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GENERAL  ELECTRIC

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AND TECHNICAL INFORMATION FOR 5 NEW SETS

GROUP
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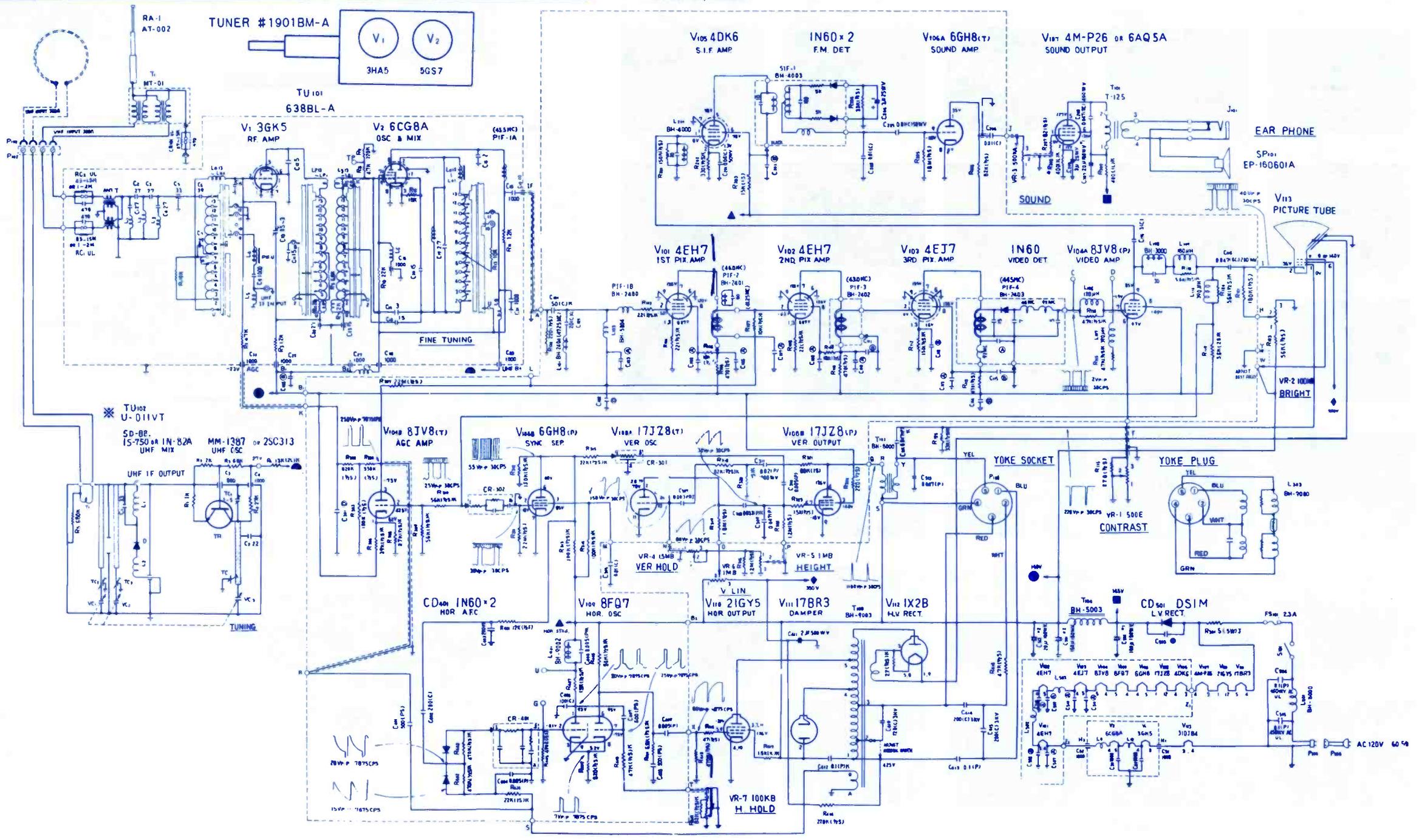
EMERSON TV Model	SCHEMATIC NO.	1375	RCA SALES CORPORATION Color TV Chassis CTC 55 Series	SCHEMATIC NO.	1378
GENERAL ELECTRIC Color TV Chassis C-2/L-2	1376		OLYMPIC TV Chassis 9P94 Series	1379	
MAGNAVOX Color TV Chassis T956	1377				

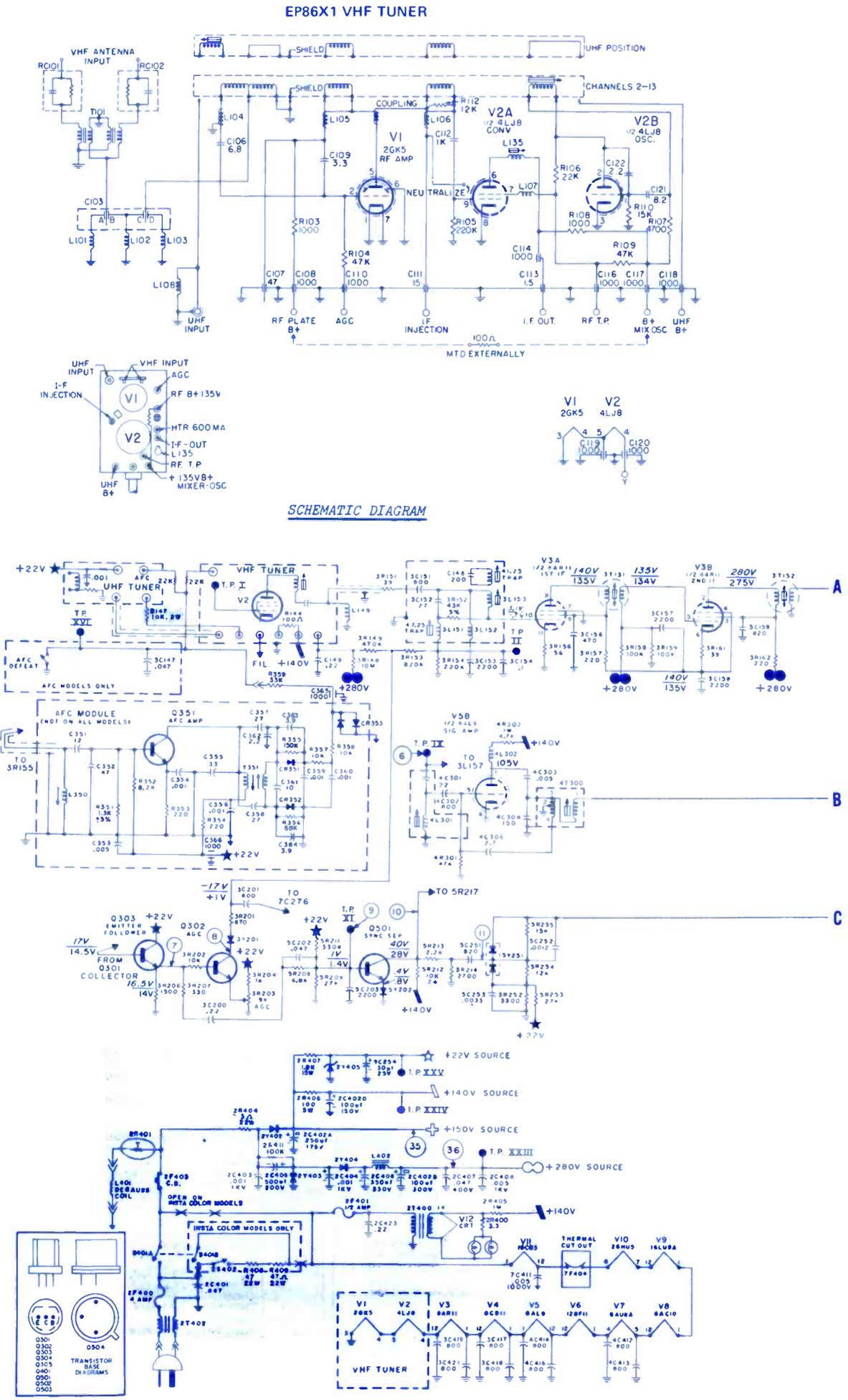
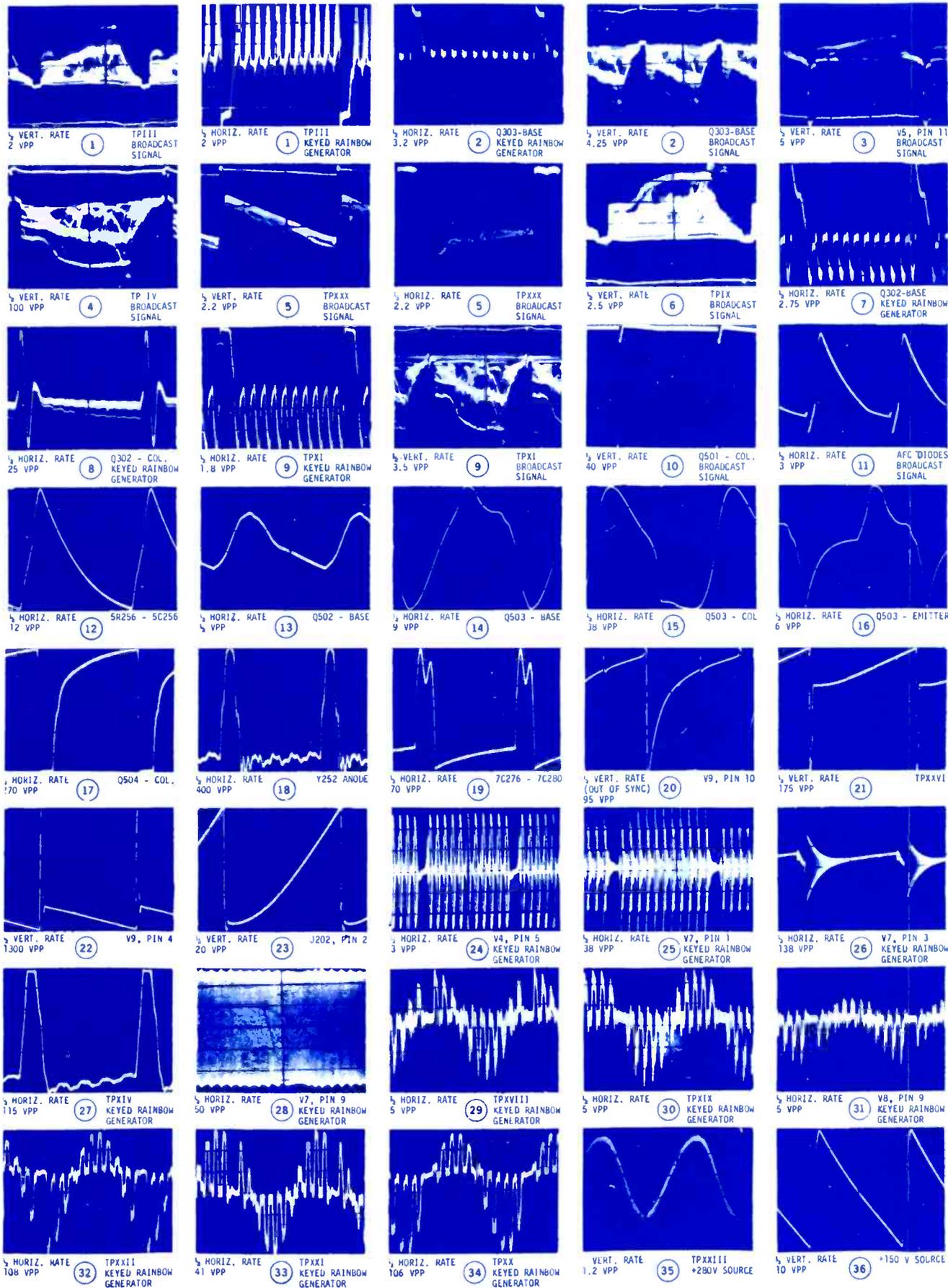
SYMBOL NO.	TUBE TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10	PIN 11	PIN 12
V-1	3GK5	0	2.6M (FILAMENT)	*1.2K	0	0	0	0	0	0	0	0	0
	3HA5	1M	0 (FILAMENT)	*1.2K	0	0	0	0	0	0	0	0	0
V-2	6CG8A	10K	*10K	0 (FILAMENT)	*1.2K	*22K	0	225K	0	220K	0	0	0
V-101	4EH7	22	5M	22 (FILAMENT)	0	*470	*18.5K	0	0	0	0	0	0
V-102	4EH7	22	5M	22 (FILAMENT)	0	*470	*18.5K	0	0	0	0	0	0
V-103	4EJ7	150	0	150 (FILAMENT)	0	*470	0	0	0	0	0	0	0
V-104	8JVB	17K	35K	500K (FILAMENT)	10 to 175	120	*0	5.6K	0	0	0	0	0
V-105	4DK6	2	330	(FILAMENT)	*15K	0	0	0	0	0	0	0	0
V-106	6GH8	*82K	2.5M	*100K (FILAMENT)	75K	0	0	1.8M	0	0	0	0	0
V-107	1M126 or 6AQ5A	0 to 500K	400	(FILAMENT)	620	420	N.C.	0	0	0	0	0	0
V-108	17JZ8	(FIL.)	*1.8M to 2.8M	N.C.	150	N.C.	1.2M to 1.7M	220	0	500K to 2.0M	0	(FIL.)	0
V-109	8FQ7	1.6K	400K	820 (FILAMENT)	*56K	50K to 90K	820	0	0	0	0	0	0
V-110	21GY5	(FIL.)	*0.1 to 500K	*1.5K	0	470K	*470K	*1.5K	N.C.	470K	0	*1.5K (FIL.)	0
V-111	17BR3	N.C.	0	N.C. (FILAMENT)	N.C.	N.C.	N.C.	N.C.	(CAP) 1.2M	0	0	0	0
V-112	1X2B	INF	INF	INF	INF	INF	N.C.	INF	INF	(CAP) 1.2M	0	0	0
V-113	C.R.T. 3101A	33K	180K to 250K	(FILAMENT)	33K	*1M	0 or 0	0	0	0	0	0	0

RESISTANCE READINGS

SYMBOL DESCRIPTION	EMERSON PART NO.
VR1,2,3—triple control—contrast, bright, volume	043121
VR4,5,6,7—quad control—vert hold, height vert lin, horiz hold	043120
R501—resistor—5Ω, WW, ±5%, 5w	040048
C207,502,512,501—electrolytic—160×20 μf/180v	039060
CR301—vert integrator couplate	039001
CR302—sync separator couplate	039004
CR401—horiz integrator couplate	039005
SIF-1—sound detector xformer, 4.5MHz	BH-4003
L201—sound take off coil, 4.5MHz	BH-4000
L303—deflection yoke assembly	BH-9000
L401—horiz stabilizing coil	BH-9002
T101—sound output xformer	T-125,020039
T102—vert output xformer	BH-8000
T103—horiz output xformer	BH-9003
T104—filter choke—power supply	BH-5003

NOTES: All resistance readings are in ohms, unless otherwise specified, "K" denotes kilohms; "M" denotes megohms; "N.C." denotes no connection to terminal indicated; * Indicates measurements taken with common lead of meter connected to junction of T-104 and C-501 (B+140V point); ** are used relay terminals.

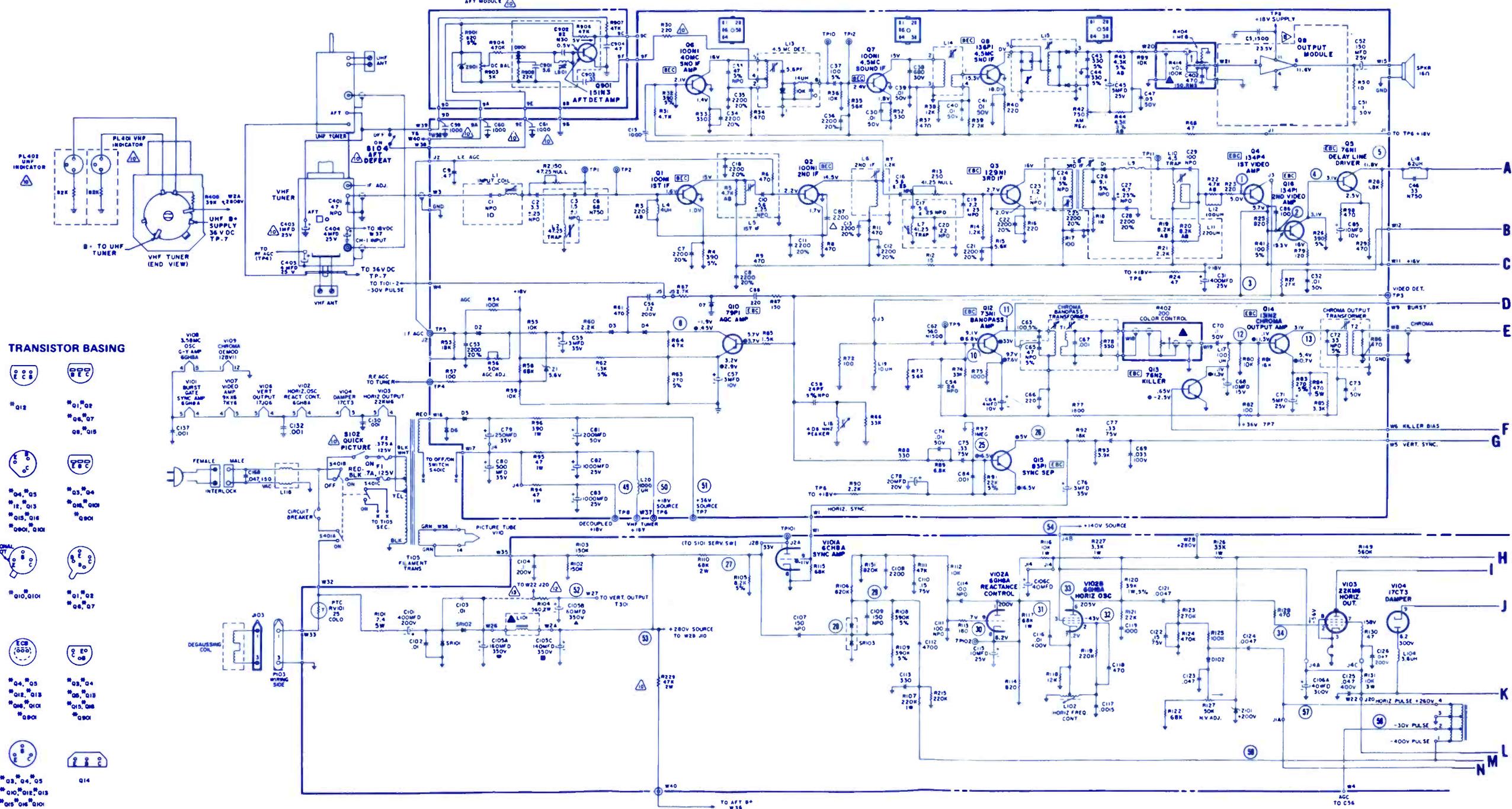
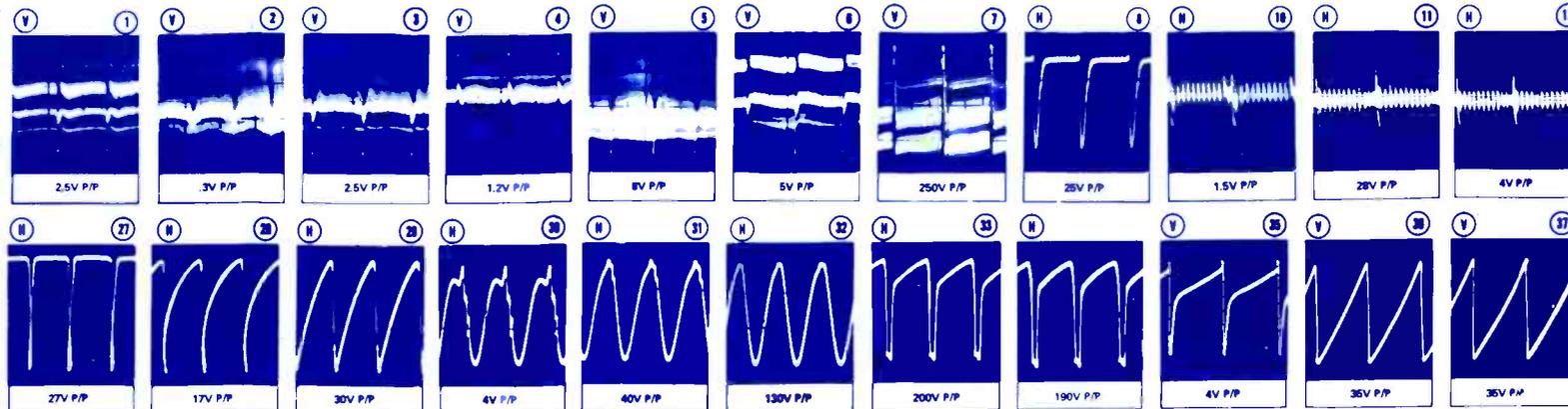




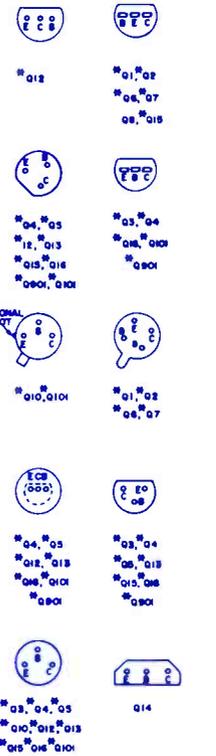
SYMBOL DESCRIPTION MAGNAVOX PART NO.

L13-4.5MHz sound detector coil	361336-2
L14-4.5MHz sound IF coil	361331-1
L15-ratio detector	361338-1
L102-horiz frequency coil	361269-1
L104-5.6µh RF choke	360676-5
L111-620µh peaking coil	360853-11
L118-line filter	361400-1
L901-discriminator coil (T956-01)	361405-1
T1-chroma bandpass xformer	361339-1
T2-chroma output xformer	361343-1
T101-horiz output xformer	361342-5 or 361376-2
T103-burst xformer	361296-1
T105-filament power xformer w/fast on (T956-01)	320353-5
T105-filament power xformer (T956-02)	320354-5
deflection yoke	361429-1
C105-electrolytic, 160/140/60µf, 350v	270099-9
C106-electrolytic, 40/30/40µf, 300v	270099-11
R56-50K, AGC threshold control	220220-18

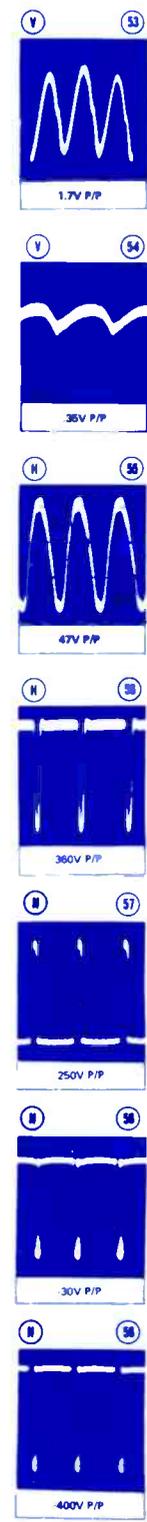
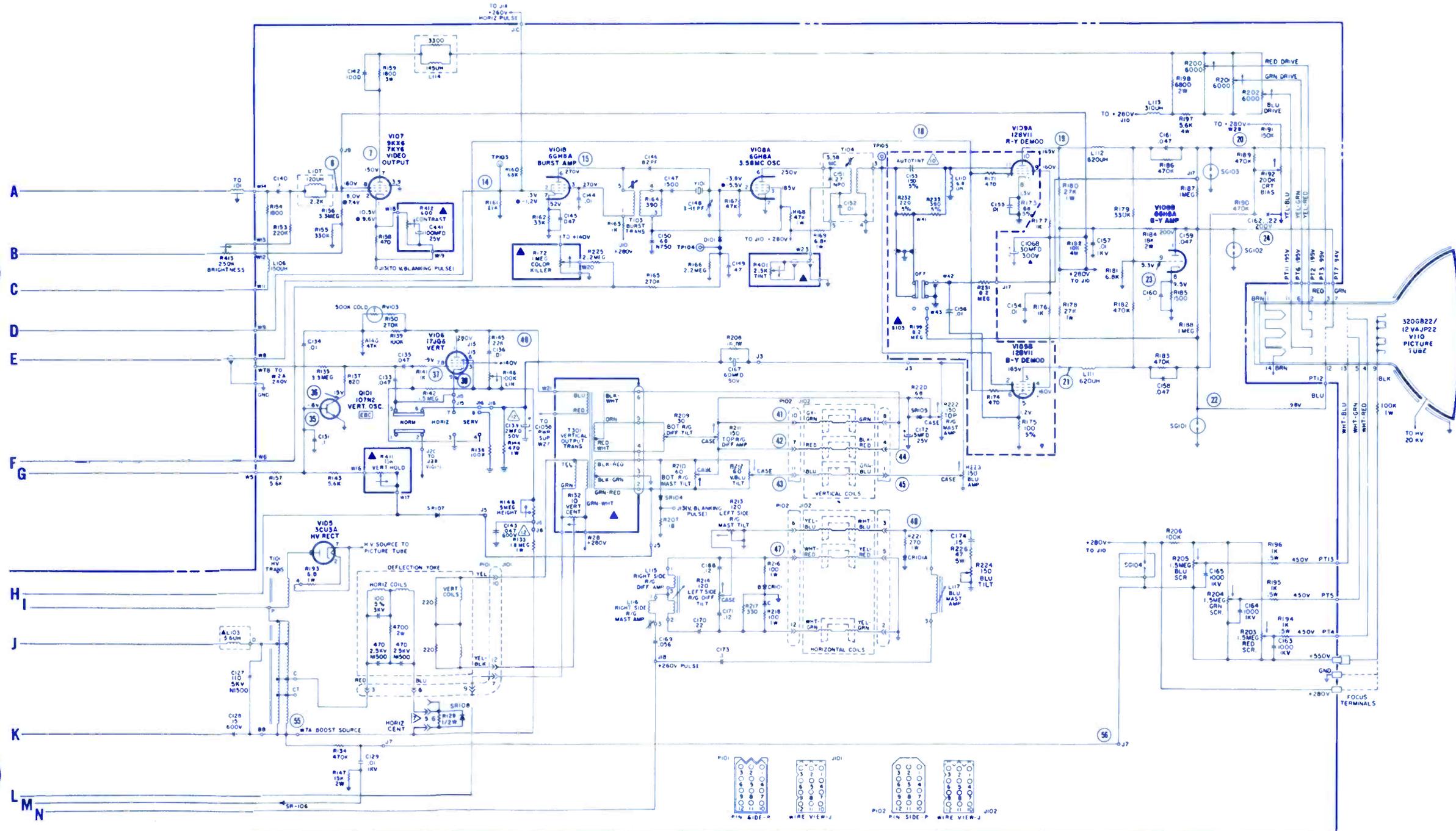
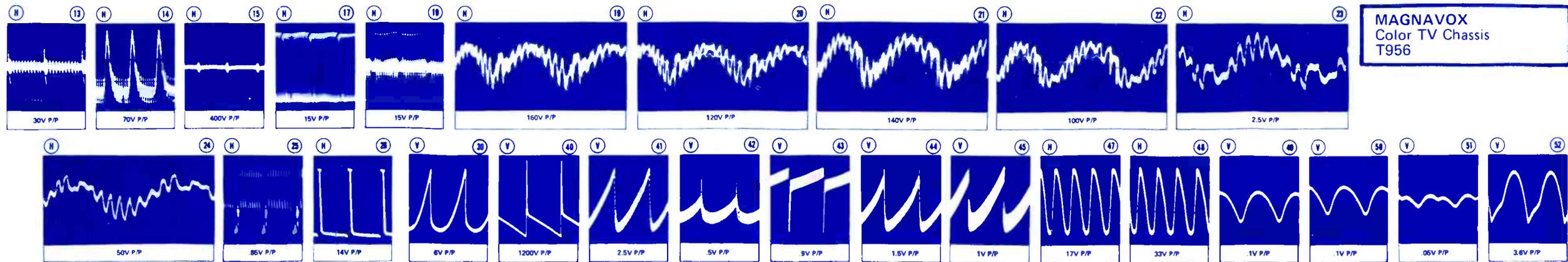
R127-50K, high voltage adjust control	220220-20
R132-10, vert centering control	220246-1
R146-100K, vert lin (Part of R132)	220246-1
R148-5M, vert height control	220220-19
R172-1M, color killer control	220208-45
R192-200, CRT bias adjust control	220220-21
R202-6K, blue drive control	220220-22
R401-2.5K, tint control (T956-01)	220255-16
R401-2.5K, tint control (T956-02)	220263-4
R411-15K, vert hold control	220-146-77
R412-600, contrast control	220146-75
R413-250K, bright control	220-146-76
R414-100K, vol w/switch S401 (T956-01)	220260-34
R414-100K, vol w/switch S401 (T956-01)	220261-10
R903-5K, dc balance (T956-01)	220217-16
RV101-thermistor (PTC) 25 cold; 5K hot	230207-1
RV103-thermistor (NTC) 500K cold	230130-6
TD101-delay line	360949-6
F1-fuse, 0.75a, 125v, slo-blo	181021-5075
F2-fuse, 0.4a, 125v, slo-blo	181021-5040
1.3a circuit breaker	180723-5



