquiries received.

I would like to hear personally from any of your readers who have experienced unusual delays in receiving literature from us. In the meantime, I would like to take this opportunity to thank your readers for their continued interest and support in our B & K Products.

HAROLD J. SCHULMAN
EXECUTIVE VICE PRESIDENT
DYNASCAN CORP.
1801 W. BELLE PLAINE AVE.
CHICAGO, ILL. 60613

For Sale

I have a going business here in south Alabama about 50 miles from the Gulf Coast. The people are friendly, the climate is very good and there is plenty of hunting and fishing. Due to failing eyesight and age, I am retiring from the sales and service business.

This business is fully equipped (complete with record center) and would be an excellent opportunity for one or two younger men to take over. I would appreciate your passing this information along to your readers.

I think your publication is second to none and worth every cent, and then some. In fact, our subscription has been renewed for another three years.

JOHN SHIPP
SHIPP'S TV & ELECTRONICS
108 MILDRED ST.
BREWTON, ALA. 36426

I would like to sell my color TV servicing equipment, parts and service literature. Most of these items are less than one year old. If anyone is interested, please write for a list.

DAVID R. CAMP
BOX 173
VESTAL, N.Y. 13850

Selling Shop

As a subscriber of long standing, I wish to express my deep appreciation of your very fine magazine.

I know of no other magazine that assists the technicians as much.

After over 40 years of electronics, I am ready to retire come September. I would like to dispose of my shop and equipment at cost inventory, approximately $3500. The shop has been established at this location for 22 years, good clientele, reasonable rent and good prices.

