May, 1973 ☐ 75 cents

A HOWARD W. SAMS PUBLICATION

Electronic Servicing®

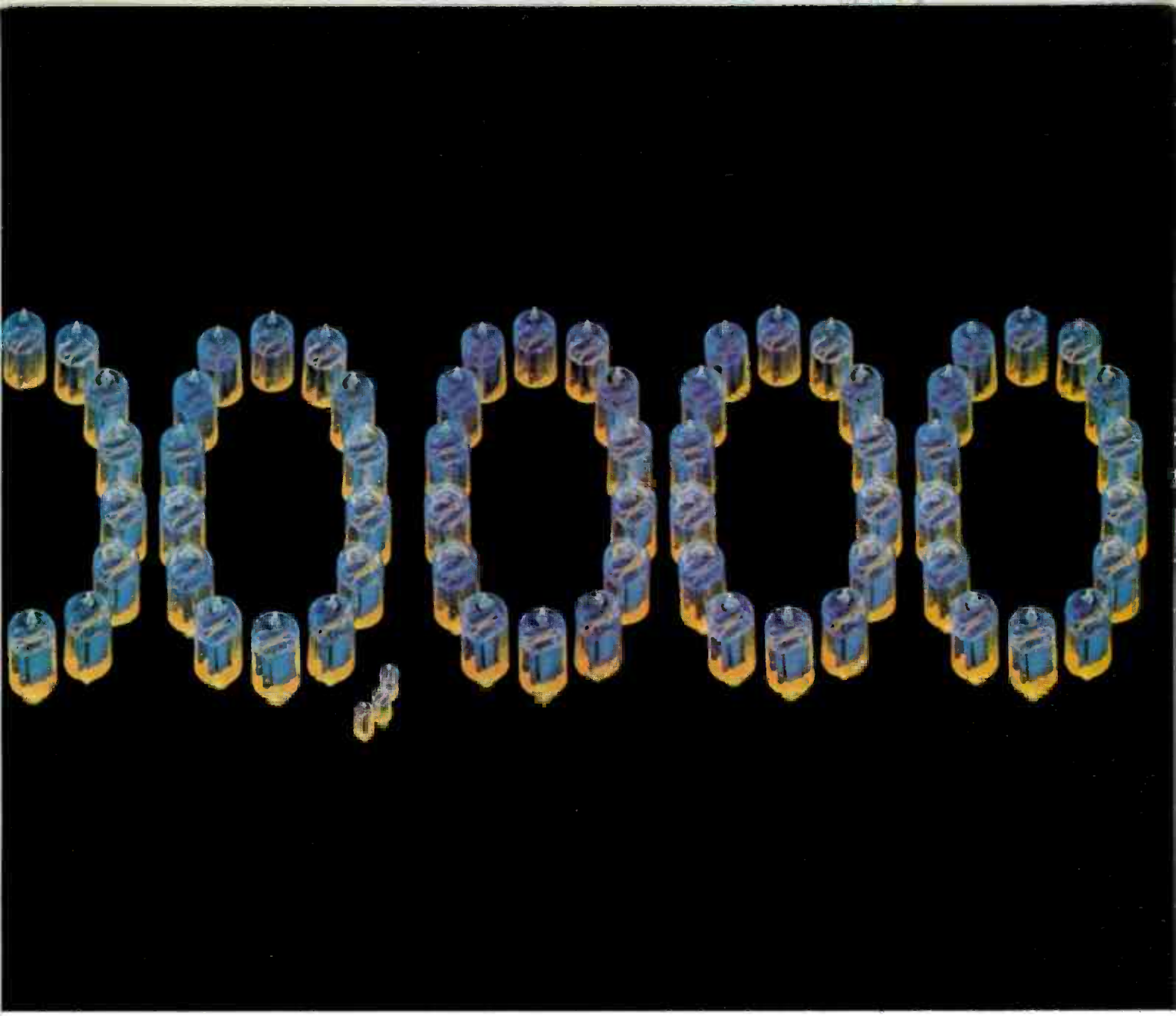
The basics of digital logic

Misbehaving microwave

Where did the convergence go?

Signature patterns

Tubes: a business with



a helluva big future!

Receiving tubes spell opportunity. The replacement market was approximately $442 million* in 1972, and 75% of new TV sets produced last year use tubes.

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Based on actual and projected E.I.A. figures for 1972 and calculated at RCA's optional list prices.

RCA is a leader in tube development. Our record is over three billion receiving tubes produced to date.

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Over one and a quarter billion tubes are turning it on.

For More Details Circle (1) *on Reply Card*

RCA Electronic Components

May 1973 □ Volume 23, No. 5

Electronic Servicing®

in this issue...

DEPARTMENTS

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Robert E. Hertel, Publisher

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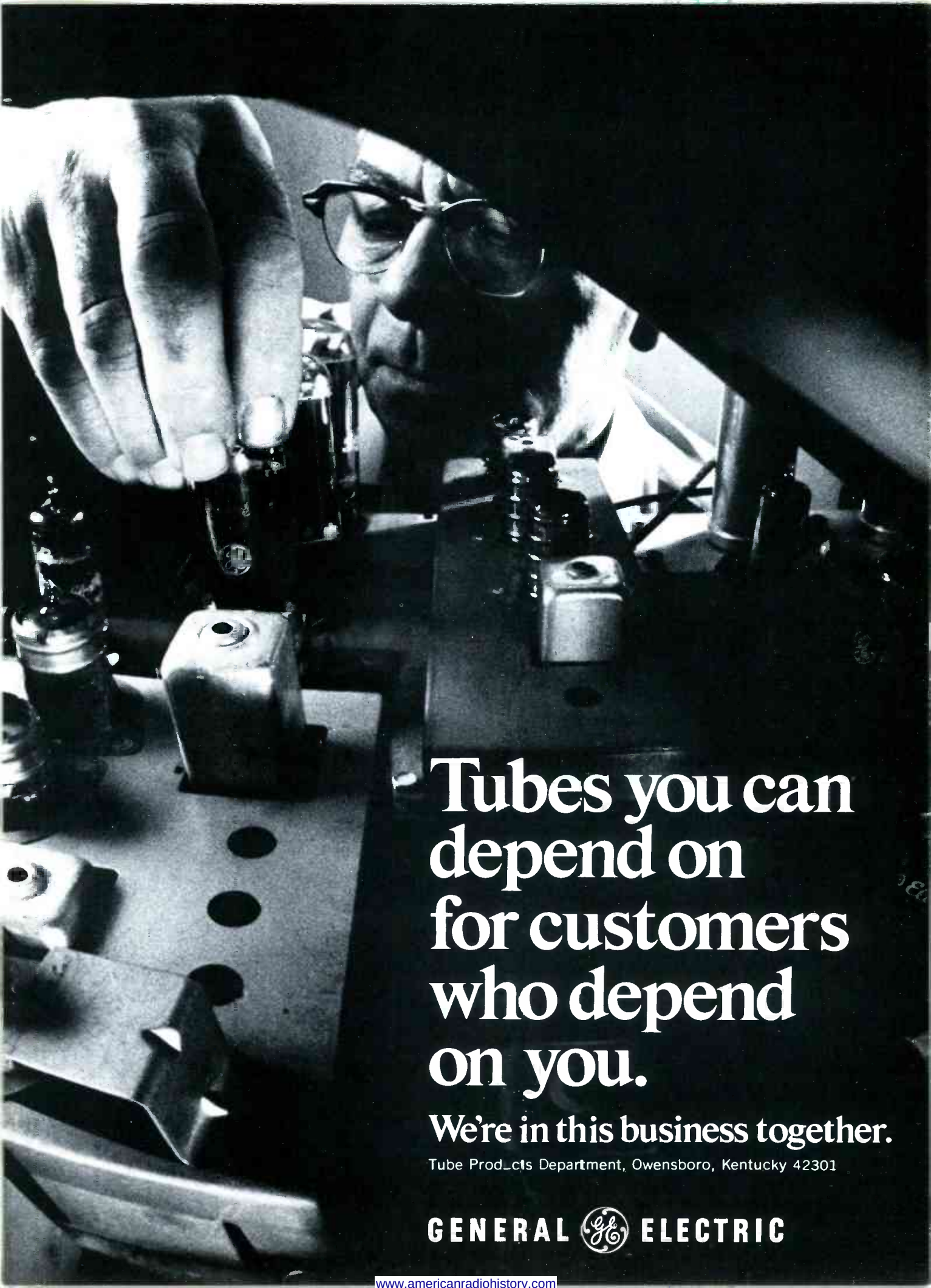

Tubes you can depend on for customers who depend on you.

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Tube Products Department, Owensboro, Kentucky 42301

GENERAL ELECTRIC

electronic scanner

news of the industry

A computer voice response of up to 16,000 words is claimed for the Voice-Response Controller marketed by the Qantel Corporation. The device is connected by means of a standard touch-tone telephone to a computer. In one usage, the caller is verbally instructed by the computer as to how to get the information he wants from the computer. Another typical application is for a field salesman to phone his headquarters for direct access to the computer, which would read back to him the information stored about inventories, sales or credits. No human operator is required between the telephoner and the computer. Approximately the same data is available as is now displayed on picture-tube readouts.

Sales total in the U.S. electronics market for the year of 1972 totaled $30.6 billion. This is a 9.6% increase over 1971 sales, according to the Electronic Industries Association (EIA). Consumer-electronic product sales increased a substantial 19.5% up to $6.6 billion.

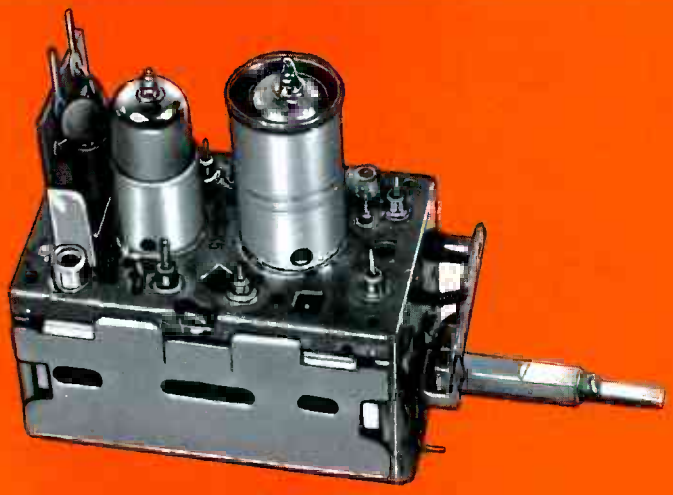
Sixty-five MATV installers, contractors and technicians attended the Jerrold Advanced-MATV school held recently at the Ramada Inn near Chicago's O'Hare Airport. The two-day seminar was conducted by Allen Pawlowski, Jerrold Product Manager. Jerrold sponsors both basic and advanced MATV schools all over the country on a year-round basis.

Tom Young has been appointed general manager of the PTS Electronics, Inc. new branch in Philadelphia, Pa. This is their seventh regional tuner-repair facility.

RCA has been awarded an Air Force contract to develop an airborne television system that can freeze an individual TV frame, and provide instantaneous reconnaissance data for in-flight analysis. The system will be built around the RCA-developed Return-Beam Vidicon (RBV) camera tube. One feature is the capability of enlarging portions of a still picture to bring out details not normally visible in the entire frame, and this can be done merely by knob adjustments. Picture sharpness is said to be 200 times that of conventional TV receivers. The video of received data can be recorded on tape and returned to a ground station for more detailed analysis, if desired.

Still pictures were transmitted by means of the unused subcarrier of the FM station operated by the public school system in Flint, Michigan starting in April. Conventional TV receivers, equipped with a converter, can display a complete picture after six seconds of "build-up" time. This is "slow scan" and appears to be similar to the method used by radio amateurs. The purpose of these broadcasts is to find out if a succession of still pictures can be used as an effective substitute for the much-more-expensive fast-scan television.

(Continued on page 6)



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VIRGINIA	4538 E. PRINCESS ANNE RD., Norfolk, Virginia 23502	TEL: 703-855-2518

TSC

WATCH US GROW

For More Details Circle (6) *on Reply Card*

Day-and-night cloud-cover photos in four spectral bands extending from the visible to the far infrared will be supplied for world weather forecasting by a 4-channel Very-High-Resolution Radiometer to be developed by the Aerospace/Optical Division of ITT. The Radiometer is to be orbited by a Tiros-N rocket.

A new $2-million audio-visual facility is now under construction at the Crown Center in Kansas City, Missouri. Scheduled to open this fall, the communications center will be available for business meetings, educational seminars, or artistic performances. Closed-circuit TV will link the Crown Center Hotel (where the combined NATESA/NEA convention is to be held) with the retail area and the apartment-condominium community. Also, a two-way television system will link the Multi-Media Forum with the medical complex located on a neighboring hill. A two-storied presentation hall will seat as many as 450 persons in upholstered chairs. The floor of the hall will be the raised "computer" type for access to the wiring.

A new-type of flat motor without iron in the rotor has been developed by Matsushita Electric of Japan (Panasonic). Thickness of the motor is only 1/3 to 1/4 that of conventional motors, and can be used on 120 VAC power with the addition of a rectifier diode. Previously, flat motors used a rotor with coils printed on a resin disc, but these were limited in power and voltage. The new motor is of the commutator-motor (DC with brushes) type, but has no iron in the rotor to eliminate the sparking at the brushes. Estimates place the lifespan at two to three times that of the usual brush-type motor. The size and shape of the new motor compared to other types are shown in the picture. □

Courtesy of Panasonic

Introducing the expensive digital multimeter that doesn't cost a lot.

The B&K Precision Model 281. A solid-state, lab-quality portable instrument that measures AC/DC voltage, current and resistance.

The state-of-the-art Model 281 shows readings on a large, clear, 2½-digit numeric display. It also has positive over-range and reverse-polarity indication. There's no need to switch leads. You can reverse polarity at the flick of a switch.

Model 281 readings are faster and more accurate than analog-type meters. Unlike hard-to-see needle indicators, you can read the large, illuminated numerals—including the decimal point—from a distance.

Featured are 26 ranges: five DC voltage, 100mV to 1000V, with 1% accuracy and 10 megohms input impedance; five AC voltage, 100mV to 1000V RMS, five DC current, 100μA to 1A; five AC current, 100μA to 1A; and six resistance, 10 ohms to 10 megohms.

With built-in protection, the 281 can't be harmed by overload. And for safety's sake, it has a three-line AC grounded cord.

Everything about the 281 says expensive—except the pirce.

Call your B&K distributor.
Or write Dynascan Corporation.

Very good equipment at a very good price. B&K

$169.95

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For More Details Circle (7) on Reply Card

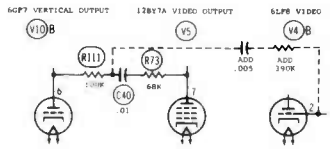
troubleshooting tips

Send in **your** helpful tips—we pay!

Vertical retrace lines
RCA CTC16 color TV chassis
(Photofact 736-4)

This circuit modification greatly reduces vertical retrace lines, especially during low contrast and high brightness operation.

Notice that R111 is on the sweep board near the 6GF7 tube, while C40 and R73 are on the chroma board just behind the 12BY7A tube. The 6LF8 tube is on the video-IF board.



There is one precaution: the 390K resistor you add should be located near the 6LF8 tube to minimize blurring the fine detail. The added .005 capacitor can be mounted at any convenient point. A smaller value doesn't give enough blanking, and a larger size causes the top of the picture to be darker than the lower part.

D. S. Raju
St. Lambert
Quebec, Canada

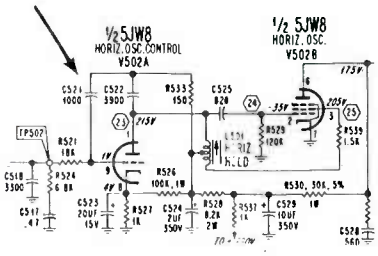
Poor horizontal locking
Admiral K19 color chassis

The picture would begin in horizontal lock, but fall out of sync in just a few seconds. Locking was critical as though the horizontal sync pulses were weak.

First, I grounded TP-502 to eliminate all locking and tried in vain to obtain zero-beat by using the horizontal-hold coil (oscillator coil). All the DC voltages were within tolerance, so I started substituting capacitors in the oscillator-control stage.

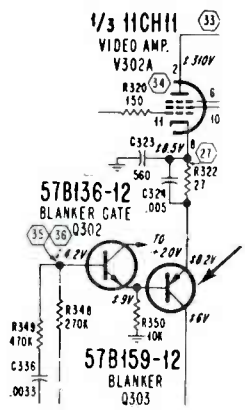
When C522 was replaced, the horizontal could be brought into solid locking. Evidently C522 was open.

David M. Eshbaugh
Eshbaugh TV
Clarion, Pennsylvania



Dark picture, or retrace lines
Admiral K19 color TV chassis

Failure of the Q303 blanker transistor in the Admiral K19 chassis can cause either a dark picture, if the transistor is open, or a normal picture with vertical-retrace lines at low contrast, if the transistor is shorted.



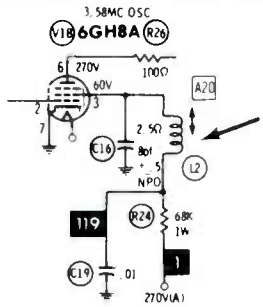
Courtesy of the Admiral Corp.