TRANSISTOR BASING

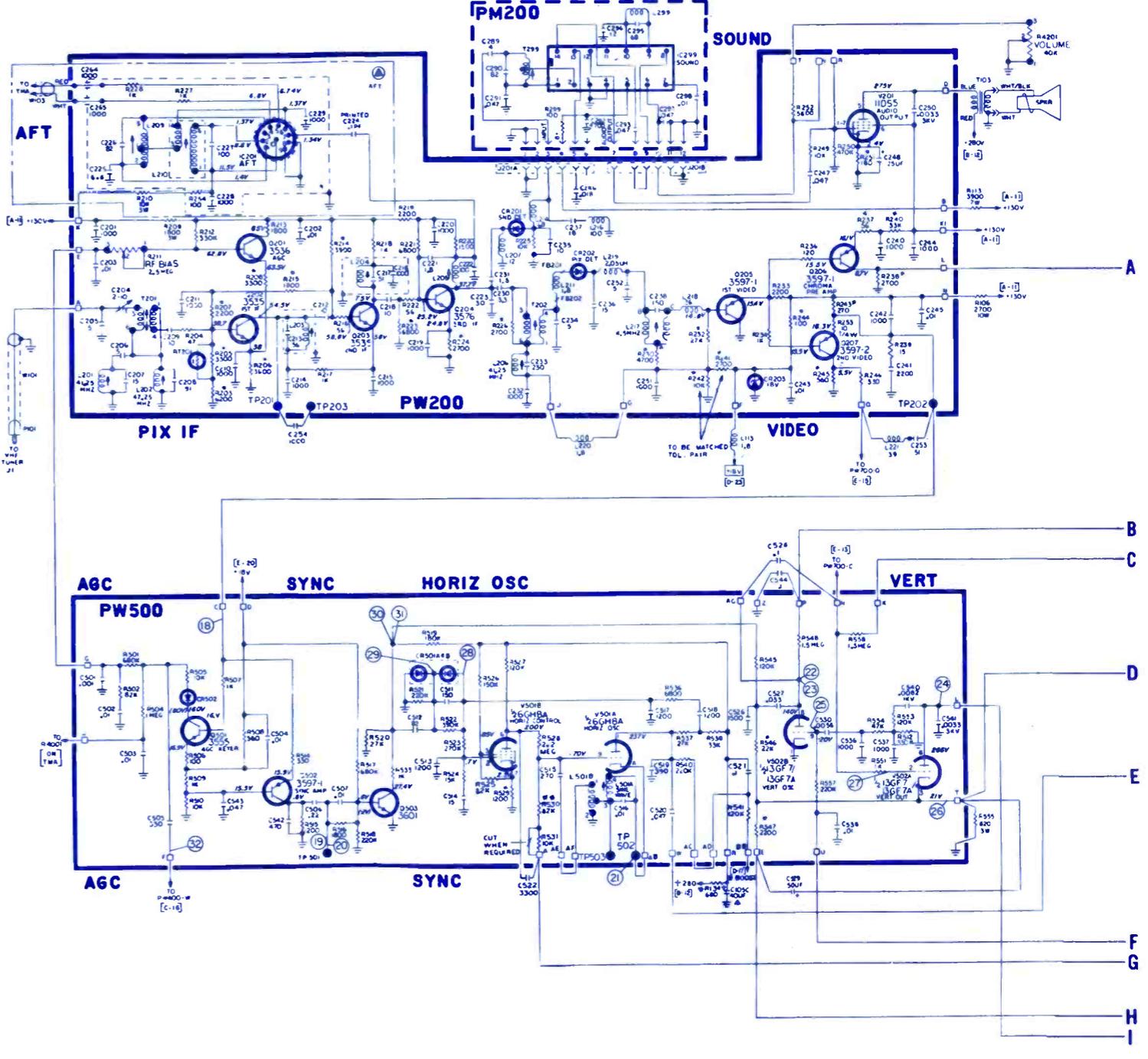
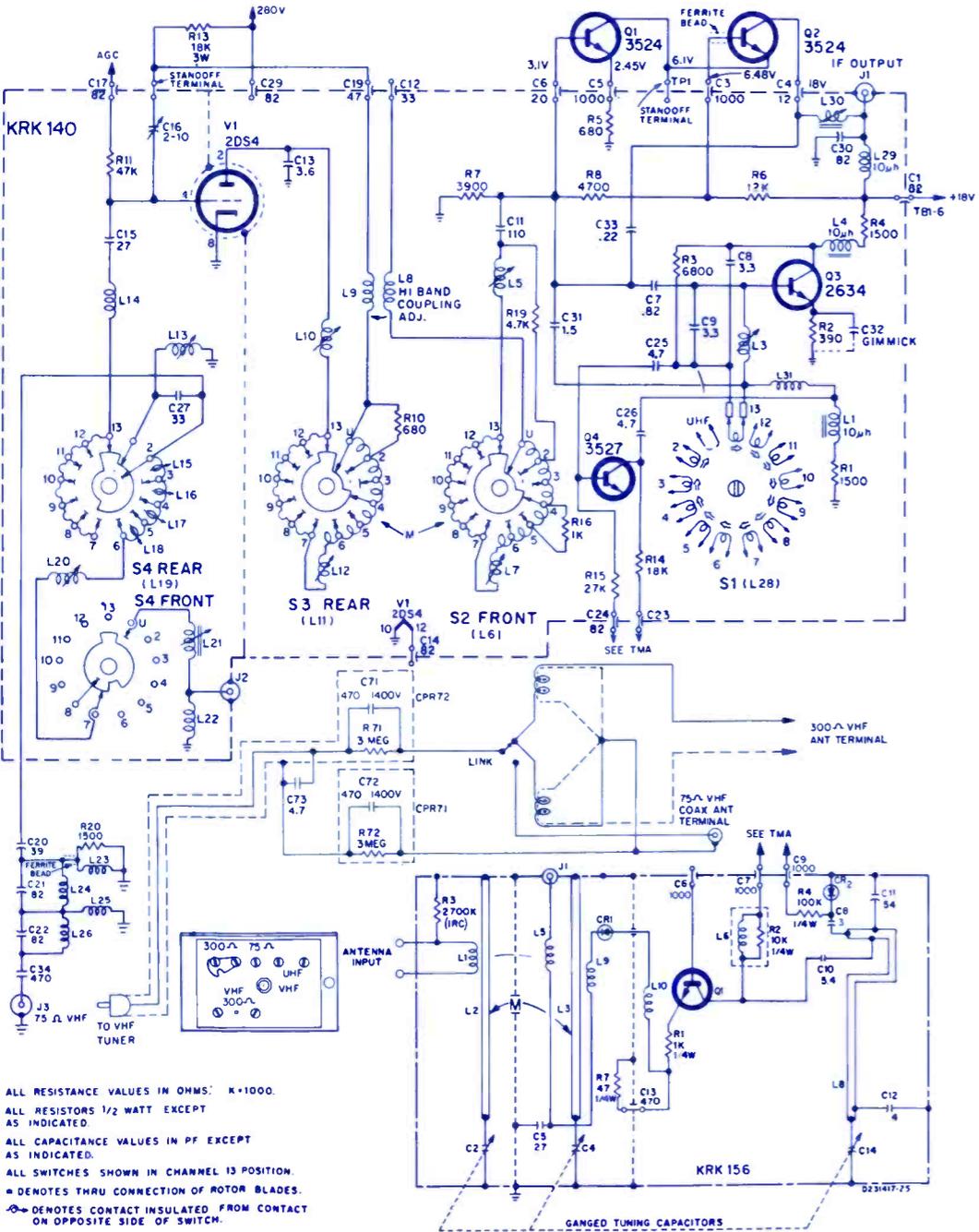
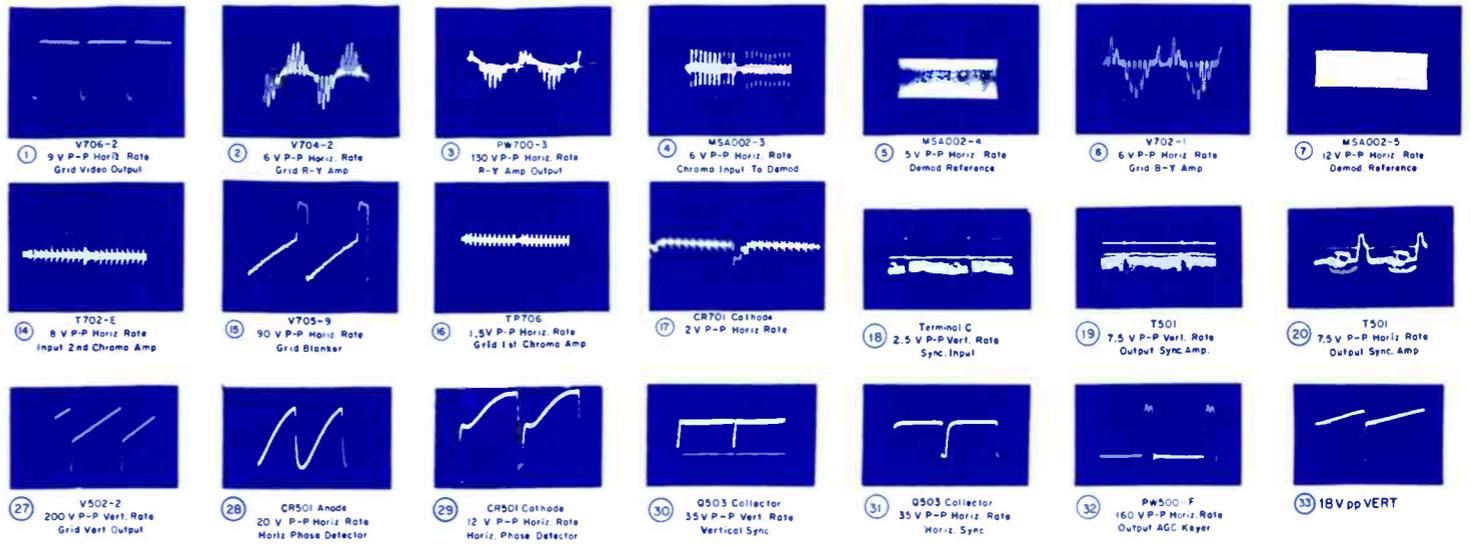


MAGNAVOX
Color TV Chassis
T956

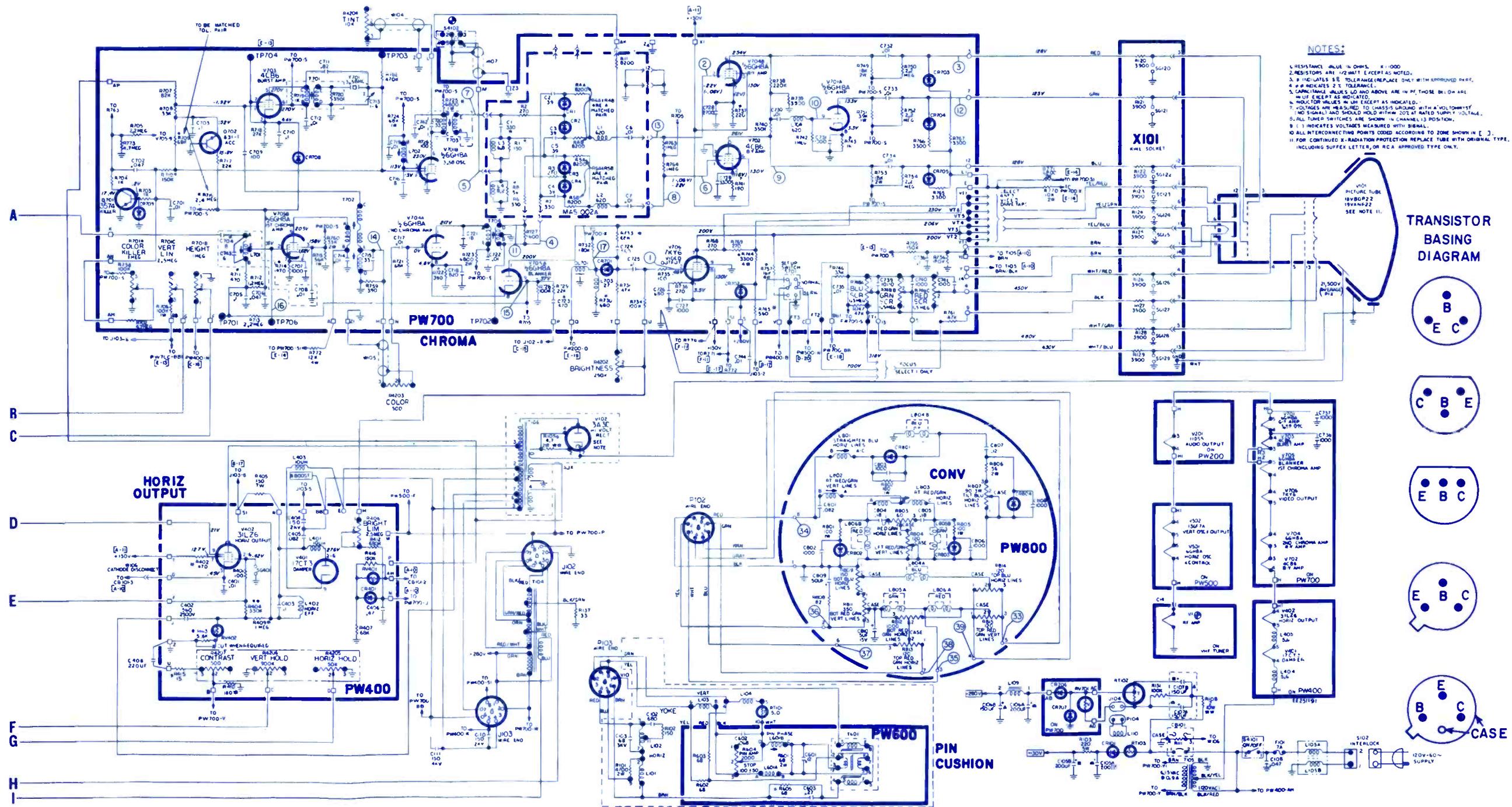
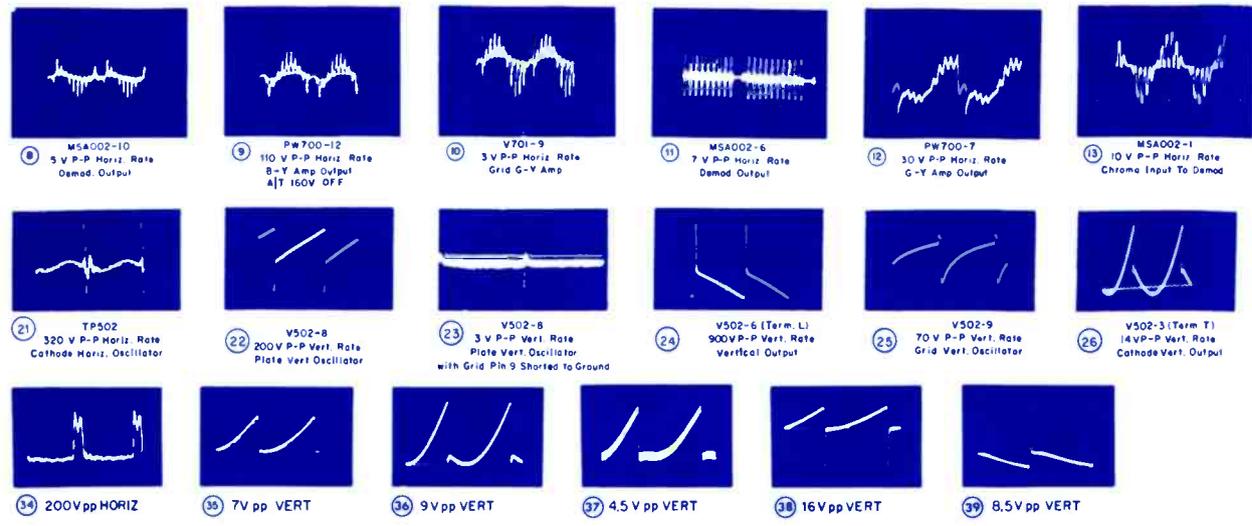


SYMBOL	DESCRIPTION	RCA PART NO.
C105A	200 µf, 500v elect	133128
C105B	200 µf, 500v elect	133128
C105C	50 µf, 500v elect	133128
C106A	200 µf, 350v elect	126340
C106B	150 µf, 350v elect	126340
C107A	150 µf, 175v elect	130769
C107B	150 µf, 175v elect	130769
CB101	circuit-breaker	133068
F101	7a fuse	120785
RT101	5n cold thermistor	114742
RT102	240n cold thermistor	127227
T102	horiz output xformer	133136
T103	audio xformer	120822
T104	vert output xformer	130092
T105	power xformer	133245
MAS2A	module-accutint, complete	133144
PM200	module-sound, complete	130753
IC299	integrated circuit	130753
L299	discriminator coil	130121
PW200	circuit-pix AFT, complete	133147
IC201	integrated, AFT circuit	130130
L201	47.25MHz coil	121564

L202	41.25MHz coil	124803
L214	1.8 µh	109248
RT201	4300n cold thermistor	124813
T201	pix IF input xformer	127244
T202	pix IF output xformer	124708
PW400	horiz output circuit, complete	133143
L402	horiz efficiency coil	133177
L404	5.6 µh coil	109171
R406	bright limiter control	125076
RV401	vert bias varistor	133181
RV402	regulator varistor	133137
PW500	deflection circuit, complete	133146
L501A/B	horiz coil	109947
PW600	pin amp assy, complete	132512
PW700	chroma circuit, complete	133145
DL701	delay line	130109
RV701A	killer control	130107
RV748A/B	blue/green screen control	126763
RV701	54v varistor, maximum	126424
T701	burst xformer	130104
T702	1st chroma xformer	130100
T703	oscillator xformer	121559
T704	2nd chroma xformer	130101
	deflection yoke	133102



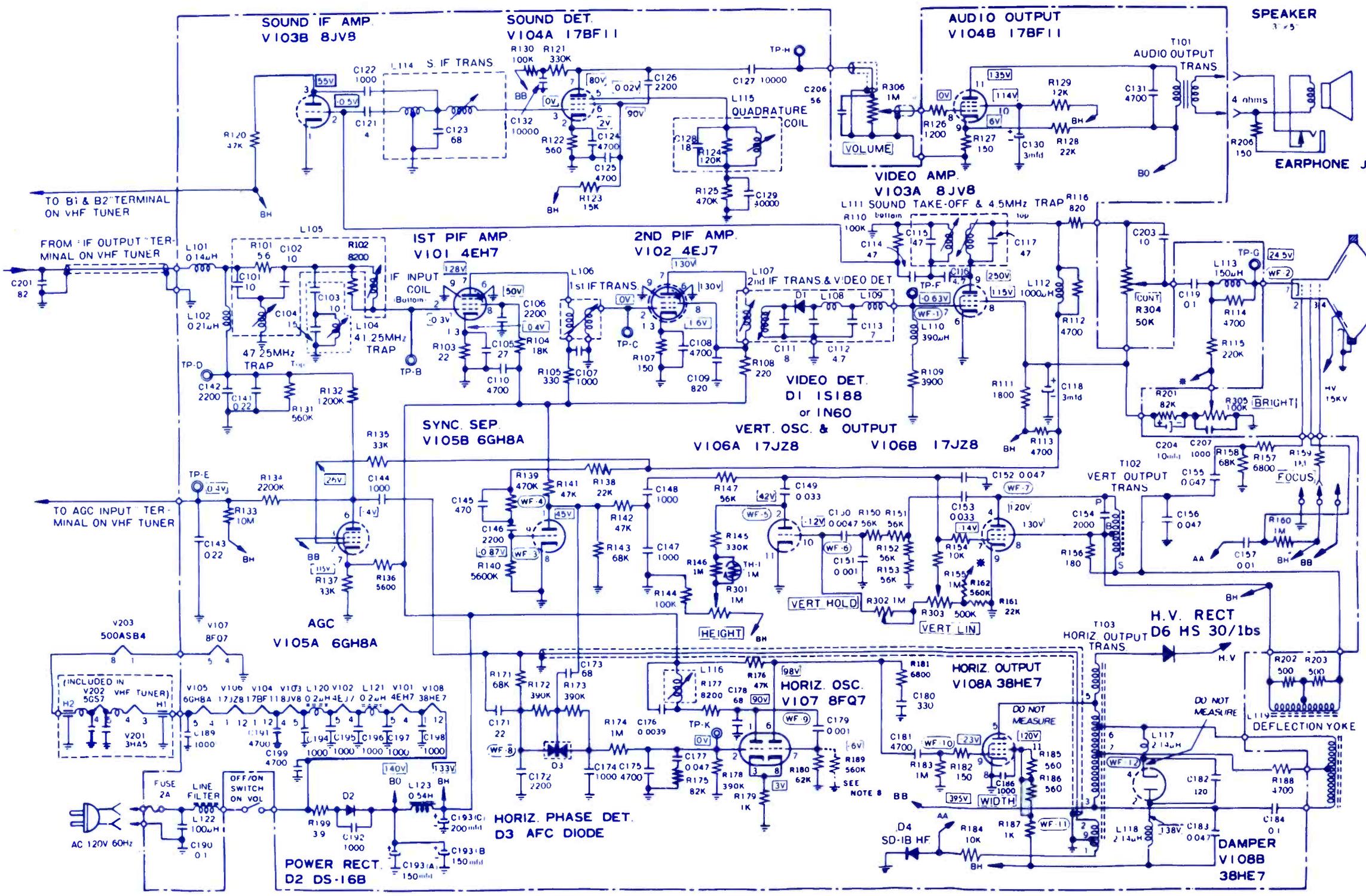
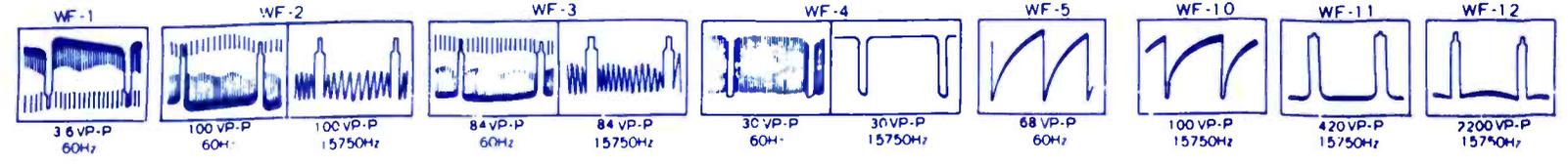
ALL RESISTANCE VALUES IN OHMS: K=1000.
ALL RESISTORS 1/2 WATT EXCEPT AS INDICATED.
ALL CAPACITANCE VALUES IN PF EXCEPT AS INDICATED.
ALL SWITCHES SHOWN IN CHANNEL 13 POSITION.
• DENOTES THRU CONNECTION OF ROTOR BLADES.
⊕ DENOTES CONTACT INSULATED FROM CONTACT ON OPPOSITE SIDE OF SWITCH.



SYMBOL DESCRIPTION OLYMPIC PART NO.

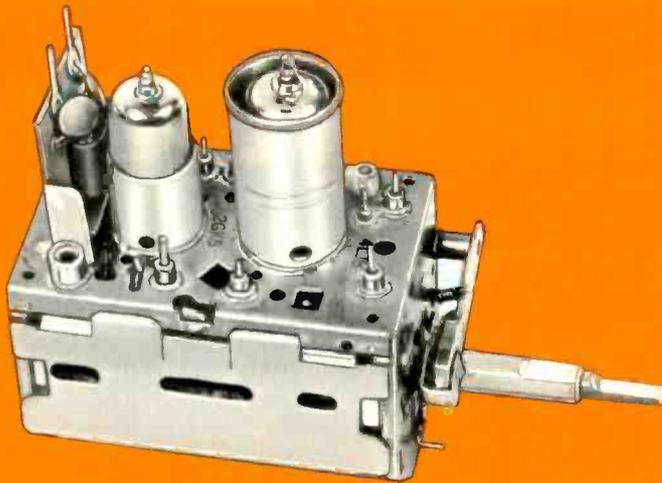
R301-1M, variable vert height control	PTJ70140
R302-1M, variable vert hold control	PTJ70140
R303-500K, variable vert lin control	PTJ70140
R304-50K, variable contrast control	PTJ70142
R305-100K, variable bright control	PTJ70143
R306-1M, variable volume, power On/Off control	PTJ70141
C193-150µf, 180V/150µf, 180V/200µf, 180v elect	COJ70144
T101-audio output xformer	TRJ70119
T102-vert output xformer	TRJ70138
T103-horiz output w/diode (OPO4 only)	TRJ70165
L104-41.25MHz trap	CLJ70131
L111-sound take-off and 4.5MHz trap	TRJ70121
L114-sound IF xformer	TRJ70120
L115-quad coil	CLJ70122
L116-horiz hold stab	CLJ70126
L118-filter coil	CLJ70129
L119-deflection yoke	REJ70139
D4-rectifier	REJ70149
D6-high voltage selenium diode (9P94 only)	REJ70161
TH-1-thermistor	REJ70150
2a fuse	FUJ70151
complete P/C board less tubes	ASJ70098
VHF tuner	CLJ70099
UHF tuner	CLJ70100

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PICTURE TUBE
V203 500ASB4

- NOTES:
- All resistance values in ohms K=1,000; M=1,000,000.
 - Unless otherwise noted in schematic, all capacitors less than 1 are expressed in mfd, and the values larger than 1 are in pF.
 - Voltage readings taken with "VTVM" from point indicated to chassis ground. Tuner on unused channel, contrast at maximum, AGC at fully clockwise, other controls at normal, line voltage 120 volts.
 - All waveforms measured with strong signal input, contrast set to give normal picture and AGC line operating normally.
 - Voltage readings may vary ± 20%.
 - If picture is found too wide, clip the wire near R185 on the circuit board by using a nipper. This wire may have been opened in some chassis as a result of factory adjustment.
 - If picture is still too wide, clip the wire near R186 on the circuit board.
 - Remove R189, if picture does not go out of sync by full clockwise rotation of Horizontal Hold control knob.



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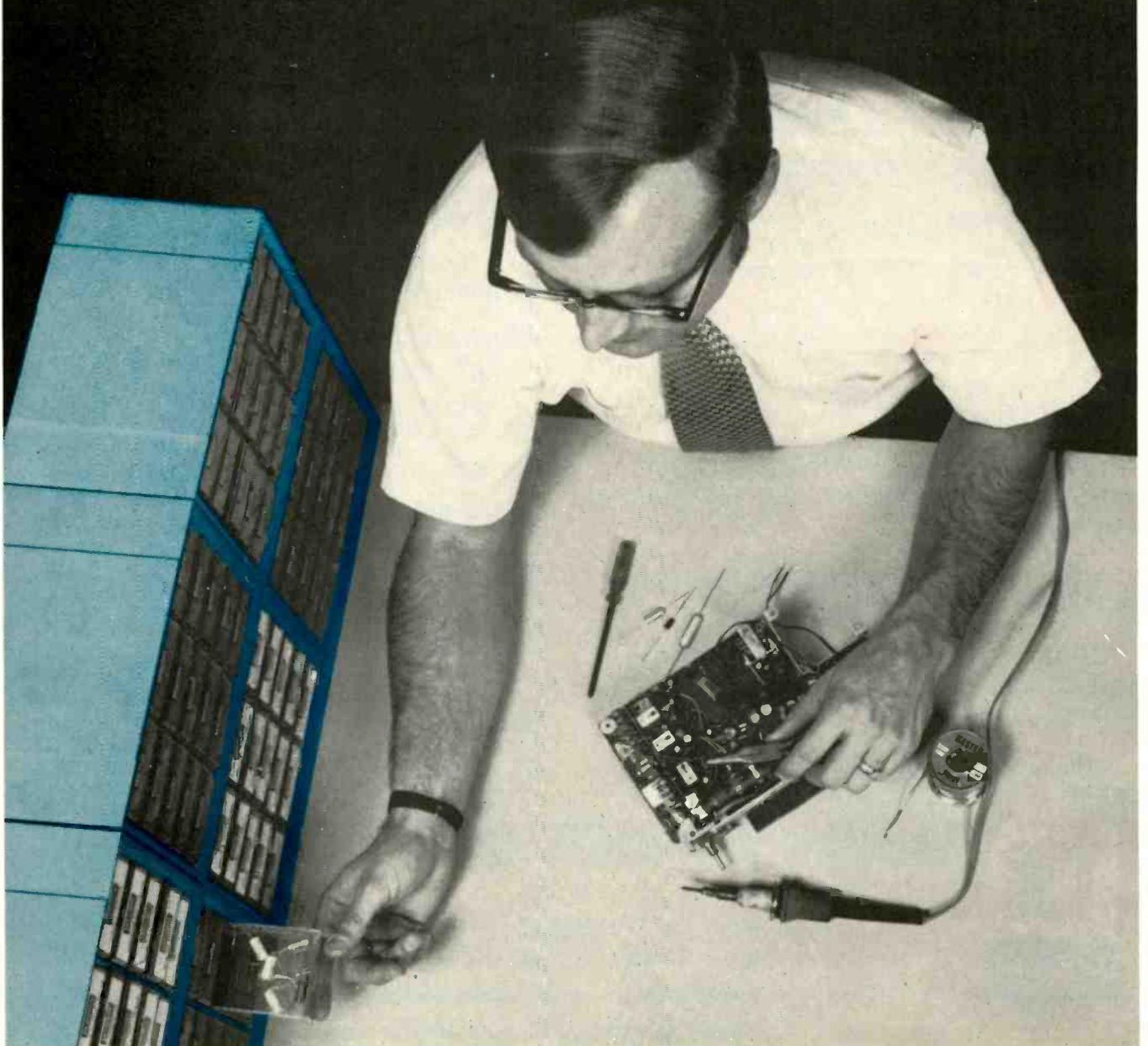
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In this month's cover photo, courtesy of Channel Master, Jeffery Pasbrig demonstrates that you do not have to be trained in electronics to get a good picture with a transistorized indoor antenna. More details concerning the reception obtained are included in the article beginning on page 40.