H. E. HILL
HILL'S TV SALES & SERVICE
1126 LINCOLN AVE.
ALAMEDA, CALIF. 94501

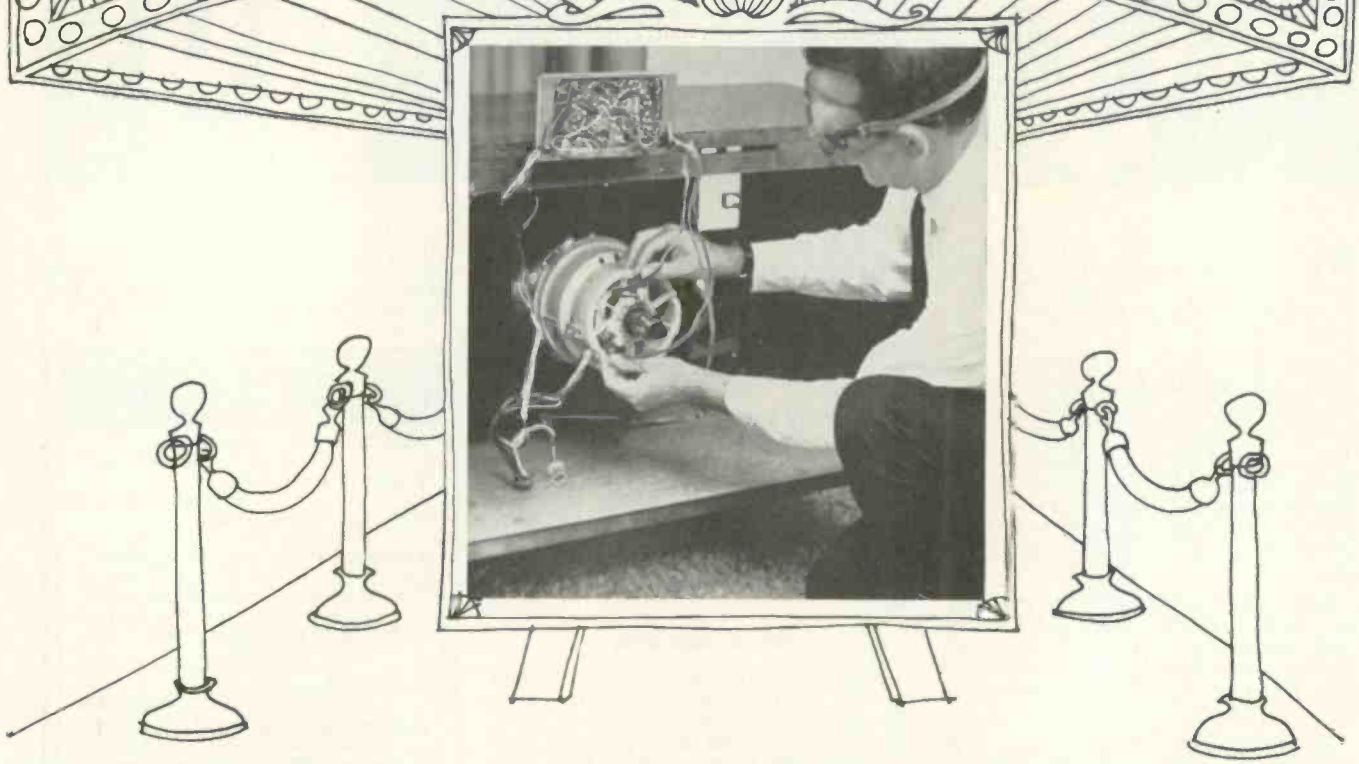
Helpful Suggestion

A third alternative to the two suggested by Thompson in the July 1970 issue to disable the oscillator section of the mixer-oscillator tube is to switch the VHF tuner to the UHF position. In most tuners this step cuts off the plate voltage to the VHF oscillator tube section. To make sure there is no pickup from the UHF tuner, simply disconnect the coaxial feed cable between the two tuners.

I hope this suggestion may be helpful to those technicians not already familiar with it.

RAYMOND P. GHELARDI

ASK YOUR RCA DISTRIBUTOR FOR A FREE SHOW



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Electronic Circuit Design Handbook

New Third Edition—A brand-new, enlarged edition of the ever popular circuit designer's "cookbook," now containing over 600 proven circuits, for all types of functions, selected from thousands on the basis of originality and practical application. Now you can have, at your fingertips, this carefully-planned reference source of tried and tested circuits. Selected from thousands submitted by distinguished engineers, these "thought-starters" are a collection of original circuits selected on the basis of their usefulness. This detailed compilation of practical design data is the answer to the need for an organized gathering of proved circuits . . . both basic and advanced designs that can easily serve as stepping stones to almost any kind of circuit you might want to build. 384 pps., 19 big sections, over 600 illus., 8½" x 11".

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Pinpoint Transistor Troubles in 12 Minutes

A giant of a book—495 pages . . . a virtual library of practical data of value to everyone who works with transistor circuits. Here is a unique servicing text you can put to immediate use, whether your interests are oriented toward home-entertainment or industrial type equipment. Organized so that needed information can be located quickly and easily. A quick-reference table tells you exactly where to find appropriate trouble-shooting charts and service procedures for practically every type of transistorized device. In all, nearly 100 different types of equipment are categorized under general headings such as amplifiers, radio receivers, radio transmitters, power supplies, test instruments, and special equipment. 495 pps., 243 illus. 78 tables, 10 sections. 5½" x 8½".

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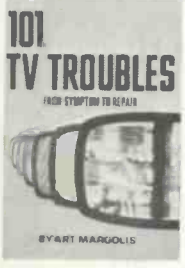
101 TV Troubles: From Symptom to Repair



An invaluable "cause and cure" guide to the practical, easy solution for virtually any TV trouble—color or B&W. All you do is analyze what you see and hear, look up the symptoms in the book, and follow the clear and simple steps to a speedy trouble cure. To show how and why certain troubles occur in specific types of circuits, schematics and other illustrations are included for every major manufacturer—Admiral to Zenith. TV troubles are broken down into five basic categories: Brightness, Contrast, Sweep, Color, and Sound. Each category lists specific troubles relating to that symptom. For example, under "Contrast" are 22 causes of actual picture problems. With the categorized trouble list and index, you can quickly and easily find the exact symptom—and the trouble cure—for virtually any TV circuit defect you might encounter. 224 pps. Hardbound.

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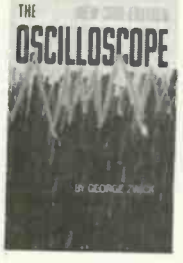
The Oscilloscope



An all-new revised third edition of the classic work on understanding and using oscilloscopes. Completely expanded and updated to include triggered sweeps, dual-trace scopes, electronic switches for multi-waveform displays, DC-to-DC supplies, DC-to-AC inverters, and DC-to-DC converters, this brand-new book is right up-to-date. Revised to include the latest information in keeping with technology. It is a virtual handbook on the subject, explaining scope operation from the simplest to the most intricate uses. Beginning where the scope manual stops, the author covers basic waveforms (DC, sine, sawtooth, trapezoid, and pulse) clearly detailing their generic characteristics and how they are interpreted in oscillography. 256 pps., over 179 illus., 8 chapters.