I have found the original part number 57B159-12 can satisfactorily be replaced by either a ECG-159 or a GE-21.

Robert G. Huhlman, CET
Sheffield, Pennsylvania

No color
RCA CTC52 color chassis
(Photofact 1211-3)

This receiver had no color at any adjustment of the fine tuning, color control, or killer control. Preliminary tests showed no signal output from the 3.58-MHz oscillator tube.



Next step was to measure the DC voltages at the oscillator tube. The screen grid (used as anode of the oscillator) had zero voltage because L2 was open. Replacing the coil and resetting the AFPC brought back the original performance.

Al's Radio & TV Repair
Roxbury, Massachusetts

HV arcs, or flashing in CRT
Any television receiver

In all cases where a receiver in the home has had intermittent high-voltage arcs, you should suspect an excessively-high line voltage. I have found several cases like this where the line voltage measured around 128.

To check in the shop for such a possibility, use a variable or tapped line-voltage-adjusting transformer to temporarily raise the voltage for a test.

Many high-voltage arcs are normal at elevated line voltages. If the power company will not remedy the situation, sell the customer an up-10/down-10 voltage transformer.

James O. Woodward
Woodward TV & Changer Repair
New Castle, Indiana □

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For More Details Circle (9) *on Reply Card*

reader's exchange

Need a not-available schematic? Need an obsolete part? Have an unusual service problem and want help? Send information and full mailing address to ELECTRONIC SERVICING. Other ES readers should send replies with their offer of help direct to the writer. We reserve the right to edit and print all letters sent to this column. **Let us help one another.**

Needed: *Schematic for an Atwater Kent radio model 559. This model is about 38 years old.*

William L. Wilson
121 North K Street
Lompoc, California 93436

Needed: *Schematic for a model 2908J J.B. Hunter color television made by the Victor Company of Japan.*

T. R. McDonald
1256 Vance Avenue
New Albany, Indiana 47150

Needed: *Schematic and service manual for a Waterman scope model S14A.*

Joseph Grisafi
33-65 14 Street Room 5C
Long Island City, New York 11106

Needed: *Schematic diagram and other information for an RCA radio model BC-352M. Also, would you help me get obsolete components, schematics, etc. in exchange for Indian-made articles?*

K. Ponmalai
'ULAVAGAM'
Ganapathy P.O.
Coimbatore 641006
India

Needed: *Schematic and parts list for an old Majestic radio model 290. Also, tubes such as G48, 57S, 56, 58, 47 and 82.*

Donald Lewis
Lewis Radio & TV
Route 1
Central City, Nebraska 68826

Needed: *Schematic and parts list for an Atwater Kent radio model 41. Might trade one or two old Atwater Kent radios without tubes for a set of tubes for one.*

Donald Lewis
Lewis Radio & TV
Route 1
Central City, Nebraska 68826

Needed: *Schematic or manual for Gonset G76 Model 3338 AM/CW transceiver. Especially, what power is required at the 10-prong Jones plug?*

J. E. Strenk
RD 2 Box X
Rhinebeck, New York 12572

Needed: *Power transformers for a Waterman 14A or B pocket scope and a Philco model 58200.*

G. E. Howarth
Howarth Sales & Service
P.O. Box 467
Oskaloosa, Iowa 52577

Needed: *Schematic or service data for a Silvertone Model 4441 (Ch. 101450) radio, and a Philco Model 37-610 radio — both are old.*

David P. Alessi
2709 W. 11th Street
Erie, Pennsylvania 16505

Needed: *Schematic for a Brunswick radio model 15. Does this old radio have any antique value to you?*

Vincent Deiuro
310 Washington Street
Carlstadt, New Jersey 07072

Needed: *Schematic and service information for an old Philco radio, Chassis Type 17, Code 121.*

Louis P. Schuitema
627 Deerfield Drive
Streamwood, Illinois 60103

Needed: *Schematic and alignment data for an Avia Products Company fixed-frequency VHF FM receiver model FM-R152.*

Everett G. Snapp
2124 Barr Road
Wilmington, Delaware 19808

Needed: *Instruction manual for an Accurate tube tester Model 157.*

E. L. Carreau
420 Hastings
Pt. Townsend, Washington 98368

Needed: *Horizontal output transformer part number 033-012800 for a Hoffman TV model W7419.*

George B. Weller
Weller TV Repair
16243 122 Ave. S.E.
Renton, Washington 98055

Needed: *Two 10-inch reels for a very old Berlaut Concertone Tape Recorder.*

Anthony Lougo
9 Fairview Place
New Rochelle, New York 10805 □

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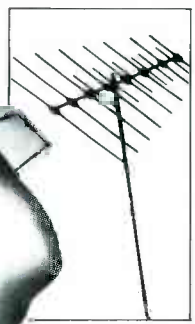

FM Block—reduces FM gain if desired.
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Double Butterfly UHF Elements—provide high UHF gain.
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You can also choose from an expanded line of Zenith quality accessories. Installation hardware. Antenna rotors. Wire and cable.

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At Zenith, *the quality goes in before the name goes on.*®

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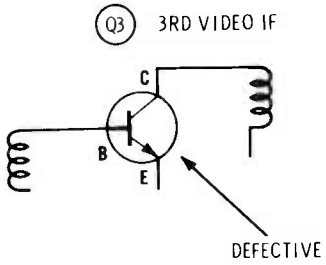
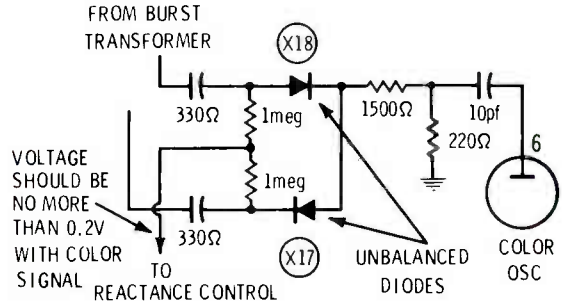
Chassis—All Philco hybrid color chassis
PHOTOFACT—954-2 for reference



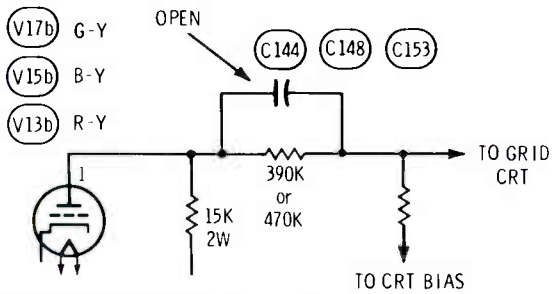
Symptom—Picture negative or has white compression
Cure—Check 3rd video IF transistor, and replace if defective

Chassis—All Philco hybrid color chassis
PHOTOFACT—954-2 for reference



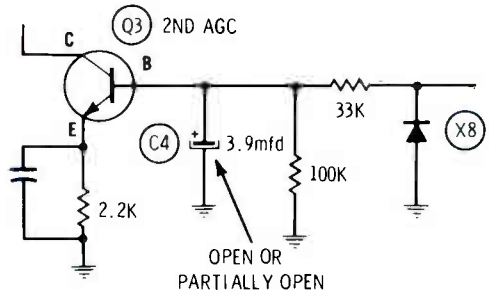
Symptom—Color slow to come on, or out of lock
Cure—Check diodes X17 and X18 for balance.

Chassis—All Philco hybrid color chassis
PHOTOFACT—954-2 for reference



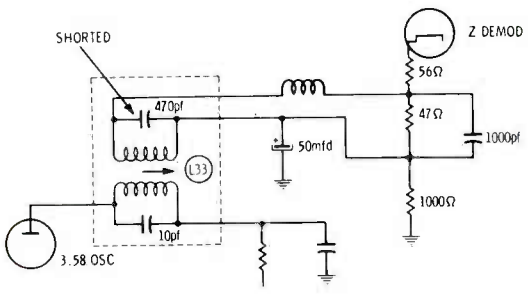
Symptom—Left edge of raster tinted, and smeared color
Cure—Check for open capacitor from -Y amps to CRT grids

Chassis—All Philco hybrid color chassis
PHOTOFACT—954-2 for reference



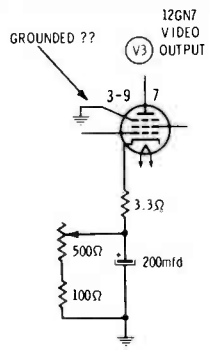
Symptom—Soft vertical locking or shimmy
Cure—Check C4, and replace if reduced in capacitance

Chassis—All Philco hybrid color chassis
PHOTOFACT—954-2 for reference

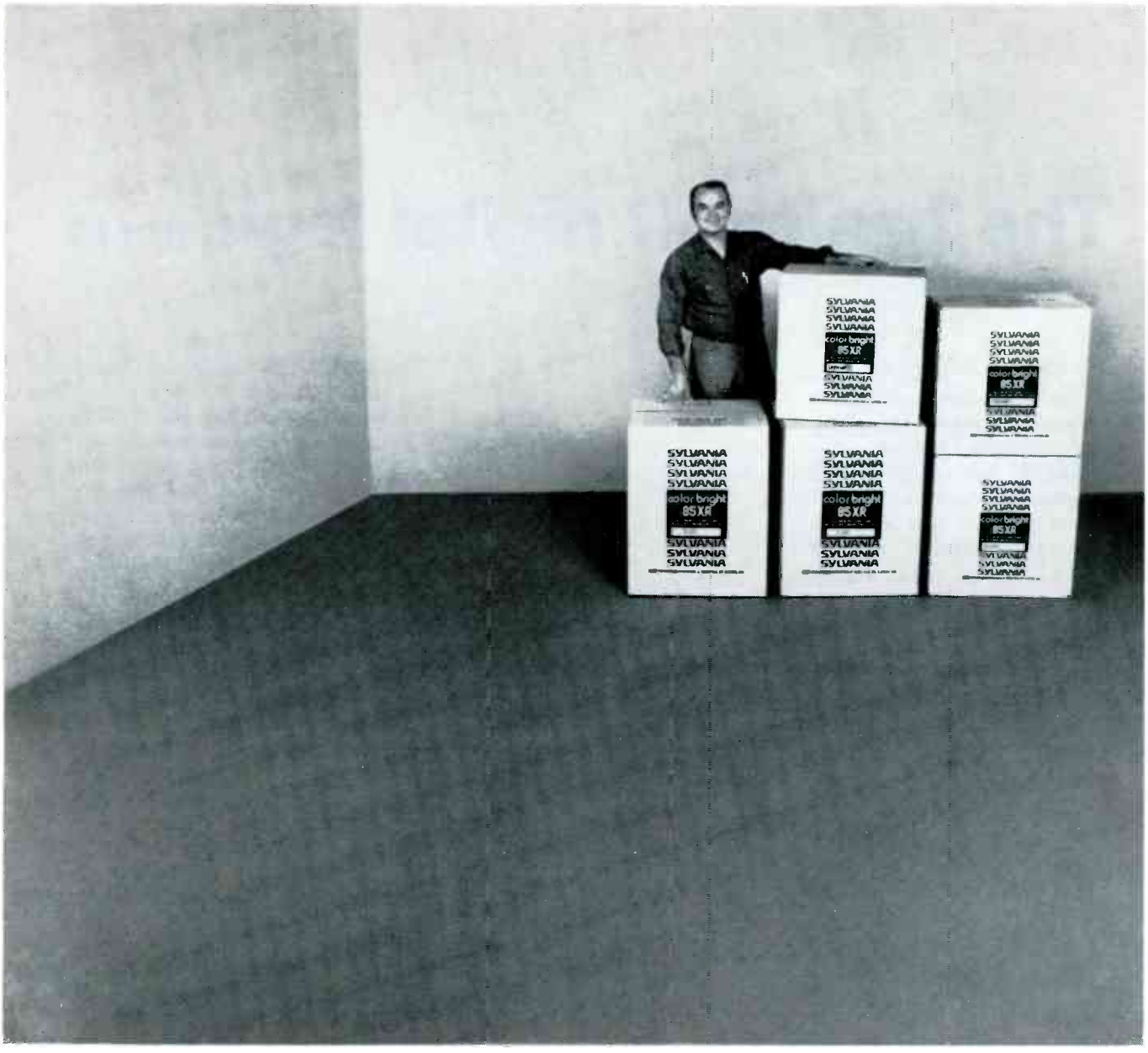


Symptom—Colors are mainly magenta
Cure—Check the 470 pf capacitor inside L33, and replace if shorted

Chassis—All Philco hybrid color chassis
PHOTOFACT—954-2 for reference



Symptom—Vertical b-w bars
Cure—Check for a good ground at suppressor (3-9) of video output tube



As you can see, your Sylvania distributor has 200 picture tubes in stock.

And they're all in just five Sylvania cartons.

Because our line of five color bright 85XR® OEM-quality tubes gives maximum coverage of 19V, 21V, and 25V diagonal sets with a minimum of stock.*

It also means faster service because these Sylvania picture tubes are direct replacements. You replace a kimcode with a kimcode, a bonded with a bonded.

And then, there is the biggest advantage of all: You can count all your large-screen color tube needs on the fingers of one hand.

See your local GTE Sylvania distributor for a complete replacement list. With needs that you can count on one hand, you can bet he has the tube you want in his hands.

Sylvania Electronic Components, 100 First Ave., Waltham, Mass. 02154.

*XR23VANP22/ SRE25BGP22	Replaces 53 types
XR23VAQP22/ SRE25BHP22	Replaces 27 types
XR19VABP22	Replaces 22 types
XR18VAHP22	Replaces 82 types
XR18VADP22	Replaces 16 types

GTE SYLVANIA

The basics of digital logic part 1

By Carl H. Babcoke

One of the most significant events of the twentieth century is the entry of digital arithmetic into the electronics field. At first, digital circuits were confined to computers; but now in our field we have digitally-reading test meters of various kinds, TV tuners with digital circuits, and digital frequency-meters whose readout replaces the dial of FM receivers. In this first of a series of articles, we are presenting the basic information necessary to an understanding of simple digital equipment.

Decimal Versus Binary

Our form of arithmetic is "decimal". That is, it's based on units of tens. Perhaps it originated because people have ten fingers and ten toes. At any rate, a decimal system is handy and easy to work with when mathematical problems are solved by use of pencil and paper.

The most simple electric device is an on-off switch. Only two states are possible (See Figure 1); either the switch conducts current, or it doesn't. Such a system is properly called "binary".

It is the custom to call the binary system "digital". This is a mistake, for the term comes from digits (fingers) and should refer to ten. However, we don't want to further confuse the issue, so all systems with only **two conditions** will from here on be called digital.

Bits and States

The "bit" is the basic unit of digital logic, and it represents the "state" of the signal at any fixed point of time.

Two possible states of the bit are "high" and "low". One complication is in the language used by some digital engineers. Some call the high state 1, yes, positive, true or active, and the low state O, no, negative, false or inactive. We will use this system, although some use the reverse definition. However, it's only natural for us to call a positive voltage "high" and a negative or zero voltage "low". This system is called "positive true logic".

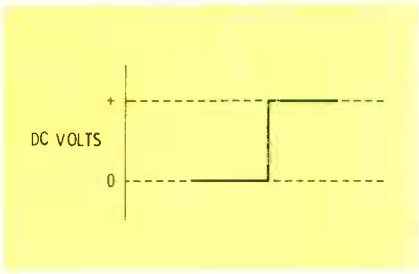


Fig. 1 A digital signal voltage is either there or not; nothing in between is wanted. Digital circuits usually have no adjustments or signals of varying amplitude.

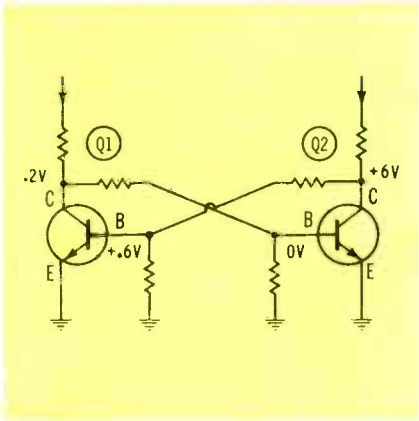


Fig. 2 This is the schematic of a basic DC flip-flop. At turn-on, one of the transistors will have more current flow, or start drawing current before the other. That transistor (assumed to be Q1 in this example) will become saturated. Q2 will have virtually no base voltage, because it is obtained from the collector of Q1, which has little voltage. If the collector voltage of Q2 is reduced to less than one-half the supply voltage, Q1 draws less current, its collector voltage rises, and with it, the base voltage of Q2. This reduces the collector voltage of Q2 even more, in a regenerative pattern. Therefore, the circuit switches very rapidly to the opposite stable state where Q2 is saturated and Q1 is cutoff. Reducing the collector voltage of Q1 reverses the stable condition, and so on.