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What Are Your Instruments Worth?



During the recent National Electronics Associations Convention I visited with a number of electronic technician/dealers who were of the opinion that

for efficient, money-making shops it is necessary that all technicians have access to the more sophisticated test instruments now on the market. They indicated that if a shop is able to streamline servicing with the use of \$1000 and \$1500 instruments, the reduced service time will more than compensate for the additional investment. (If you are able to repair a TV set in 45 minutes rather than in 3 hours because you have access to better instruments—charging the same amount for the job—then these instruments are an excellent investment!)

At least one of these men was very critical of our Reader's Aid Column in which we occasionally assist technicians who wish to repair or upgrade test instruments generally considered obsolete by the industry. (Despite the rising costs involved in publishing ELECTRONIC TECHNICIAN/DEALER, we still plan to continue offering this service free of charge to our readers.) In response, I indicated that we have a number of subscribers straight out of technical school who are technically well qualified to service consumer

electronic products, but who have yet to acquire the necessary capital reserves to purchase all new instruments when opening their shops. Although it is true that they do not have the efficiency of larger, more sophisticated shops, they are partially able to compensate for this with lower overhead and less take-home pay.

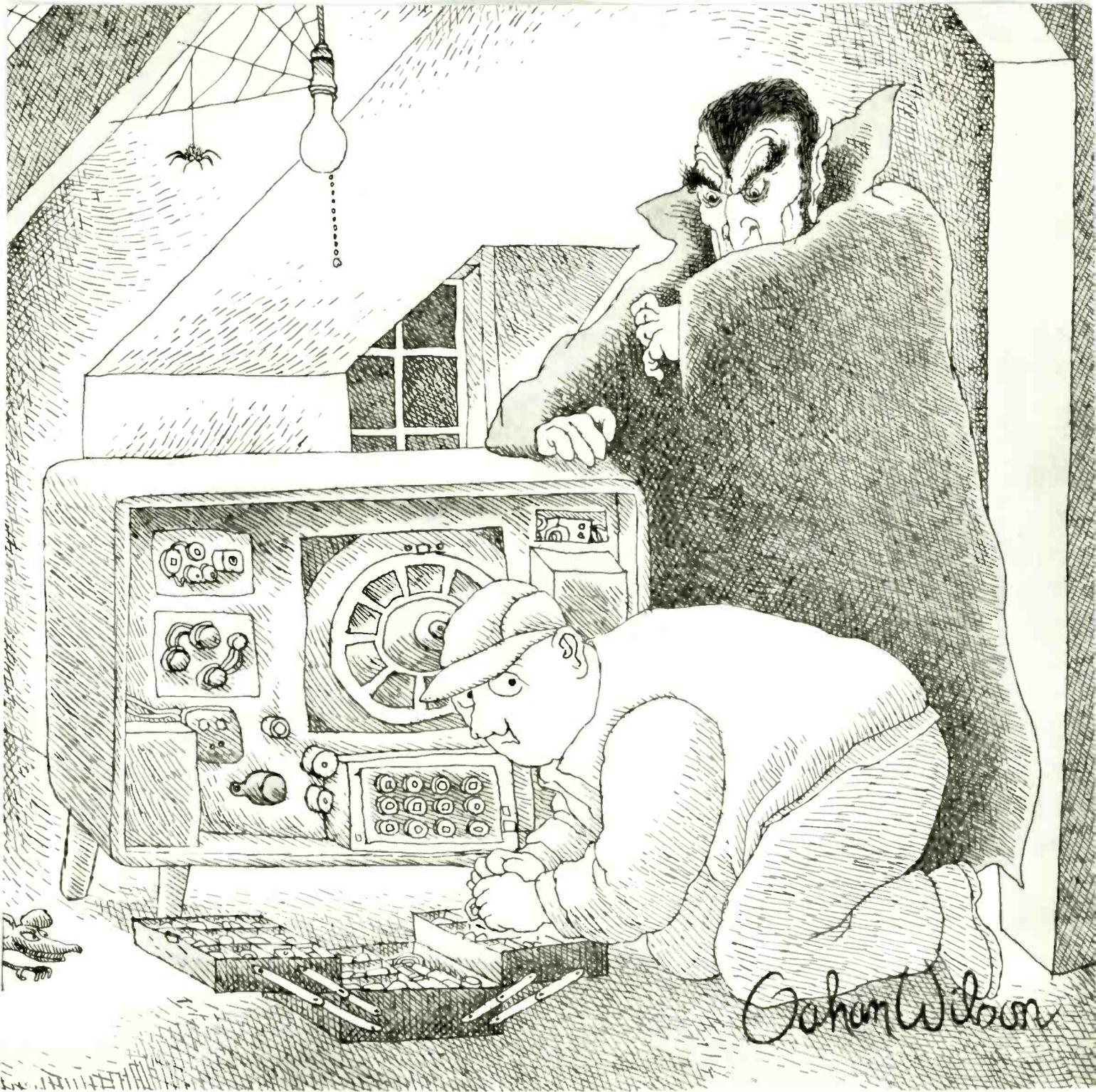
We have all heard of pilots who in the past have "flown by the seat of their pants," reaching their final destination—despite great obstacles—without the aid of modern instrumentation. They didn't get there as fast as our modern jets and they took far greater chances, but they did get there. Unfortunately, there are still some electronic technicians that feel they can also live a charmed life. These men will tackle even some of the newer, more-complex solid-state color-TV sets without knowing how to use even a simple scope. If it takes an extra day to fix the TV set, then they charge a little more. If they are unable to get the TV set back in working condition, then they either consult a friend or tell the customer that the TV set is beyond repair—moving on to the next sucker (or customer).

Just a few years ago I visited a new shop, located in a new shopping center, accompanying my grandmother as she went to pick up a fairly new solid-state radio that she had left for repairs. The technician returned it to her in a box, saying that after he tore it apart he found that it wasn't worth fixing. I don't know if his shop is still there or not.

There is certainly no point in purchasing sophisticated test instruments if you are either unwilling or unable to make adequate use of them. If your competency is not increased with the use of a better scope, then why get the better scope? But if your job requires a level of competency that you are unable to provide, then you are in for trouble. (The NEA spoke seriously of ways to remove from our industry the few technicians that give us a bad name. More information concerning this subject is included in this issue's News of the Industry.)

If we can assume that technical competency increases as the test instrument capability increases (ignoring the human factor), then we can also assume that there is a correlation between increased revenue and increased instrument cost—up to some level of diminishing returns. The only factor that places a lower limit on the quality of instrument purchased is the technical competency of the best technicians available to work with the test instruments purchased. For some shops it is advisable to purchase a \$1500 scope, for others a \$400 to \$800 scope is best, a few shops can get by with a \$100 scope . . . and some shops had better get out of business before the industry forces them out.

Phillip Walker



When you're in a hurry, it's nice to know GTE Sylvania has the parts.

Only 15 tubes and ECG solid-state components will solve practically all of your damper replacement problems.

And they're all available from your Sylvania distributor.

Because tubes are tubes, we can't promise to reduce the number you'll have to carry. But, with the Sylvania line, chances are your distributor will have the tube you need when you need it.

In semiconductors, the story is different. Just 124 ECG solid-state devices including transistors, diodes and integrated circuits will replace over 41,000 differ-

ent types. In the damper section alone, only 3 ECG solid-state devices will take care of almost every job.

And they save a lot of space in your tube caddy.

When your distributor is stocked with Sylvania receiving tubes and ECG semiconductors you'll have the parts you need. And you'll get them fast.

It's like having a complete warehouse built into your telephone.

And that can save you from a real pain in the neck.

GTE SYLVANIA

We make our own wire and cable. That's our thing.

There are a lot of wire companies that call themselves wire manufacturers. But in reality, they're more wire jobbers, than wire makers.

We're the real thing! We manufacture wire and cable from the raw materials to the finished product.

So what? So plenty!

Because we make wire and cable from the beginning to end, we can watch out

to see that every piece is perfect.

We can also keep an eye out to see that our production rate never falls behind and causes production shortages.

And what's more, we can look out to see that our warehouses are always fully stocked with items so we can fill shipments on schedule.

The next time you want wire and cable, order it from the people who

produce it - us! For complete information on Columbia wire, cable and cord sets, contact your local stocking Columbia distributor. Columbia Electronic Cables, 11 Cove Street, New Bedford, Massachusetts 02744 (Phone: 617-999-4455 • Telex: 929411). California: 1950 Naomi Avenue, Los Angeles, Cal. 90011.



Columbia Electronic Cables

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

READERS' AID

Space contributed to help serve the personal needs of you, our readers.

Needs Chart

I recently acquired a Calnex Mfg. Co. 123-Socket "Do-It-Yourself" Tube Tester, Model 602. Unfortunately the chart for tube number-socket-meter setting was not with it. Could someone tell me where I could get such a chart?

D. A. RICE

208 Indianwood Blvd.
Park Forest, Ill. 60466

For Sale

I have a complete set of TEKFAX schematics from ELECTRONIC TECHNICIAN/DEALER from the very beginning, which I would like to sell.

JOHN LIND

14732 72nd Rd.
Flushing, N.Y. 11367

I have old radio magazines dating back to 1920 for sale plus a large supply of old radio and TV tubes.

JOE RUSINKO

Rt. 1
Colbert, Wash. 99005

Needs Meter

I need a meter, Model 50-292X, for a Hickok Model 292X signal generator. Hickok is no longer able to supply this meter. Any assistance from your readers to procure a new meter, a used meter, or a defective meter which is still complete would be greatly appreciated. (Hickok can rebuild a defective meter, my instrument was received without one.) I'll be glad to cover expenses for this item.

JAMES M. KOONE

Box 5006
Ft. Amador
FPO N.Y., N.Y. 09580



"How could he? He had all the business he could handle."

The RCA portable color bar generator



Performs like the big ones Costs only \$75*

- Provides color bar, dot, cross hatch, and blank raster patterns
- All solid state circuitry including ICs
- Pattern signals, RF output frequency and color subcarrier all crystal-controlled
- Battery operated, AC adapter available
- Lightweight — less than 20 oz., only 6½" wide x 4" deep x 3" high

For all the technical specs get in touch with your RCA Distributor. RCA | Electronic Components | Harrison, N.J. 07029.

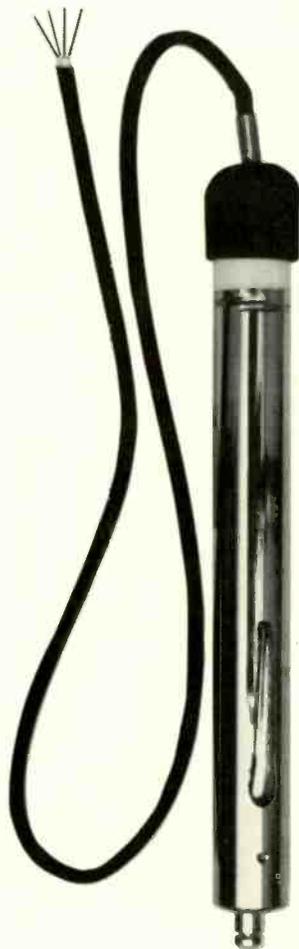
* Optional User Price

RCA

... for more details circle 131 on Reader Service Card

SEPTEMBER 1971, ELECTRONIC TECHNICIAN/DEALER | 25

**STOCK UP ON BLUE STUFF NOW
AND GET THIS UNIQUE BEND-O-LITE
FREE***



The flexible light-extension twists and turns to put light right where you need it — works just like the spray extension does on **BLUE STUFF** in getting into tight tuners.

Just buy a case of **BLUE STUFF** marked BEND-O-LITE on top from your participating jobber, and you'll find your BEND-O-LITE and batteries packed inside. Ready to use.

*BEND-O-LITE and batteries are worth \$4.55

Offer expires October 10, 1971

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SPRAY**

makers of better chemical tools for technicians
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... for more details circle 136 on Reader Service Card

LETTERS

Reader comments concerning past feature articles, Editor's Memos, previous reader responses or other subjects of interest to the industry.

Has Precise Schematics

In the May 1971 issue you asked for any information on instruments manufactured by Precise Electronics and Development Corp. I have a complete instruction manual and schematic for the Precise Model 909 VTVM, should anyone need such

BOB KAMPF

Audio & Hi Fi Consultant
P.O. Box 7
Saranac Lake, N.Y.

Another Nervous at the NEW Show

If you were a bit nervous about the Second Century Dinner at Bal Harbour (as per your excellent editorial in the July issue) I'd gladly have changed places with you that afternoon.

As you may have surmised, we sold NEDA on the Second Century theme, and managed to come up with the proclamations and greetings from the President and the Governors of the leading electronics producing states.

But the threatening weather was of minor concern that afternoon, for we were prepared to move the tables indoors at the last minute. The real cliff-hanger for me was something I hadn't even told the dinner sponsors until that afternoon—the possibility that President Nixon might make a last-minute surprise appearance at the dinner.

Somewhere along the line the plan was vetoed—possibly for security reasons, or press of State affairs. But for a while at least we had the prospect of welcoming the President to our big event.

The reason for not making that public in advance was that had we sold tickets that day, it might have seemed to be a gimmick—particularly if the President was a “no-show.” As it turned out, the banquet was a success as you so kindly noted—and for my money, so was the NEW Show.

S. I. NEIMAN

ELECTRONICS INFORMATION BUREAU

MOVING ?

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

SERVICE

technicians know that Color TV repair demands more time and effort. That's why Sprague strives to simplify Color TV capacitor selection.

COLOR

TV capacitors by Sprague come in the exact ratings required to meet the exacting requirements of Color TV.

TV

service becomes more demanding as Color TV keeps expanding. That's why exact capacitor ratings are important. They help you to restore original set performance.

EASIER

selection of replacement capacitors for Color TV is assured when you look to the broad Sprague line. You'll get the capacitor you need—when you need it—every time.

Just off the press! See your Sprague Distributor for a free copy of our new 40-page K-110 Twist-Lok[®] and Print-Lok[®] Capacitor Replacement Manual, or write to: Sprague Products Company, 65 Marshall St., North Adams, Mass. 01247

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SEPTEMBER 1971, ELECTRONIC TECHNICIAN/DEALER | 27

Industry Work to Develop Voluntary Self Regulation

Let's face it, there are electronic technicians who, due to unethical practices and technical incompetency, are making a bad name of our profession. (Reference to this problem is mentioned this month in the Editor's Memo.) The problem is not uniquely ours. We can easily point our finger at the mechanics servicing automobiles, physicians, etc., etc. . . . and rightly say that their hands are not clean either.

One point that Morris Finneyburgh, Sr. (an industrialist that the electronics industry has honored in their Hall of Fame for advocating the cause of electronic technicians) stressed in a recent interview was that we are guilty of cowering to such criticism. We tend to hide our heads in the sand, failing to realize that the public is pointing many fingers in many directions and failing to join together to improve our public image (and in the process our income as well).

The March and April 1971 issues of ELECTRONIC TECHNICIAN/DEALER gave considerable attention to some very important meetings held last February in Dallas. At these meetings a great deal of attention was given this problem, and plans were begun for upgrading the technical competency of electronic technicians, for uniting the trade associations so that they can more effectively represent you, and for developing a program for self policing.

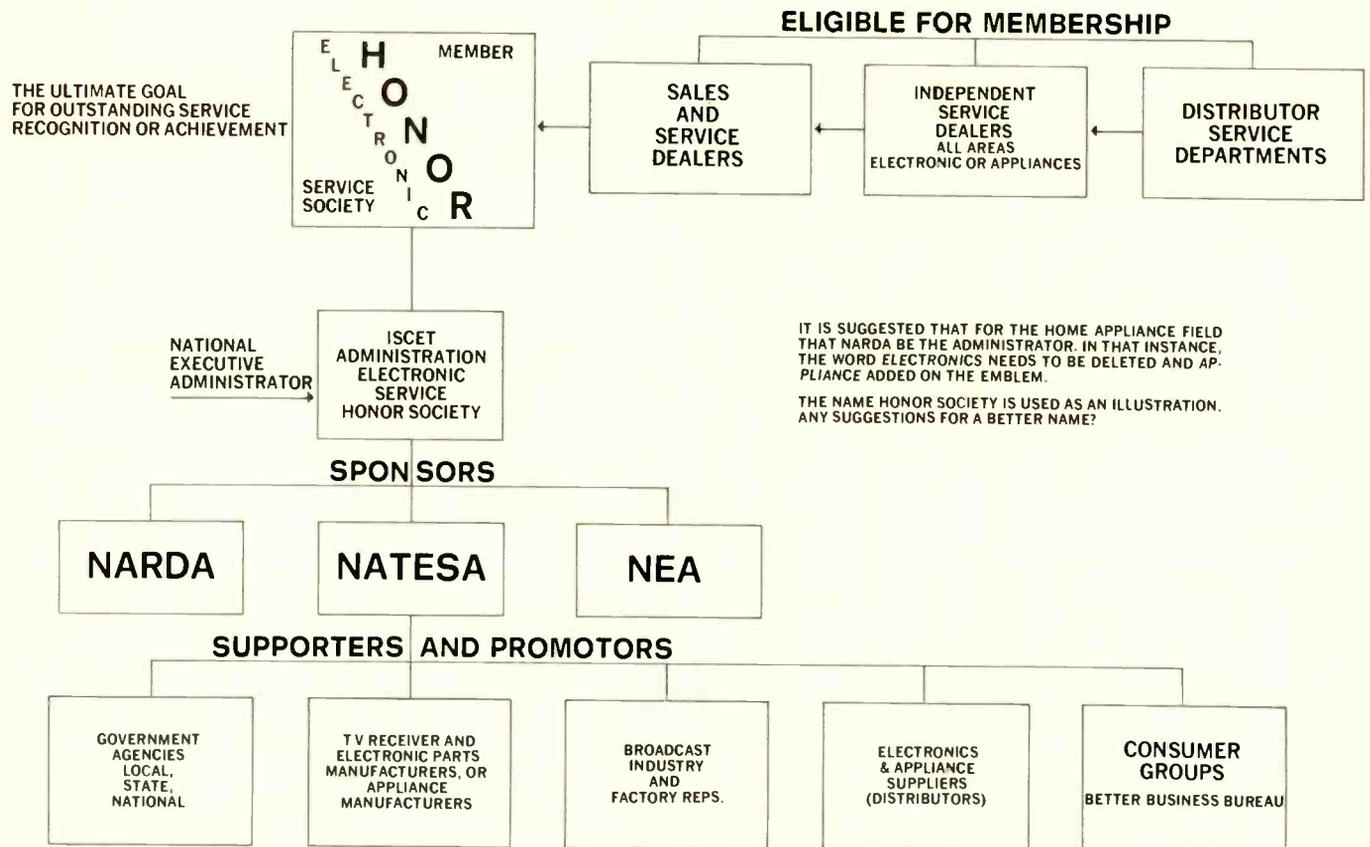
We are certain that the blood pressure of some of our readers has risen a point or two with our coverage of this subject. If this results in some action, then good! These trade associations are representing you. Although in our support of you we promote many of their projects, it's their members that determine what they do. So, whether you strongly agree or disagree, write them directly, with a car-

bon to us, and join the local chapter of the appropriate group. These associations include the National Electronic Associations, Inc. (NEA), National Alliance of Television & Electronic Service Associations (NATESA), and National Appliance & Radio-TV Dealers Association (NARDA). They will reply to your comments and advise you concerning the location of your local association. Ed.

Members of the Industry Wide (Consumer Electronic Service Industry) Investigative "Self-Regulation" Committee, representing NEA, NARDA and NATESA, include the following: Chairman: Mr. Charles R. Couch, Jr. CET, P.O. Box 536, Gainesville, Fla. 32601. Co-chairman: Mr. M. L. Finneburgh, Sr. EHF, 34 W. Interstate St., Bedford, Ohio 44146. Other members include officers of the three associations: Mr. Dick Glass CET, Executive Vice President, NEA, 1309 W. Market St., Indianapolis, Ind. 46222; Mr. Frank Moch, Executive Director, NATESA, 5906 S. Troy St., Chicago, Ill. 60629; and Mr. John Gooley, Assistant Executive Director, NARDA, 318 W. Randolph St., Chicago, Ill. 60606. Also included are: Mr. Norris Browne CET, Mr. W. S. Harrison, Mr. Virgil Gaither CET, Mr. Emmett Medford CET, Mr. Lew Russell CET, Mr. Les Nesvick CET, Mr. Fred Watjen CET, Mr. C. J. Rucker CET, and Mr. Everett Pershing CET.

At a banquet closing the April NARDA Convention, Mrs. Virginia Knauer, special assistant to the President of the United States on Consumer Affairs, said, "If your industry knows all about the problems that consumer groups are shouting about, why haven't you done something about them before they grew to such proportions at the government level?" She continued by saying, "The time is late, because there are many bills on the 'hill' that will make you do the things you say you cannot do."

continued on page 33



Cut arc-back in TV damper circuits with RCA tubes...

6AF3

6AY3B

6BS3A

6CG3/6BW3

6CJ3/6CH3

6CL3

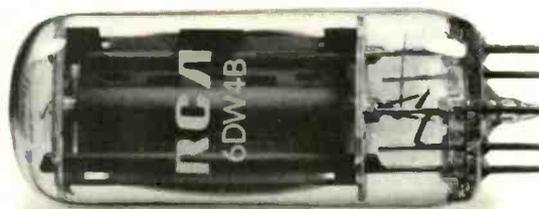
6DW4B

17AY3A

17BE3/17BZ3

17BS3A/17DW4A

All have the pre-coated cathode!



These are the 10 most popular industry types for TV damper circuits. The cathodes in these RCA tubes are pre-coated to reduce arcing.

A special manufacturing process pre-coats the cathode and pressure-welds the coating. This produces a smooth, uniform surface that virtually eliminates arcing.

In every way, the quality that goes into these tubes backs up your reputation for quality work. Systematic

parts inspection, tough environmental testing, sample life testing . . . these are some of the ways we build quality in and then check it out.

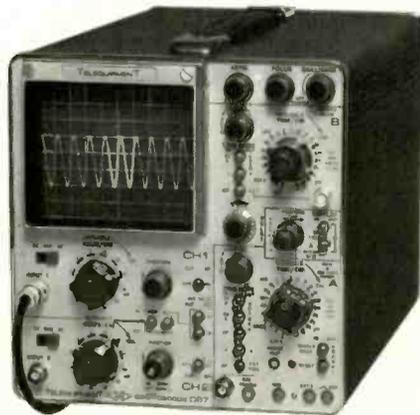
See your RCA tube distributor for the complete line of RCA tubes for damper circuits, high-voltage circuits and all your other tube needs.

RCA | Electronic Components | Harrison, N.J. 07029.

RCA

NEW AND NOTEWORTHY

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



DUAL-TRACE OSCILLOSCOPE

Has a rectangular
5-in. CRT face

700

The dual-trace solid-state scope, Model D67, is designed with a 25MHz bandwidth, 10mv sensitivity and delaying sweep. The rectangular 5-in. CRT face reportedly has a display area of 8 by 10cm. Specifications indicate a measuring accuracy of 3%, a vertical signal delay line and a regulated power supply. Other specifications indicate that the vertical trace drift is minimized by using FET inputs plus a range of sweep rates from 2s/cm to 0.2 μ s/cm, delayed sweep and a 14ns risetime. The unit weighs 25 lb and is priced at \$975. Tektronix.

TWO-CHANNEL RECEIVER 701

Designed for VHF TV sound and
FM Broadcast reception

The Video-Voice, Model RV-04, a solid-state dual-band VHF TV sound and FM Broadcast portable receiver, is designed with a VHF and FM monopole antenna and a 3-in. speaker. Reportedly operated on batteries, the unit measures 5 in. H by 5 in. W by 5 in. D. Price \$24.95. Concept Plus.

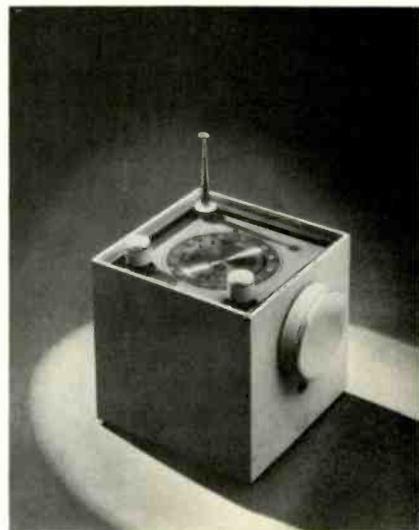
FOR MORE NEW PRODUCTS SEE PAGE 60



FREQUENCY COUNTER 702

Designed with a frequency
range of 5Hz to 32MHz

The Model 1250 frequency counter, designed for bench and field servicing, reportedly features solid-state LED readouts, storage circuitry for non-blinking readout, four ranges with automatic decimal positioning, and a carrying handle that can be converted to a tiltstand. Specifications indicate a frequency range of 5Hz to 32MHz with an input impedance of 1M shunted by 30pf. Other specifications indicate an input sensitivity of 250mv rms with a power requirement of 115v or 230v, 50 to 60Hz. Dimensions for the unit are 7 in. W by 3 in. H by 7 in. D, and weight is 4 lb. Price \$395. Weston Instruments.



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HOME TV/FM MULTIPLE SET AMPLIFIERS

Amplifies TV/FM signals for distribution to every set in the house!

Solid state design meets the most demanding reception conditions
Five different models for every reception requirement

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FOR COLOR TV . . . BLACK & WHITE TV . . .
FM/FM STEREO



G-922

300 ohm system, VHF-UHF-FM, 300 ohm input and four 300 ohm outputs using twin lead wire.
List \$43.95

G-923



75 ohm system, VHF-UHF-FM, 75 ohm input and four 75 ohm outputs using coaxial cable.
List \$46.95

G-924



75 ohm system, VHF-UHF-FM, 75 ohm input and single 75 ohm output using coaxial cable.
List \$45.95

G-920



300 ohm system, VHF-FM only, 300 ohm input and four 300 ohm outputs using twin lead wire.
List \$33.95

G-921



75 ohm system, VHF-FM only, both 75 ohm and 300 ohm inputs and four 75 ohm outputs using coaxial cable.
List \$39.95

WRITE DEPT. 110-9 FOR CATALOG NO. 20-594.