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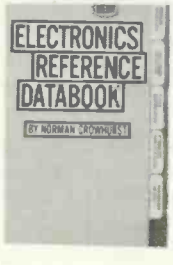
Electronics Reference Databook



This new book is much more than a simple collection of tables, formulas, graphs, equations, etc. In addition to the abundance of helpful information given, it provides specific guidance in the use of data. Numerous problems associated with every level of interest—from electronics theory (formulas, laws) to measurements, tests, and circuit design work—are covered. In so doing, the author explains how to use the data (from this or other volumes) for purposes other than those listed. Covers Electronics Theory, Use of J Operator, Exponential and Other Tables. Attenuators and Equalizers, Filter Design, Practical Component Design and Application, Tube and Semiconductor Circuit Design and Operation, and Transmission Lines. 224 pps., over 100 illus., plus 45 tables. Hardbound.

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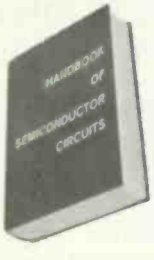
Handbook of Semiconductor Circuits



Contains 124 examples of standard transistor circuits, complete with operational data for amplifiers, oscillators, logic and switching circuits, power supplies, and various nonlinear circuits. The broad range of circuits included were selected on the basis of application and practicality. A design philosophy section is included with each group of circuits, thereby providing a basis for understanding circuits other than those selected as examples. This is not a handbook of "preferred" circuits, but rather a collection of practical circuits which have wide application and exemplifying good engineering design. Each circuit description includes data concerning any unique design or operational data, along with schematic diagrams. Hundreds of illustrations and diagrams. 448 pps., 6" x 9". Hardbound.

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DEALER SHOWCASE

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Build-it-yourself kits for 3 solid-state units

A line of stereo kits has been designed which is said to be comprised of three-solid state units: a 50w AM/FM stereo receiver, a 50w stereo amplifier, and an AM/FM stereo tuner. The receiver measures 4 by 16½ by 9⅛ in. while the tuner and amplifier

each measure 3⅛ by 12 by 6⅝ in. Price of receiver kit $109.95. Price of the amplifier and tuner $69.95 per kit. EICO.

AUTOMATIC TURNTABLE 716

Incorporates synchronous motor for precise speed

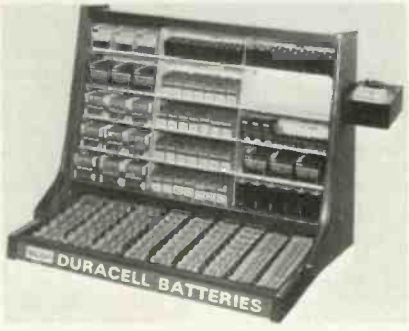
The Model 610/X total turntable package is said to incorporate a synchronous motor that provides precise

rotational speed. The turntable reportedly features a viscous damped cue and pause control, dual range anti-skate control, swing-away control arm for unobstructed single-record play, and a machined case platter. Specifications indicate that the turntable comes complete with factory-installed Shure M-93E magnetic cartridge, the decormatic power base and smoke tinted dust cover. BSR (USA).

BATTERIES 717

Battery display with built-in tester

A battery service center designed to display all popular battery types is obtainable from the manufacturer. The display is said to include a built-



in tester for checking batteries of all sizes, shapes and voltages. Mallory.

STEREO CASSETTE DECK 718

Cassettes snap in and pop out automatically

The Model 1125 stereo cassette tape deck is designed to record up to 2 hrs.

of program material. Cassettes reportedly snap in and pop out automatically at the end of the tape or when the eject button is pressed. Specifications indicate that the unit has pushbutton controls for record, play, fast forward, rewind, pause and stop. The manufacturer indicates that it employs an all silicon transistor circuit with a frequency response of 10 to 12,000Hz. The unit measures 3½ by 8¼ by 11¼ in. Price, including two patch cords, $129.95. Allied.