Basic DC Flip-Flop

Perhaps the most basic digital circuit is the DC flip-flop shown in Figure 2. It resembles a multivibrator because each collector feeds the other base. But there are no coupling capacitors, and the circuit is stable in whichever of the two possible states it finds itself, until changed by outside forces. The full explanation is given with the schematic, but if Q1 was saturated, its collector voltage would be virtually zero and there would be no supply for the base of Q2. Therefore, Q2 would be cut-off. These conditions prevail until the collector voltage of Q2 is reduced enough, or the base voltage of Q2 is increased enough to cause the circuit to "flip" to the opposite set of voltages.

This particular flip-flop does not divide the frequency of any incoming trigger pulses, so it cannot be used in counting circuits.

Triggered Flip-Flop

Figure 3 shows a modified flip-flop that functions as a DC flip-flop when there are no triggering input pulses. But in addition, it has a pulse-shaping network, steering diodes, and capacitors across the feedback resistors. In this circuit, the saturation of the transistors reverses during the negative-going edge of the triggering square wave.

Look at it this way: suppose Q2 is

Delta Answers Four Big Questions About Security Systems With Their Problem Solver, The All New Centrally Controlled System.

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Can it be installed easily with minimum wiring?
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Is it flexible to use with existing systems?
Yes, the system is completely flexible and can be used with other existing systems.

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(1) Fire Detector: Detects dangerous gases and fire. Activation puts computer system in immediate alarm condition by overriding any other signal. **(2) Phase Lock Loop Alarm Transmitter:** Used to connect existing N/O or N/C circuits to computer with minimum wiring. **(3) Phase Lock Loop Emergency Transmitter:** Panic/emergency signal device puts system into instant alarm. **(4) Computer:** Central control unit receives signals from Delta's alarm transmitter via existing AC power lines, thus activating self-contained horn, Delta's telephone dialer (when attached) or other alarm devices. Equipped with time exit and entrance delay. The system will sound an alarm condition should AC power fail for more than 45 seconds. **(5) Disable Transmitter:** Allows the complete system to be turned on and off from some remote area. **(6) Phase Lock Loop Receiver:** Accessory to activate 110V light, bells or other alarm device. **(7) DeltAlert Ultrasonic Detector:** Senses movement of intruder in protected area causing activation of alarm system. **(8) Projector:** All-weather type speaker creating loud 100db noise.

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Chart 1 Decimal-to-digital (binary) conversion up to 33.

0	0000	17	10001
1	0001	18	10010
2	0010	19	10011
3	0011	20	10100
4	0100	21	10101
5	0101	22	10110
6	0110	23	10111
7	0111	24	11000
8	1000	25	11001
9	1001	26	11010
10	1010	27	11011
11	1011	28	11100
12	1100	29	11101
13	1101	30	11110
14	1110	31	11111
15	1111	32	100000
16	10000	33	100001

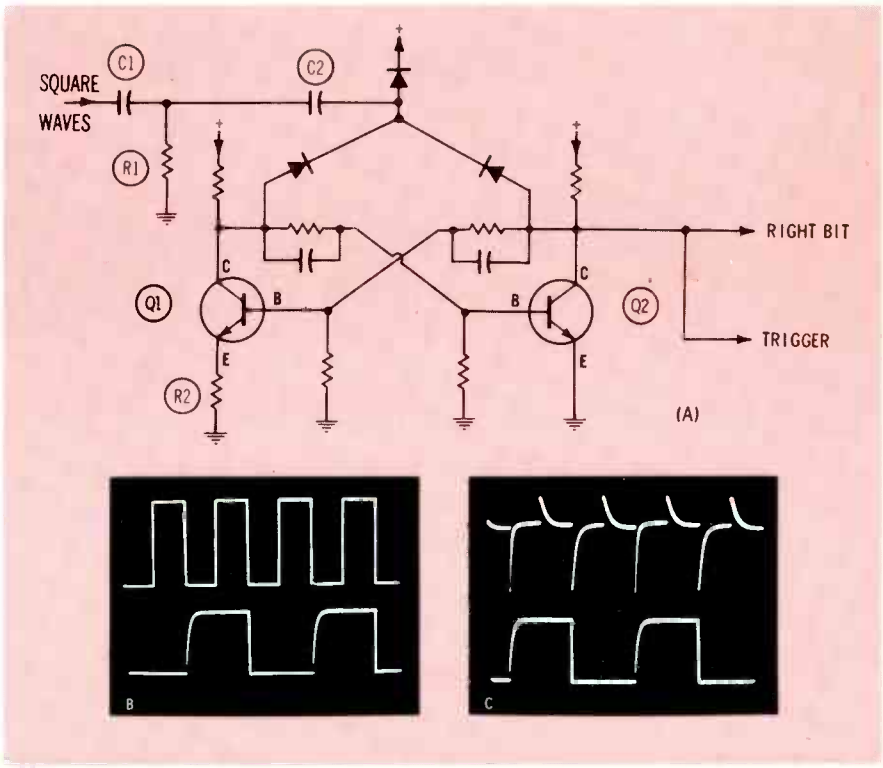


Fig. 3 The schematic and waveforms of a bread-boarded AC flip-flop circuit. **(A)** To the DC flip-flop circuit are added the high-pass filter components, the capacitors across the biasing resistors, and the "steering" diodes. The diodes D1 and D2 conduct the negative-going tips of the pulses to the collector which is highest in voltage. D3 resets the charge in C2 and clips some of the positive-going tips.
(B) Square-wave input signal from a generator (upper waveform) and the frequency-divided output near-square wave (lower). Triggering is by the negative-going edge.
(C) The waveform at the top is the triggering pulses at the junction of C2, D1, D2 and D3. Lower waveform shows the output square wave.

saturated (output bit is O) and Q1 is cutoff. A negative pulse reaches the common cathodes of D1 and D2 and is of the proper polarity to travel through either diode. However, the collector of Q1 is the most positive, so D1 has the highest voltage across it and the trigger pulse flows through it to the collector of Q1. At the collector, the DC voltage temporarily is cancelled and there is no forward bias voltage at the base of Q2. The circuit "flips" with Q2 cutoff and Q1 saturated.

The next negative-going trigger pulse flows through D2 and reduces the collector voltage of Q2 to zero, leaving no forward bias for Q1. This causes the circuit to "flop" with Q1 cutoff and Q2 saturated.

Notice that two cycles of the input triggering signal have changed the flip-flop back to its original condition. In other words, the flip-flop has divided the frequency in half. Whatever the repetition rate of the triggering pulse or square wave, the repetition rate of the square-wave output of the flip-flop is just one-half.

Many of these flip-flop stages can be cascased to provide any desired frequency division. However, most practical circuits limit the flip-flops to four, producing a division by 16.

Counting With Flip-Flops

The waveforms from four flip-flops counting up to decimal 10 are shown in Figure 4. Notice that each flip-flop is changed to the opposite state by each second negative edge of the one above it.

Now for an example of decimal to digital coding. Take decimal 1 and express the outputs of the flip-flops as 1's or O's, and with the highest frequency listed on the right. The coded digital number 1 is 0001. Number 3 codes as 0011, number 4 as 0100 and so on up to 1010 for number 10.

Chart 1 shows the complete decimal-to-digital relationship up to decimal 33.

So far, there seems to be little value to such a numbering system. But, suppose we were to send the digital code to some remote point (perhaps by telegraph wires) and then run it through a decoder to recover the original decimal values. Two examples of such a decoder are shown in Figure 5. Only when the polarity of the pulses or square waves at the bases of the transistors are such that they forward bias the transistors can there be continuity through all four transistors. Output from the bank of four transistors might be used to light a numbered lamp, for example, to indicate the decimal number.

From these examples of coding from decimal to digital, and decoding from digital back to decimal, we can visualize some of the uses for digital logic.

Which Came First?

A reasonable question is this: were flip-flops developed first and the digital system of mathematics developed to fit those specifications, or did the math come first and flip-flops engineered to conform?

the New BUSS® SNAP-LOCK
Rear Panel Mounted FUSEHOLDERS

It's a "SNAP" to install....

Easy...
Quick...
Time Saving...

The new BUSS fuseholder with special "SNAP-LOCK" feature is quick and easy to install. It saves time because the fuseholder can be **pre-wired** and "snapped" quickly into place from rear of panel. A fastening nut is eliminated because the "SNAP-LOCK" feature securely holds the fuseholder in place.

The fuseholder with "SNAP-LOCK" feature is simply installed by pushing it into panel from rear side. "SNAP-LOCK" fingers engage edge of hole in panel and lock holder securely in place.

The new BUSS "SNAP-LOCK" fuseholder can be used in panels .025 to .085 inch thick. (See recommended mounting hole in dimensions below).

The BUSS "SNAP-LOCK" feature is available on the following BUSS fuseholders:

to take ¼x1¼ inch fuses:

Symbol HTA-00, Space Saver, extends just 1 in. behind panel.

Symbol HLD-00, Visual Indicating Fuseholder.

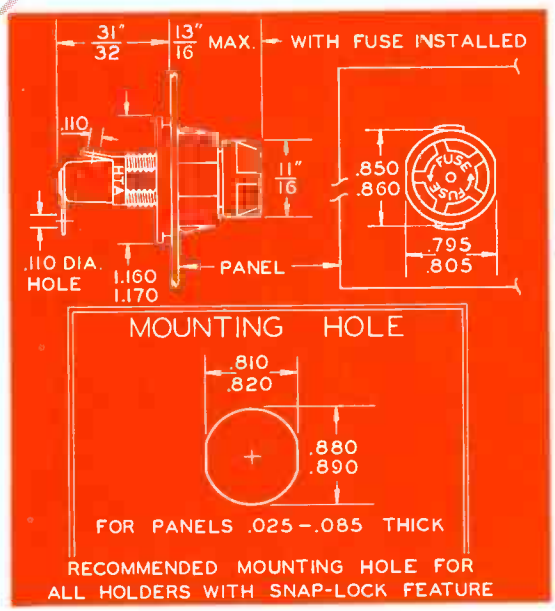
Symbol HKP-00, Standard Fuseholder.

to take ¼x1 inch fuses:

Symbol HJM-00, Standard Fuseholder.

All are available with quick connect terminals, if so desired.

HTA-00 Fuseholder-actual size



Dimensions of HTA-00 holder.
When tooling up for mounting get latest blueprint.

Also fits ½ in. knock-out in electrical boxes

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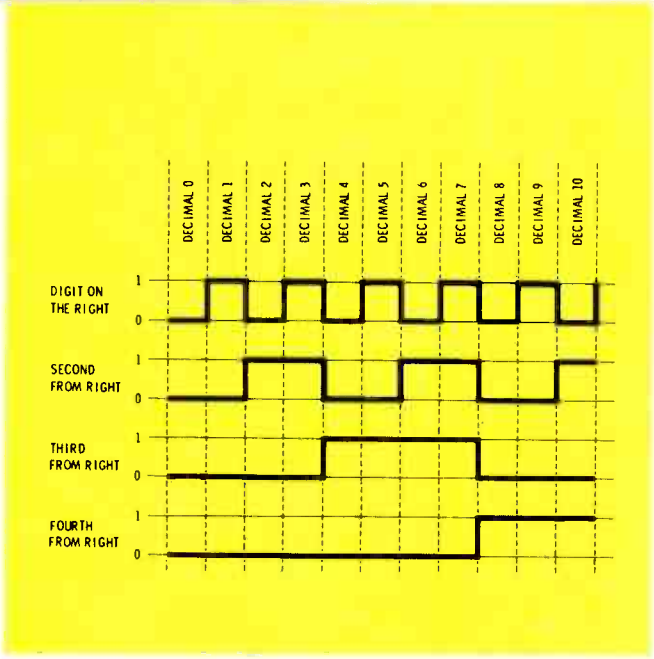

Fig. 4 Drawings of the waveforms at the collectors of four consecutive flip-flops show how the digital equivalent of decimal numbers are obtained using flip-flops.

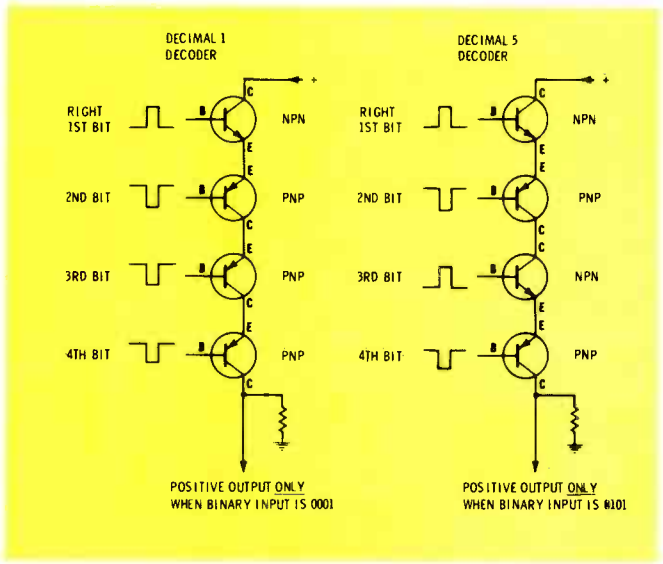

Fig. 5 Simplified examples of digital-to-decimal decoders. Polarity of the transistors determines the conduction.

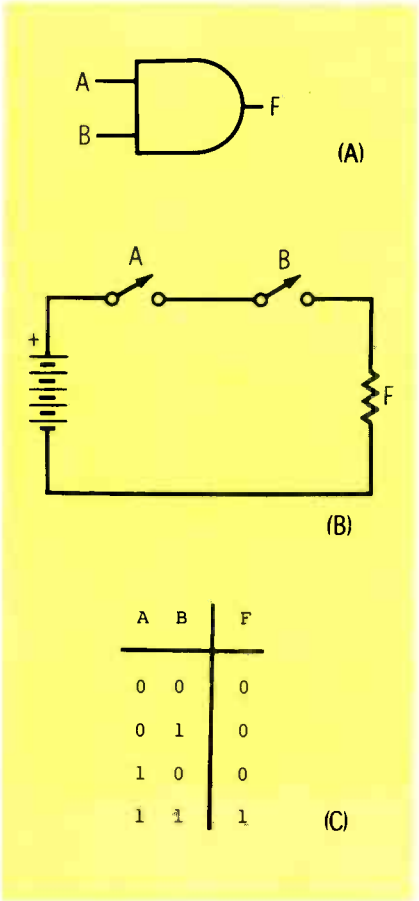

Fig. 6 The output from AND gates is "high" **only** when **all** the inputs are in the high state. Or, **either** input "low" causes a "low" output. **(A)** Symbol used for AND gates. **(B)** Switch logic shows the basic principle. **(C)** Truth-chart shows the outputs with all combinations of inputs. O is "low" state and 1 is "high" state.

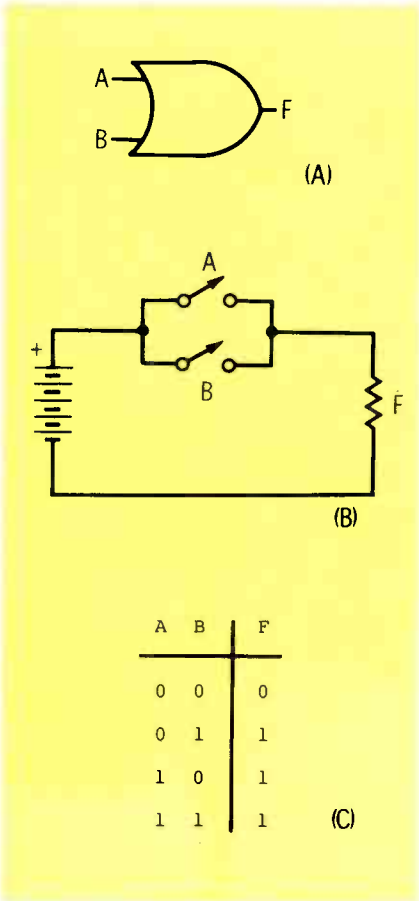

Fig. 7 OR gates produce a "low" output state **only** when all inputs are in the "low" state. Or, either input "high" causes a "high" output. **(A)** Symbol used for OR gates. **(B)** Switch logic shows the basic operation. **(C)** Truthchart shows the outputs with all combinations of inputs.

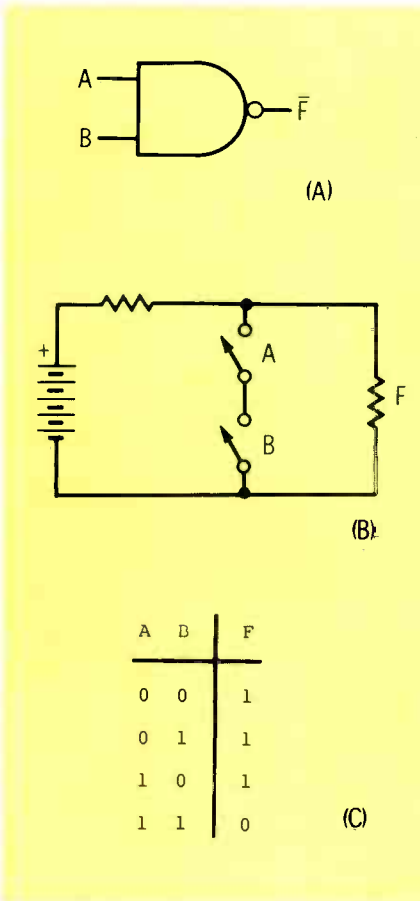

Fig. 8 NAND gates are the same as AND gates whose outputs are inverted 180 degrees. The term means not-AND. The output from a NAND gate is "low" when **all** the inputs are "high", otherwise the output is "high". **(A)** Symbol used for NAND gates, the small circle means inversion. **(B)** Switch logic shows the basic principle. **(C)** Truthchart shows the outputs with all combinations of inputs.