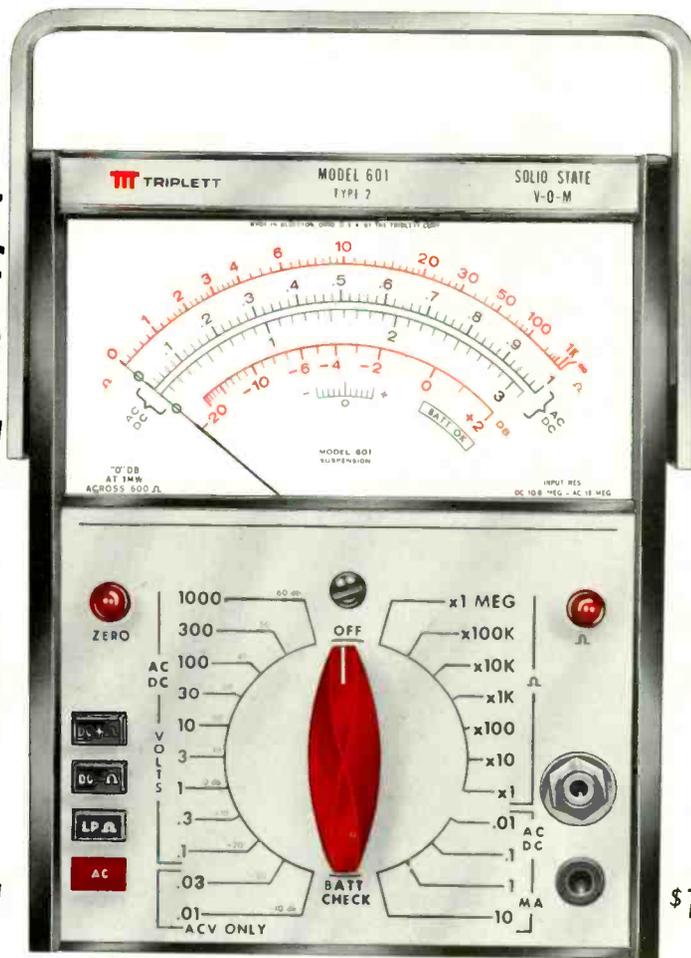
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If your problem
is in-circuit
testing of
transistorized
and integrated
circuits . . .
Solve it with
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Model 601

\$166

1. Low power ohms — 7 ranges with 75 mV power source.
2. High sensitivity — 10 mV AC full scale at 10 megohm input impedance; 100 mV DC at 11 megohm input resistance.
3. Simplified scale — only 4 arcs for all 53 ranges.

It has 7 low-power resistance ranges that apply only 75 mV to the device under test . . . does not activate or damage solid-state component . . . full-scale DC measurements down to 100 mV and 10 μ A and AC as low as 10 mV and 10 μ A, it's obvious the Model 601 was designed for in-circuit testing.

Add such features as 10 megohm input impedance on AC

and 11 megohm input resistance on DC, voltage readings to 2% DC and 3% AC (current: 3% DC and 4% AC), separate range-selection and function-selection switches, and a simplified dial on which all 53 ranges are read on only 4 scales, and it's equally obvious that here's a V-O-M that has what you need to do the job better, faster and more easily.

See the capable Model 601 —

priced at \$166 — at your local Triplett distributor. For more information, or for a free demonstration, call him or your Triplett sales representative right away. Triplett Corporation, Bluffton, Ohio 45817.

TRIPLETT

The World's most complete line of V-O-M's . . . choose the one that's just right for you

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continued from page 28

The chairman of the recently formed self-regulation committee has prepared a self regulation plan (as shown in the block diagram). Although the International Society of Certified Electronic Technicians (ISCET) mentioned in the diagram is currently associated with NEA, he feels that the tie is so tenuous that this society would be concerned with electronic technicians in general and not the special interests of each of these three associations.

Some of the points presented by the chairman as a partial approach to self regulation include the following:

- Get TV set manufacturers to recommend and push CET's to the consumer in their instruction manuals.
- Interest and secure the help of the broadcast industry in pushing CET's. Their audience will benefit from it.
- Pave the way for Better Business Bureaus and other prospective consumer organizations to recommend CET.
- Change CET status to where moral character and integrity are part of becoming a CET. Likewise, make it grounds for revoking a CET certificate.
- Influence states with licensing examinations to be willing to accept a CET in waiver of the state examination, after paying the license fee.
- Continuously upgrade CET examinations to keep up with technological engineering and scientific advancements taking place every second in the industry.
- Interest bright, intelligent young men to become electronic technicians by improving the image of our profession in the consumers' and manufacturers' eyes.
- Provide self regulation. If the industry does not control itself, the government at all levels will. Government restriction can and will be more expensive to operate under.

Frank Moch suggests that the industry adopt the NAT-ESA Codes of Ethics. In the Chicago Chapter, these include the following:

- Employ qualified personnel to assure proper service. No student shall be passed off as a technician.
- Make proper arrangements for the protection of reserve funds on contracts.
- Carry adequate insurance coverage.
- Avoid trick advertising which offers to service or deliver materials under conditions which are questionable or unfair to the set owner or your fellow members.
- Employ professional methods of doing installations and maintenance.
- Issue a standard guarantee.
- Have available sufficient and proper test equipment to assure a good job.
- Maintain an adequate service data library.
- Render service without undue delay.
- Install only parts as are really necessary. Use only new parts of a quality at least equal to original.
- Leave with, or return to customer, all parts replaced, when requested (except where impractical).
- Issue an itemized bill.
- Furnish estimates upon request.
- Service sets in home whenever possible.
- Be honest, courteous and treat each customer in a professional manner.
- Observe the Golden Rule.

Under NATESA's plan of self licensing, each member restates his adherence to the code of ethics of his group, agrees to abide by the Better Business Bureau's rules for advertising and guarantees to abide by the decisions of a duly constituted grievance committee in any case of customer complaints. He further gives to the license authority power of attorney to act if he violates his agreement. The

latter is the teeth that makes the plan acceptable to the public.

Further committee action is required before any final proposal can be submitted to the appropriate associations for final action. Your efforts to assist the committee members as they develop a plan are welcome. (If you wish, you may send carbons of your letters to our attention, addressing them to: Phillip Dahlen, Editor, ELECTRONIC TECHNICIAN/DEALER, 1 E. First St., Duluth, Minn. 55802.)

National Electronic Associations Holds Seventh Annual Convention

On July 17th, the National Electronic Associations, Inc. (NEA) reelected Norris Browne, CET as its president and retained Emmett Mefford, CET as its vice president. Henry Hyde, CET was elected secretary and Tom Cooper, CET was elected treasurer. Also elected were eight regional vice presidents.

In the June issue of ELECTRONIC TECHNICIAN/DEALER, we indicated that, "... those attending the convention will be learning the business practices of others in the industry in an informal manner while at the same time taking part in family fun, deep sea fishing, bowling, golf tournament, Indian Bar-B-Que and sight seeing trips." And as you can see from the photos, that is just what they did!

However, a lot of significant business activity also occurred during the convention. (Two other news items in

continued on page 47

your NORTRONICS distributor is the best source for professional tape heads!

Nortronics... world's leading designer and manufacturer of magnetic heads... offers the precise replacement head for virtually every professional recorder... heads that provide outstanding performance, longest life and easy replacement with minimum downtime.



Nortronics' distributors stock the 'right' replacement head for your professional recorder—be it Ampex, Mag-necord, Scully, Concertone, Gates, Crown, RCA, ATC, Collins, KRS, Macarta, MCI, Tape-a-Thon, Sparta, Tape-caster or any other!

See your Nortronics distributor today for professional reel-to-reel or cartridge head requirements. He also carries a complete line of Nortronics accessories and offers head relapping services.

world's leader in magnetic heads



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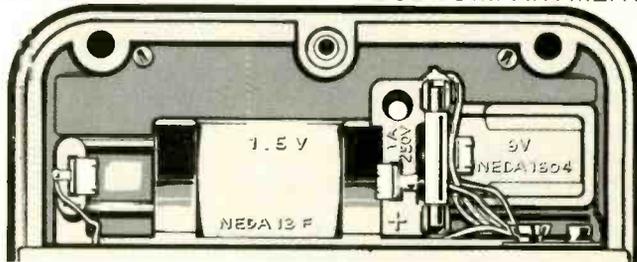
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SERIES 6
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THE NEW SERIES 6 HAS ALL THESE NEW FEATURES PLUS ALL THE ADVANCEMENTS IN THE SERIES 5:

- External access battery and fuse compartment.
- Clip-type fuse holder.
- 0-1 volt DC range.
- 0-500 volt AC and DC ranges.
- Available 5000 volt adapter-type DC safety probe.
- Multi-purpose, screw-on test leads with combination probe and alligator clips.
- Only 2 batteries . . . one 9-volt NEDA 1604 and one 1½-volt "D" cell.
- Rugged taut band movement.
- Varistor overload protection.

260-6 \$65.00
260-6M (Mirror scale) \$67.00

EXTERNAL BATTERY AND FUSE COMPARTMENT



260-6RT (Roll-top protective case) \$71.00
260-6MRT (Mirror scale and roll-top case) \$73.00
260-6P (Overload protected) \$97.00
260-6PRT (Overload protected and roll-top case) \$103.00
Safety Probe: 5000 volt DC adapter type #00506 \$4.50

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TEKLAB REPORT

Exploring Zenith's Titan 110 Color-TV Chassis

by Joseph Zauhar

Five plug-in modules employing plug-in transistors and integrated circuits provide for easier and simpler servicing

■ As new color-TV receivers appear on the market, it is very obvious that modular solid-state circuitry will soon dominate the color-TV field. As an example, Zenith has just introduced its first all solid-state color chassis, called the Titan 110, employing five modular circuits.

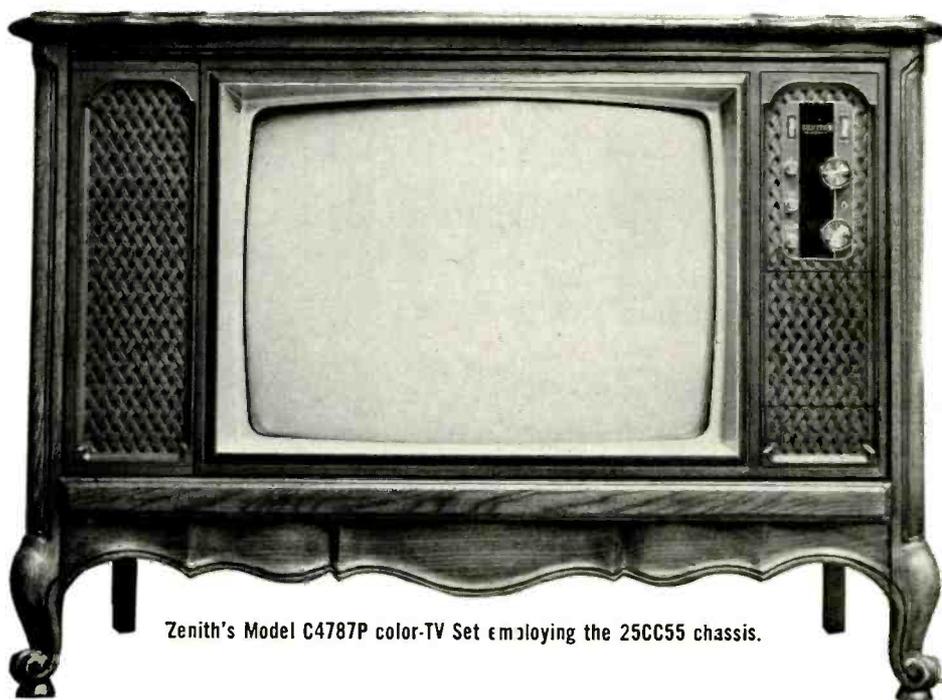
After reading the product releases with great interest, we ordered Zenith's Model C4787P console color-TV set, employing the 25CC55 chassis. Upon viewing this TV set from the front, we noted

that it has many useful features—not only for the customer, but the service technician as well. Their adjustments are simplified with the use of new TINT, COLOR LEVEL, BRIGHTNESS, CONTRAST and VERTICAL HOLD controls. By turning each control until its red-line indicator is in the 12 o'clock position, a satisfactory picture is obtained—or the control can be adjusted to customized setting if they are desired. By removing two screws (Fig. 1), the speaker can be removed to provide access to the convergence board for up-front adjustments.

The 25CC55 chassis that we examined (Fig. 2) is of all solid-state design similar to last year's 40BC50 chassis. But since that chassis was never produced in commercial quantities, the 25CC55 can be considered a new chassis.

This chassis employs five plug-in integrated circuits and five Dura-Modules (Fig. 3). These snap-in modules provide both a carrier and interconnecting system for a number of solid-state circuits. The transistors and integrated circuits plug into sockets on the modules, thus eliminating the need to remove the modules for the replacement or testing of components.

The CRT socket (Fig. 4) incorporates several 1K resistors at the pin terminals of the CRT elements for improved arc protection. Should



Zenith's Model C4787P color-TV Set employing the 25CC55 chassis.

an arc occur in the picture tube, its energy should be dissipated across the resistor near the source of the arc. Spark gaps are also employed at each end of the resistors to dissipate any energy that is not fully dissipated by the resistors.

Power Supply

The power supply employed in this chassis is quite similar to the supply used in the 40BC50 chassis but with a few significant changes. A simplified schematic of this power supply is shown in Fig. 5. Voltage feedback is not utilized and a zener diode is used as a voltage reference. A zener diode (Z1) is used in the input and transistor TR1 acts as a constant voltage generator. The emitter of TR1 is a fixed voltage source (E1), and the current has to be amplified to supply enough current (up to 15ma base current for a 450ma output) to transistor TR3. Transistor TR2 is the second current amplifier.

Transistors TR2 and TR3 have a minimum current gain of 30. With both current gains multiplied, the minimum total gain will be 900. If the maximum current through TR3 is equal to 450ma, then with a gain of 900 the base current drawn from TR2 will be 450/900 or 0.5ma. This load will reflect back to the voltage divider, located at the emitter lead of TR1, which passes a minimum current of 10ma. This means that the maximum output load will offset the voltage of the divider by no more than 5 percent, or 6v, because of the 120Ω, 22w resistor in parallel with TR3 and the gain of TR2 and TR3.

An "instant on" feature is employed in this chassis—requiring the use of an additional transformer which supplies only the filament voltage for the CRT (approximately 4.8v when the receiver is turned on). A winding in the main power transformer—which is connected in series with the additional transformer—adds approximately 1.5v to the CRT filament source to obtain the 6.3v required when the TV set is used.

Horizontal Circuitry

We found the horizontal circuitry similar to that employed in the

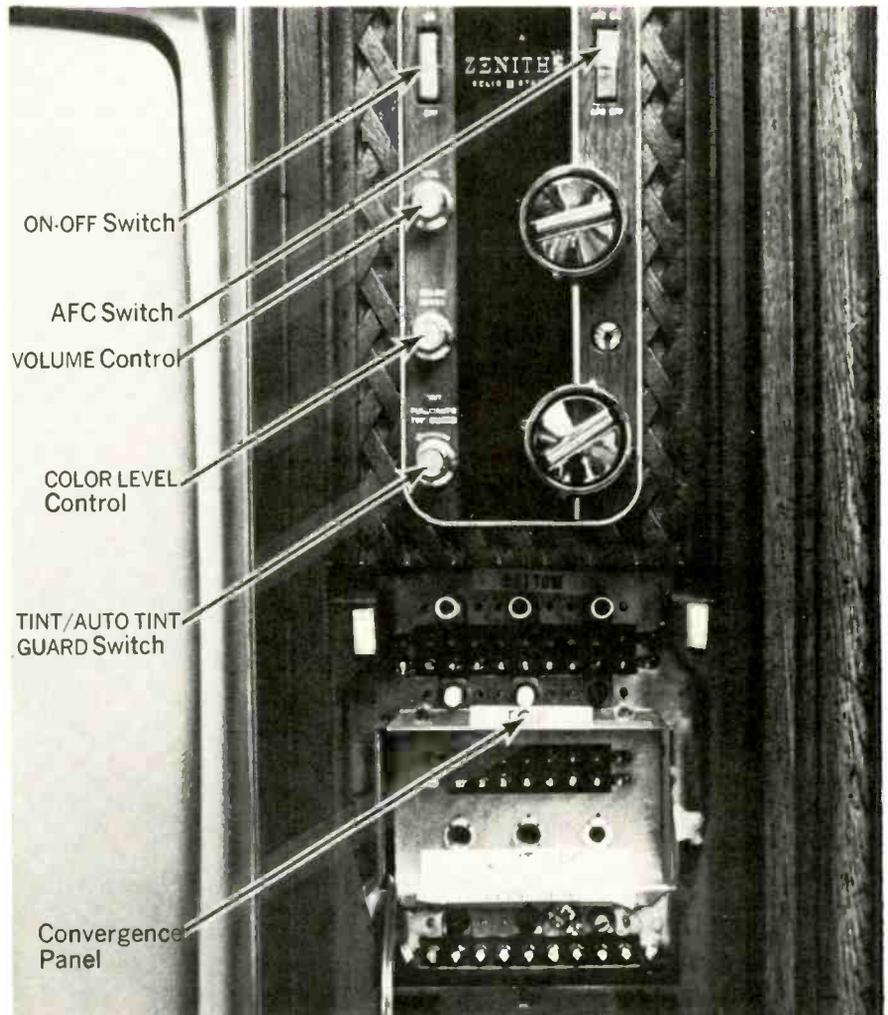


Fig. 1—After removing two screws, the speaker can be removed to expose the convergence board for up-front adjustments.

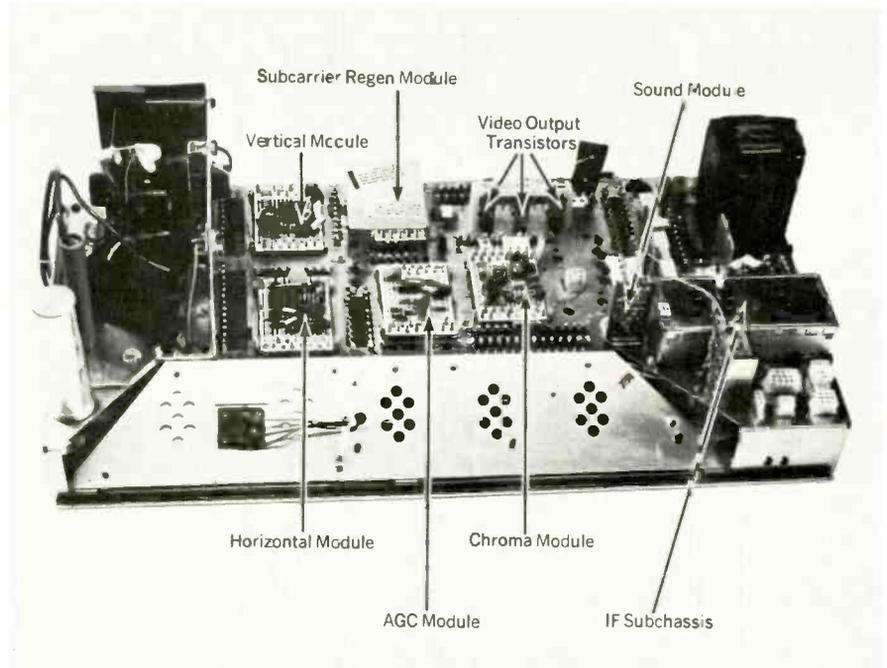


Fig. 2—Zenith's 25CC55 fully solid-state color-TV chassis features a unique system of five integrated circuits and plug-in Dura-Modules.

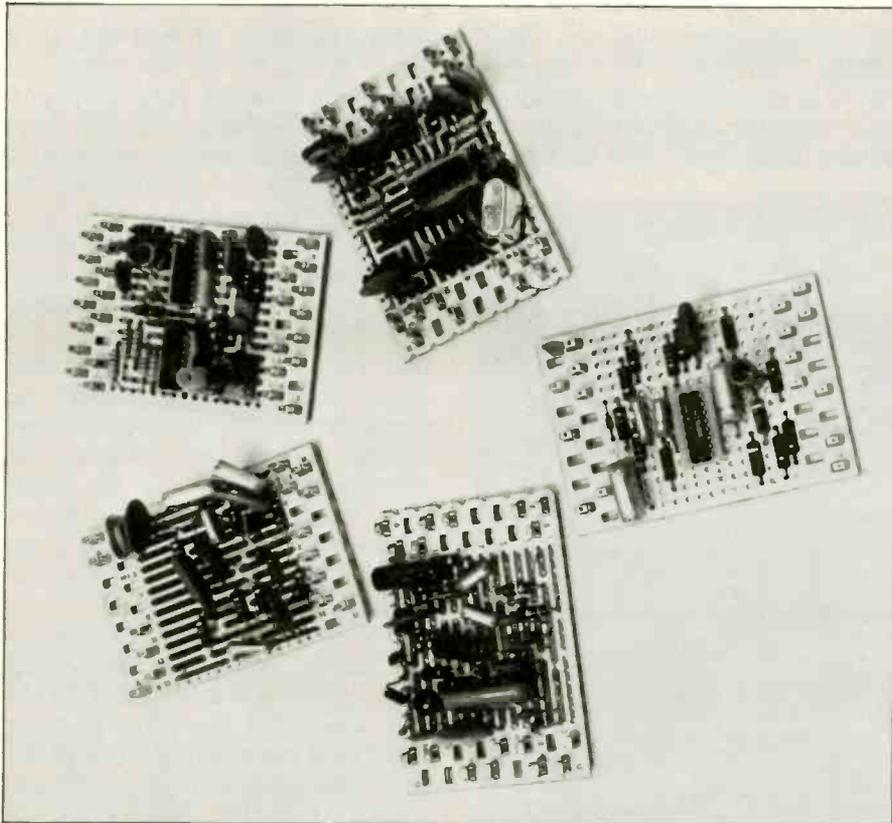


Fig. 3—Five snap-in modules provide both a carrier and interconnecting system for a number of solid-state circuits.

40BC50 chassis. Although some capacitive values in the output circuitry were changed to optimize performance, the circuit operation is identical. To improve the horizontal phase lock, the AFC transistor's forward bias circuitry was modified.

In some TV sets, part of the horizontal sweep circuitry is mounted on a module assembly, Part No. 9-57 (Fig. 6), as used in the chassis for our report, but an alternate Part No. 9-70 is also used with the sweep circuitry incorporated on a substrate (thick film) soldered to the module. The horizontal output stage, flyback, damper, focus and related circuits are all chassis mounted (Fig. 7). This chassis contains no high-voltage adjustment. High-voltage regulation is accomplished by regulating the B+ and using a flyback that is tuned to the fifth harmonic of the pulse frequency. This provides inherent regulation without a separate regulatory stage.

The horizontal output transistor, Q216 (Fig. 8), is driven into saturation by the positive-going portion of the square wave coupled to its

base from transformer T206. This "loads" the primary winding of the flyback transformer, causing increased current flow until the positive going square wave at the base of Q216 swings negative. The same current flow also occurs in the yoke and causes the CRT beam to be deflected from center to edge.

When this occurs, transistor Q216 is completely cut off and the magnetic field in the flyback collapses. The collapse causes a positive high voltage of very short duration to be generated and applied to the collector circuit of Q216 (retrace interval). The build up and collapse of voltage (about 1kv) takes approximately 12 μ s. Since this is a tuned circuit, the positive half cycle then begins to swing negative, but damper diode CR217 now becomes forward biased and this causes a "reverse" current flow through the yoke. The reverse current drives the beam spot through the first half of the horizontal scan. As previously stated, the beam is scanned from center to right side of the CRT by the yoke current that

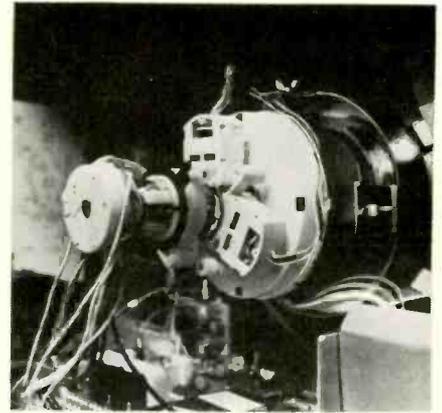


Fig. 4—The CRT socket employs several resistors and spark gaps at the pin terminals for arc protection.

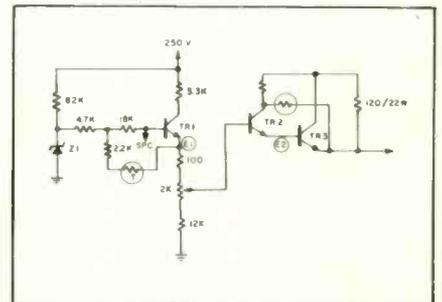


Fig. 5—Simplified schematic of the 25CC55 chassis power supply having a constant-current transistor input. Courtesy of Zenith Radio Corp.

occurs when the horizontal output transistor is in saturation.

The primary winding of the horizontal transformer and the yoke are tuned to the retrace time intervals. In transistor sets, this is usually

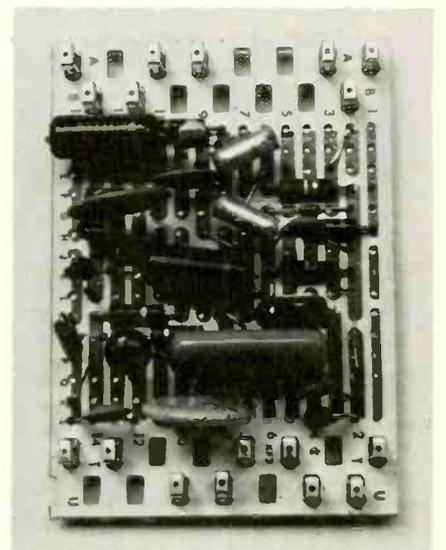


Fig. 6—The horizontal sweep module, Part No. 9-57, employs the horizontal AFC, oscillator, sawtooth shaper and horizontal-driver transistors.

about 12 μ s or about 41.5kHz. Common practice in the past has been to wind the third winding of the horizontal transformer so that its leakage inductance, the capacity of

the tertiary (third winding), high-voltage rectifier and the leads, resonates at six times the frequency of the frequency corresponding to the retrace time. Since the horizontal

output transistor is operated as a switch in this TV set and solid-state regulators have not been developed with the reliability needed, fifth harmonic tuning is used in the tertiary winding. This is accomplished by reducing the capacitance.

Since the TV set contains voltage tripler circuitry, it is able to function with a smaller tertiary winding. Only 8.5kv pulses is required to obtain 25kv. By being tuned to this upper harmonic, about 200kHz, the conduction time of the high-voltage rectifier is increased, lowering the effective impedance of the load. This is said to give much better high-voltage regulation than untuned flybacks or third-harmonic tuned flyback circuits.

The flyback circuit is also used as a source of current for the second grids in the CRT—diode CR219, with associated filters and bleeders being used to rectify a portion of the 1kv pulse generated by the flyback retrace. And the 250v supply for the other CRT grids and video output circuits is obtained by adding a small winding on the flyback, and rectifying and filtering the pulse with diode CR221, and capacitors C257 and C258. The -40v tuner bias supply is also obtained from the flyback at one of the convergence windings. This is rectified and filtered with diode CR218 and capacitors R346 and C351.

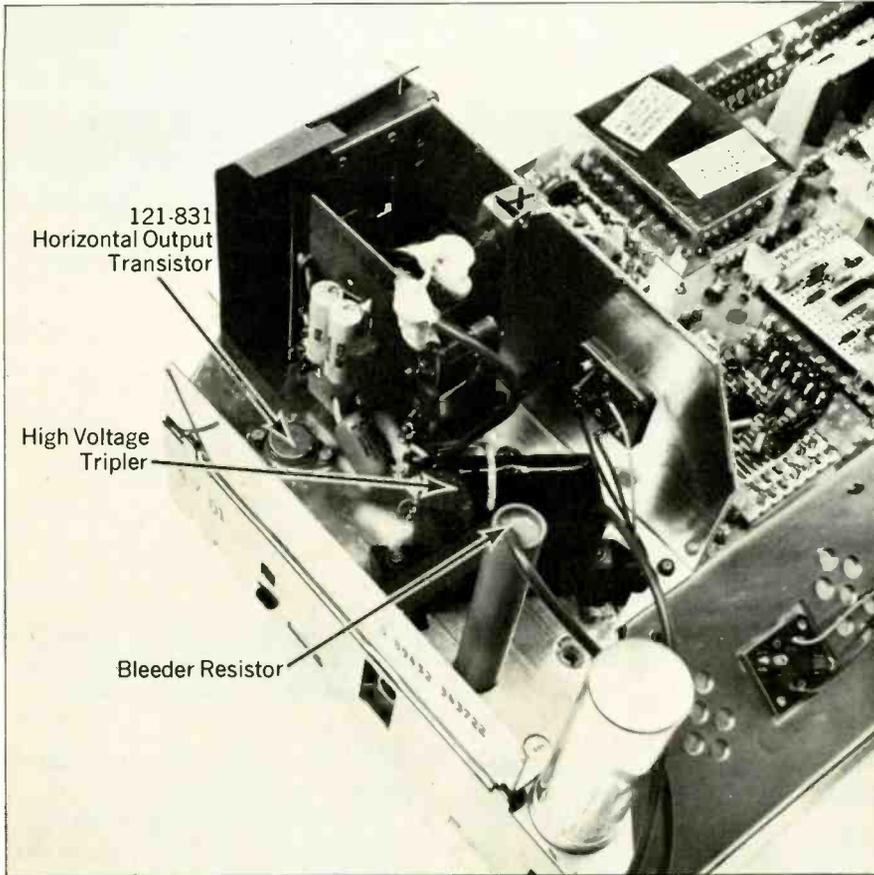
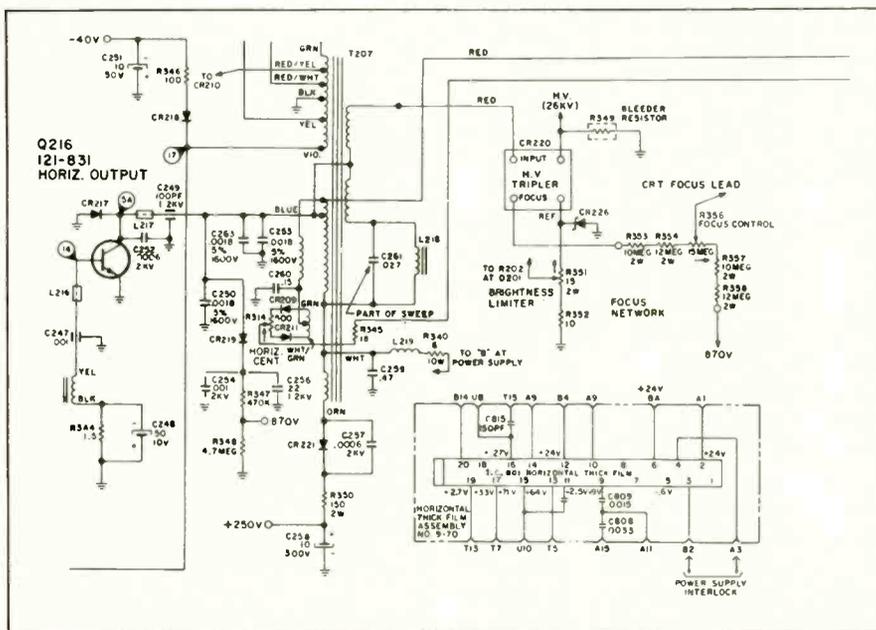


Fig. 7—The horizontal output stage, flyback, damper, focus and related circuits are chassis mounted.