INTRUSION ALARM 719

Ultrasonic beam blankets a given protected area

The Model SA-3 Ultrasonic Intrusion Alarm is said to produce an ultrasonic beam which effectively "blankets" a given area. The beam reportedly does not penetrate solid objects,

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therefore an interruption of this beam by a briefly sustained motion of an in-

truder activates a selected alarm system, such as direct telephone dialers, central alarm systems, etc. The ultrasonic beam can not be seen or heard, and according to the manufacturer, it cannot be bypassed or defeated. Bourns.

720

STEREO RADIO AND PLAYER

Combines FM/AM stereo radio and eight-track stereo player

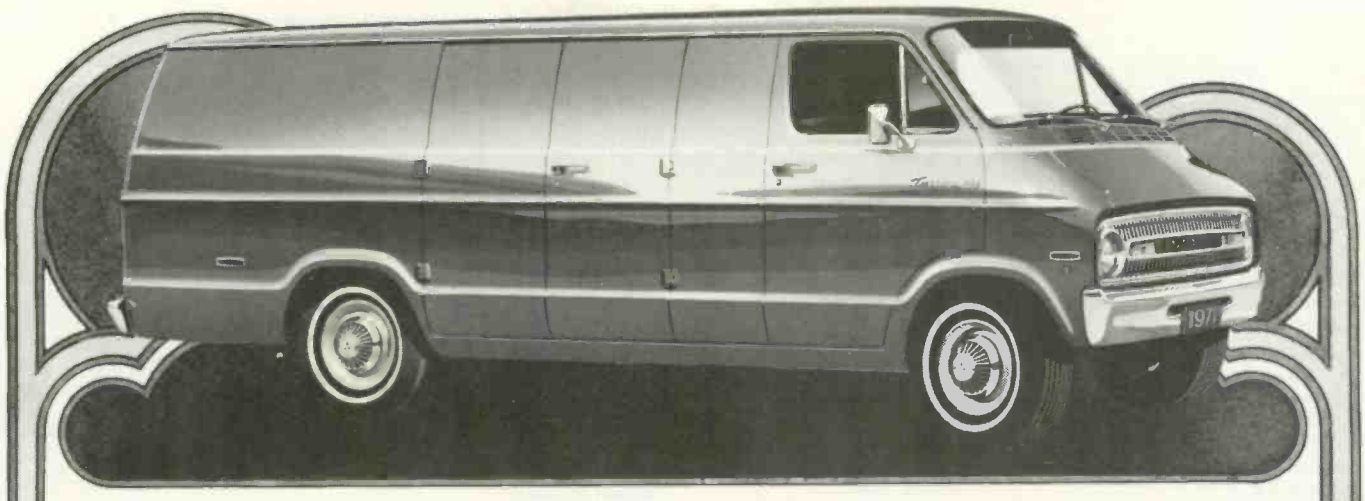
The Montvale, Model RE-7800, combines an FM/AM stereo radio and an eight-track stereo player. Maximum stereo separation is said to be assured with the aid of a continuous separate tone control that is said to guarantee true treble and bass bal-

ance. Retail price $189.95. Panasonic.

TAPE DISPLAY 721

Tape recorder products for dealer display

Two miniature displays of blank cassettes and reel-to-reel magnetic tapes are being offered by the manufacturer to tape recorder dealers. RCA.



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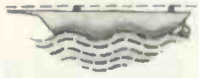
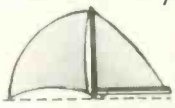
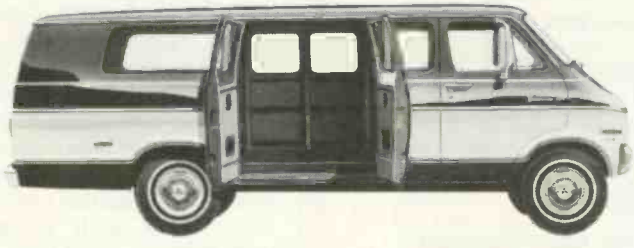
will carry a 12-foot sailboat  , plus its mast  , a living room-size roll of carpeting  , a snooker table  , or a full-size alligator  , under cover, and still give you all 31 features the other **Dodge Strong Box** models do. There's only one way to get power steering  and Fresh Air air conditioning  in a compact van, and that is to buy a Dodge. Go ahead, call it the **world's**  **biggest compact van**. Because that's what the Dodge Maxivan is. Open its doors and say, "ah!" At your Dodge Dealer's.