My guess is that the flip-flops came first.

Digital Mathematics

If you want to do digital-to-decimal calculations in your head, you should memorize the following multiples of two:

$2^0 = 1$	$2^7 = 128$
$2^1 = 2$	$2^8 = 256$
$2^2 = 4$	$2^9 = 512$
$2^3 = 8$	$2^{10} = 1024$
$2^4 = 16$	$2^{11} = 2048$
$2^5 = 32$	$2^{12} = 4096$
$2^6 = 64$	$2^{13} = 8192$

Digital to decimal conversion

Take the digital number 11001. Examine the rightmost bit. If it is a 1, add in a one; if the next is a zero, add nothing; also nothing for the next zero. For the fourth bit from the right, if it is a 1, add the third multiple of two (8); and if the last bit is a 1, add the fourth multiple of two (16). Now add the 1, the 8 and the 16 for a total of 25. Notice in Chart 1 that 25 is listed as 11001.

Decimal to digital conversion

Assume you want to find the digital equivalent of 525. Ask yourself what is the largest multiple of two that **isn't** larger than 525. From the previous listing we see it is 512, so we write a "1" in the 512 column. 525 less 512 leaves 13, and the largest multiple of two not larger than 13 is 8; so we write zeros in the 256, 128, 64, 32 and 16 columns and a "1" in the 8 column. 8 from 13 leaves 5 unaccounted for, and the largest multiple of two not larger than 5 is 4, so we add a "1" in the 4 column. 4 from 5 leaves 1, and the largest multiple of two not larger than 1 is zero, so we add a zero to the 2 column and a "1" to the 1 column.

512 256 128 64 32 16 8 4 2 1

1 0 0 0 0 0 1 1 0 1 = 525

Methods of adding, dividing and multiplying digitally will be delayed for a later article.

Gates and Combinatorial Logic

Continuously-operating flip-flops are not often desirable. Usually, a specific flip-flop will count up to 16 or 10 and, when it "overflows", the count goes back to zero and starts again. Or in the case of frequency counters, the count must go on for a certain precise unit of time. Simple on-and-off keying of transistors or IC's seldom is done because of the uncertainty when the count began and when it ended relative to complete square waves. Keying-on a square wave near the end of plateau would give the effect of a narrow pulse and add an error to the count, for example.

For these and many other reasons, "gates" are the foundation of digital logic. These gates are available in many different versions, as we shall see, and are seldom drawn as discrete components, but as what are essentially block diagrams. The type of gate is denoted by the shape of the drawing.

Symbols, Switch Logic, and Truthtables

The important relationships between the symbols, truthtables and examples of logic performed with simple switches are illustrated in Figures 6 through 10.

We advise you to study these illustrations very carefully, even to the extent of memorizing them.

Simplified Symbols

In actual instruments, an AND gate might be followed by an inverter to provide the action of a NAND gate. Or, an OR gate with all the inputs inverted can be thought of as a NAND gate.

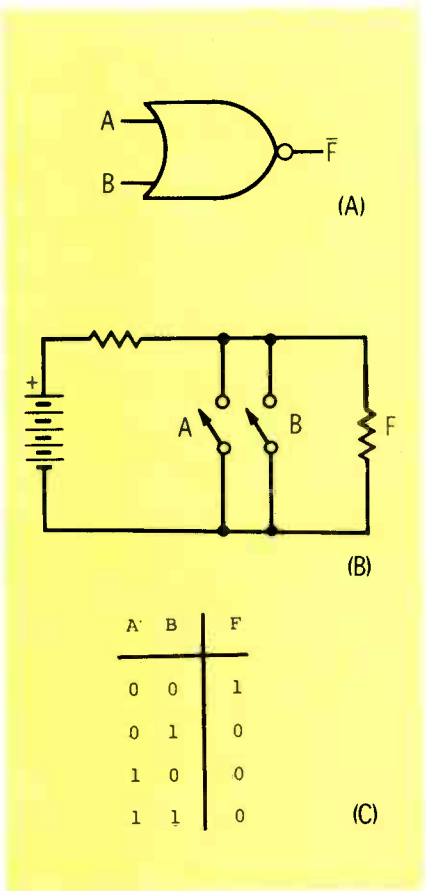

Fig. 9 NOR gates mean not-OR, and are the same as OR gates whose outputs are inverted. The output from a NOR gate is "high" whenever **all** the inputs are "low", and the output is "low" otherwise.
(A) Symbol used for NOR gates.
(B) Switch logic shows the basic principle.
(C) Truthchart shows the outputs with all combinations of inputs.

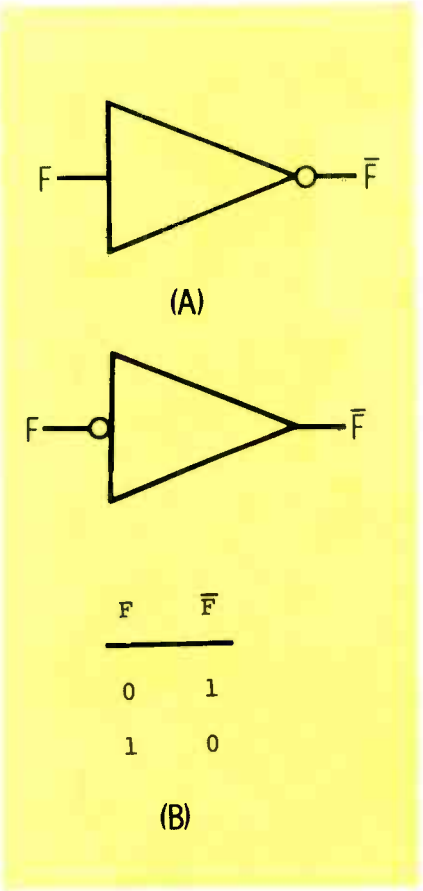

Fig. 10 INVERTER gates have only one input and one output, and the output signal is inverted relative to the input. **(A)** Two symbols used for inverters. **(B)** Truthchart for inverters.

This interchangeability is called "equivalence", and it has been expressed as Demorgan's Theorem. Quite often, the symbols on the block diagram will be shown in ways making the action clear, rather than reflecting the actual circuitry.

Combinatorial Logic

The gates discussed just now are part of a class of digital logic known as "combinatorial logic". This is a set of devices or circuits whose current output state depends **only** upon the current state of its inputs. There is no storage and no memory. Combinatorial devices are characterized by truth tables and logic circuits.

Combinatorial Devices

There are four main types of combinatorial devices:

- gates,
- decoders,
- line-driver/receivers, and
- MSI/LSI devices.

Gates

In addition to the gates previously described, there are "buffer gates" that provide higher-voltage outputs to drive more than one device. These come in both inverting and non-inverting types.

Other devices are called "expander gates", although they are not actually gates, but analog circuits.

Line-driver/receivers

Line drivers are semi-analog devices generally performing a gating function on the input, and providing differential outputs driving a twisted-pair line.

Line receivers are high-input impedance, high-sensitivity devices used to detect the differential signal and convert it to a signal compatible with the logic family in use.

Decoders

Decoders are multiple-input, multiple-output devices which accept a predefined set of inputs, and produce a predefined set of outputs.

MSI/LSI

MSI and LSI are acronyms for Medium-Scale Integration and Large-Scale Integration. These are complex devices which we will explain in later articles.

Next Month

Next month, Joseph J. Carr takes over authorship of several articles in our digital series.

We suggest that you preserve all the articles of this series, because you will want to refer to them many times. □

This tube has a 1-Year Warranty.
This tube has a 2-Year Warranty.
This tube has a 3-Year Warranty.

The choice is up to you.

Now, you're the one to decide the best type of customer warranty for Sylvania Color Bright 85® replacement tubes.

The one-year warranty is basic. GTE Sylvania gives you that.

But, through your distributor, you can offer a 2- or 3-year warranty for just a little extra cost.

No matter which warranty you offer, it's backed up all the way.

The whole idea of this program is to give you and your customers an added incentive for using Color Bright 85 replacement tubes.

Now, you can offer your customer the warranty that suits both of you best.

Or better yet, you can offer him all three.

Talk to your GTE Sylvania distributor to get full details.

Sylvania Electronic Components, 100 First Ave., Waltham, Mass. 02154

GTE SYLVANIA

Advertise now to boost your business

By Robert G. Amick and Ronald Merrell

Usually it's only the spur of competition that makes the operators of small service businesses think of advertising and sales promotion. However, if you agree, you might be your own worst enemy.

"I don't need to advertise; I've got the only shop in town." "Times are tough; I can't afford to spend money for advertising and sales promotion."

Because of those two common fallacies many businesses have failed completely, and others with marginal operations are dying slowly. You simply can't afford to ignore advertising and sales promotion.

Advertising And Sales Promotion

Neither advertising nor sales promotion is a cure-all. Neither one will generate business where there is none or cover for bad management or incompetence. But properly used, they play an important part in the growth of any business such as yours.

What's the difference between them? Sales promotion is the broad field. It's anything by which you move whatever goods or services you have to sell. It includes symbols, slogans, advertising, store "image", store policies, displays, and your customer relations.

Advertising is a major tool in this effort to get more business or to retain your share. It's the means of publicizing the special reasons for doing business with **you.**

Advertising can take many forms: word-of-mouth, telephone directory, direct mail, billboards, handbills, signs on your building or in front of your shop, space in shopper publications, newspapers or magazines, and time on radio and television stations.

To a certain extent, as these definitions and examples show, you've had an advertising and sales promotion program going ever since you founded the business. Perhaps you didn't plan it, and any benefits might have been accidental, but you've been playing the game already.

But accidental benefits are not enough. Most businesses today—faced with a more-than-five-percent-a-year increase in costs—plan for doubling their volumes in each five-to-seven year period. They have to, or else! Costs that rise five-percent-a-year will double in 15 years. Adjusting your rates or finding five-percent more business per year only keeps you even. Getting more business by using a definite growth plan is a better way.

One Example

Earlier this year, I read an article in a trade journal about a woman who operated a bookstore for 18 years and just barely scratched out a living. Then, purely by **accident,** she added a new line of merchandise, advertised it, and her business volume jumped almost 50 percent.

In those 18 years of just scraping by, she didn't advertise. Her only attempts at sales promotion were a window sign, a friendly attitude toward customers coming in, and a friendly farewell to them when they left. All fine and necessary, but hardly enough.

She justified her lack of advertising by believing she had no competition in the city of 75,000 people. No competition! She had the worst kind of competition: herself. Who else stunted growth of the business to hold down the profits? Who else deprived her of public attention just as surely as a competitor would with his bigger ads and better promotion?

Her other reason for not advertising was that she relied on personal service. Part of the personal service was the cheerfulness, previously noted, plus her custom of special-ordering (without extra charge) any item she didn't stock. That's fine, too, for real service is a valid point to promote. But it's not likely any business will ever reach its highest potential without the extra boost of advertising.

Why Should You Advertise?

Perhaps you feel there's no more business to be gotten, that you have it all now. But are you certain? Suppose you're the only service operator in your town and the nearest competitor is 15 miles away. Who gets the business in the area half-way between? Even if your position now is strong, can you count on the other fellow always being content with his low position? So much for the fallacy that lack of

The Makeup Of Good Advertising

There are four main essentials for effective advertising:

1. To attract the **attention** of potential customers.
2. To **interest** them in what you have to sell.
3. To arouse in them the **desire** for your services or products.
4. To inspire them to take **action,** and to do it now.

*These are the major points of the **AIDA** System Of Advertising All good advertising must contain these four elements.*

Here's everything you'd expect from a high-priced portable multimeter.

Except a high price.

The B & K Solid-State Electronic Multimeter (Model 277) has 8 important features that you can get on most other quality-made units, but not at prices like ours.

You'd expect to pay quite a lot for a multimeter featuring both high and low power ohms ranges. Both are critically necessary. The B & K 277, with its .068 V power source on low power ohms, will always read the true value of a resistor shunted by a semi-conductor without concern for the semi-conductor's presence. A conventional ohmmeter with a 1.5 volt supply could cause a shunt semi-conductor to conduct, giving a false resistance reading.

The 277's high-power resistance ranges are useful in determining whether transistors are good or bad simply by first forward biasing them to make them conduct and then reversing the leads to qualify the front-to-back ratio.

The B & K 277 has so many features you wouldn't expect at the price: like a .1 V low-voltage scale for both AC and DC; a DC current range of 1 μA full-scale for testing sensitive semi-conductor leakage; the unit is fully protected from overloads by fuse; input impedance of 15 M Ω on DC; 1% precision resistors; a 4½ inch, 50 μA mirrored scale meter; frequency response to 150 KHz and 59 individual ranges.

Our price alone doesn't make it a value, but our features at our price make it a fantastic value.

$99.95

B&K Very good equipment at a very good price.

Product of Dynascan Corporation/1801 W. Belle Plaine Ave., Chicago, Ill. 60613

For More Details Circle (14) *on Reply Card*

competition compensates for lack of advertising.

If you do have strong competition, the need for promotion and advertising becomes mandatory, not optional.

Advertise during slumps

As mentioned at the beginning of this article, the second fallacy says, "Stop advertising when things are rough; don't spend any money when sales are down." But tell me, which way is going to bring in more business, to give up completely (don't advertise), or to fight all the harder (advertise more and better)? Common sense supplies the answer to that one.

Actually, the smart businessmen plan advertising especially for those slack periods. Every business has its seasonal low points. Successful retail stores advertise in December to fight other retailers, but they also advertise heavily in January and February to fill in the valley between Christmas and Easter. Most gross business which is not transacted during a slump is not just delayed until later, but is lost forever. The moral is: get the business volume now, or never.

Seasonal Promotions

You, too, have seasons to deal with. And you can find promotional angles for each season. In TV servicing, there is the excitement of the new fall TV shows, and a lift at the beginning of each new sports season. Each of these offers you a chance to sell a service job or an antenna checkup. If you can fit these promotions into the low spots of your own business cycle, so much the better.

Promotions during slumps is the right time for you to bring out pricing specials. Your overhead is largely fixed, and it's better to have some business at a lower profit than none at all.

Then after you find that advertising will bring in business where you thought there was none, it's time to think about **keeping** those customers. That's the frosting on the advertising cake.

Everything You Always Wanted To Know About Advertising But Were Afraid To Ask!

If you haven't done any advertising, you might have the idea that: (1) it's too expensive; (2) takes too much knowledge of advertising; and (3) would involve too much of your time to work out an ad that would be successful.

Taking it from the top, those ads might not cost as much as you've suspected. If you are working in a city served mainly by a newspaper that comes out two or three times a week, you will find the cost is really inexpensive.

An ad one-column wide and five-inches high will probably cost you between $10 and $20 dollars. But that is the price you might expect to be quoted if you run the ad once. In most cases, the newspaper will lower the cost per ad if you indicate that you want it inserted once a month, or once a week, or even more often. In other words, let's say you ran an ad this month. It did well, so next month you have the newspaper run it again...and so on for several months to come. If you had no committment or ad contract to run it more than once, you would be charged the "one-time rate", or the highest rate. On the other hand, if you plan a schedule of insertions with the newspaper, they will give you a discount per ad, based on the number of times the ad will run. If you do this, you may find that the $10 ad run once will cost you only $6.50 per insertion when it has been scheduled to run over a period of time. The once-a-month unplanned insertion at the "one time rate" would cost you $120 (for a $10 ad) if you were not committed to a contract. But under a contract for 12 insertions (one per month), that cost total now might be as low as $78.30. So, if you're going to advertise, it pays to advertise on a fairly regular basis.

Now, if your shop is in a large city served by a daily newspaper, you can expect the cost for each inch of advertising to be higher. Newspapers charge according to how many readers they can deliver to you. So the same ad that ran in a smaller circulation newspaper probably will cost you twice as much in a big city newspaper.

Planning An Effective Ad

Once it is in the big city newspaper, your ad must compete with others in your business. On the other hand, you may now have several thousand potential customers seeing your ad. But then, you must have a story to tell in your ad that will make people want to buy.

At about this point—in any market size—you might be hesitant because you still don't know anything about how to put together a really good ad. Frankly, a newspaper ad salesman doesn't expect you to be an expert. He does expect you to tell him how your operation is unique, better, faster, more efficient, or more economical.

Because of his experience in advertising, a good salesman can help you put together an ad that will help you sell your services. If the ad doesn't sell anything, you'll know it. And he knows all too well you'll tell him so. Therefore, he'll do his best to help you construct a good ad.

Together, the two of you should sit down and sketch-out (referred to in the business as a "thumbnail") a rough version of how your ad will appear and what will be said in it. At first, you may find that this will take as much as a half hour of your time, because he will need time to find out what you can offer the reader.

If you make an appointment to have a salesman call on you, and you have trouble thinking of anything different or special about your operation, it might be better if you call off the appointment and consider an equally challenging thought: **are you "just another radio and TV repair shop"?** If you can't find anything you can honestly brag about, you need to review your approach to the business.