3.5v to 3.75v p-p output for 90 percent modulated signals.

The AGC comparator is "gated" so that rapid alternating signals can be utilized with good noise immunity. However, two "gates" are used. To charge or discharge the AGC filter, two inputs to the comparator must be present. As with conventional circuits, the line flyback pulse must be present but additionally, the negative going separated sync pulse from the input video signal must be present. Coincidence of the two pulses will result in AGC action if the detected signal level changes.

If, however, the line oscillator is out of synchronization, no AGC action will occur until the line pulse coincides with the signal sync pulse. Thus, no sampling is accomplished during scan time. Further, whenever an AGC gating pulse is produced by coincidence of the line flyback pulse and the separated sync, not only is the AGC comparator activated but a constant-current discharge of the AGC filter occurs. This means that to maintain a control voltage on the filter, there must be a level difference between the video detector output and the reference voltage.

The discharge current is about 1.7ma and is always constant while gating action occurs. The level difference between sync tips and the reference voltage will replenish the charge lost by the filter capacitor and maintain a constant voltage on the capacitor for a given signal level.

If the signal strength at the detector increases (changing the level between sync tips and the reference voltage) additional discharge current will be provided by the AGC comparator to increase the filter capacitor voltage. This control voltage will reduce the RF and IF gain to keep the detector level constant as the AGC comparator again equals the discharge current—but at a new control voltage level. The detector level is therefore virtually constant for all signal strengths and control voltages.

The filter control voltage is amplified and "buffered" (a circuit used to prevent interaction between two stages) before application to the IF and RF amplifiers. As with

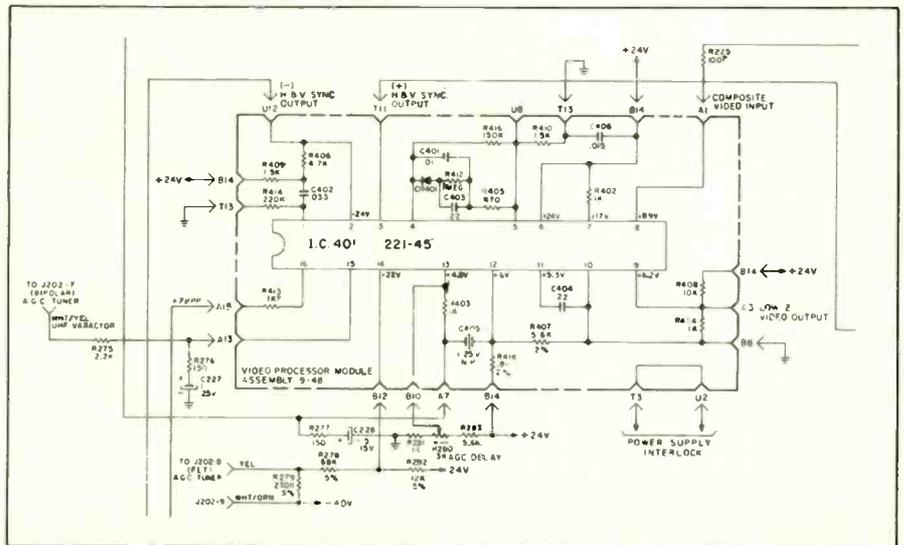
conventional discrete circuits, the AGC voltage is fed initially to the IF amplifier and then, after a suitable delay, applied to the RF amplifier. The delay point is adjustable by an external control, and positive-going or negative-going RF control voltages are available. When the sync tip level at the detector is below the required threshold level (i.e., very weak signals), the filter voltage is maintained at the correct level to ensure maximum signal gain of the RF and IF systems (for maximum sensitivity) by an externally

adjustable clamp voltage.

While gating the AGC comparator with sync pulses limits the period during which the system is susceptible to impulse noise to merely 20 percent of the signal time, additional techniques are employed for improved noise performance.

When the noise pulse amplitude exceeds a certain threshold level below sync tips, a noise pulse is developed. This pulse is amplified, "stretched" (i.e., increased in width) and inverted. Simultaneously, the

continued on page 74



An Alternate Solution

by Phillip Dahlen

Sometimes you just can't use a roof antenna

■ Just about all electronic technicians will agree that a good roof antenna is a *must* if you are to obtain the best possible, interference-free color-TV signal. There are, however occasions when you may encounter customers who either fear

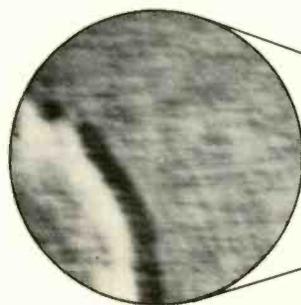
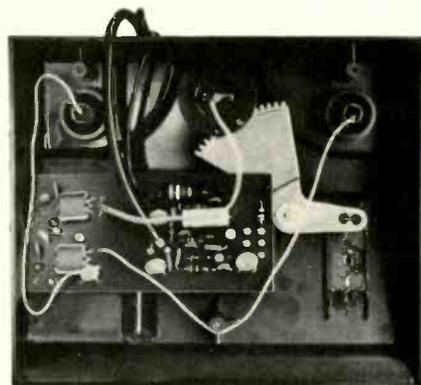
repercussions from their landlord should they attempt a roof installation, or loss of the antenna should they move in the near future. For similar reasons, it may not be feasible to make an attic installation (a second best installation).

As an alternate solution, Channel Master has developed a transistorized indoor antenna for use on top of a TV set. The antenna has controls for rotating the UHF antenna, switching the amplifier between UHF and VHF functions, and tuning

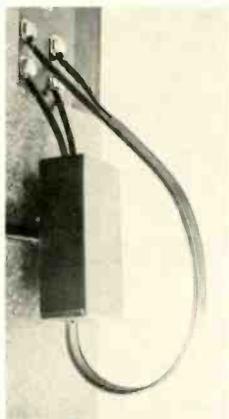


Channel Master's transistorized Super Chroma 82 antenna contains controls for rotating the UHF antenna, switching the amplifier between UHF and VHF functions, and tuning the circuitry for best reception.

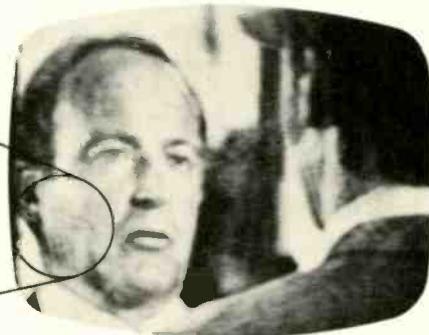
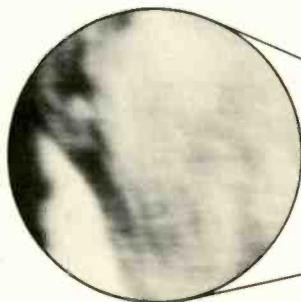
The complete solid-state amplifier is housed within the base of the antenna.



On one channel, the rabbit ears built into the TV set are unable to adequately receive the high-quality signal transmitted by the station.



A shielded cable is used between the amplifier and the UHF/VHF splitter at the back of the TV set—thus preventing feedback between the input and output of the antenna amplifier.



By substituting the transistorized antenna for the rabbit ears (and operating its elements at the same length as the rabbit ears), a much better picture is received from the same station.

ing the circuitry for best reception. To prevent feedback between the input and output of the antenna amplifier, a shielded cable is used between the amplifier and the UHF/VHF splitter at the back of the TV set.

Although accurate specifications can always be written so that they sound impressive, the proof really comes in seeing how the product actually performs. It was therefore decided to take the antenna home—10 to 12 miles from a hill where all of Duluth's TV transmitters are located.

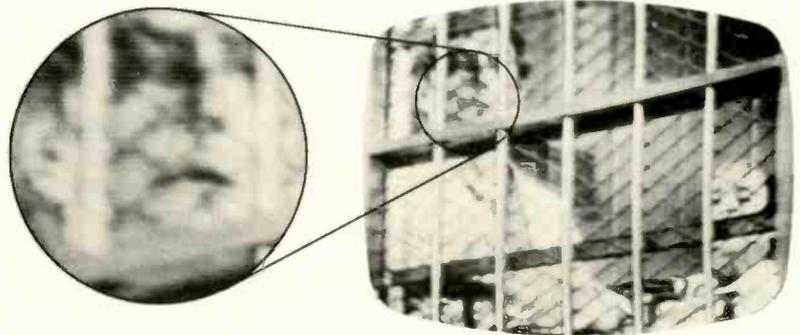
The house that we purchased last spring came with a large directional antenna with a twin-lead to the living room. Unfortunately, there has never been enough free time available to run another wire to the bedroom for our second color-TV set (not that TV programs are watched much in either location). And by using merely the rabbit ears built into the second TV set, we have never been able to obtain ideal color-TV reception. However, we have found that a *far* more satisfactory picture can be obtained by substituting the transistorized antenna. As shown on this month's cover, we were also able to obtain satisfactory color-TV reception in the living room when substituting the transistorized antenna for the roof antenna.

Only one slight problem was encountered when using the transistorized antenna on the second TV set. (This problem may have resulted from some minor defect in the particular sample used, had something to do with the design of our second TV set, or been the result of using unshielded lead-in wire from the antenna on the roof above to the TV set in the living room.) Whatever the cause, we discovered that when the second TV set was turned off, certain settings of the antenna's amplifier (while connected to that set) would produce beat patterns in the

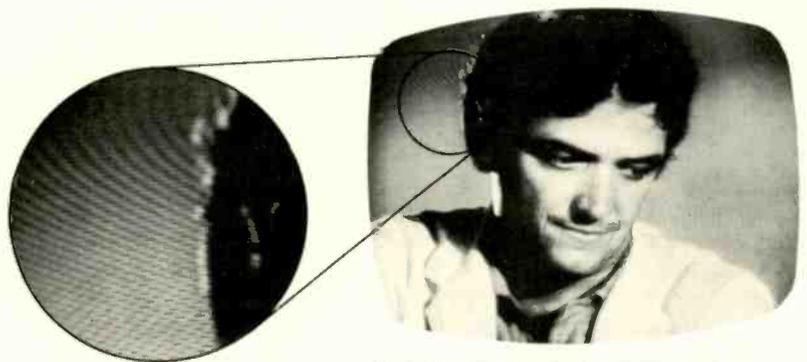
picture of the living room TV set, about 50 ft away. Retuning the amplifier completely eliminated this interference. Whatever its cause, this interference is certainly not a problem that will be experienced in a home having but one TV set, or

where TV sets are an adequate distance apart.

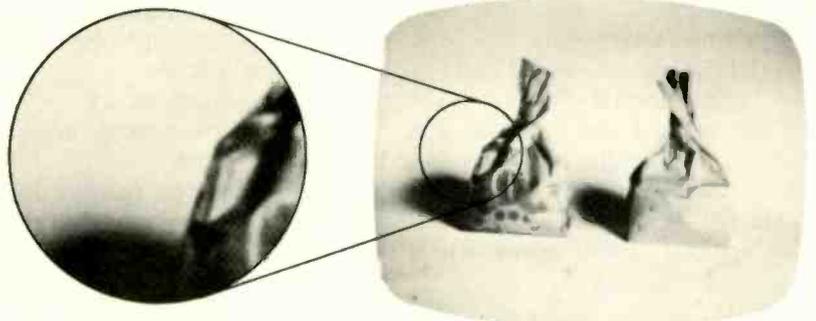
We have been quite pleased with the transistorized antenna, and hope to continue using it until there is time to make an additional connection to our roof antenna. ■



Reception with the transistorized antenna is improved by changing the TV set to another channel.



Using the transistorized antenna results in a slight interference pattern on the other TV set.



No interference pattern can be seen on the other TV set after retuning the transistorized antenna.

The CAT Game -- Part II

by Lambert C. Huneault

C.A.T.—Circuit Analysis and Troubleshooting—is the name of the game. The first quiz (October 1969 issue of ELECTRONIC TECHNICIAN/DEALER) dealt with a vacuum-tube TV set. Now, for the sake of variety and to bring your troubleshooting up-to-date, this second game is based on the schematic diagram of a solid-state TV set.

■ The following 20 multiple-choice questions test your understanding of circuit functions and your ability to predict the symptoms expected from component failures. At the end of this question section, answers are given along with explanations which, we hope, will shed some light on transistor circuit behavior and general transistor TV theory.

We hope you enjoy the game. . . . Good luck!

Questions

- Horizontal damper diode X12 opens. There will be . . .
 - no raster
 - white vertical bars on left side of raster
 - narrow raster (shrinks in from the sides)
 - little noticeable effect
- Capacitor C86 opens (located near horizontal phase detector diodes).
 - no raster
 - picture breaks into diagonal bars
 - raster okay, no picture (blank white screen)
 - piecrust (geartooth) distortion in picture
- The 33K resistor opens in the base circuit of the video-output transistor.
 - no raster
 - no picture, sound and raster normal
 - washed out picture with only bright highlights visible on a gray background
 - little noticeable effect
- Capacitor C49 opens (near

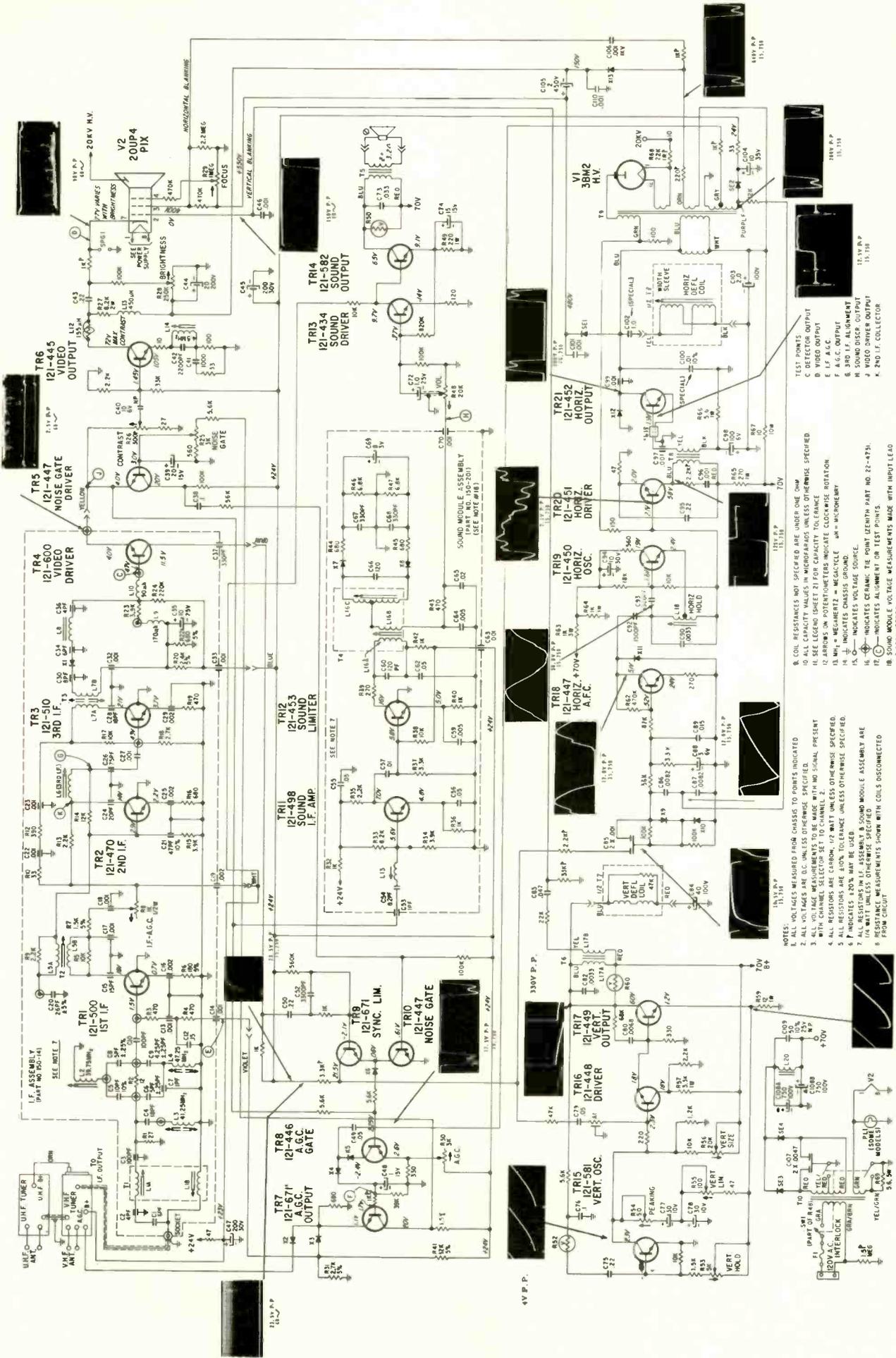
AGC Gate transistor TR8).

- no raster, sound okay
 - no picture, sound and raster normal
 - picture snowy, sound okay
 - "overloaded picture," i.e., picture has excessive contrast, or, depending on signal strength, may even turn "negative" (white-and-gray scrambled picture) with buzz in the sound
- The 2.2K resistor opens in the base circuit of the video-output transistor.
 - no picture, no sound
 - no picture, with sound
 - no raster
 - "white crushing" (no intermediate contrast values); most of the picture is uniform white, with only the very darkest picture areas showing as dark gray.
 - Damper diode X12 shorts.
 - picture very non-linear, horizontally
 - no raster
 - raster slightly narrow, with white vertical bars on left side
 - narrow raster (lacks width)
 - The 100K resistor opens in the base circuit of Noise Gate Transistor TR10.
 - picture snowy
 - picture okay, noise in the sound
 - no sync (picture rolls vertically and slips horizontally)
 - picture okay on strong, noise-free signals, but sync unstable on weak, noisy signals
 - Electrolytic capacitor C74 shorts

(emitter circuit of audio-output transistor TR14).

- picture okay, no sound
 - no picture, no sound
 - picture okay, distorted sound
 - little noticeable effect
- Capacitor C76 shorts (above vertical oscillator transistor TR15).
 - non-linear vertical deflection
 - picture rolling vertically
 - no vertical deflection (bright line only, at center)
 - picture shrinks about 3 in. from the bottom
 - Capacitor C100 opens (collector circuit of horizontal output transistor TR21).
 - no raster
 - raster lacks width
 - no noticeable effect
 - horizontal sweep badly non-linear
 - Capacitor C110 shorts (located to the right of high-voltage rectifier tube V1).
 - raster blooming and out of focus
 - retrace lines visible through the picture
 - raster okay, no picture (blank white screen)
 - no raster
 - Electrolytic capacitor C78 shorts (in collector circuit of vertical oscillator transistor TR15).
 - no vertical deflection
 - picture rolls vertically
 - picture has excessive height (and non-linear)
 - vertical sweep non-linear and lacks height
 - Capacitor C75 opens (base circuit of vertical oscillator).
 - picture rolls (no vertical sync)
 - no vertical deflection
 - non-linear vertical sweep
 - raster lacks height
 - Capacitor C83 opens (located above the vertical deflection coil).
 - vertical retrace lines visible through the picture at low-contrast and/or high-brightness levels
 - no vertical deflection
 - no raster (not even a bright horizontal line)

The author is supervisor of the Electronics Dept., Audio Retraining Div., St. Clair College of Applied Arts and Technology, Windsor, Ontario.



- TEST POINTS**
- A DETECTOR OUTPUT
 - B VIDEO OUTPUT
 - C I.F. A.G.C.
 - D I.F. A.G.C. OUTPUT
 - E 3RD I.F. ALIGNMENT
 - F VIDEO DRIVER OUTPUT
 - G 2ND I.F. COLLECTOR
- NOTES:**
1. ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED
 2. ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED
 3. SEE LEGEND SHEET Z1 FOR CAPACITY TOLERANCE
 4. ALL RESISTORS ARE CARBON, 1/2 WATT UNLESS OTHERWISE SPECIFIED
 5. ALL RESISTORS ARE 10% TOLERANCE UNLESS OTHERWISE SPECIFIED
 6. P INDICATES 10% TOLERANCE UNLESS OTHERWISE SPECIFIED
 7. ALL RESISTORS IN I.F. ASSEMBLY & SOUND MODULE ASSEMBLY ARE 1% TOLERANCE UNLESS OTHERWISE SPECIFIED
 8. RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT
 9. COIL RESISTANCES NOT SPECIFIED ARE UNDER ONE OHM
 10. ALL CAPACITY VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
 11. SEE LEGEND SHEET Z1 FOR CAPACITY TOLERANCE
 12. ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION
 13. W.M. INDICATES WAXED CONTACTS
 14. W.M. INDICATES WAXED CONTACTS
 15. W.M. INDICATES WAXED CONTACTS
 16. W.M. INDICATES WAXED CONTACTS
 17. W.M. INDICATES WAXED CONTACTS
 18. SOUND MODULE VOLTAGE MEASUREMENTS MADE WITH INPUT LEAD DISCONNECTED

Schematic Diagram

Schematic of 1Y21B55 color-TV chassis. Courtesy of Zenith.

- (d) picture rolls vertically
15. Capacitor C50 opens (above and to the right of Sync Limiter transistor TR9).
 - (a) picture okay on strong signals, but unstable sync on weak signals
 - (b) no sync (picture rolling vertically and tearing horizontally)
 - (c) picture locking horizontally, but rolling vertically
 - (d) no picture, raster and sound okay
 16. Electrolytic capacitor C88 opens (base circuit of AFC transistor TR18).
 - (a) piccrust (geartooth) distortion in picture
 - (b) no raster
 - (c) picture tears into many diagonal bars
 - (d) picture slips sideways
 17. The 330Ω resistor opens in the base circuit of the vertical-output transistor.
 - (a) no vertical deflection
 - (b) the picture shrinks vertically (raster only about 2-in. high)
 - (c) slightly non-linear vertical sweep
 - (d) vertical sweep very non-linear with slightly reduced height
 18. Electrolytic capacitor C39 shorts (in base circuit of Noise Gate Driver transistor TR5).
 - (a) raster okay, no picture, no sound
 - (b) raster and sound okay, no picture
 - (c) picture tearing and rolling (no sync)
 - (d) no noticeable effect under normal reception conditions
 19. Capacitor C76 open (above vertical-oscillator transistor, TR15).
 - (a) no vertical deflection
 - (b) picture lacks vertical height (about 1 in. black—top and bottom)
 - (c) very non-linear vertical sweep
 - (d) poor vertical interlace
 20. Capacitor C79 open (in base circuit of Vertical-Driver transistor, TR16).
 - (a) picture rolling vertically,

but horizontal sync okay

- (b) no vertical deflection
- (c) vertical sync okay, but picture tears into diagonal bars
- (d) little noticeable effect, under normal signal-strength conditions

Answers

1. (d)—In this respect, a solid-state TV set is very different from its vacuum tube counterpart. A dead (open) damper does not mean “no raster,” because reaction scanning can continue almost unaffected in the absence of the diode, a conduction path being provided through the collector-to-base junction of the horizontal-output transistor. During the early part of the horizontal trace, when diode X12 is expected to conduct, the negative-going collector voltage forward biases the collector-to-base junction of transistor TR21—allowing yoke current to flow backwards into the collector, out of the base, and down to ground through the low-resistance base circuit. This is a rugged power transistor and can take it! Diode X12 normally produces a slight improvement in horizontal-sweep linearity by providing a parallel conduction path, but even with X12 open, the change in linearity is difficult to notice.
2. (b)—Capacitor C86 couples the sample (reference) sawtooth wave from the H.O.T. back to the dual-diode phase detector for comparison with the incoming sync. With this capacitor open, no comparison is possible; and thus no dc control voltage (AFC) is supplied to the reactance control transistor (TR18), resulting in a free-running horizontal oscillator.
3. (c)—Since this is the resistor which applies forward bias (positive dc voltage) to the base of transistor TR6, one might expect that without it TR6 could not turn ON, and therefore no picture information would appear on the CRT

screen. As a matter of fact, this would be true in the case of, say transistor TR1 (the first IF amplifier), where signals are at the millivolt level. However, in the case of TR6, the input signal supplied by the video driver is large enough, on its positive peaks (white highlights), to overcome the potential hill of TR6's base-to-emitter junction and turn the transistor ON.

4. (d)—Capacitor C49 couples the keying pulses from the H.O.T., through diode X5, to the collector of the gated AGC transistor. With C49 open, transistor TR8 does not operate for lack of collector voltage, and therefore the whole AGC system is inoperative (transistors TR8 and TR7), causing overload in the RF and IF circuits. Incidentally, X5 protects TR8 by preventing the positive AGC voltage normally produced by C49 from forward biasing the collector-to-base junction of TR8.
5. (d)—With its 33K companion, this 2.2K resistor forms the base bias voltage-divider network. Its purpose is to stabilize the bias for transistor TR6. With it open, the base voltage increases by nearly 1v, driving the transistor into saturation for all but the most negative (darkest) video input levels at the base of the transistor; i.e., all medium gray, light gray and white areas of the picture (positive-going swings of the base input signal) result in collector current saturation, and these appear as a uniform white background.
6. (b)—With diode X12 shorted, not only will there be no raster, but the H.O.T. primary winding will pass excessive current and the 10Ω, 10w resistor, R67, will glow red hot before something finally opens (maybe fuse F1, but don't count on it)!
7. (c)—This resistor is the all-important base bias resistor for transistor TR10. It normally supplies sufficient base voltage (about 0.6v) to allow the resulting low emitter-to-collector

resistance of TR10 to effectively return the emitter of sync separator transistor TR9 to ground—this provides normal sync separator action. With the 100K resistor open, TR10 turns OFF, opening TR9's emitter circuit.

8. (a)—Normally, the emitter resistor (R49) of an audio-output transistor is used only for bias stabilization (preventing thermal runaway), and so, if its bypass capacitor were to short, only a shift in operating point with some resulting audio distortion might be expected. But in this specific circuit, the dc voltage provided by R49 is also used as a bias source for the base of audio-driver transistor TR13. With capacitor C74 shorted, the 9.1v source drops to 0v, causing the driver transistor to turn OFF.
9. (c)—Transistors TR15 and TR17 constitute a collector-coupled multivibrator (emitter-follower transistor TR16 serving as an impedance-matching device), and capacitor C76 is in the feedback loop between the two transistors. With it shorted, the positive feedback signal is shorted to ground rather than coupled back to the base of TR15; thus the whole vertical deflection system is inoperative.
10. (a)—With capacitor C100 open, the horizontal-output transistor (TR21) is almost sure to break down! Normally, the back EMF causes the collector voltage to rise to a peak of about +500v during retrace. This is a very high reverse voltage for the collector-to-base junction to withstand. By acting as a partial bypass capacitor (capacitors oppose sudden voltage changes), C100 prevents the retrace pulse from rising any higher. With C100 out, the amplitude of the retrace pulse would rise beyond 500v, exceeding the maximum collector voltage rating of TR21. CAUTION: When replacing TR21, it is advisable to use a genuine 121-452 transistor from the TV-set manufacturer.

Universal (horizontal-output) replacement semiconductors usually have a maximum collector voltage rating of only 300v or so.