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TECHNICAL LITERATURE

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Solder and Flux 400

A 6-page bulletin is available which lists all of their various solders and fluxes and provides authoritative data covering both electronic and general industrial applications.

The brochure also includes technical information on the chemical analysis for QPL approved solders, tensile and shear strengths for selected soft solders, flux recommendations for metal alloys, the solderability of metals and the tin-lead melting point graph. Bow Solder.

Electronic Test Accessories 401

A 56-page general catalog of electronic test accessories is introduced. The edition now contains 420 items—50 of which are new this year. The general catalog contains the entire line of ¾ and ½ in. spaced molded test accessories, molded patch cords, cable assemblies, test leads, connecting leads, test socket adapters, "Black Boxes" and other electronic test accessories—all designed to meet rigid industrial and military specifications. The catalog provides complete engineering information on all items, including product photographs, dimensional drawings, schematics, specifications, features, and operating ranges. Pomona.

Panel Meter Catalog 402

A 20-page catalog, D-70, featuring standard and special panel meters, has been designed for such applications as electronic instrumentation, communications equipment, industrial process control, military ground support equipment, laboratory and educational uses, plus many more. The two-color, three-hole punched catalog for ring binder reference usage, is complete with detailed electrical and mechanical specifications and dimensional and mounting drawings. User net prices are also given for all panel meters listed. Many of the manufacturer's new instrument additions are provided in the catalog, such as shallow barrel "G" type meters. A complete listing of sales and service modification centers plus sales representative organizations is also provided. Triplett.

BOOK REVIEWS

MAGNAVOX COLOR TV SERVICE MANUAL *by Stan Prentiss. Published by Tab Books. 160 pages, leatherette cover, $7.95, paper bound, $4.95.*

This manual is the latest addition to a growing list of manuals covering popular makes of TV sets. It contains most of the essential data needed for Magnavox receiver service.

Much of the text is concerned with factory set-up procedures and service methods, while portions of the manual are devoted to actual case histories of troubles and shortcuts for faster servicing.

One chapter covers alignment procedures for most of the circuits along with illustrations and actual scope waveforms obtained from various circuits. We felt this chapter provides excellent coverage for the service technician who needs to "brush up" on alignment and how to employ the vectorscope.

Also covered in detail were the AGC and remote control circuits, subjects worthy of review.

The manual includes a 36-page schematic foldout section and 34 separate schematics covering VHF and UHF tuners.

The chapters discussed the following topics: test instruments, antennas and transmission lines, setup and convergence, basic troubleshooting, typical Magnavox receivers and TAC, the T936 chassis, automatic gain control, remote controls, alignment, tuners and case histories.

TELEVISION SERVICE MANUAL *by Edwin P. Anderson and revised by Robert G. Middleton. Published by Theodore Audel & Co., 544 pages, hard cover.*

Revised to include solid-state circuits, the author has covered the general principles of television from TV cameras to the receiver picture tube—too diverse a field to cover any one particular subject in any great detail. For this reason, the title of the book seems inappropriate in that it could lead one to believe that it is a text on how to repair TV sets. Although some of the basic principles on how TV sets operate, TV interference, antenna coupling and even integrated circuit functions are included, none of these topics are covered in adequate depth to enable a beginning technician to service a TV set. This book is a good introduction for those wishing to learn the basic principles of television (all aspects included).

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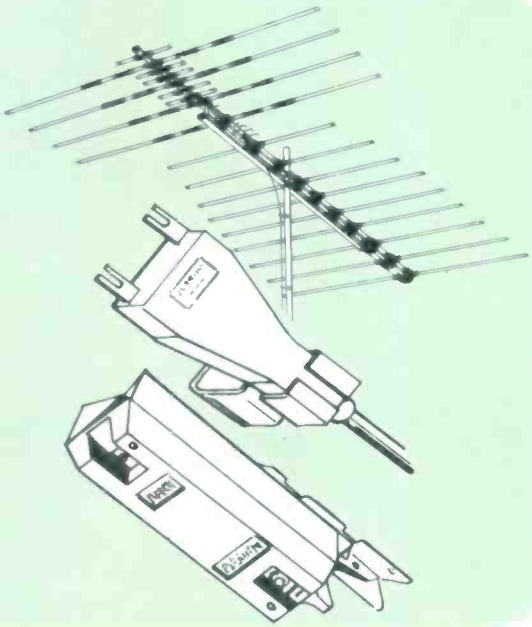