Do you want to be known as the shop that does the job right the

first time? Do you specialize in fast in-the-home service? Do you service all brands, or just one? Are your prices better? Do you offer outside-the-shop services such as sound installations and repair, or antenna installations? The list could go on and on, but the point is this: Find your strong points and truthfully advertise them (maybe each ad should have a separate approach). If you can't find any strong points you really pride yourself on—you have a business operational problem, and it would be best to work out those problems first, because not all advertising is good.

If you are less than honest with the reader/customer, he will be quick to spot it. Then word-of-mouth advertising among his friends will do as much damage as if you ran an ad saying "We do a poor job, we just don't like to admit it".

One of the most common faults of ads is that they don't **move** the reader into **action.** It's true that your ad should let the reader know you're in business and that you offer radio-dispatched service, but it also is true that you need to tell the reader what to do: "Has your TV become a one-eyed monster? **Call us now** and we'll dispatch a technician by radio. He knows how to handle monsters!" Or how about, "If it looks like you're about to lose your TV picture, **call us now.** When you've finally lost the picture completely, the repair bill will be a lot higher."

Poor advertising can exhibit bad taste. The approach or language might even be insulting. Once you become ad conscious, you'll spot ads like this more often than you thought possible.

Some ads take up considerable space, but do little to enlighten the reader. You should tell something about your services besides your name and address. When was the last time you saw a TV-service ad that told the store hours? Did it include a phone number to call, or was there a night-answering service number? Did it tell how the reader would be better served or more fairly charged? (By the way, an answering service might alert you to any demand for nighttime service.)

Planning Radio Spots

Most of these same principles apply also to radio and TV advertising.

In many areas of the country—and especially for stations serving smaller cities and towns—the cost of a spot ad on the local radio station may be lower than you think. It pays to check. A 15-second spot announcement might cost as little as $1.

Other Media

One sure-fire advertising winner is the Yellow Pages of the telephone directory. Next in effectiveness are ads in the neighborhood shopping papers or newspapers covering mainly your area only. This limits the message to the audience and area you want, and doesn't waste money reaching people who couldn't be customers.

Some dealers and shop owners use handbills. But this method is not as cheap as you might imagine.

It's not reliable, either. Kids have a way of tossing a bundle under the porch of a vacant house. Worse yet, there are places where handbills are classed as litter. At best, a permit is required; at worst, you might be fined if your handbills are found in the wrong places.

Direct mail is of questionable value. It takes a lot of planning, postage, extra help and expensive printing. Yet a response of only three to four percent is considered good. As you can see, it's not efficient.

One variation of direct mail that **does** work well is to mail only to former customers, people who already know and trust you. This is often effective in offsetting a slump.

How Much Should You Spend

After you decide to advertise, the first item to be settled is how much to spend. All companies, large or small, wrestle with this problem. Some watch their competitors and follow their lead. However, it's very possible your competitors might have been using ineffective ads.

So you need not be alarmed by the **amount** of advertising your competitors use...unless you can see they're good ads. Even then, you might get more mileage out of running two or three small ads in the same issue than the competitor obtains from one large ad.

One business source says the average small service operation is spending a bit over 1.5 percent of its gross income on advertising and promotion. But your amount will depend upon how much additional business is available and how much of it you want. Trouble is, there's just no final standard on how much you need to spend to get a given amount of business.

If you find that an ad has brought you more business, it probably follows that continued advertising will bring with it additional increases. But...this cannot continue indefinitely. If it begins to surpass the capability of your shop, increased business can degrade the quality of your service. This is one of the first signs of a good business that is headed for growing pains. And expansion is not necessarily beneficial. More about that later.

Even after you have reached the high level of business that you want, a minimum amount of advertising is necessary to keep you from drifting backwards.

Next Month

More details of newspaper advertising and sample "thumbnails" will be presented. □

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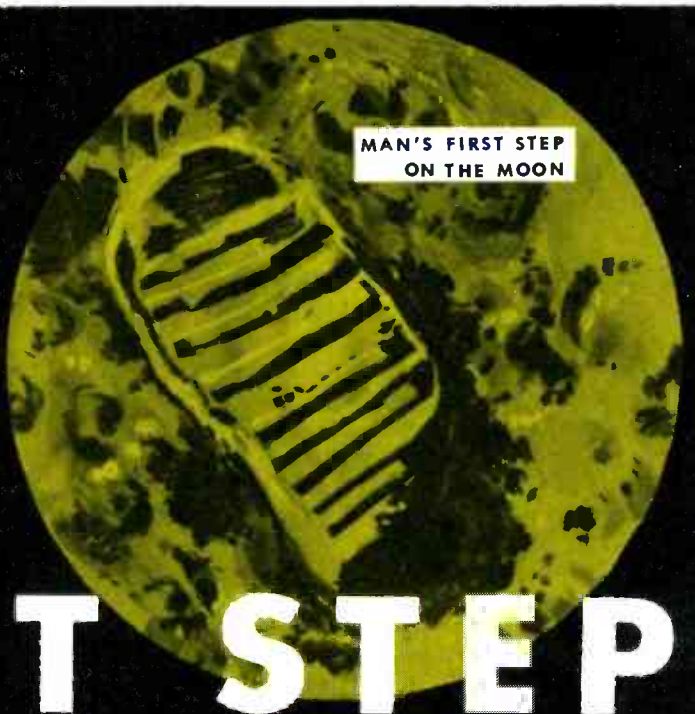

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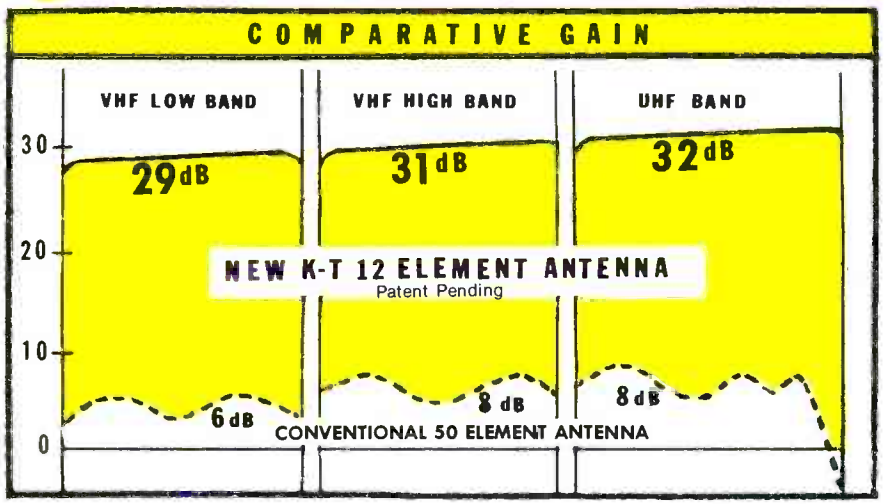

FEATURES	CONVENTIONAL ANTENNA	NEW K-T ANTENNA
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WEIGHT	18 lbs.	7 lbs.
RANGE	150 mi.	200 mi.
TURNING RADIUS	95 in.	42 in.

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For More Details Circle (15) on Reply Card

Where did the convergence go?

By Inman House

Would you believe a color picture tube with the yoke, purity magnets and convergence magnets factory adjusted and then permanently sealed to the tube? Well, there's more; read on!

Convergence and purity adjustments have been a necessary evil to color-TV technicians for the past 18 years. Sure, progress has been made. Remember those huge rotary purity magnets around the mask, and later the hairpin magnets halfway back on the bell? And the recently-manufactured sets are easier to obtain good purity and to converge dynamically with less interaction of the adjustments.

But, despite all the improvements, purity and convergence adjustments are time-consuming, and probably avoided as much as possible by most technicians.

One Solution: Eliminate Purity And Convergence

One radical solution for these problems was given in a paper presented in June of 1972 at the IEEE Spring Conference by R. L. Barbin and R. H. Hughes, RCA engineers. They described a new type of color picture tube featuring factory-adjusted and **sealed** convergence and purity adjustments. Now RCA has introduced a television receiver to drive this new type of picture tube. The receiver has a 15-inch viewable screen (although the Barbin/Hughes paper also described 17- and 19-inch sizes).

When I first saw a production-model CTC62-chassis receiver with the back removed, my thought was that somebody had "ripped-off" the convergence panel and most of the yoke. Otherwise, it looked similar to other RCA modular sets.

Incidentally, the vertical module is different, and the power-supply module has been eliminated, but the other modules are the same. Also, the horizontal sweep uses the basic SCR circuitry, with some large changes that will be described later.

The Picture Tube

Viewed from the front, the picture tube looks about the same as any conventional tube. Unlike the Trinitron, the faceplate is curved in both directions. When turned on, the raster has a distinctive pattern. This is the result of the phosphors, which are placed in consecutive vertical stripes of red, blue and green, rather than the more usual dot trios.

The biggest difference in appearance of the tube is shown by the back view (Figure 1). The tube has a 90-degree bulb, a small 29-millimeter neck, and the same type of socket RCA uses in their modular sets.

Six ring-type magnets are permanently mounted on the neck of the tube. The rearmost two are purity rings, and look like the ones used on other sets. In front of these, are four more rings, but these are thicker and made of plastic. The front pair have four-pole magnets, and the pair behind contain six-pole magnets. These are

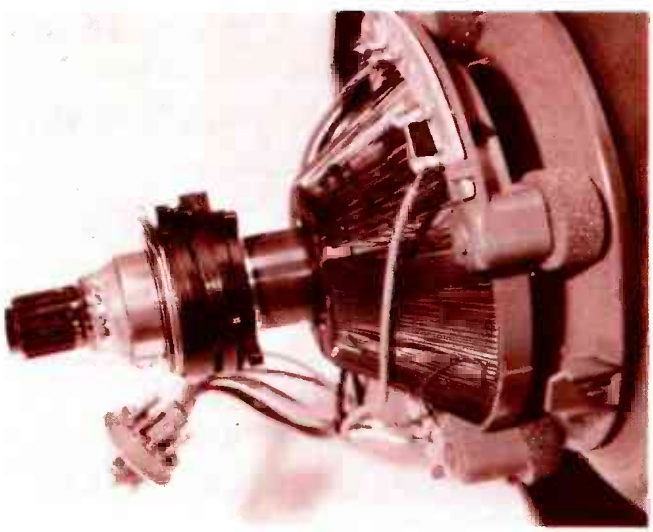

Fig. 1 The purity magnets, center-convergence magnets, and yoke shown here are factory adjusted and sealed to the picture tube for use with the RCA CTC62 chassis.

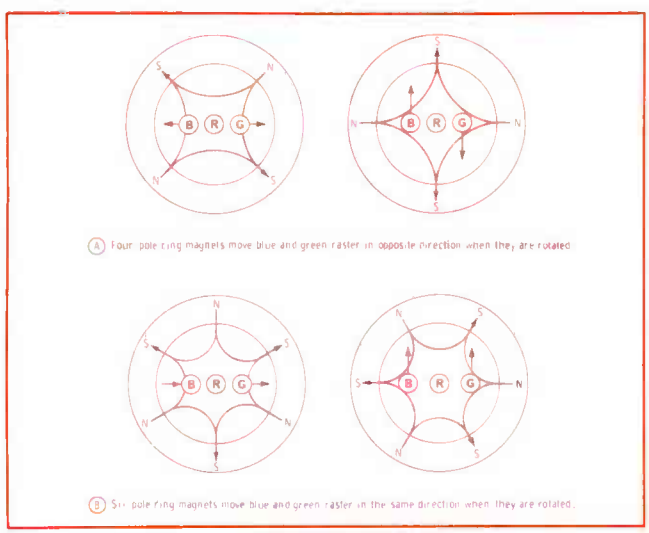

Fig. 2 Movement of the blue and green rasters is accomplished by factory adjustment of the neck-ring magnets. The red raster is not movable. **(A)** The four-pole ring magnets move the blue and green rasters in **opposite** directions when they are rotated. **(B)** The six-pole ring magnets move the blue and green rasters in the **same** direction when they are rotated.

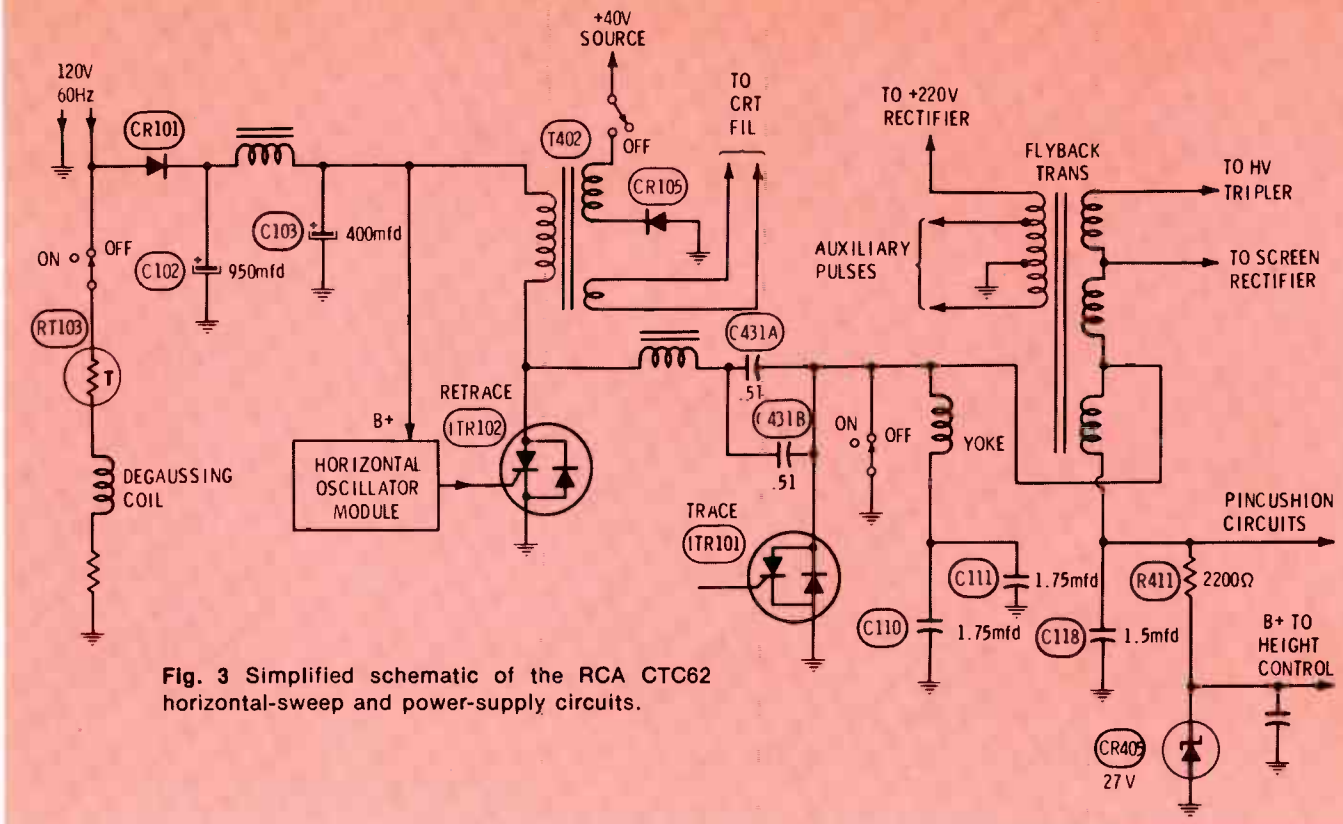

Fig. 3 Simplified schematic of the RCA CTC62 horizontal-sweep and power-supply circuits.

all factory adjusted to give best purity and convergence and then locked into place.

Figure 2 shows how the four- and six-pole magnets move the blue and green fields to achieve center convergence. The red field is not affected by any of these magnets.

Yokes

Both b-w and color yokes of conventional design are called "saddle" yokes. But the yoke used with this new picture tube is a toroidal-type, consisting of a very few turns of heavy wire wound into guide slots of the core. This type of yoke allows precise winding which tightly controls the amount of magnetic field. In fact, the windings appear to have been "tweaked" by the use of small loops before the windings are locked into position.

Even more important, the magnetic field of the toroidal windings acts the same for each of the three beams, thus eliminating the need by dynamic convergence.

According to RCA, the location of the yoke on the neck of the CRT is extremely critical, so they position it at the time of manufacture, then seal it into place with a thermosetting plastic. Obviously, if either the yoke or the picture tube should fail, the entire unit would have to be replaced. However, offsetting the increased cost of replacing the entire assembly is a considerable saving of installation time.

The Gun Structure

A unique gun structure in the neck of the picture tube produces three beams, which are in-line and oriented horizontally. In this respect, the gun is similar to the GE Portacolor gun. But, here the similarity ends.

The RCA in-line gun has electrically-separate cathodes, but the control grids, screen grids, and focus grids are common to all three beams. This permits the three cathodes to be placed very close to each other, and to be mechanically aligned very precisely. The net result is that there is little dynamic distortion of the three fields and no need for dynamic convergence. Without this precise alignment and close spacing, even a toroidal yoke would not be able to provide satisfactory convergence over the entire raster.