11. (c) . . . but not for long, then (d)—Diode X13 is a half-wave rectifier which produces a B+ of 150v for the BRIGHTNESS control and the collector of the video-output transistor (TR6). With bypass capacitor C110 shorted, transistor TR6 would be inoperative (no picture, raster okay), but the load on the H.O.T. and on the 70v dc power supply would be so heavy that components would smoke and the set would soon fail completely (no raster). It is interesting to note that in solid-state TV sets, the video amplifier is usually the only transistor that requires a high supply voltage (usually 100v or more) for its collector. This is because the transistor has to produce sufficiently large collector voltage swings (e.g., 90v p-p) to drive the CRT from white to black. All the other transistors can be operated at much lower dc collector voltage levels.
12. (d)—Capacitors C77 and C78 in series provide the "sawmaker" capacitance in the vertical-oscillator collector circuit. However, C78 is also part of a feedback loop between the emitter of transistor TR17 and the base circuit of transistor TR16. A shorted C78 kills this feedback, resulting in a modified vertical-sweep waveform.
13. (b)—Without capacitor C75, the vertical signal cannot be coupled back from the collector of the normally ON transistor (TR17) to the base of the normally OFF transistor (TR15).
14. (a)—Transformer T6 is not a vertical-output transformer in the usual sense of the word. Its primary inductance is the collector load for transistor TR17, which is impedance-coupled to the vertical deflection coil. The secondary winding (L17B) is not used to match the impedance of the yoke. Instead, it serves as a source of negative-

going vertical retrace blanking pulses for the control grid of the CRT. With capacitor C83 open, these pulses cannot reach the CRT.

15. (b)—Capacitor C50 is the coupling capacitor feeding composite video signals from the collector of the video-driver transistor (TR4) to the base of the sync separator (limiter) transistor (TR9).
16. (a)—Capacitor C88 and its 3.3K series resistor form the AFC anti-hunt network. With this circuit disabled, the AFC system will over-correct the horizontal oscillator and cause a severe "piecrust" effect, as the oscillator is constantly hunting for the proper frequency.
17. (c)—The vertical trace is affected only slightly because the 330 Ω resistor is not an essential component. Without it, transistor TR16 will still drive the vertical output-transistors TR16 and TR17 forming a Darlington amplifier. The emitter current of the driver becomes the base current of the output transistor, the latter's operating point being shifted only slightly by the absence of the 330 Ω resistor.
18. (d)—Under normal signal conditions, transistor TR5 is a common-base amplifier whose emitter-to-base junction is normally reverse biased (1v) and therefore does not conduct. With capacitor C39 shorted, its base-to-emitter junction has a 4v reverse bias, so the transistor still remains inoperative and the picture is not affected. This transistor would only conduct in the presence of high-amplitude noise in the video—negative-going noise pulses would then forward bias its base-to-emitter junction, producing amplified negative pulses (remember, a common-base amplifier does not invert signal phase). These pulses would be coupled through capacitor C38 to the base of the PNP noise gate, turning transistor OFF and thus opening the emitter return

continued on page 74

Cutting Costs with EOQ

by Raymond Herzog

Operating an efficient TV service business requires more than just earning a good income—it also involves saving money and cutting costs where possible

■ All too frequently, the “saving money” and “cutting costs” aspects of a TV service business could be applied to a greater advantage. Toward the end of more effectively cutting costs, this article shows how a TV service business (or any similar small business) can practically apply an inventory control method used by large manufacturers and distributors. This method is the Economic Order Quantity (EOQ) used for purchasing items.

With the Economic Order Quantity method, factors involved in ordering inventory (replacement parts, radios, TV sets, etc.) are all considered together so as to get optimum benefits at minimum costs. A mathe-

mathematical formula for EOQ gives the relationship of these factors:

$$EOQ = \sqrt{\frac{2 A s}{i}}$$

EOQ = most economical number of pieces of an item per order

A = fixed cost per order

s = annual usage of the item

i = annual cost of carrying one item in stock for one year

Let us say, for example, that you pay \$1.00 for a certain TV-set replacement part, and you use 100 pieces of this part per year. Your average cost for placing an order is 10¢*—this could be transportation costs to get the part, administrative charges for the paperwork of an order and so forth. And let us assume an annual cost for carrying the part in stock to be five percent* of the cost of the part (for our example, $0.05 \times \$1.00 = \0.05)—this carrying cost could be for shelf space, money invested for inventory and therefore not available for other uses, etc. Thus, in our example, the Economic Order Quantity:

$$EOQ = \sqrt{\frac{(2)(\$0.10)(100)}{(\$0.05)}} = \sqrt{400} = 20 \text{ pieces.}$$

By ordering 20 pieces of this part at a time, you would have the lowest overall costs.

Now, you might be thinking that if you used about two pieces of this part each week (or 100 per year), and if you had a weekly parts order and delivery or pickup, then it might be less expensive to get only two pieces each time (assuming a sufficient buffer stock). Paying for two pieces instead of 20 leaves more money for other uses—or in other words, buying two pieces instead of 20 with each order gives a higher turnover of inventory.

But, on the other hand, having to place an order and take an inventory count more frequently often adds to your administrative costs.

So where then is the ideal compromise point? The EOQ.

To better illustrate the EOQ method, let us see just what the cost would be for ordering our example part—say, two at a time instead of 20. The following formula will help:

$$T = (A)(N) + (i)\frac{(q)}{2}$$

T = total annual cost of ordering and carrying an item

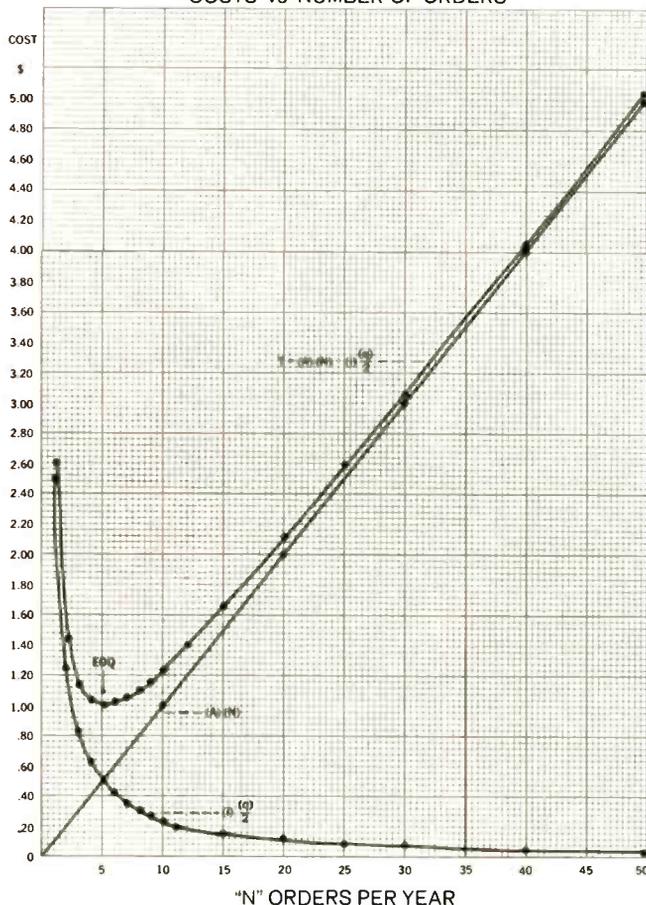
A = fixed cost per order

N = number of orders per year

i = annual cost of carrying one item in stock for one year

q = quantity of pieces of the item per order

ORDERING AND INVENTORY CARRYING COSTS - vs- NUMBER OF ORDERS



*The value used in this example for the fixed cost per order is 10¢. This easy-to-work-with, round figure is used to conveniently illustrate the EOQ formula. An actual cost in practice may vary over a wide range. The same is true for the cost for carrying an item, and the value in this example does not necessarily represent a typical cost.

For getting 20 pieces per order, the total annual cost would be:

$$T = (\$0.10) \frac{(100)}{(20)} + (\$0.05) \frac{(20)}{(2)} = \$1.00.$$

And for getting two pieces per order, the total annual cost would be:

$$T = (\$0.10) \frac{(100)}{(2)} + (\$0.05) \frac{(2)}{(2)} = \$5.05.$$

A good picture of the situation is given in the graph of costs versus number of orders. As might be expected, the cost for placing orders increases linearly as the number of orders increases—i.e., the straight-line plot represents the (A)(N) portion of the total cost formula.

The $(i) \frac{(q)}{2}$ portion, however, plots as a curve which decreases at a decreasing rate as the number of orders increases. Keep in mind that "q" equals $\frac{100}{N}$. Thus, the cost involving the quantity of pieces is inversely proportional to the value of the number of orders.

Combining the two plots gives a third curve which has a minimum value at the EOQ point of five orders per year.

For values of "q," only $q = 20$, which is the same as $N = 5$ since $(q)(N) = 100$, will give the lowest overall ordering costs and carrying costs. Granted, the possible savings may not be large, but even a savings of about \$4.00, as in this example, when multiplied by

perhaps a couple dozen or more items, could offer a significant cost reduction. ■

- References consulted for "Cutting Costs with EOQ"
- Magee, John F. *Industrial Logistics: Analysis and Management of Physical Supply and Distribution Systems*. New York: McGraw-Hill, Inc., 1968. (p. 97)
- Plossl, G. W. and O. W. Wight. *Production and Inventory Control*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1967. (p. 76)
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NEWS . . .

continued from page 33

this issue tell of ISCET's election of officers at the convention and of NEA's efforts as the industry works to develop voluntary self regulation.) And the following are brief descriptions of resolutions passed during the NEA convention.

- A resolution of the NEA asking for and recommending the installation of interference rejection circuits in all TV receivers to reduce the problem of FM interference in TV reception.
- A resolution of the NEA to set Hawaii as the site of its 1973 convention.
- A resolution of the NEA to change the name of the annual NEA Outstanding Local Association President's Award to the John Betz Memorial Award.
- A resolution of the NEA to ask the Federal Trade Commission to adopt the California law regarding the grading of picture tubes as a national regulation as part of their current rules regarding the disclosure of what is new or what is used in the manufacture of picture tubes.
- A resolution of the NEA approving, and recommending to all State affiliates of NEA, and all other local and national service organizations to consider and endorse the new RCA solid-state training concept of joint service association / distributor / manufacturer / technician upgrading training seminars.
- A resolution of the NEA thanking the officers and members of the Oregon Television Service Association and the Washington State Electronics Council for their work and sponsorship of the 1971 convention in Portland, Oregon.
- A resolution of the NEA commending Mr. M. L. Finneburgh, Sr., EHF and Mr. Donald J. Martin for their efforts on behalf of the service industry in directing the activities of the S.I.S. program, 1970-71.
- A resolution of the NEA to create a permanent committee dedicated to providing a program for self regulation of the electronic service industry, and the development of a national code of ethics, and the creation of a method of enforcement of this program.
- A resolution increasing the NEA monthly dues to \$3.00 and providing half of the increase, 50¢, be used for affiliated states travel funds.
- A resolution of the NEA recommending that NEA sponsor the next National Electronics Service Conference in Hot Springs, Ark., August 26, 1971, and solicit the aid of NATESA in this project.
- A resolution of the NEA recommending the control of CATV by the FCC.

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Data plotted to obtain graph shown in this article

N	(A)(N)	q	$(i) \frac{(q)}{2}$	T
1	\$0.10	100	\$2.50	\$2.60
2	0.20	50	1.25	1.45
3	0.30	33	.83	1.13
4	0.40	25	.63	1.03
5	0.50	20	.50	1.00
6	0.60	17	.425	1.025
7	0.70	14.3	.358	1.058
8	0.80	12.5	.313	1.113
9	0.90	11.1	.278	1.178
10	1.00	10.0	.250	1.250
12	1.20	8.3	.208	1.408
15	1.50	6.7	.167	1.667
20	2.00	5.0	.125	2.125
25	2.50	4.0	.100	2.600
30	3.00	3.3	.083	3.083
40	4.00	2.5	.063	4.063
50	5.00	2.0	.050	5.050

. . . where $T = (a)(N) + (i) \frac{(q)}{2}$

Employee Relations for the Service Dealer

by William Joseph

In good times or bad, employee turnover is a more serious and costly problem than you may realize. Each time an employee resigns or is discharged, the firm involved incurs considerable direct expense; and overall efficiency suffers until a replacement can be hired, trained and put to productive work. Depending on the frequency with which this happens, the results can be disastrous.

■ The Small Business Administration estimates that the direct expense of replacing one employee in a small business will run between \$200 and \$2000. The more skilled and specialized the employee, the higher the cost.

Despite the disheartening and expensive effects of high employee turnover, many service dealers do not seem to have any idea why their employees leave, or what to do about it.

"I pay as well as anybody in town," said one dealer recently, "and yet, my best man just told me he's leaving."

According to the employee relations manager of one large corporation, such a statement clearly reveals one of the most common weaknesses in small business. "A good salary and a pat on the back," he says, "simply cannot be depended upon to attract and keep valuable employees."

The big companies learned their lessons a long time ago. They know that the employee turnover rate is a crucial factor, and they definitely know what to do about it. While the small dealer cannot afford his own experts, there is nothing to stop him from employing the same principles used so effectively by his bigger competitors. And make no mistake about it, the small dealer is in direct competition with the big corporations when it comes to manpower. If he makes no effort to compete, he will be left with only the "rejects." And the turnover rate among this type of employee is astronomical.

No matter how small the company, turnover of employees already on the payroll can probably be im-

proved through the use of a good program of employee relations. The experts agree, though, that there is a first crucial step too often overlooked by the small businessman—the careful selection and hiring of new employees. The following points are recommended as minimum precautions for any hiring of new personnel:

Never hire at the first interview.

Recently, a Philadelphia service dealer advertised for an electronic technician. The very first applicant was clean-cut and impressive. He was hired on the spot. Three weeks later, the new man was gone—with him went a full tube caddy and \$200 of the firm's money.

Always check references. Even a cursory investigation of references will often help to avoid experiences such as the one just mentioned. Remember, references from former employers are more useful than those of friends or relatives. The chances are that even the worst swindler in town could fill a page with the names of friends and relatives willing to vouch for him. Check carefully with each former employer, and be on the lookout for any unexplained gaps in the work history.

Require a medical examination.

It may seem like an unnecessary expense, but hiring a new man without knowing if he is physically fit is flirting with serious trouble. If you don't think so, just ask the dealer who hired a new man only to have him go on workman's compensation the following day for a back injury that "happened on the job." Your insurance agent can advise you on how to set up pre-employment physicals.

Avoid misunderstandings. During

the initial interview, make certain that you carefully spell out all of the terms and conditions of the job you offer. Be specific about what you will expect of your new employee. Cover your wage policies in detail, and don't forget to tell him about your fringe benefits, or the lack of them. Department of Labor statistics indicate that a substantial percentage of "quits" can be traced to new employees' misunderstandings concerning their jobs or working conditions.

Minimizing turnover of employees already on the payroll is a job for your own employee relations program—a term that unjustifiably frightens many businessmen. Here again, we can take our cue from the experts in the big companies. Through wide experience, they have learned that there are specific areas of concern considered very important by the majority of working people. Company policies that recognize and take these concerns into consideration are the basis for a good program of employee relations. Handled with interest and care, they will help to develop the kind of climate that will attract and hold productive employees.

It is well to understand that an adequate salary is a necessary foundation for an effective program of company benefits. While it is true that salary alone is not enough, it is equally true that no program of employee benefits can effectively substitute for proper wages. The two must work together.

You should investigate regularly to make certain that your wage rates are competitive in your community. Conditions change rapidly today, and you should be sure that you always know what your competitors are paying for similar jobs. You can be certain that your employees will know, and any serious discrepancies will make it easy for other firms to entice your best people away from you.

Compensation plans that permit

employees to share in the success of the business—even in a small way—are now considered essential by a growing number of businessmen. While there are differences of opinion on this subject, there is no doubt that profit-sharing and bonus plans are more popular than ever before. The theory, of course, is that employees who participate in the profits are motivated to do their best to make the business successful and are less likely to want to change jobs.

There are infinite variations of such plans and, if you are interested, your accountant can probably advise you of the possibilities. Before putting a profit-sharing or bonus plan into effect, you should make a careful explanation to your employees in order to avoid misunderstandings that could negate the value of the plan. Also, have your lawyer look over the plan in order to avoid legal commitments beyond those which you intended.

Whenever a formal survey of employee attitudes is taken, the question of security is certain to appear very high on the list of concerns. This is not surprising when you consider the fact that the quest for a feeling of security has long been recognized as one of the most basic of all human drives. In earlier times, security was purely a physical matter—protection from one's enemies or predatory animals. Today, the circumstances may not be as dramatic, but the need is every bit as important. To be insensitive to it is to invite employee unrest.

The chances are that your employees will view security largely in terms of job stability for the present, and some provisions for the retirement years when they are no longer able to work. To be effective, your program of employee relations should recognize both.

Every employee is entitled to know precisely what is required of him, and what rules he is expected to follow. He, in turn, wants to feel

that his job is reasonably secure so long as he holds up his end of the bargain. Once your policies and rules have been carefully defined, it is essential that they be enforced equally for all employees. Favoritism, or even the appearance of it, is certain to damage employee morale and to foster feelings of insecurity.

There are some excellent suggestions on this subject in a Small Business Administration pamphlet entitled, "Points on Preparing an Employee Handbook." It is free, and you can get it by writing to the Small Business Administration, Washington, D.C. 20416. Ask for Management Aid No. 197.

As far as future security is concerned, most people now recognize that social security alone cannot amply provide for the retirement years. Because of this, a pension plan of some sort is becoming an increasingly important requirement for reducing employee turnover. One employee relations consultant flatly states that some form of pension plan to supplement social security is an absolute requirement for any employer who expects to attract and keep the kind of employees who will make a contribution to the firm's success.

The cost of a retirement plan may be much less than you think. Your bank or insurance company probably has a special department qualified to work out a plan suited to your particular requirements. You will need guidance on this because there are a number of federal laws affecting employee pension plans.

In spite of the progress that has been made in other areas, many service dealers have done little to improve working conditions and surroundings. There is probably no easier way for an employer to show genuine concern for the well being of his employees than through a careful effort to provide a proper working environment. The cost of such an effort will often be less than that for any other form of company

benefit, and yet most employees place physical working conditions very high on the list of requirements for a good place to work.

Among working conditions often neglected, the Small Business Administration mentions lighting, condition of washrooms, rest periods, housekeeping and safety. There is, of course, a long list of other possibilities.

An area of particular importance to electronic technicians is the availability of proper tools and equipment. Nothing is more frustrating and time consuming to a good technician than the lack of proper tools to do a job—the resulting loss of productivity representing a serious loss to the service dealer.

An analysis of working conditions is one area where outside help is not necessary. You can find out what gripes your employees have if you will take the time to ask them. Good employee relations demands constant two-way communications. An employer must always be prepared and willing to listen to his people when they have something to say. He must then show his interest by acting on their suggestions, or by providing valid reasons why he cannot.

Finally, don't forget training as an aid to good morale. The desire to do professional work is characteristic of most electronic technicians. Proper emphasis on training helps a man gain the skill and self-confidence necessary to do good work. As an added bonus, an interest in training on the part of the service dealer also shows his concern about quality workmanship and good productivity.

There are still many service dealers who feel that they "cannot afford fringe benefits." That is a decision that each dealer must make for himself. However, there is ample evidence to suggest that employee turnover is costing many small dealers far more than even the most ambitious employee-relations efforts. ■

Make Your Name Synonymous With Quality

by Bert Wolf

Some technicians feel that the best way to sell is to be the cheapest place in town. Don't fall into this trap. The cheapest place in town is usually the first one to fold.

■ Someone once said, "the bitterness of poor quality lingers long after the sweetness of low price has been forgotten."

As a businessman, your reputation is your most valuable asset. Sell the most "inexpensive" products you can find and you'll be known as a shoddy merchandiser. Sell top quality goods, and your reputation will brighten every year.

Think of the most prestigious store in your area. Chances are, they sell the finest, most expensive merchandise they can find. And it's a pretty good bet that they are mak-

ing more money than the "bargain" stores.

Quality is especially important in outdoor antenna installations.

Despite their vehement denials, TV is a very important factor in the lives of your customers. They want good reception on every set in their homes. They don't want snow or ghosts or color smears. They don't want a picture that gradually gets worse, as the antenna or the lead-in wire deteriorates. And they blame you for all their troubles.

Yes, it is easier to sell a cheap antenna using a cheap mount and cheap lead-in wire. If you're not too particular about your workmanship, you can get the cost of labor pretty low. But you will inevitably become known as a sloppy workman. What's more, you may not make as much money on the installation as you had anticipated, because you'll be plagued with callbacks.

On the other hand, if you resist the path of least resistance and sell up to quality, it can make a great difference.

Quote a price for the job that includes a top quality antenna, excellent mounts and hardware, coaxial cable or a rugged twinlead, and enough allowance for labor to enable you to do a really professional job. Once you get the job, make sure the antenna is up to stay, ward off the possibility of leaks with roof cement, orient the antenna right "on the money" and dress the leads as neatly as possible. Be especially careful how and where you take the lead-in into the house.

Your customer will often balk at the price. "What! \$80 for an antenna? I can buy one for \$35."

"I could sell you a \$35 antenna installation, too," you might reply. "But I wouldn't. Do you see how bent out of shape your neighbors' antennas are? Have you ever seen the ghosts and smears on their TV sets? The antenna I will install for you is the best you can use in this area. It's exceptionally good on color. It's made to last for years.

"What's more, we take our time and do a first class installation job, using only the finest of materials. You'll buy three \$35 antenna installations before you have to replace this one. You spend a lot of money for your TV set. A good antenna will protect your investment."

Customers gripe a lot about price, but they really like to be sold up. They want quality. However, they want some justification for spending the extra money.

Once the system is in, point out its quality features. Your customer will enjoy bragging about it to his neighbors, and showing them what great color-TV reception he gets.

Of course, you will lose some sales to people who think price is everything. However, you'll do more volume and enjoy a better profit percentage on the sales you do make. And the missed sales will be more than compensated for by referrals from satisfied customers.

You're missing a bet, too, if you don't sell up to home MATV systems. If the home has two or three TV sets, plus an FM receiver, they should all be connected to your antenna. Your customer may not even know that this is possible.

When you sell him a home system, you not only increase the size of the sale, you also amortize the cost of a quality antenna over several sets.

Selling quality enhances your self respect, your business reputation and your bank account. ■



Bert Wolf is manager of the Distribution Sales Div., and Educational and Communication Systems Div. of the Jerrold Electronics Corp. Having been with Jerrold for over 17 years, he is responsible for the overall operations in sales and marketing for these two divisions. Formerly national sales manager, Mr. Wolf has been responsible for the sale of home TV antennas, reception aids and MATV systems and components through a network of distributors, dealers and engineering-contractors.

TEST INSTRUMENT REPORT

Heath's EU-70A Dual-Trace Trigger-Sweep Oscilloscope

by Phillip Dahlen

Flexible enough to meet future needs



Heath's EU-70A Dual-Trace Trigger-Sweep Oscilloscope. For more details, circle 900 on the Reader Service Card.

■ In these times of rapid technological change, it is virtually impossible to reliably determine future test instrument needs for effective servicing. For that reason, when selecting new equipment for the shop it is important to consider flexibility—the ability of one instrument to function in as many ways as possible.

One such flexible instrument is Heath's EU-70A dual-trace, trigger-sweep scope. This scope can be triggered by Channel 1, Channel 2, both channels simultaneously, the power line or externally—using either an ac signal or a slight change in applied dc voltage. Positive or negative slope triggering is switch selectable and automatic triggering at the crossover point is available with the flip of a switch. Separate variable controls are provided for trigger level and stability.

Other front panel switches permit viewing only Channel 1, only Channel 2, Channel 1 on the Y axis with Channel 2 on the X axis, both channels during alternate sweeps, or both channels during the same sweep—the two channels reportedly being sampled at an alternate rate of 100kHz.

In addition to using Channel 2 to provide the external X-axis sweep, another terminal is also provided for applying external horizontal sweep signals. Thus, both Channel 1 and Channel 2 can be compared together to a third external signal for phase, amplitude or other waveform relationships.

The instrument is said to have horizontal sweep rates of $0.2\mu\text{s}$,

$0.5\mu\text{s}$, $1\mu\text{s}$, $2\mu\text{s}$, $5\mu\text{s}$, $10\mu\text{s}$, $20\mu\text{s}$, $50\mu\text{s}$, $100\mu\text{s}$, 0.2ms , 0.5ms , 1ms , 2ms , 5ms , 10ms , 20ms , 50ms and 100ms per centimeter gradient, plus a separate vernier control with calibrated positions for continuous control between settings. A times five magnifier is said to permit more detailed trace viewing.

Separate slide switches are mounted on the front panel for either grounding or selecting ac or dc coupling for both Channel 1 and Channel 2. There are also separate controls for vertically positioning each channel trace, plus a third horizontal position control. Both channels have gain controls for sensitivities of 0.05v , 0.1v , 0.2v , 0.5v , 1v , 2v , 5v , 10v and 20v per centimeter gradient, plus a separate vernier control for continuous control between settings.

Specifications indicate that the amplifiers for both channels have dc to 15MHz bandwidth and 24ns rise time—full bandwidth being provided from 20v/cm to 50mv/cm sensitivity.

Besides the front panel gradient illumination control, and the sweep intensity and focus controls, other manufacturer specifications indicate a rear panel sweep gate output delivering a $+5\text{v}$ pulse in sync with the sweep—a TTL-compatible Z-axis input—and front and rear tilt bails designed for tipping the scope up for bench work or down for shelf installations.

The scope is also said to have an 8- by 10-cm (3.15- by 3.93-in.) rectangular flat-face CRT, plus a camera mount on the bezel. ■

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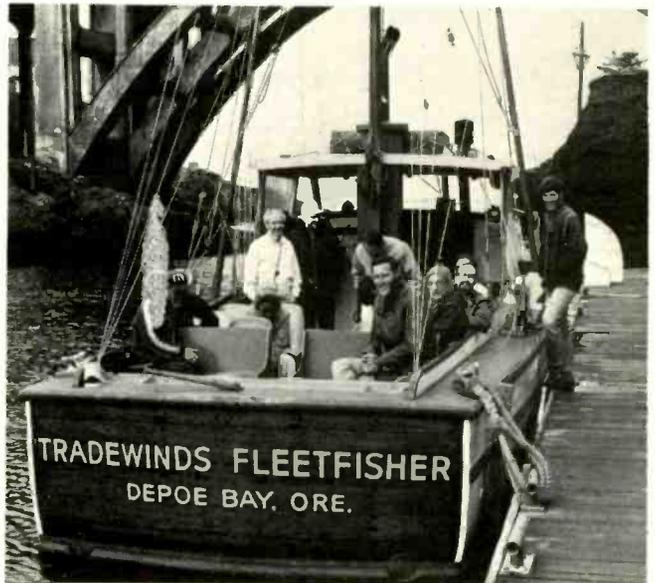


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NEWS...

continued from page 47

Whereas: It has been determined that many CATV systems are not performing properly for the consumer and Whereas: there is a need for a more stringent set of regulations to guarantee quality installation and performance for the consumer and



All of the passengers aboard this and the other boat rented by The Finney Co. appear bright eyed, despite having to leave for the ocean at 3:30 a.m.



Damon's salmon feast, sponsored by General Electric's Tubes Div., was a great success with plenty for all to eat even though only one fish had been caught the day before.

Whereas: a government agency should control the franchising of CATV system operators in order to enforce the regulations

Therefore: let it be resolved that NEA goes on record as being in favor of the control, and regulation of CATV being under the FCC.

● A resolution of the NEA commending the mutual cooperation committee members of NATESA and NEA and their efforts to hold a joint convention of both associations in 1972.

Whereas: The mutual cooperation program of NATESA and NEA is functioning and

Whereas: the concept of a joint site for both national associations is desirable and

Whereas: both organization committees have agreed to New Orleans as the site for the 1972 conventions and

continued on page 54

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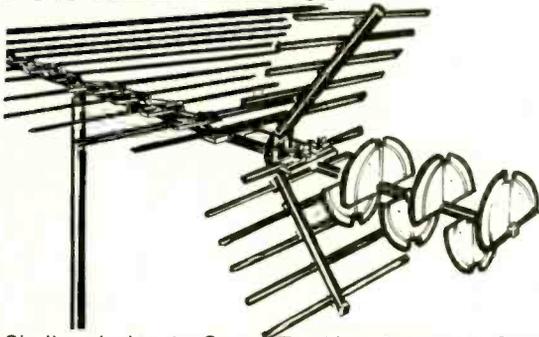
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They're called Ansafones. You can buy one outright or possibly lease it for about what you're paying your answering service now. And it works for you 24 hrs. a day, 7 days a week.

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NEWS...

continued from page 52



Mr. M. L. Finneburgh, Sr., EMF speaking at the Hall of Fame Banquet. Upon concluding, the audience stood in response to what he said and in respect for what he has done for electronic technicians and dealers.



Tom Bull, CET, master of ceremony at the Saturday night banquet, gets an enthusiastic response from the audience. Sitting to his right is the speaker, Dr. Amo DeBernadis.