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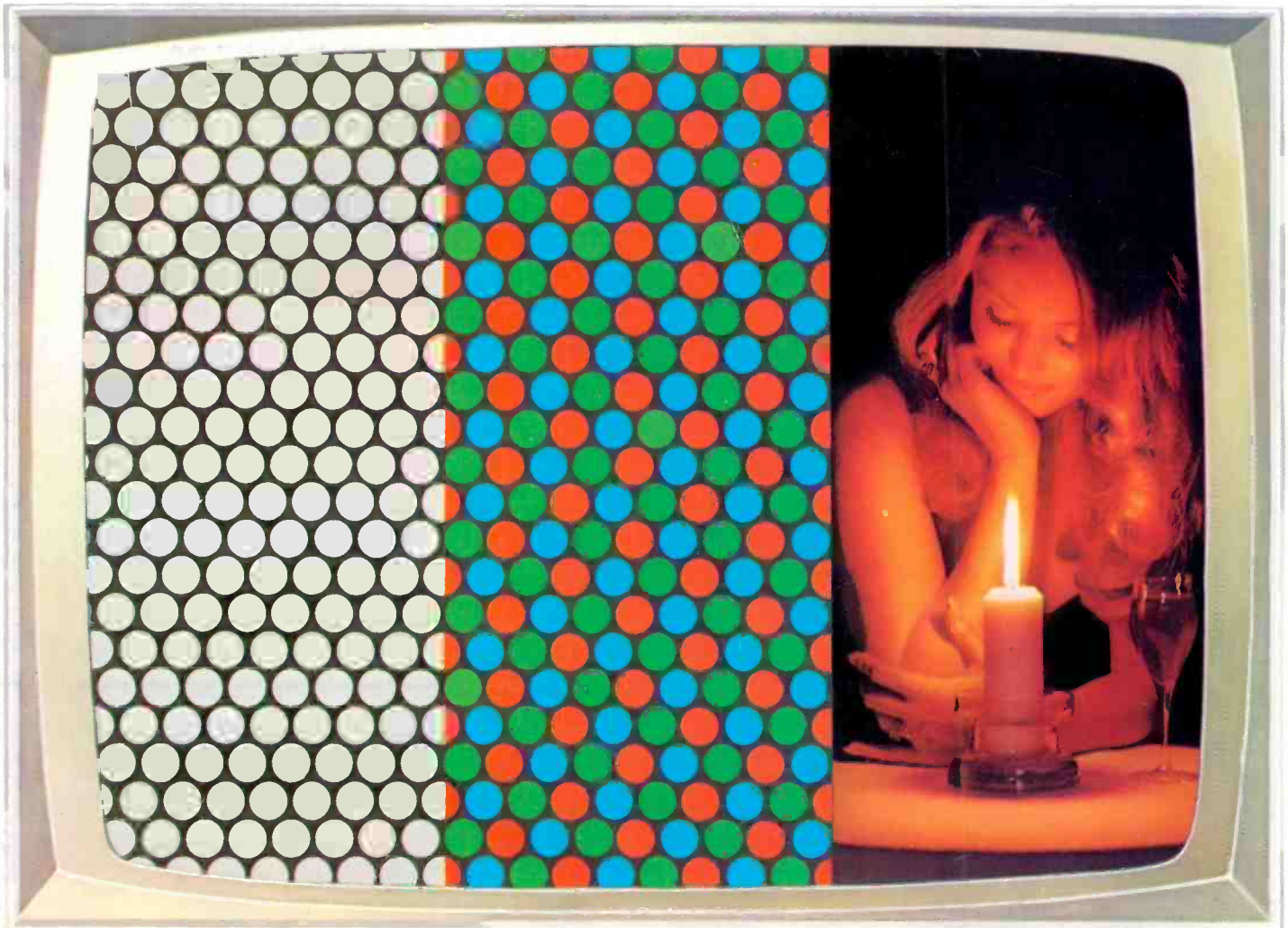

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