The common grids make necessary a different driving circuit from those of conventional TV receivers. There can be only one screen control and one grid-bias voltage. Also, both luminance and chrominance signals must be fed to the cathodes (pre-CRT matrixing). Of course, this is not a difficult problem, and RCA has adapted the circuitry in their earlier modular chassis for use here.

Chassis Changes

As stated before, the CTC62 chassis of this new receiver uses most of the same modules that have previously appeared in RCA modular models. Only the vertical-deflection module is new. However, the control circuits for the video-driver modules are changed to permit gray-scale tracking adjustments.

Vertical deflection

A single module contains both the oscillator and output stages of the vertical-sweep circuit. The module is built on a ceramic substrate, similar to the video drivers, and the entire unit is mounted on a heat sink which also helps to shield the deflection circuits from the signal circuits.

To replace the ceramic module, it is necessary to remove the large heat sink from the chassis. Two screws must be removed for each

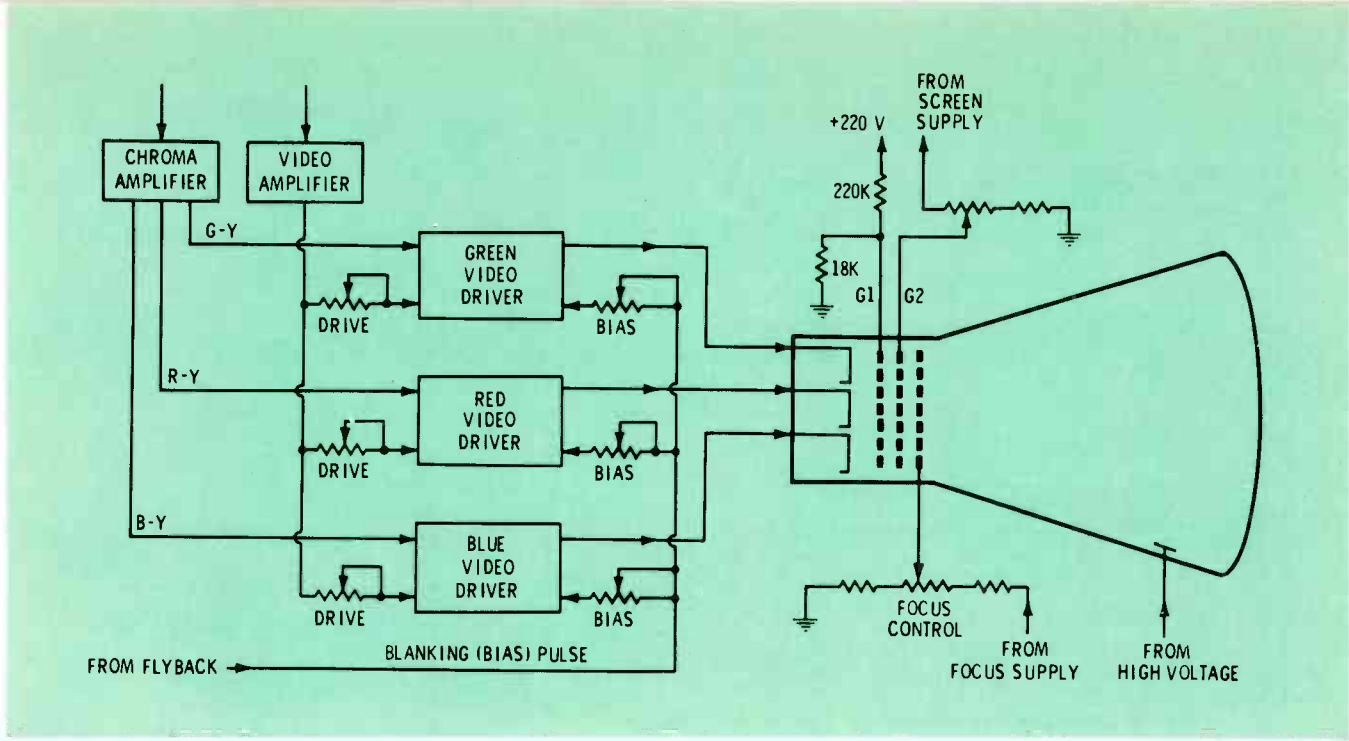

Fig. 4 Block diagram of the video-driver stages, and the gray-scale control system.

step.

Electrically, the vertical-sweep system is not greatly different. The impedance of the yoke is much lower, and there is no convergence board requiring drive from the yoke current, so the value of the coupling capacitor between the output transistors and the yoke has been increased to 4700 microfarads. Also, the supply voltage for the output transistors has been reduced from the 77 volts of earlier chassis to about 40 volts.

Horizontal deflection

Although the horizontal-sweep generally resembles other RCA circuits using SCRs, there are some differences. For example, you will look in vain for the trace and retrace diodes. In this circuit the diodes are **inside** the same cases as are the trace and retrace SCRs, respectively. These new devices are called "Intrinsic Rectifiers" or ITRs.

Also deleted are the regulator transistor, saturable reactor, high-voltage adjustment and other components associated with HV regulation.

A solid-state tripler (rather than the previously-used quadrupler) is employed to rectify the high voltage.

Power supply

It's a bit difficult to find the power supply. There is no power-supply module, and most of the B+ voltages are obtained from the horizontal-sweep system.

As shown in Figure 3, only the horizontal-deflection circuitry takes power by rectification directly from the AC line. About 150 volts is supplied by the half-wave rectifier **at all times**, and the horizontal oscillator and retrace ITR operate continuously regardless of whether the set is turned on or is in the standby position (corresponding to off).

Output from the horizontal oscillator is a series of pulses at the horizontal rate, each having a duration of about 6 or 7 microseconds. Each pulse momentarily keys-on the retrace ITR. In standby therefore, the small ITR current through T402 provides heater current for the picture tube.

But there is no input signal to the yoke or flyback transformer during standby because both of these components are shorted by a section of the on-off switch (anode of ITR101 to ground).

There are two other sections of the power switch. One disconnects the 40-volt supply from its rectifier, CR105. The other connects the degaussing coil to the AC line.

Actually, degaussing takes place immediately **following** turn-off. After a few seconds, the thermister (RT103) reduces the degaussing current to an inconsequential amount, and the degaussing is over.

When the set is turned on, the short is removed from across the yoke and flyback transformer, and the degaussing coil is disconnected. Immediately, deflection current and high voltage are generated. This increases the load-current pulses through T402, which increases the heater voltage of the CRT to normal. At the same time, CR105 is connected to its loads. After filtering, the 40-volt supply feeds the vertical-sweep system, and voltage dividers furnish the 30-volt busses for the signal modules.

Screen-grid voltage of about 850 volts and 220 volts for the video-drive modules are rectified from taps on the flyback transformer. Focus voltage is taken from a tap of the high-voltage tripler.

Video drivers

Figure 4 shows the CTC62 video-driving system. The same MAD modules that have been standard in other RCA models are used.

Because individual adjustment of the screen grids is impossible, three bias controls were added to the video-driver circuits.

Gray-scale tracking

Use this method for gray-scale tracking:

- Use the set-up switch to collapse the raster to a horizontal line;
- Preset the drive controls fully CW, the bias controls fully CCW, and the screen control fully CCW;
- Advance the screen control until a line is visible, then barely extinguish the line;
- Advance the bias controls to produce three faint lines of equal brightness;
- Return the set-up switch to normal; and
- If the picture is not white, reduce the drive control of the dominant color.

Service Tips

Although the servicing of this receiver should be no more difficult than its predecessors, the radical changes in the power supply make necessary one important precaution. **If there is serious trouble in the horizontal-sweep system, nothing else will operate, because there will be no B+ for the remainder of the circuits.**

Be sure the supply voltages are present before checking anything else.

One more precaution: Don't operate the receiver from a wall outlet that is switched. Not only will the instant-on be delayed because the CRT heaters are cold, but damage to the picture tube might result from the application of high voltage when the cathodes are cold.

Summary

There is no need for dynamic convergence because of the combination of a small in-line gun structure, a precision-wound toroidal yoke and non-adjustable neck magnets. Therefore, replacement of the picture tube is only slightly more complicated than replacement of a b-w tube. Gray-scale tracking of a familiar type is the only concession to color.

To make the power supply easier to filter (15,734-Hz versus 60-Hz ripple), all stages except the horizontal oscillator and retrace ITR obtain their B+ voltages by rectifying pulses present at taps on the flyback transformer.

Also interesting is the idea of the on-off switch grounding part of the horizontal sweep circuit, while B+ is applied constantly to the retrace circuit. □

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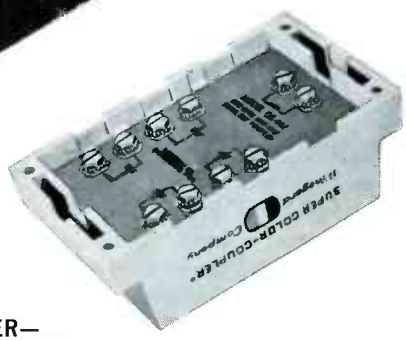

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For More Details Circle (19) *on Reply Card*

Radio repairs can be frustrating

by Wayne Lemons

Often we tend to feel radio repairs are beneath our skill. Not so, for some radio defects are just as difficult to locate as TV problems.

I started my electronic career repairing radios, and I still get a big kick out of fixing a real pesky one.

A few days ago, one of the shops for which I act as a consultant-if-you-can-find-me-at-home called me about a problem in the AM section of an expensive stereo console.

Weak, But Intermittent

The AM function was weak on all stations, but when tuned to a certain few stations the volume blasted full-on for 3 or 4 seconds every minute or so.

Another odd symptom was the slow starting on AM. Although the radio was solid state, there would be no reception for 30 seconds or so after turn-on.

FM and phonograph operations were normal, and this eliminated the audio amplifiers from suspicion.

The shop man, using good logic, had decided the trouble must be in the AM-converter section. He had replaced the AM-converter transistor, and then in desperation also had installed a new 455-KHz IF transformer in the converter section.

I tuned in a local AM station. It was weak but showed no tendency to blare out. "Oh, I forgot to tell you," the shopowner said, "It doesn't act up on that station. Try a weaker one."

"Then you're implying," I said, "That the trouble must be connected to a certain signal level. And that indicates the possibility the

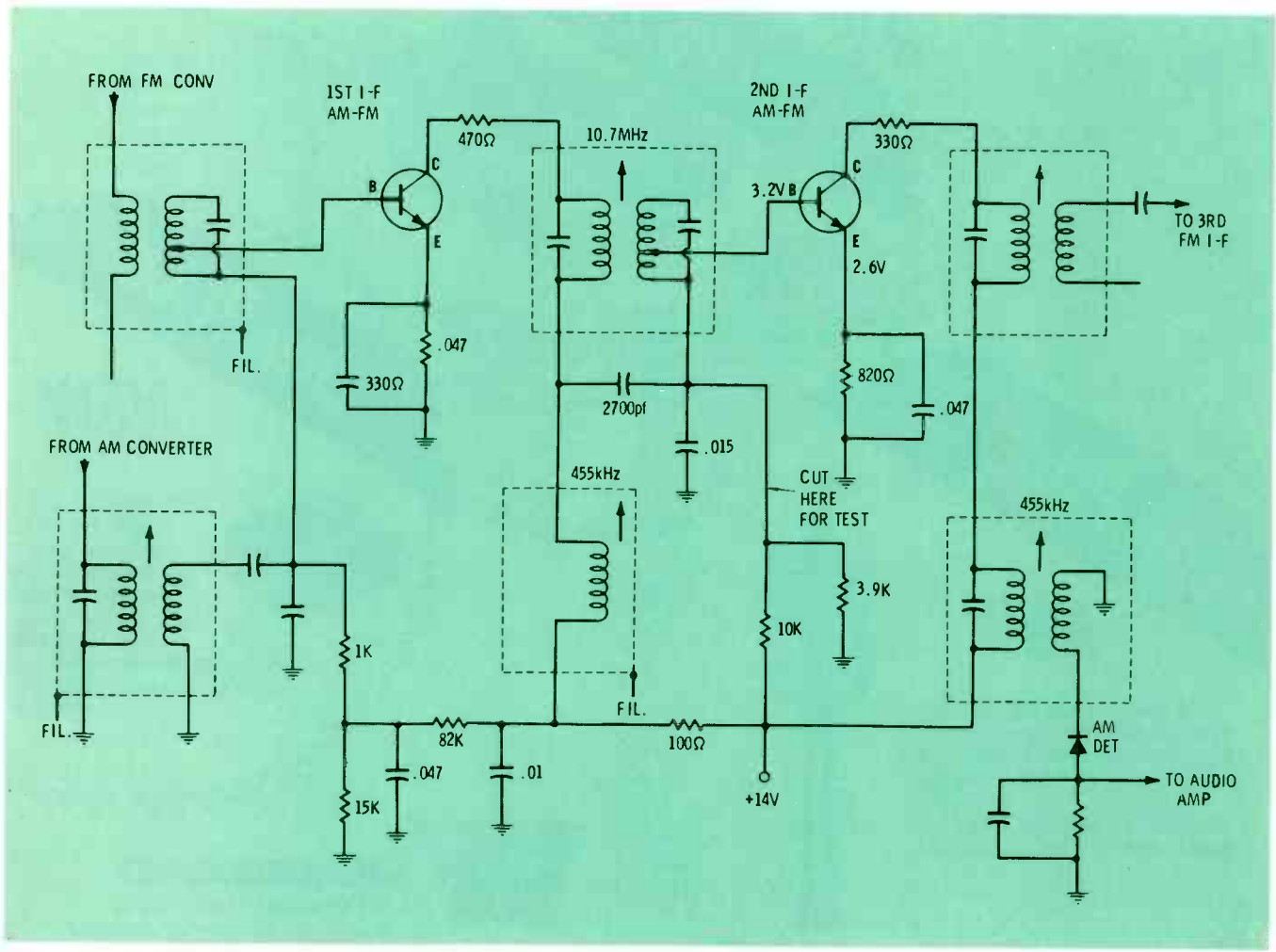

Fig. 1 Schematic of the IF circuit of the radio having intermittent AM volume.

defect might be in the combination AM/FM part of the IF circuit. Have you tried signal tracing?"

"I did," he replied, "But I've never worked on a chassis like this one before, and I really didn't know how much signal to expect."

I studied the circuit (shown in Figure 1), and asked for a scope. A strong 455-KHz IF signal easily can be traced with a good scope. The signal at the collector of the converter transistor seemed fine, at the collector of the 1st IF it was much stronger, but at the collector of the 2nd IF transistor the signal was about the same in amplitude as it was at the previous stage. To check the possibility of scope loading, I moved the probe to the cathode of the AM-detector diode and found even less amplitude there.

It seemed certain the 2nd IF stage was not amplifying.

The schematic listed the average DC voltage at the emitter of the 2nd IF transistor at +2.6 volts. I measured it with a VTVM and found it to be just a few tenths of a volt. The base voltage was nearly the same. A measurement between base and emitter showed nearly zero voltage, certainly an abnormal condition for a silicon transistor.

I clipped the meter leads to emitter and ground, left the scope probe connected to the cathode of the AM-detector diode, then waited for the intermittent. After two or three long minutes, the radio fairly exploded with sound, the emitter voltage jumped up to around +2.6, and the scope signal stretched off the screen.

Before I could move the meter lead to the base of the transistor, the volume faded away again, but I connected to the base and waited. In another two minutes, "old faithful" crackled to life and the base voltage read about +3.3 volts.

A Time For Logic

Now was the time to think this over. Was it a bias problem? Perhaps an intermittently-shorting capacitor? A bad solder joint? Not likely to be a problem in the emitter circuit because the base would still have about +.7 if the emitter were grounded. And both emitter and base would measure much higher if the emitter circuit opened. All symptoms pointed to the base circuit.

After turning off the power, I cut across the copper foil of the circuit board where the 10K resistor connected to the IF transformer. With an ohmmeter, I measured from the base of the transistor to the emitter using both polarities by switching leads. Good diode action, so the transistor appeared to be okay.

With the power on, I measured the bias voltage at the junction of the 10K and 3.9K resistors and found it was about +3.7 volts with the open in the foil, and either nearly zero when the volume was low or about +3.2 when the volume was normally loud. Yet, if the voltage was nearly zero, and the continuity of the foil opened, the voltage rose to about +3.7 each time.

After trying this test several times, I was convinced something in the base circuit of the 2nd IF stage was shorting and removing the forward bias from the transistor. However, there were very few components which could cause such a short. It narrowed down to the .015 capacitor, the IF transformer, the transistor or the associated wiring.

While it's not unheard of, it is unusual for a capacitor to be intermittently shorted, so that possibility was set aside for a time. Mechanical prodding of the IF transformer, and the adjacent area, would not trigger the intermittent in either direction.

As a last resort, I unsoldered the base lead of the transistor and positioned it so a small movement by means of a diddle stick would make it contact the foil.

Now when the volume was weak, disconnecting the base lead brought the bias voltage up to normal. And at the few times when the bias voltage was high, disconnecting the base lead made only a small difference in the base voltage.

There was no doubt now: the transistor was intermittently shorting from base to emitter, although the transistor had been tested by the use of a high-quality in-circuit tester and pronounced okay. And when it was removed and tested out-of-circuit, it tested perfect.