Whereas: this action would bring together the memberships of both organizations to solve the mutual problems for the first time

Therefore: let it be resolved that NEA has officially set New Orleans as the site for their 1972 convention [August 12-15] and encourages similar action by NATESA at their annual convention in August.

Women in TV Servicing Form Nationwide Club

A new, nationwide club exclusively for women engaged in professional electronic servicing has been formed. Called LITES—Ladies in Technical Electronic Servicing—the unique professional organization was founded by Mrs. Sandra Schaffner who works with her husband, Len Schaffner, a TV service Technician at his servicing firm, Country Club Electronic Service in Simi Valley, Calif.

According to Mrs. Schaffner, the purpose of the club is two-fold. It is designed to encourage more women to enter the field of consumer electronics repair and also intended to serve as a forum to exchange ideas and technical developments for women already in the TV repair field.

All the club members will be invited to convene once a

continued on page 56

How to tell which is the largest compact van built in America.

(No matter how you look at it.)



**If you can't close the rear doors,
you haven't loaded a Dodge Maxivan Strong Box.**
And you'd better get one.

Dodge Strong Boxes give you a lot more than just more room: Independent front suspension and longer 127-inch wheelbase mean better handling and ride. Shorter turning circle. Even with a 127-inch wheelbase, you have greater maneuverability. Wind-tunnel body and curved windows reduce wind-sway effect. Front wheels can be inexpensively aligned on passenger-car equipment. Biggest V8 engine offered. 360 cubic inches.* Three-speed TorqueFlite automatic transmission* with a choice of three engines available on all models. Integral power steering.* Power brakes. Fresh Air air conditioning* and exclusive Fresh Air heater provide even flow of clean air. Air is not recirculated. High-level air intake helps keep incoming air cleaner. Front passenger's seat does not block side cargo door entrance. Both front seats are easily adjustable. Concealed side safety-step offers firm footing since it doesn't collect ice or snow. Wider front doors and door steps and less wheelhouse intrusion make for easier ins and outs. Full-foam padded bucket seats up front give softer ride and more comfort.



Dodge

Dodge Trucks

Two-stage door checks conveniently hold doors in two positions. Biggest gas tank. 26 gallons. Smaller engine cover is easy to remove for servicing. Also, easier for driver to reach back seats. Extra rust protection on undersides, doors, and panels. Large hood opening. Battery, dipstick, and radiator are easy to reach. Engine can be removed quickly and easily through the front. And the list continues at your Dodge Dealer's.



Dodge Maxivan takes the "packed" out of compact vans!



*Optional at extra cost.

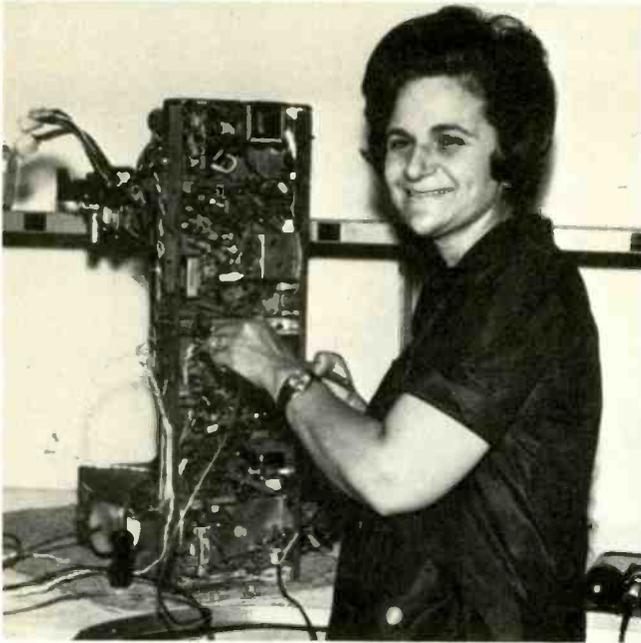
... for more details circle 107 on Reader Service Card

NEWS...

continued from page 54

year on a national basis and to have several regional meetings each year. In addition, a newsletter providing for an exchange of information will be issued on a regular basis.

Mrs. Schaffner stated that while the number of women professionally employed in consumer electronic servicing



now is relatively small, the vocational opportunity is enormous. "There is not only a tremendous shortage of qualified consumer electronic repair personnel today, but the field is high compatible with its women's capabilities," said Mrs. Schaffner. "Not only is it a wide open career field for interested women, but the natural feminine concern for small intricate detail and for wanting everything working properly in its place, makes electronic repair a natural vocation for women."

ISCET Elects Officers At First Convention

The International Society of Certified Electronics Technicians (ISCET) elected new officers at their first annual convention, held in Portland, Oregon on July 18, 1971.

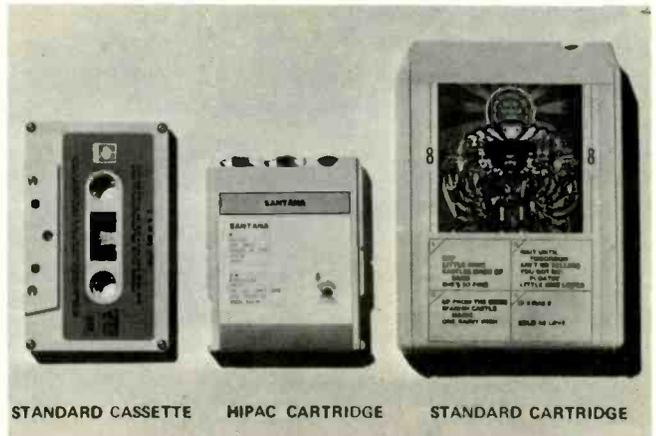
Elected chairman was Darryl Widman, CET, Darryl

Widman's Television City, Santa Barbara, Calif. Vice chairman is Tom Bull, CET, Tom's TV Clinic, Portland, Oregon. Secretary is J. A. Wilson, CET, Kent State University, Kent, Ohio. Re-elected treasurer was Leslie Nesvik, CET, service manager, Wholesale Television, Indianapolis, Ind.

Rehired as executive director for the year is Ron Crow, CET, Iowa State University, who was the first chairman of ISCET.

Development of a New Mini Stereo Tape Cartridge System is Announced

The development of a new mini stereo tape cartridge system, a quarter the size of an eight track cartridge and



smaller than a cassette, has been announced by Nozomu Matsumoto, president and founder of Pioneer Electronic Corp.

The new tape system is the combined result of research and development by 10 companies in Japan. The new equipment will be introduced to Japanese consumers through the release of 180 music albums.

Precision Tuner Service Changes Name

Precision Tuner Service has a new name—PTS Electronics, Inc. It has also purchased the entire tuner parts line from Colman Electronic Products, Inc., plus adding two more service departments that will now repair IF modules and car tapes.

Precision Tuner Service started as a one-man operation a few years ago and now boasts six company owned service centers located throughout the United States.

Kansas City Area Vocational-Technical School Announces Courses

Low tuition courses in basic electricity, basic electronics, solid-state electronics, radio-TV and many other skills will be offered again this fall by the Kansas City, Kans., Area Vocational-Technical School—a unit of the Kansas City, Kans. School District.

These adult evening courses are scheduled one evening per week in three hour sessions. Enrollment is limited to a realistic class size so an early call to Mr. Terry (334-1000) for enrollment reservations is suggested.

FREE CATALOG

HARD-TO-FIND PRECISION TOOLS

Lists over 1700 hard-to-find tools used by electronic technicians, instrument mechanics, engineers, and scientists. Included are many types of pliers, tweezers, wrenches, relay tools, soldering irons, wire strippers, watchmakers tools, drills, precision grinders, files, optical equipment, lighting, vacuum systems, tool cases, and tool kits. Included also are a solder section and four pages of useful "Tool Tips" with valuable data on fasteners, color coding, drill and metal gauges, insulation facts, and tool selection.



CAT. 470

JENSEN TOOLS and ALLOYS
4117 N. 44th Street, Phoenix, Arizona 85018

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Finally.....

An Rx to end the headaches of stocking replacements for

TETRAD CARTRIDGES

YOU WANTED THE VM HEAD WITH THE RED SOCKET EH? WELL, I'VE GOT IT WITH A YELLOW SOCKET... OR HOW ABOUT A PHILCO HEAD WITH THE RED SOCKET.... NO, IT WON'T QUITE FIT AND THE NEEDLE'S WRONG TOO, WE CAN ORDER IT, YOU'LL HAVE IT IN ABOUT 2 OR 3 WEEKS.



ARISTA CHANGES THIS SCENE!!

NOW REPLACE TETRAD CARTRIDGES AND NEEDLES AS EASY AS 1-2-3

Arista's

5 CARTRIDGES AND 6 DIAMOND NEEDLES REPLACE OVER 200 ORIGINAL TETRAD MODELS

ALL SNAP-IN AND STANDARD BRACKET MODELS MADE INSTANTLY



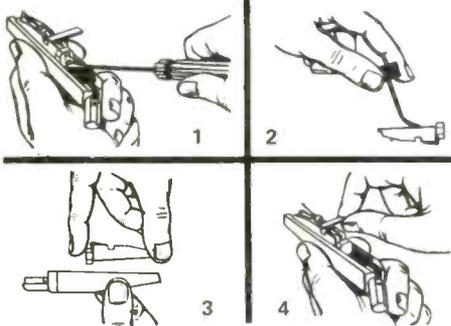
Snap in type



Standard bracket type

The fastest selling Tetrad models are either snap-in or standard bracket types. Arista assures you of virtually 100% replacement from stock with minimum of expense. You always have the right one because you assemble it yourself from your modular replacement kit.

KEEP YOUR HEAD—REPLACE ONLY THE DEFECTIVE ELEMENT



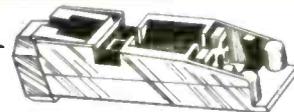
There are over 30 different custom designed heads currently used by major phono manufacturers (and more are coming fast). Few of these are requiring replacement at a rate fast enough for you or your distributor to keep replacements in stock. In addition, each of these over 30 heads can contain any color socket (which are not interchangeable). This can mathematically add up to endless possible combinations. Now a new breakthrough from Arista eliminates replacement problems.

HERE'S HOW:

In practically every case the defective cartridge (element) can be removed from the old head (fig. 1), and by applying a few drops of our special adhesive (fig. 2), you need replace only the defective element (fig. 3), and the needle (fig. 4).

5 CARTRIDGES and 6 NEEDLES

- A1 - Black socket
- A2 - Blue socket
- A3 - Gray socket
- A5 - Yellow socket
- A6 - Red socket



- TD-1D - Black coupler
- TD-2D - Blue coupler
- TD-3D - Gray coupler
- TD-4D - Green coupler
- TD-5D - Yellow coupler
- TD-6D - Red coupler

No. 4000-DX

DELUXE MODULAR KIT

Contains:

- 1 ea. A1, A2, A3, A5
- 2 ea. A6
- 1 ea. TD-1D, TD-2D, TD-3D, TD-4D, TD-5D, TD-6D,
- 2 ea. SN mounts
- 1 ea. A, B, C mounts
- 1 ea. 9 replacement heads

FREE: Deluxe storage box



Arista
ENTERPRISES INC.

BROOKLYN, N. Y. 11223

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promptly, for we've reserved only a limited number of books for new Members.

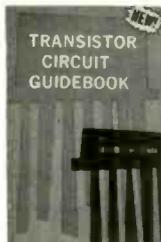
To start your Membership on these attractive terms, simply fill out and mail the postage-paid airmail card today. You will receive the three books of your choice for 10-day inspection. **SEND NO MONEY!** If you are not delighted, return them within 10 days and your Trial Membership will be cancelled without cost or obligation. Electronics Book Club, Blue Ridge Summit, Pa. 17214.

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Electronic Designer's Handbook	List Price \$9.95; Club Price \$5.95
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Computer Circuits & How They Work	List Price \$7.95; Club Price \$4.95
Commercial Radio Operator's License Study Guide	List Price \$7.50; Club Price \$5.95
Japanese Color TV Service Manual	List Price \$7.95; Club Price \$4.95
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AN EXTRAORDINARY OFFER..

Transistor Circuit Guidebook

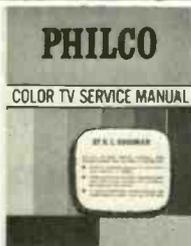


Regardless of your niche in the world of electronics, you'll find this collection of transistor and solid-state circuits of value. Section titles read like an electronic circuit "Who's Who": tuners and receivers — amplifiers — test devices — power — controlling — light — controlling — transmitter — audio — special receiver — automotive — computer — TV circuits, and many, many others. Within each section is a wide variety of circuits touching virtually every point of interest. Each circuit is accompanied by a description of how it works, pointing out unusual features and applications. Technicians who acquire a familiarity with these circuits will be far better equipped to cope with present and future equipment troubles. 13 big sections, 104 circuits in all, 224 pps. Hardbound.

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Philco Color TV Service Manual

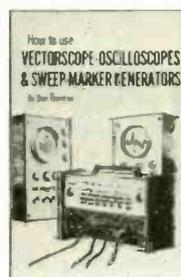


An all-in-one service guide for Philco color sets, with 12 complete schematic diagrams for chassis 15M90/91 to 20QT88. Here in one manual is complete service data for all the color models produced by Philco and Philco Ford (thru 1970), from the all-tube to the latest hybrid solid-state chassis, including the small-screen portable Model T5062WA. The unique 36-page foldout section contains 12 complete schematic diagrams, representing all the chassis covered. The profusely illustrated text delves into each section (video, chroma, vertical, horizontal, etc.), and points out specific problems based on the author's extensive experience. Included are complete alignment and setup instructions, detailed in step-by-step form. 160 pps., plus 36-page schematic foldout section. Long-life vinyl cover.

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How to Use Vectorscope-Oscilloscopes, Sweep-Marker Generators



At last, a practical guide that tells how to use modern TV test instruments. Scope types and specifications are covered, including DC dual-trace amps, and probes. Thoroughly explains vectorscopes, with details on vector timing charts, demodulated patterns, phase and frequency measurements; practical oscilloscope applications, encompassing how to make peak-to-peak and DC measurements, time-base measurements, video and sync waveform analyses; sine, square, and triangular wave testing; using the new push-button signal & sweep-marker generators; vectorscope troubleshooting and alignment techniques; how to isolate defective ICs and transistors, using as examples more of the current modular TV circuits. 256 pps., over 225 illus.

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Electronic Hobbyist's IC Project Handbook



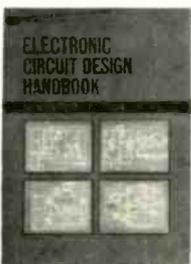
Here's your chance to become familiar with those fascinating components—integrated circuits—and have fun building some useful devices at the same time. In all, this new book describes 50 different projects, all based on using popular IC's which are inexpensive and available at all parts stores. Some of the devices—such as

the 1-watt phono amp and IC power supply—can be built in an evening. More sophisticated projects—like the electronic organ or the RDIAA equalization preamp—offer a greater challenge. You can build practical devices like the tachometer with bulb alert, or the 50-watt amplifier, or some "just for fun" gadgets like the simple memory tester or the miniature adding machine. 160 pages, 50 projects, 100 illus.

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Order No. 464

Electronic Circuit Design Handbook

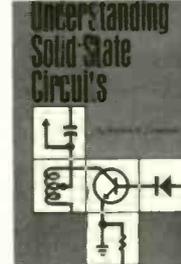


New Third Edition—A brand-new, enlarged edition of the ever popular circuit designer's "cookbook," now containing over 600 proven circuits, for all types of functions, selected from thousands on the basis of originality and practical application. Now you can have, at your fingertips, this carefully-planned 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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Order No. T-101

Understanding Solid-State Circuits

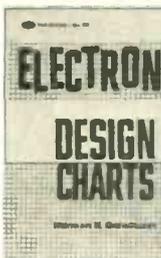


This brand-new book truly eliminates the mystery of solid-state circuits and devices. Written to serve the interests of anyone at the sub-engineering level (service technicians, hobbyists, students, etc.), the content thoroughly explains semiconductor circuit operation without delving into electrochemical physics and high-level mathematics. Encompasses amplification, feedback, sinusoidal and non-sinusoidal oscillators, gain control, logic circuits, and integrated circuits. Semiconductors covered include SCRs, FETs, ICs, light-sensitive and voltage-sensitive devices. The perfect text and reference on solid-state devices and basic circuit operation. Even if you have already mastered the important aspects of solid-state electronics, this book will update and add much to what you already know. 192 pps., over 150 illus.

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Order No. 513

Electronic Design Charts



Here is a collection of 59 often-needed design charts, reproduced in large 8½" x 11" format, organized to save busy technicians and engineers hours of computation. The graphical reproduction used eliminates the ambiguity which results when key reference scales are not clearly identifiable. In many instances, the design data on which the

charts are based has been presented elsewhere in forms which are either difficult to use or do not offer the required accuracy. This volume takes these factors into consideration, inasmuch as the author has actually tried and tested various presentations to develop those which provide the most direct and accurate computations possible. 128 pps., 8½" x 11". Comb-bound.

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Small Appliance Repair Guide



Learn to repair dozens of small household appliances with the use of this authoritative, low-cost handbook. Profusely illustrated, the text tells how to find the cause of trouble in minutes, and how to go about making the required repairs. You'll also pick up helpful hints on disassembly and assembly, one of the real "tricky" aspects of many appliance repair jobs. General troubleshooting procedures are explained to familiarize you with the techniques of appliance repair. Succeeding chapters deal with thermostats, skillets, sauce pans, irons, toasters, coffee makers, blankets, mixers, knives, deep fryers, hair dryers, electric shavers, and small motors found in countless appliances. You'll learn how they operate, and how to make practical tests and repairs. 11 Chapters, 224 pps. Over 150 illus. Appendix and Index.

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FET Applications Handbook



This revised 2nd edition contains a wealth of data on the FET and its various applications in practical circuit designs, material prepared by some of the most capable engineers in the field. Early Chapters delve into current-voltage relationships, application areas, DC and AC amplifiers, voltage controlled attenuators, and limiter and chopper circuits. Additional Chapters deal with linear applications, chopper and switching circuits, integrated circuits and photo-FETs. Also FET oscillators, describing various types and the necessary biasing arrangements. Essential design data includes starting conditions, power output, frequency stability, and efficiency. Information of immediate value to anyone looking for FET circuit applications, including numerous practical circuits. 320 pps., 250 illus., 26 Chapters. Hardbound.

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COLORFAX

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

RCA SALES CORP.

Color TV Chassis CTC 46 Series—Servicing with the ACM Switch Disconnected

The automatic color (ACM) switch associated with this chassis is secured to the cabinet mask (rather than the tuner mount assembly) by two Phillips type screws. The switch can be left in place by unplugging one Molex-type connector and disconnecting two automatic color control light switch leads from the tuner assembly.

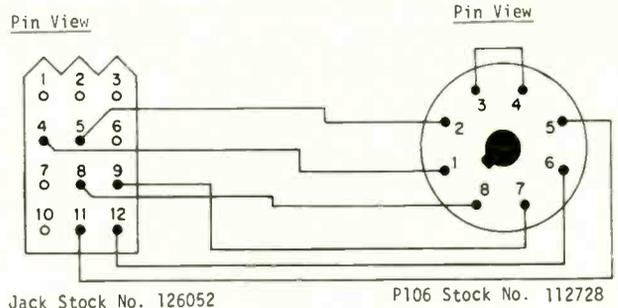
The chassis can be operated without the automatic color switch connected. However, the serviceman should be aware of the following: the AccuTint circuitry will be ON. Color cannot be completely extinguished with the color control unless controls R4204A (AccuMatic color level) and/or MAC-R9 are misadjusted. The TINT control range will be off-center (toward greenish fleshtones).

When troubleshooting color circuitry, or for a final operational check after other circuits have been serviced, the ACM switch should be connected.

Servicing can be simplified by stocking a spare switch. Either switch assembly (Stock No. 133653 or 134507) can be used for troubleshooting purposes.

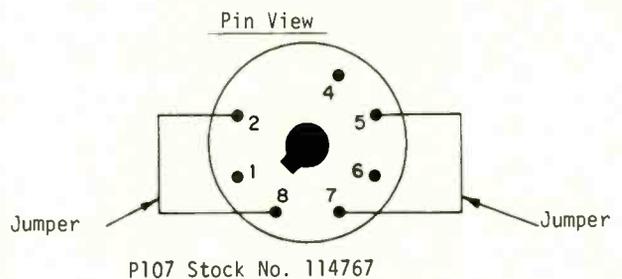
Color TV Chassis CTC 46 Series—Operating the CTC 46 on a CTC 40-44-47 Test Fixture

A special yoke adaptor and convergence jumper plug are required to operate the CTC 46 chassis on a test jig that is set up for the CTC 40, 44 and 47 chassis.



Jack Stock No. 126052

P106 Stock No. 112728



Jumper

Jumper

P107 Stock No. 114767

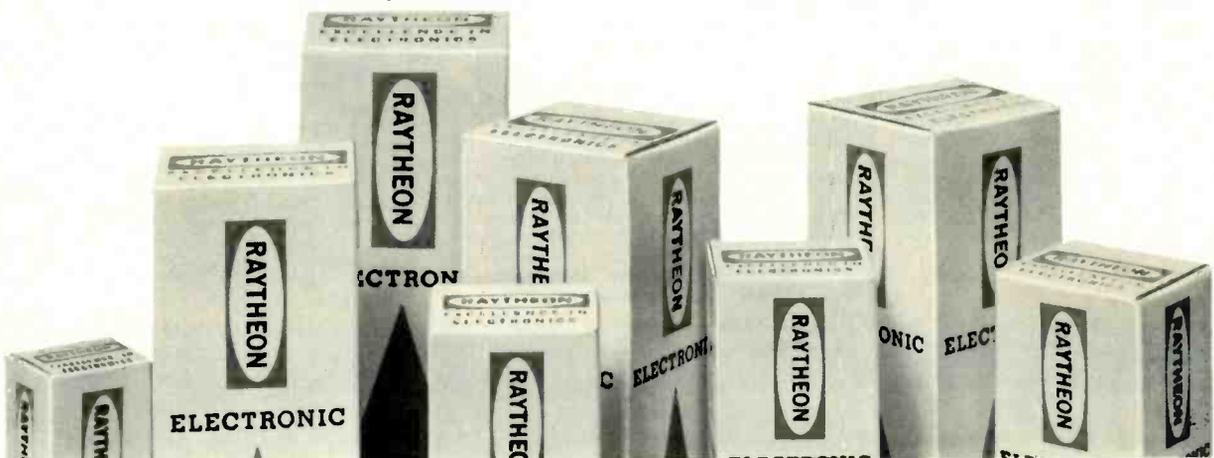
Without you, we don't go anywhere.

You're independent, and so are we. No service trucks, no captive business. The only market for our tubes is you — the independent serviceman.

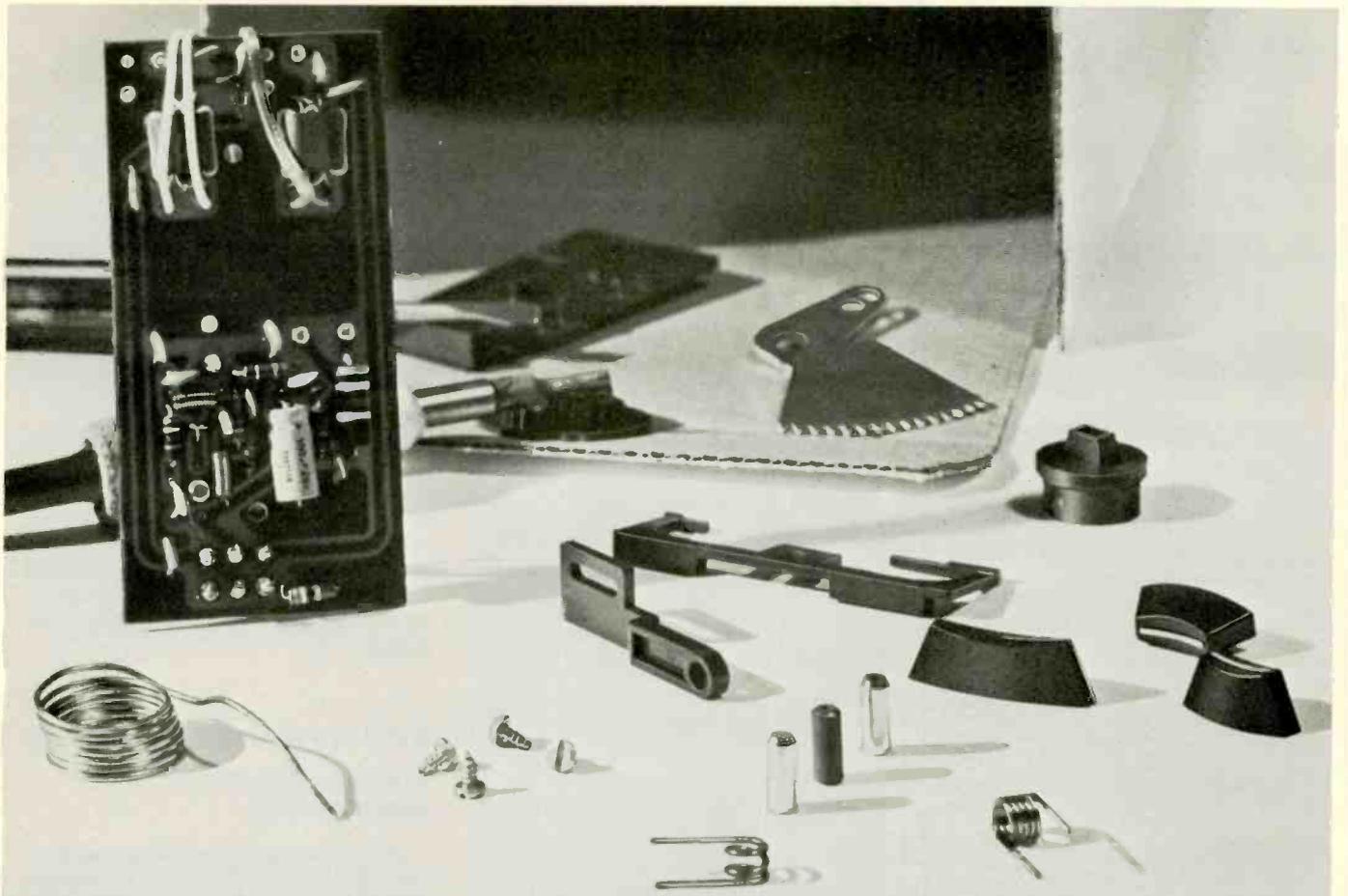
We're the largest independent tube supplier in the business. But you did that for us. You've learned you can depend on us.

Because we depend on you.

Cooperation, not competition. Together, this has been our key to success in the past. Let's keep it that way.



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The Channel Master Perfect Color Kit!



For outstanding color reception in metro and suburban areas, our brand new, easy to install color kit includes the following:

1. A transistorized 17dB amplifier that boosts signals in weak reception areas ... on all UHF/VHF and FM channels!
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It's perfect for color ... and it all comes preassembled in our new Super Chroma-82 ... the world's only fully amplified UHF/VHF/FM antenna with the unique Chroma Sensor tuning!

The most powerful color and black and white reception ever seen indoors, only \$29.95 retail!

The Super Chroma 82

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ELLENVILLE, N.Y. 12428

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INFORMATION

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CHECKS: sync, sweep, video, audio circuits, high voltage supplies (DC, RF or Pulse), low voltage supplies, coils, capacitors, resistors, tubes, transistors, diodes, transformers, speakers, etc. Will locate trouble to a particular stage, determine defective component and can actually be clamped in circuit to restore circuit operation temporarily in 80% of component or tube defects. Ideal for locating and confirming intermittents.

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Sensitivity: Over 200 MEG OHMS

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LEE ELECTRONIC LABS., CO.



88 Evans Street
Watertown, Massachusetts 02172

NEW PRODUCTS

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

PLAS-T-PAIR 703

Repair Kit for mending
knobs, handles, cabinets, etc.

A repair kit for all soluble plastics, can be used as either a cement or plastic putty. Suggested uses include: repairing radio and TV knobs, cracked

you when you are at the precise pre-set soldering temperature by periodically blinking on and off. Temperature



adjustments are controlled by a knob on the handle. The manufacturer indicates that the handle is designed to be cool to the touch and is protected from thermal and electrical overload by a proprietary fuse. Weight is 4 oz. Edsyn.



or broken plastic cabinets, screw mounts, carrying handles on portables, etc. The compound consists of two parts—a powder and a liquid solvent—which reportedly can be mixed and then poured, or mixed and allowed to set for a few minutes to be molded as a putty. Plas-T-Pair is said to be strong, fast setting and waterproof, requiring no clamp or pressure. Chemtronics, Inc.