In years past, I thought transistors seldom went bad, except for a few that developed open leads. But as the number of transistors in use multiply, so do the types and varieties of troubles.

Why Did The FM Work Okay?

Although we might theorize and explain the intermittent shorting of the transistor by a thermal action which brought parts of the junction together, that doesn't explain why the FM apparently was not affected.

The key word here is "apparently", for undoubtedly the transistor either was weak or intermittent during FM reception, also. But the built-in limiting of the FM circuit kept the volume from reflecting the change of gain in this one stage.

Old-Fashioned Methods Are Needed, Too

Despite the usage of transistor testers, curve tracers and signal tracers (and I am very much in favor of their use), there are times when the ability to reason logically, combined with some old-fashioned cut-and-measure, can pay big dividends. □

The misbehaving microwave alarm

By John E. Cunningham

A "false alarm" is the cardinal sin of any security device. All of the general testing methods are given here, although the system you are called to work on probably will have a different defect.

This particular job of servicing a security device was one I'll long remember, for every component of the system seemed to operate perfectly.

False Alarms

The complaint was that the microwave-type burglar alarm frequently sounded in the early hours of the morning, and at no time was there any proof of an illegal entry. The owner became so frustrated because of being called out of bed by the police that he often failed intentionally to turn on the system when leaving for the night. However, the high rate of burglary in the area indicated that a good alarm was essential.

At the time we received the call, two security firms previously had checked the installation and had recommended the owner replace the system. Also, the owner had returned the microwave unit to the manufacturer who stated positively that the unit was operating normally, and who insisted the trouble must be something on the premises triggering the alarm.

One final fact: the alarm had been in use for over two years without any false alarms until just a few months ago.

Microwave Systems

Before you can follow the steps of troubleshooting, it's necessary that you understand the general operation of microwave systems (block diagram in Figure 1).

The microwave-transmitter antenna radiates energy into the protected area. Some of this energy is reflected back to the receiver where it is picked up by the receiving antenna and the frequency compared to that of a sample from the transmitter.

When nothing moves inside the protected area, the two frequencies are the same; therefore, there is no output from the detector. But, whenever a reflecting object, such as an intruder, moves about inside the area, the frequency of the reflected signal is shifted slightly higher or lower because of the Doppler Effect. Beating the sample of the signal from the transmitter against the frequency-shifted signal from the receiving antenna produces an audio tone. When the audio signal is amplified, rectified and fed to a trigger circuit, it turns on the alarm.

The System

This alarm installation was in a small repair shop located on a side street of a medium-sized city. Figure 2 shows a sketch of the installation. The siren was located on the outside wall of the building, and a key-operated switch located near the side door through which the proprietor entered the building was used to turn off the system during the day.

A sensitivity control on the system was adjusted so the alarm would sound whenever anyone walked within the area shown by the dotted lines.

Testing The System For False Triggering

The first step was to thoroughly search the premises for something that might cause a false alarm. Objects that move, such as fan blades, venetian blinds or curtains blowing in the breeze, often trigger microwave systems. In this case, there was nothing of this sort within sight of the alarm. Heat came from a steam radiator, and there were no fans or other moving machinery.

The building was of wooden construction, and undoubtedly some microwave energy leaked through the walls of the building. Therefore, a large object moving along the outside of the building theoretically might reflect enough energy to trigger the alarm. The only trouble with this hypothesis was the large amount of traffic moving by shortly after closing (when the alarm didn't trigger), and the small amount of traffic at the times when the false alarms occurred. Nevertheless, we made a careful check to see if anything moving outside the building would cause the alarm to trigger. We couldn't force it to false-trigger.

Lightning and power transients

Another frequent cause of false alarms is lightning, although microwave systems are not unusually susceptible to this type of trouble. At any rate, a check with the local weather bureau revealed no consistent weather pattern on the nights when the alarms occurred.

This brand of system had a standby battery supply that was automatically switched into the circuit whenever the regular power failed. Some such systems have been known to trigger when the power is restored after an outage. But, a check with the power company showed not only there had been no power outages on the nights when the false alarms occurred, but there had been two recent outages on nights when there were no false alarms. The line voltage was checked several times (a very good idea!), but it was always between 117 and 120 volts.

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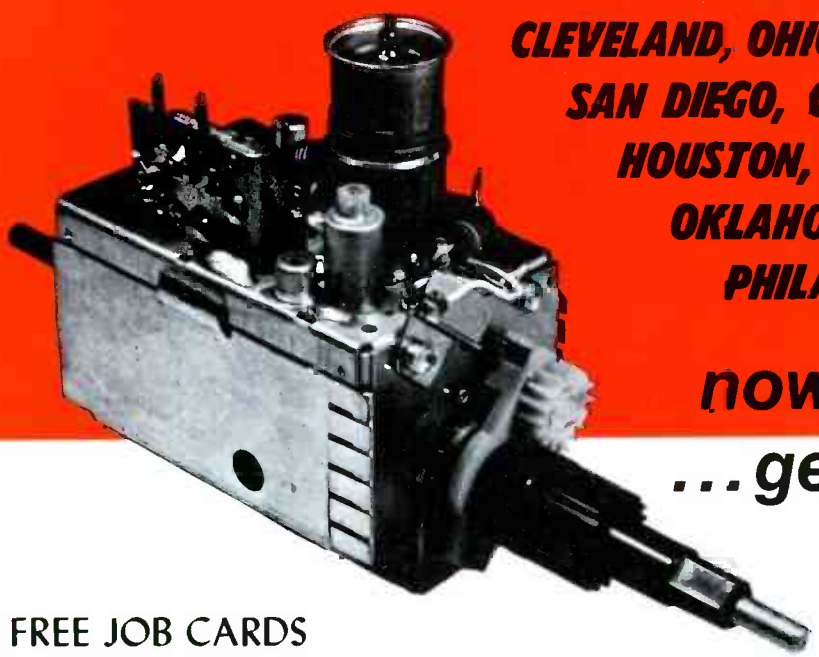

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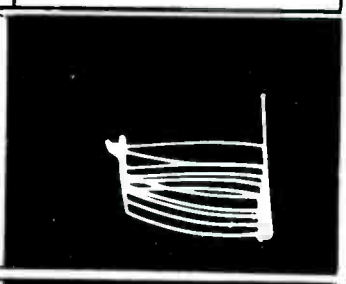
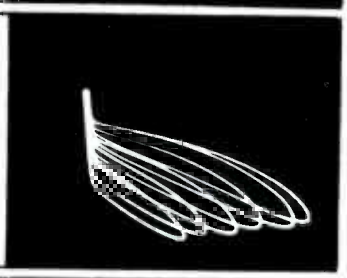
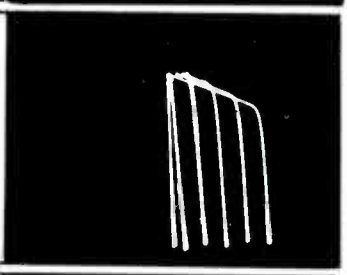
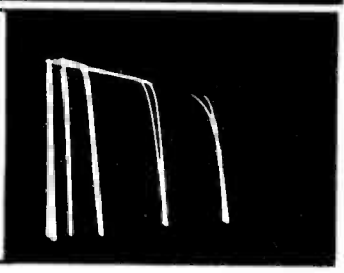
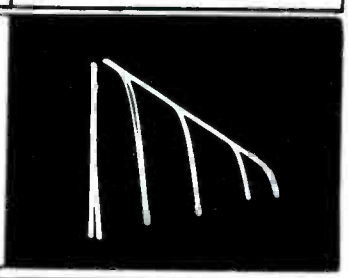
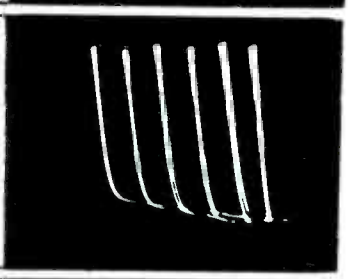
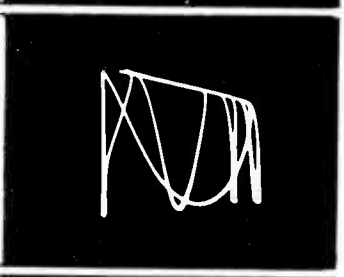
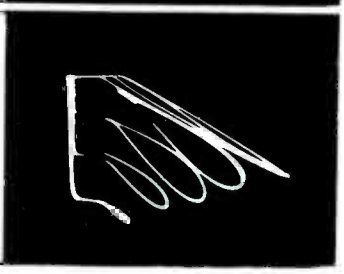
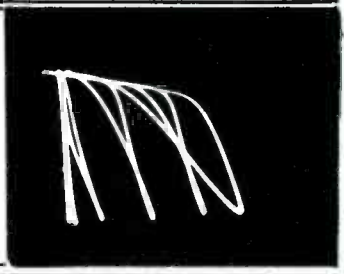
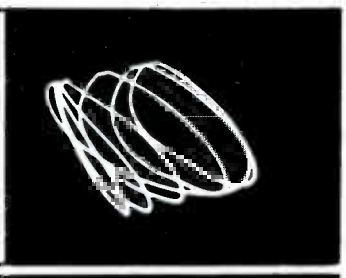
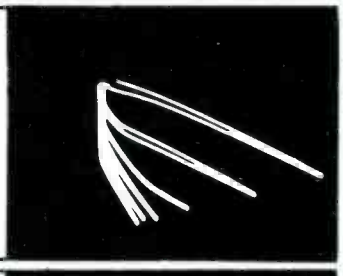
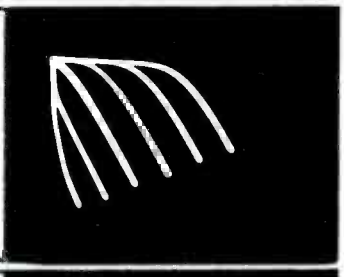
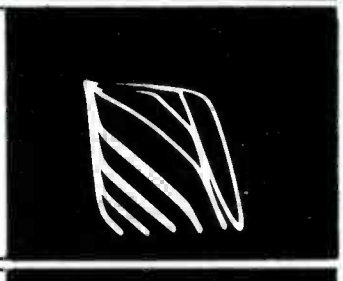
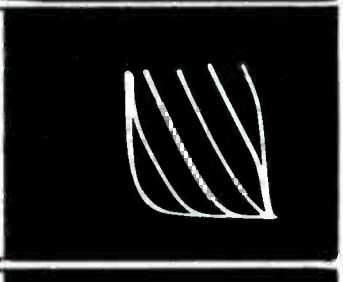
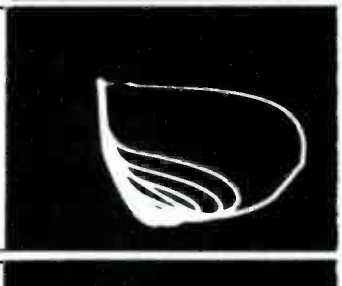
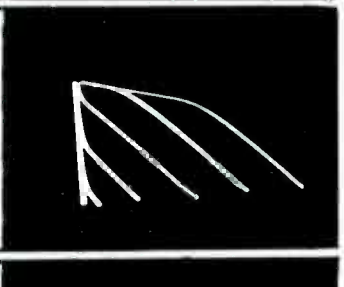
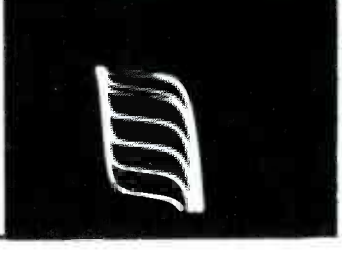
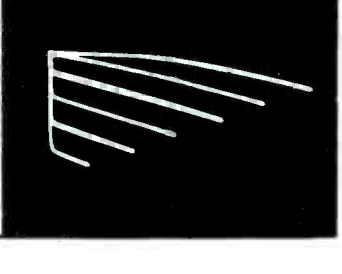
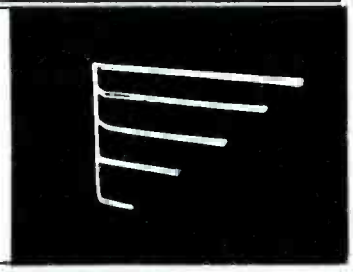
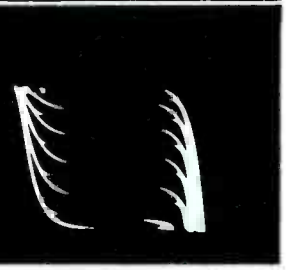
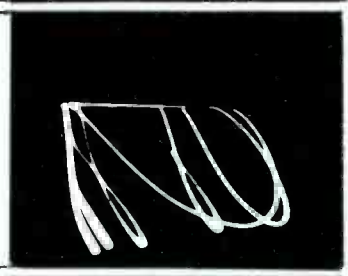
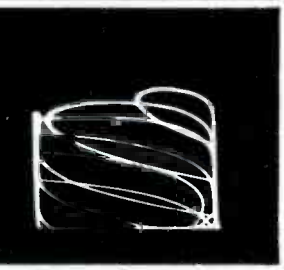
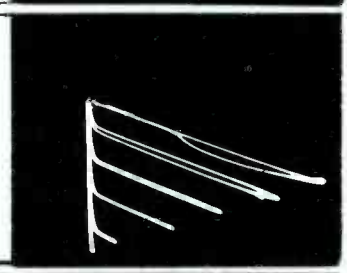
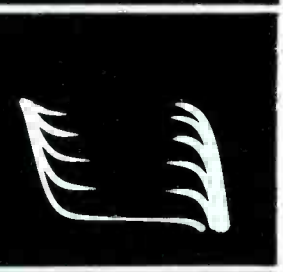
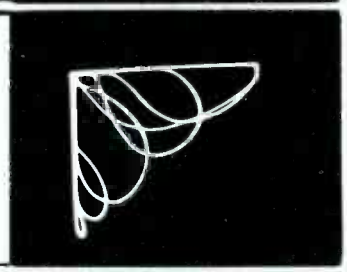
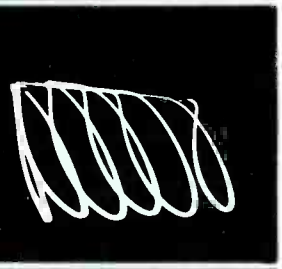
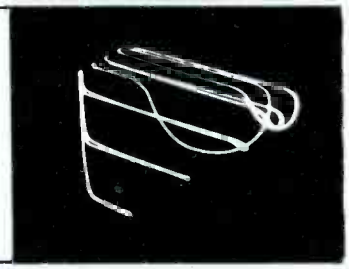
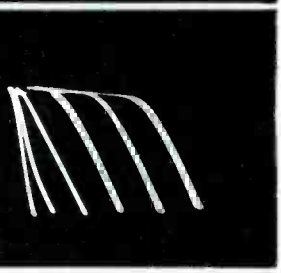
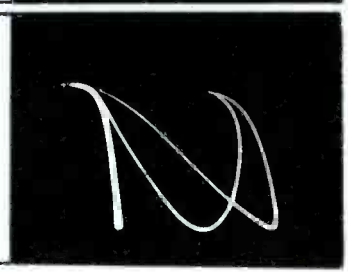
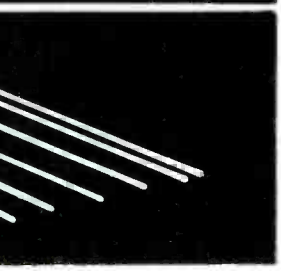
Q 100 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA	
Q 200 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA	
Q 202 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 200μA	
Q 204 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 200μA	
Q 205 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 200μA	

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q 206 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 200μA	
Q 208 **POLARITY** PNP **SWEEP VOLTAGE** 30V **BASE CURRENT** 200μA	
Q 210 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 100μA	
Q 302 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 100μA	
Q 304 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA	

MANUFACTURER SYLVANIA **MODEL OR CHASSIS** D-18 & D-19

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS	TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q 804 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA		Q1060, 1062 and 1064 **POLARITY** N/A **SWEEP VOLTAGE** N/A **BASE CURRENT** N/A	Due to the inductance connecting the base and emitter leads, these transistors cannot develop Signature Patterns. Check diode junctions.
Q 1000 **POLARITY** PNP **SWEEP VOLTAGE** 30V **BASE CURRENT** 10μA		Q 1066 **POLARITY** N-channel FET(NPN) **SWEEP VOLTAGE** 20V **BASE CURRENT** 1000μA or 1V/step	
Q 1052 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 20μA		Q 1068 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 20μA	
Q 1054 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA		Q 1070 **POLARITY** PNP **SWEEP VOLTAGE** 45V **BASE CURRENT** 50μA	
Q 1056 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 10μA		Q 1100 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 100μA	
Q 1058 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 10μA		Q 1102 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 100μA	

MANUFACTURER SYLVANIA **MODEL OR CHASSIS** D-18 & D-19

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS	TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q 306 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 10μA		Q 318 **POLARITY** NPN **SWEEP VOLTAGE** 40V **BASE CURRENT** 50μA	
Q 308 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 20μA		Q 320 **POLARITY** PNP **SWEEP VOLTAGE** 40V **BASE CURRENT** 10μA	
Q 310 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 10μA		Q 322 **POLARITY** NPN **SWEEP VOLTAGE** 70V **BASE CURRENT** 100μA	
Q 312 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 10μA		Q 600 **POLARITY** NPN **SWEEP VOLTAGE** 40V **BASE CURRENT** 500μA	
Q 314 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 10μA		Q 602 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA	
Q 316 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 20μA		Q 603 & Q 605 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 200μA	