HIGH-VOLTAGE RECTIFIER 705

Eliminates potential
x-radiation source

A solid-state, high-voltage rectifier, No. R-3A3, is designed to replace vacuum tube types 3A3, 3AW3, 3B2, 1B3, 1G3, 1K3 and 1J3. This device reportedly fits the same tube sockets



that were originally used by the vacuum tubes they replace. The rectifier is said to eliminate one of the potential x-radiation sources of a TV receiver, and eliminates the high heat source of the filament in the electron tube, prolonging the life of the flyback transformer. Electronic Devices, Inc.

SOLDERING INSTRUMENT 704

Temperature adjustment
controlled by knob on handle

The Loner soldering instrument is said to automatically maintain thermal balance during each soldering cycle, matching the termination load precisely with the preset temperature settings. The instrument will reportedly idle at 9w or match any soldering thermal load up to 50w. The ON/OFF cycle of the control system can be observed by an indicator lamp located in the handle. After approximately 25 sec, the indicator lamp is said to tell

CAR STEREO POWER SUPPLY CONVERTER 706

Provides 12v dc at
1.5a continuous current

A power converter for using automotive electronic equipment is designed to convert 117v ac house current to 12v dc. The standard model No. 30-3090 is said to provide 12v dc at 1.5amp continuous or 3amp peak. The unit is reportedly fused and equipped with an universal plug that will fit all standard stereo and other automotive electronic equipment. This

continued on page 66

... for more details circle 123 on Reader Service Card

GE is bringing in panels of independent experts to tell us how to make our new products more serviceable.



They tell us. And we listen. And we'll have better products for it. This is just one of the things that GE has been doing to improve the serviceability and parts availability of our television products.

For the last several months we have been paying the transportation on warranty parts. We've also installed direct telephone lines to regional parts centers. And, soon, we'll have three hundred independent parts distributors throughout the country.

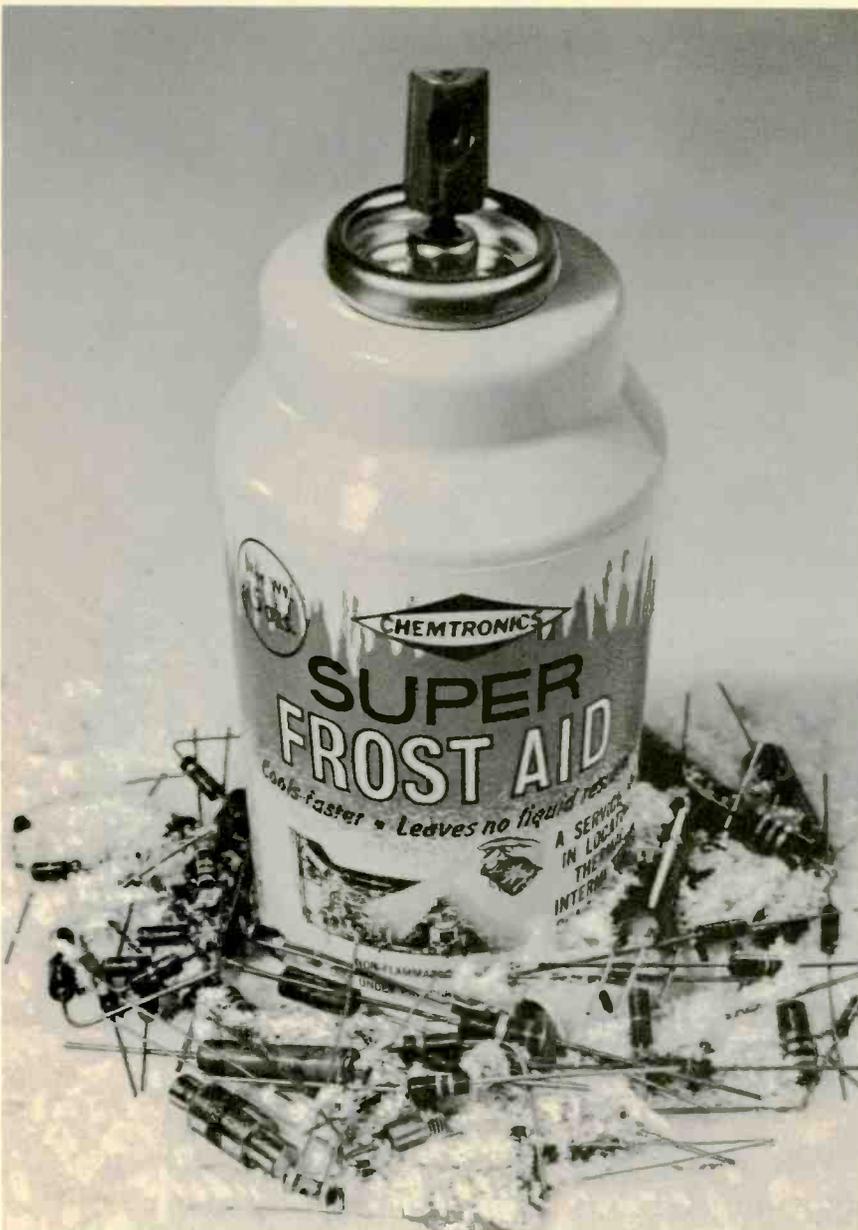
We're out to make GE television products as easy and inexpensive to service as possible. We have a little way to go yet. But we're doing something about it.

For additional information about GE service, call collect or write "Dutch" Meyer.

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The Seamless Wonder will locate thermal intermittents in half the time.

And, cool twice as many components per can.

The reason, the temperature of the spray at minus 50°F is at least 20 to 30 degrees colder than other circuit coolers. The colder the spray, the less you use and the faster it cools. Quick. Efficient. Definite in response.

Super frigid temperatures require pure Freon* ingredients and more pressure than a can with a seam will hold.

Run the "QT" (Quickie Test) check. Spray your circuit cooler on a surface. It should frost immediately and leave no liquid residue. Now sniff it. Pure Freon has no odor. Look for the stronger seamless can.

Or, to be sure buy SUPER FROST AID. The seamless wonder. Passes the "QT" check odorless and seamless.

Available at all leading parts distributors.

CHEMTRONICS INC.

1260 Ralph Avenue, Brooklyn, New York 11236



*Trade name of E. I. DuPont Ask for free copy of, "The Cool Way to find Thermal Intermittents." for more details circle 106 on Reader Service Card

NEW PRODUCTS...

continued from page 64

unit is said to not only convert auto stereo equipment for home use, but will make it possible to demonstrate and test such equipment in sales and

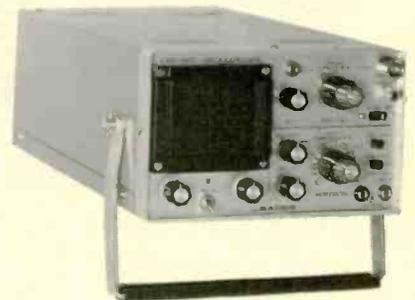


service establishments. Specifications indicate that the unit is fully transistorized, having voltage-regulating circuitry completely hum free. Price \$26.95. GC Electronics.

OSCILLOSCOPE 707

Designed for both vertical and horizontal calibration

A portable, 3-in. triggered oscilloscope/vectorscope, Model LBO-301, with solid-state circuitry, features both vertical and horizontal calibration.



Specifications indicate magnification of 5 times with a maximum speed of 0.2μs/cm. Sweep time is reportedly 1μs to 50ms/div in 15 ranges with preset TV-H and TV-V positions. Bandwidth is said to be dc to 7MHz with 70ns rise time. The unit is said to also feature 0.5v p-p square wave calibrated voltage and offer a vertical sensitivity of 10mv p-p to 5v p-p in 9 ranges. The unit weighs 14 lb and measures 4¾ in. H by 8 in. W by 12 in. D. Price \$334.50. Leader.

SCREWDRIVER 708

Includes four interchangeable bits

A multi-use screwdriver is designed with four interchangeable bits. The tool reportedly includes 3/16-in. and *continued on page 68*

GREATEST TV Schematic Bargain EVER Offered

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Color Sets
1960 - 1968

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All the information for a given model is contained on two facing sheets. The special bound-leaf format allows pages to lie flat when open. Each volume is organized alphabetically by manufacturer, then numerically by model number. In addition, a handy Chassis/Model Finder is bound into each volume. Regular list price for each year's coverage — 2 BIG volumes — is \$19.90. All 8 volumes normally sell for \$79.60. Your price is ONLY \$34.95 . . . a savings of nearly \$45.00!

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-CONTENTS-

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CONTENTS 1967 MODELS

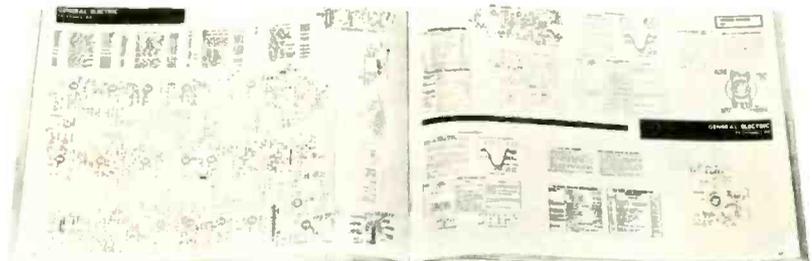
Covers all 1967 color and B & W models of: Admiral, Airline, Andrea, Coronado, Curtis Mathes, Dumont, Emerson, General Electric, Hoffman, Magnavox, Motorola, Olympic, Packard-Bell, Philco-Ford, RCA Victor, Sears-Silvertone, Setchell-Carlson, Truetone, Westinghouse, and Zenith.

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CONTENTS 1968 MODELS

Covers all 1968 color and B & W models for: Admiral, Airline, Andrea, Coronado, Curtis Mathes, Dumont, Emerson, General Electric, Hoffman, Magnavox, Motorola, Olympic, Packard-Bell, Philco-Ford, RCA Victor, Sears-Silvertone, Setchell-Carlson, Sonora, Sylvania, Truetone, Westinghouse, and Zenith.

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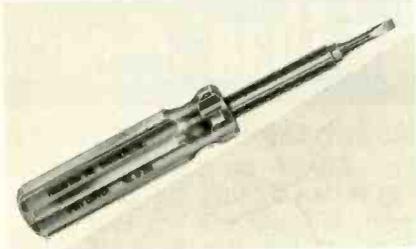
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ET-91

for more details circle 104 on Reader Service Card

NEW PRODUCTS...

continued from page 66



¼-in. flat bits and No. 2 and 3 Phillips bits. To change from one to the other, the bit is pulled out of the han-

dle and reversed. Bits are reportedly made of alloy tool steel and heat treated for maximum strength. Each bit is said to have a spring loaded ball that acts as a detent to lock the bit in place. Length, 7½ in.; weight 6 oz. Holub.

ANTENNA

709

Designed for campers, trailers, mobile homes and boats

Travel-Tron, Model AC-700R, is designed for installation on campers,

trailers, mobile homes and boats; and is said to operate similar to an umbrella. By simply pushing it up, you may get color- and B/W-TV reception



on all UHF and VHF channels as well as FM. The antenna can be snapped down, and is reportedly weatherproof. The unit rotates to pick up stations in all directions. Antenna Corporation of America.

CONTACT CLEANER

710

Protects against rust and corrosion



This contact cleaner, said to be non-toxic, non-flammable, non-explosive, non-conductive and without residue, is reportedly a fluorocarbon solvent cleaner. The manufacturer indicates that the cleaner's non-flammable, dielectric properties allow safe cleaning of electronic equipment while in operation and without disassembly. The anti-static cleaner is said to be compatible with

electrical insulation, elastomers and metals to protect surfaces against rust and corrosion. Available in 16 oz. aerosol cans. LPS Research Labs., Inc.

VIDICON CAMERA

711

Provides usable pictures with as little as two footcandles

A solid-state vidicon camera, Model CTC4000, is designed for security, surveillance and general CCTV applications. The camera is said to be completely automatic—just plug-in and adjust focus. A low-noise FET video input reportedly provides a signal-to-noise ratio of 38dB and useable pic-

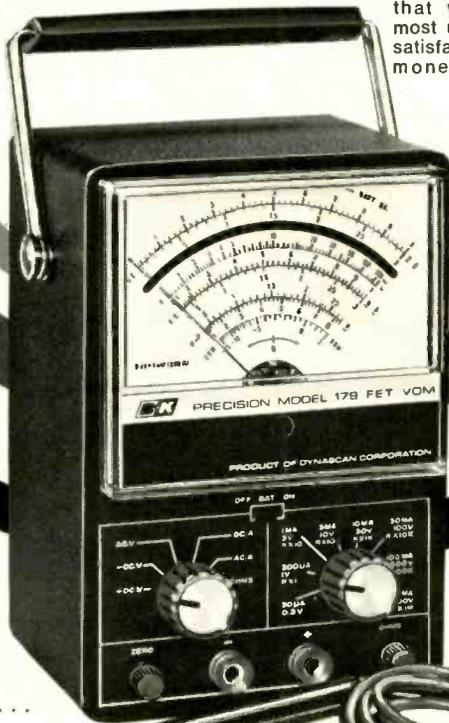
PUT IT TO THE TEST

Leave it to B&K to come up with a new model 179 FET/VOM with features that almost make it unbelievable at its price. Complete DC voltage ranges from .3V to 1000V; DC current ranges .03 to 300 mA; AC voltage ranges .3 to 1000V and AC current ranges .03 to 300 mA. Resistance 0 to 500 Meg and stable operation 0° to 40°C. Fastest and easiest to use.

The 179 uses Field Effect Transistors for drift-free accuracy. High input impedance minimizes circuit loading. And the 179's super-wide variety of ranges makes this an ideal FET/VOM for shop, lab, production line, or school. Includes mirror scale, and stay-put handle.

Now is the time to update your shop with a stable, protected FET/VOM. And the economical, yet professional B&K 179 is the instrument

that will give the most usefulness and satisfaction for your money.



Ask your distributor or write us for catalog.

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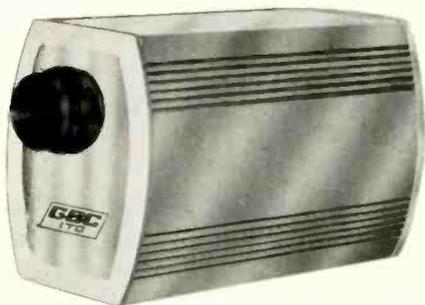
B&K Model 179 FET/VOM \$74.95
The new standard of stability



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

tures with as little as two footcandles. However, it can reportedly handle up to 60,000 lux. The unit measures 8

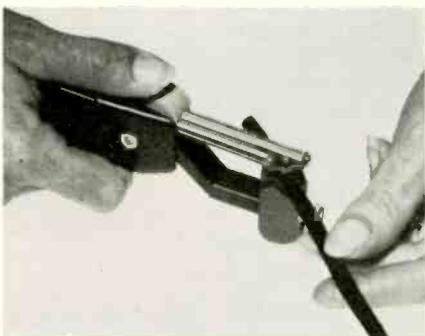


in. L by 3 5/8 in. W by 4 3/4 in. H and weighs 4 1/2 lb. Price \$199. GBC TV Corp.

COAXIAL CABLE STRIPPER 712

Can be used for circumference cutting and splitting

A thermal stripper, Model TW-6, is designed to be used for splitting as well as for circumference cutting all types of cables up to 5/8 in. diameter. A special fixture at the end of the stripper has two slots into which the cable is positioned. Specifications indicate

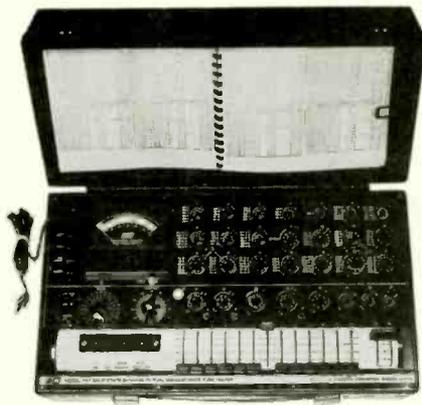


that one of these slots is provided for circumference cutting, while the other is provided for the splitting action. Jensen Tools and Alloys.

TUBE TESTER 713

Features 30 sockets for testing all tubes

A tube tester, Model 747 Dyna-Jet, is said to feature a mutual-conductance section with 21 pre-wired sockets to test the tubes currently in use with only two settings—heater and sensitivity. Tube types are listed on the panel, alongside the sockets. There is reportedly also a mutual conductance "Programmed Section" with nine sockets for testing other tubes. The controls for each pin are fast lever type switches. To clear



the programmed section for additional tests, a single lever is provided which is said to rest all programming switches simultaneously. Specifications indicate that diodes, rectifiers and high-voltage rectifiers are tested for correct emission with proper test loads and voltages. Storage space is provided in the cover for the cord and instruction manual. The tester measures 5 5/16 in. H by 20 1/2 in. W by 11 1/2 in. D and weighs 12 lb. Price \$249.95. B & K.

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that
troublesome
3A3 tube

PLUG IN
the new
all solid state
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ED1 has played a prominent role in the development of high voltage rectifier modules (multipliers) now used by one of the largest TV manufacturers in its all solid state color TV receivers. Now, ED1 has used this same technology to develop the new, solid state SOLID-TUBE as a field replacement for the troublesome 3A3 vacuum tube rectifier.

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SOLID-TUBE Type Number	Replaces Vacuum Tube Type Number
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R-3AT2	3AT2

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DEALER SHOWCASE...

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

PRINTED-CIRCUIT KIT 714

Employs use of photo-sensitive boards

A photo-etched printed-circuit kit, No. 650, is designed to produce professional printed circuits. It is said to be a completely packaged kit using a photosensitive method for producing

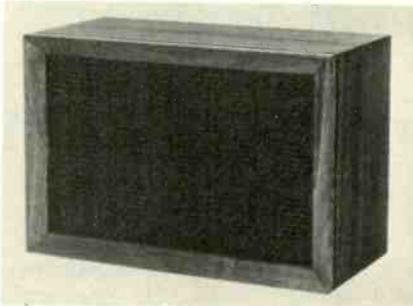


printed circuits. A darkroom is reportedly not required and the kit has materials included to let you make negatives from magazine circuits. Specifications indicate that the kit contains two photosensitized 3-in. by 4-in. copper clad boards, a photographic test negative and an ultraviolet light source. It reportedly also contains an exposure glass, clamps, developer, etchant, trays, resist remover, drill and complete instructions. Price \$10.80. Injectorall.

ALARM SYSTEM 715

Can be moved from room to room

The Model ACA-150 alarm system reportedly provides protection utilizing an ultrasonic sensor and built-in alarm. Appearing as a bookcase speaker, the



unit can be moved from room to room. No installation is necessary—merely connect the unit to any convenient 115v ac wall outlet. Any intruder entering the protected area is said to trigger the ultrasonic sensor, causing an immediate alarm—such as a lamp, bell or siren. Some 15 to 20

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This efficient new Britener corrects for cathode-to-filament shorts causing loss of black and white video drive... isolates the short, restores the black and white information necessary for color picture quality.



When needed later, sliding the boost switch raises electron emission, restores full contrast and sharpness to fading picture.

Model C-503 for round tubes
Model C-513 for rectangular tubes
Dealer Net \$7.75



PERMA POWER DIVISION OF
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... for more details circle 144 on Reader Service Card

sec later, a second alarm reportedly sounds. Specifications indicate maximum range of the unit at approximately 23 ft and 6 ft minimum range. An ON-OFF switch and a range sensitivity adjustment control are on the back of the cabinet. Dimensions of the cabinet are 11 $\frac{3}{8}$ in. W by 6 $\frac{1}{4}$ in. D by 7 $\frac{5}{8}$ in. H. Bourns Security Systems, Inc.

AMPLIFIER ADAPTER 716

Adds fourth dimension to stereo system

The QA-3 "Quatrasonic" adaptor can reportedly be connected to almost any stereo amplifier and receiver system. The adaptor is reportedly not an



amplifier but a device designed to extract the four-channel information inherent in all stereo programs. It is said to require no ac power but can simply be connected to the amplifier speaker outputs. Specifications indicate that the unit can be used with any standard stereo amplifier or receiver with 4, 8 or 16 Ω speaker output terminals. The four-position switch is said to permit the selection of four-channel operation, front speakers only, rear speakers only, plus providing a facility to balance the gain of the stereo channels. Price \$29.95 or \$17.95 in kit form. EICO.

ERRATA

We wish to apologize for a typographical error that occurred last month in our New & Noteworthy column. There it was erroneously indicated that Sencore's Caddy Bar Jr. contained a preheater powered by two mercury cells. It should have instead indicated that also featured is a new built-in preheater for fast warm-up in cold weather. Simply plug a heater cord into the receptacle provided to remove moisture and preheat the circuitry. Specifications indicate that the low battery drain of "Perma-Lock" circuits, plus Automatic Shut-Off, provides near shelf life from two mercury cells.



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From 4" miniature electronics to 10" utility. Precision made in USA. Forged alloy steel construction. Cleanly milled, perfectly aligned jaws. Hand-honed, mated cutting edges. Most with Cushion Grip handles.

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BOOK REVIEWS

TV TECH AID published by Edward G. Gorman, paperbound \$7.95 per year.

Those readers that benefit from the service tips in the Colorfax and Technical Digest portions of ELECTRONIC TECHNICIAN/DEALER, will also find useful the many service tips incorporated in TV TECH AID. There, a monthly listing (according to manufacturer and chassis) indicates the symptom that you may encounter in that particular TV set, the possible cause and the cure. Where appropriate, a partial schematic is also included with an arrow pointing to the component in question.

FIRE & THEFT SECURITY SYSTEMS by Byron Wels, published by Tab Books, hardbound \$7.95, paperbound \$4.95.

Unfortunately we are living in a time when in certain parts of our nation personal and property safety are so badly on the decline that there is becoming an increased demand for security systems. This has been reflected in recent readership response to new product and literature listings in past issues of ELECTRONIC TECHNICIAN/DEALER.

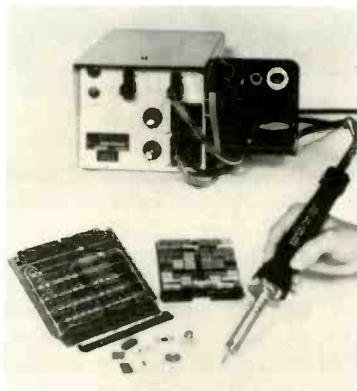
For those readers that are seriously investigating the effective use of various security systems, both for their shop and this new market, the author has done an excellent job of describing what types of equipment are most effective for what application. Probably the most amusing of these systems consists of the following: "... clip the following out of this book and carry it in your billfold. The next time you're assaulted, pull out the clipping and read it: 'I am a black-belt karate expert. My hands are registered as lethal weapons with the police department of this city. I am required by law to inform you that in any encounter with me, you may be seriously injured or perhaps killed.' Now you calmly replace the billfold in your pocket, assume a karate-like attack stance, and proceed to get 'mobilized.'"

In a more serious vein, the author covers smoke detectors, fire detectors, water detectors, deterrents, electrostatic field detectors, foil stripping for doors and windows, vibration detectors, sound sensors, infrared intrusion detectors, surveillance systems, microwave movement detectors, pocket-portable remote radio alarm controls,

SOLDER DESOLDER SOLDER DESOLDER

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... with PACE's Sodr-x-tractor®: the system that removes any soldered-in parts without damage. The Sodr-x-tractor applies three distinct modes of operation — pressure, vacuum, or hot air jet — through a tip with controlled heating capacities to 1000°F. Yes, you can



perform Sodr-x-traction and part replacement cleanly and efficiently with one integrated system. Solder, desolder, solder, desolder... but don't get carried away.

PAGE

INCORPORATED

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SOLDER DESOLDER SOLDER DESOLDER

... for more details circle 127 on Reader Service Card

telephone dialer alarms, plus even a few other systems.

In addition to telling how to select and install the appropriate alarm system, the author offers helpful suggestions for convincing the customer that he must appropriately invest in such equipment.

We feel that this book is a must for any electronic technician that is seriously considering expanding his business to include such services.

BASIC TELEVISION: THEORY AND SERVICING, A TEXT-LAB MANUAL, Second Edition by Paul B. Zbar and Peter W. Orne, published by McGraw-Hill, paperbound \$8.95.

The foreword to this book indicates that it "reflects the continued association of the Electronic Industries Association and Voorhees Technical Institute in the preparation of curricula and laboratory manuals for the training of electronics technicians."

This is probably the most comprehensive, well written and clearly illustrated book that we have seen on the subject of TV receiver theory and maintenance. Any attempt to be more specific in our description of this book would be a disservice to its authors.

We feel that this book is a must for all electronic technicians, and includes excellent coverage of both tube and solid-state circuitry.

SERVICING AUTOMOBILE STEREO by Forest H. Belt & Associates, published by Howard W. Sams & Co., Inc., 192 pages, 5½ x 8½. \$3.95 softcover.

The author of this book is a well known authority in the service industry and has written this book with the idea that it should allow an easy, systematic and practical approach to troubleshooting. He follows a 1-2-3-4 servicing procedure intended to facilitate a more complete service job because it helps the technician catch small defects in circuit operation that he might otherwise overlook until the customer calls him back.

The book has 11 chapters. The first two explain the fundamentals of the author's 1-2-3-4 approach. Chapters 3, 4, 5 & 6 describe various automobile units such as stereo receivers, FM multiplex and cartridge tape units. The next five chapters deal with applying the 1-2-3-4 servicing methods to actual troubleshooting problems. The book follows diagnostic, practical troubleshooting organization and will be of special interest to those technicians who want to learn more about servicing automobile entertainment units.



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TEKLAB...

continued from page 39

video information is delayed so that when the inverted noise pulse is added to the delayed signal, it arrives before and finishes after the original noise pulse in the signal. This causes complete cancellation of the noise in the video.

Next month we will cover the color processing circuits which employ three integrated-circuit packages plugged into sockets for easier servicing. ■

CAT GAME...

continued from page 45

circuit of sync separator transistor TR9 to ensure noise-free sync.

19. (d)—Located in the vertical system's feedback loop, capacitor C76 and the adjacent 5.6K resistor form a low-pass filter, which is necessary to prevent horizontal pulses from being coupled back to the base of transistor TR15, where they would upset the precise timing of the oscillator—producing poor interlace. These horizontal pulses are the result of "cross-talk" between the horizontal and vertical deflection coils in the yoke.

20. (a)—Capacitor C79 couples negative-going sync pulses from the collector of transistor TR9 to the base of transistor TR16 (the driver, being an emitter follower, does not invert signal phase), thus, negative-going sync pulses are fed to the input of transistor TR17. The latter inverts the pulses so that positive sync pulses are fed back to the P-type base of the NPN normally OFF transistor (TR15), triggering the oscillator ON. With C79 open, the vertical deflection system is free running.

How do you rate? Score five points for each correct answer—90 to 100 is excellent, 75 to 90 is good, 60 to 75 is fair, while less than 60 suggests that you get the books out and brush up a little on transistor theory and TV troubleshooting. ■

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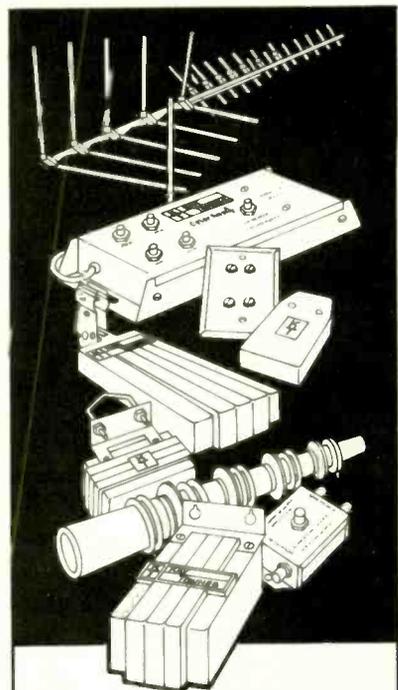
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I invite your comments in this debut issue of the ET/D Action Card Supplement which will be included in our publication about two or three times yearly.

Thank you.

Sincerely,

A handwritten signature in cursive script that reads "Al Menegus". The signature is written in dark ink and is positioned below the typed name "Al Menegus".

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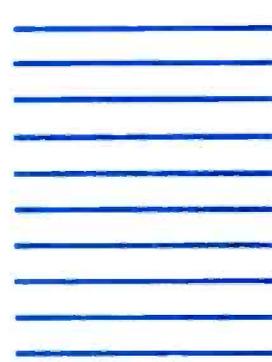
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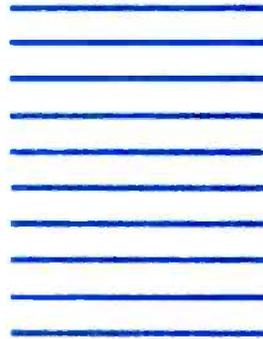
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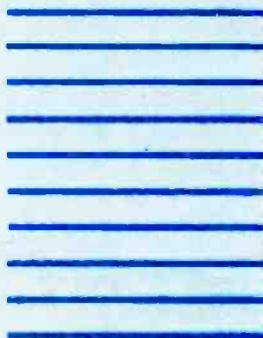
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