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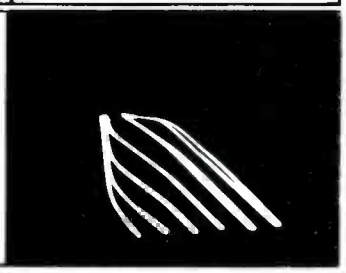
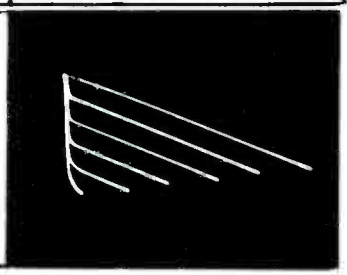
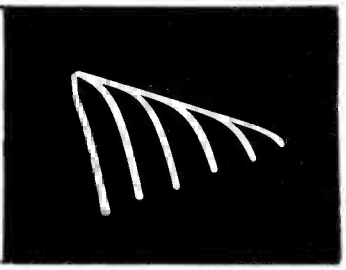
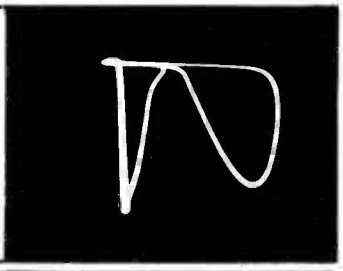
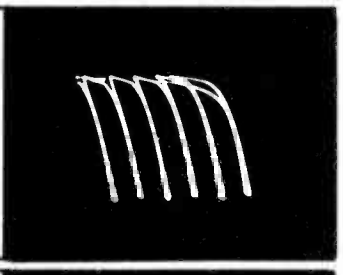
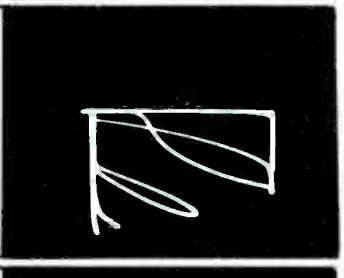
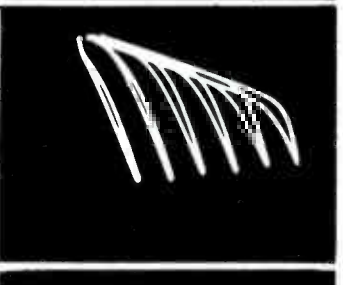
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS	TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q 604 **POLARITY** NPN **SWEEP VOLTAGE** 40V **BASE CURRENT** 20μA		Q 618 **POLARITY** NPN **SWEEP VOLTAGE** 35V **BASE CURRENT** 10μA	
Q 606 & Q 608 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 100μA		Q 620 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA	
Q 610 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 100μA		Q 622 & Q 624 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 20μA	
Q 612 **POLARITY** NPN **SWEEP VOLTAGE** 60V **BASE CURRENT** 50μA		Q 626 **POLARITY** NPN **SWEEP VOLTAGE** 40V **BASE CURRENT** 10μA	
Q 614 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA		Q 800 & Q 801 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA	
Q 616 **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 500μA		Q 802 **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50μA	

Universal color-TV setup procedures

By Wayne Lemons and Carl Babcoke

Although there are some exceptions, such as the GE Portacolor and the Sony Trinitron, many color-TV receivers can be converged by use of minor variations of the following procedures.

The majority of color-tv receivers sold during the past few years employ rectangular color picture tubes with the guns arranged in the familiar triangular (delta) pattern. Many of the convergence boards have the controls located in the same positions as earlier sets, and the controls have the same actions as those we describe here for a universal procedure.

Reprinted from **Color-TV Servicing Made Easy, Volume 3,** book 20875 by permission of Howard W. Sams & Co., Inc.

One type of color picture tube used in portable receivers has three guns which are inverted from the original standard design. For example, the blue gun is at the bottom and the red and green guns are above and on either side of the blue gun. Often the dynamic-convergence controls are on a convergence board which is mounted surrounding the neck of the picture tube.

These picture tubes are designed for low-voltage focusing. Most of the focusing of the electron beams is accomplished by the gun structure, and only a non-critical, fixed low voltage (usually selected by moving a connector from one lug to another) is necessary for obtaining the point of best focus. One version of this inverted tube is used in the RCA CTC22 chassis. Convergence and purity controls for the RCA CTC22 chassis portable color receiver are shown in Figure 1. The convergence-board assembly, including the three center-convergence rotary magnets, is fastened to the deflection yoke housing. The blue lateral and purity magnet assembly is separately attached to the neck of the picture tube by a clamp.

Some General Electric and Philco portables use color picture tubes with the three guns mounted horizontally in line. Setup instructions for these receivers are included with

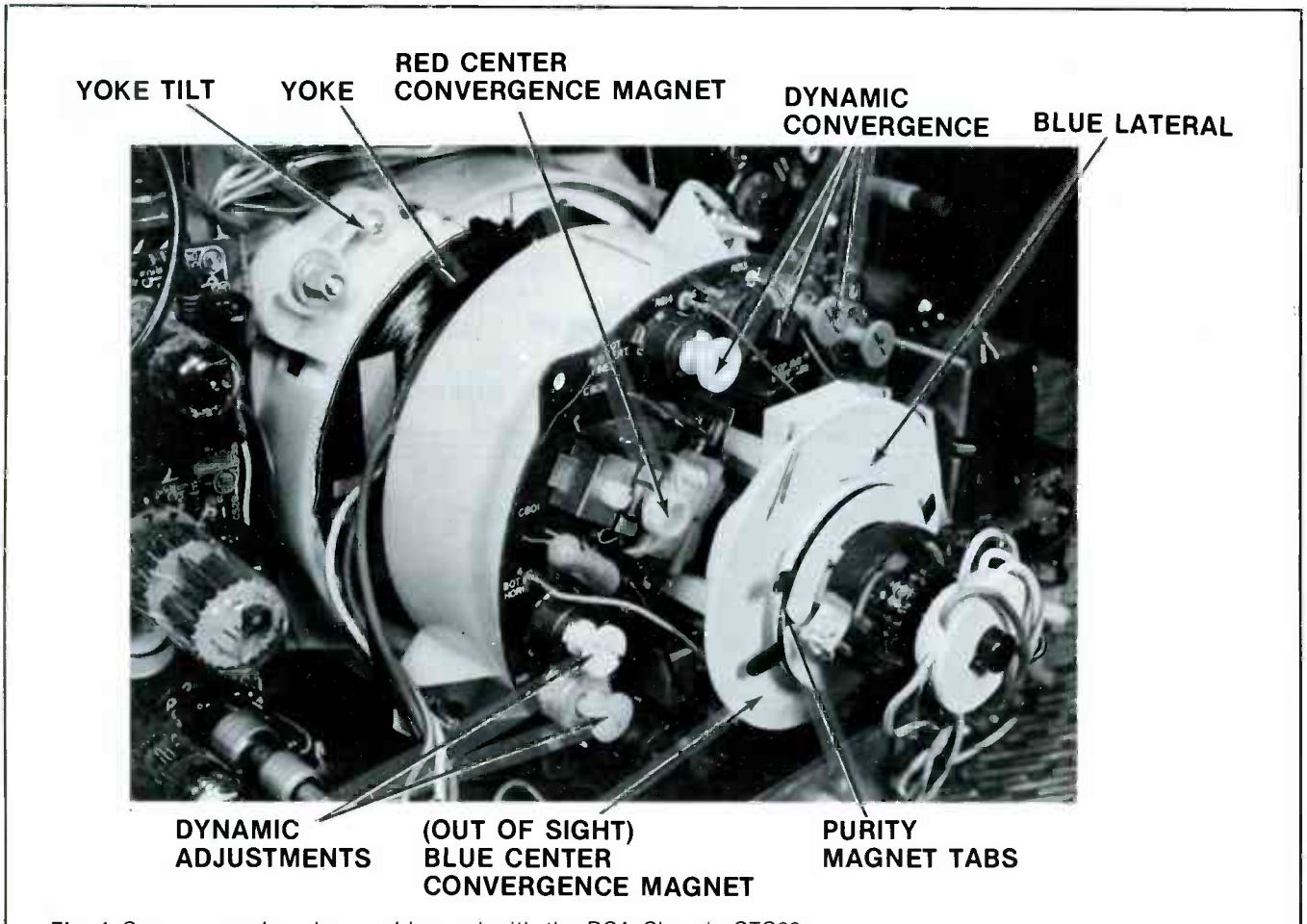
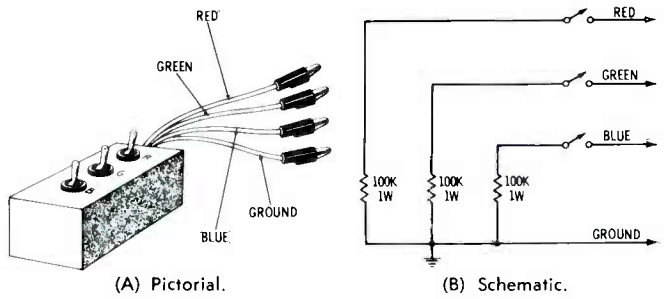


Fig. 1 Convergence board assembly used with the RCA Chassis CTC22.

and troubleshooting tips part 1



(A) Pictorial. (B) Schematic.

Fig. 2 Appearance and schematic of a gun killer.

Fig. 3 An external degaussing coil.

the servicing information.

Definitions of Terms Used During Setup

Center convergence—Accomplished by moving the individual red, blue, and green pictures until they cover one another perfectly in the center of the screen. Four permanent magnet assemblies are provided for these adjustments. Center convergence is sometimes called **static** or **DC** convergence.

Purity—Refers to the precision with which the electron beam from each gun strikes the matching phosphor dots on the screen. There is no actual color in a color receiver until the phosphor dots are illuminated by the electrons. If the beam of electrons from the red gun strikes a blue dot, the dot will glow blue. Color is determined by the phosphor, not the origin of the exciting electrons. Ideal purity is evidenced by a red raster of even hue and brightness when only the red gun is conducting. Similar blue or green purity should be observed when either the blue or the green gun is conducting alone.

Dynamic convergence—The process of converging the outer lines of a crosshatch pattern so that convergence is possible nearly to the edges of the screen. Small amounts of horizontal and vertical deflection voltages are filtered and then applied to convergence coils, which are mounted with the rotary magnets in three assemblies near the guns.

Screen color and tracking—Adjustments necessary so that the three guns will track both at high and low brightness. This is necessary so the highlights will be white and the lowlights will be gray.

Pincushioning—The nonlinearity of scanning which causes the picture to be bowed in toward the center on each of the four sides of the raster when wide-angle deflection yokes are used. Pincushion-correction adjustments do not change the other adjustments noticeably; therefore, they are usually performed last.

Setup Adjustments Without a Generator

We have been asked many times for a method of performing setup adjustments without a color-bar generator. If the question is asked by someone who intends this as a permanent method always to be followed, we can only say: "Forget it!" Dynamic convergence or pincushion-correction adjustments cannot be done practically without a crosshatch pattern.

But if the question pertains to suggestions about doing emergency adjustments because the generator suddenly malfunctioned or was forgotten, the answer is different. Even a partial setup, if done with skill, is certainly better than none. Screen color and gray-scale tracking **must** be done on the picture from a station. Purity is easily done with just a raster, and center convergence can be performed satisfactorily by spending a little extra time in finding some object in the center of the picture as a substitute for dots. The more experience a technician has acquired, the less inclined he is to waste valuable time attempting dynamic convergence without a generator.

Test Equipment Needed For Color Setup

A **color-bar generator** is a necessity, not a luxury. Color bars, sharp crosshatch, and dots are all the patterns actually needed. Other patterns such as a blank raster, a single dot, a crossbar, or separate horizontal and vertical lines are of some use, but are not indispensable. Crystal control of the most critical frequencies is very desirable. Remember that a picture carrier that is off frequency gives the same poor picture as a tuner with misaligned rf and antenna stages. An accurate and stable, unmodulated 4.5 MHz sound carrier is essential if the 4.5-MHz

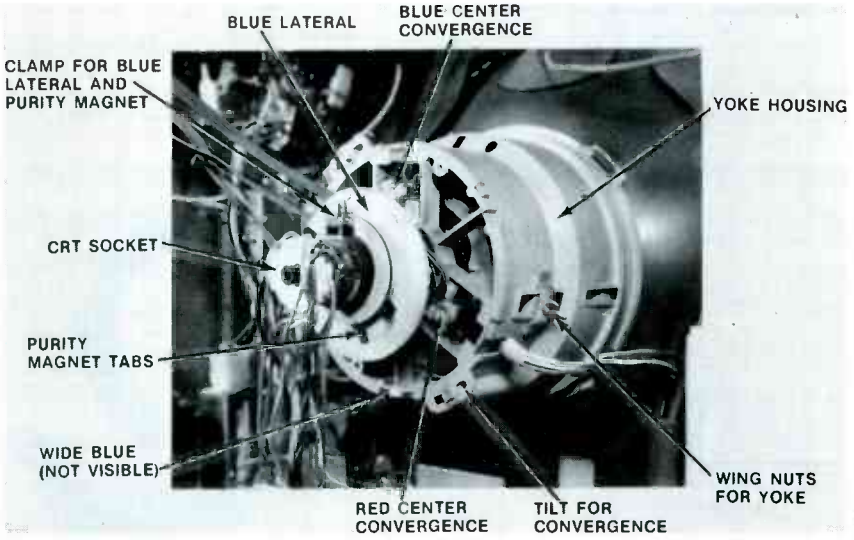


Fig. 4 Deflection yoke and convergence assembly used with the RCA Chassis CTC40 is typical of many.

sound trap in a receiver is to be adjusted, or if the color pattern is to be analyzed to determine the color quality.

A **gun-killer switch** helps a technician achieve a good setup in less time; we highly recommend them. Many modern generators come already equipped with gun-killer switches. Figure 2 shows the appearance and the schematic of a homemade gun-killer switch.

A **degaussing coil** (Figure 3) is no longer an absolute necessity because most of the color receivers sold for the past several years have built-in automatic degaussing. However, we recommend one always be available for the few cases where the internal system is malfunctioning and causing the purity to become progressively worse. Also, a degaussing coil is needed for sets that have been severely magnetized, such as by lightning. An external degaussing coil is still needed if you are to adjust the older receivers.

A **high-voltage probe** with meter is necessary to check or reset the amount of high voltage. The recent radiation scares have alerted all receiver owners to the possible hazards resulting from excessive high voltage. The high voltage should be checked before a complete setup is started, for the amount of high voltage does determine height, width, focus, and other picture characteristics.

Mirrors are needed for all setups except those on small portables. A small mirror (without distortion) is handy for setting center convergence, and a large mirror in which the entire screen can be seen for purity adjustments is convenient.

Tips Before Starting Setup

The convergence systems of all color receivers are designed to compensate for the **average** amount of line bending (misconvergence), but no more than that. Poor purity adjustments can produce either more or less bending, if the electron beams do not travel through the center of the deflection yoke coils. Even the blue vertical lines, for which no adjustments are provided, might be bowed right or left. The deflection yoke should be exactly centered around the neck of the picture tube. If it droops, a condition called "wide blue field" is caused. Some yokes have an adjustment screw at the bottom to adjust the yoke. Other yokes must be relocated by the use of shims.

Check to see that the convergence assembly containing the dynamic-convergence coils and the rotary-type center convergence magnets is not placed incorrectly in relationship to the internal gun structures. This misplacement could be to the front or to the rear, or the assembly might be rotated in a circular direction away from the optimum position.

If all controls on the convergence board appear to have nearly normal action but the adjustments just do not quite do the job, incorrect placement of the convergence components around the neck of the picture tube should be suspected.

Complete Universal Setup Procedure

Many experienced color-tv technicians have found that a few minutes spent in analyzing and preadjusting some of the most obviously needed adjustments is the most valuable time used in any setup.

Nearly all of the dynamic-convergence adjustments interact with each other. Thus, the best possible job of convergence cannot be done the first time through the procedure, no matter how carefully and slowly each individual step is performed. Three fast times through the entire procedure usually produces a good convergence job. However, one presetting, one fast complete procedure, and one careful touchup usually give the best results of all.

With the crosshatch pattern on the screen, look for the worst dynamic convergence error. Correct it, and look for more large errors. Correct them, also, but don't attempt to correct any errors that are only slight imperfections. After this step, perform the entire convergence procedure.

Preliminary Adjustments

1. Remove the back from the receiver, attach power cord and antenna. Mount the convergence board in a place convenient for adjusting.
2. Turn on the set and adjust the customer controls for a good black-and-white picture. Turn the color-intensity control completely counterclockwise.
3. Center the picture both vertically and horizontally, if neces-

sary, and if such adjustments are provided.

4. Adjust the height and vertical-linearity controls so the picture is linear and has about ¼-inch overscan at both top and bottom. More overscan reduces vertical lock-in ranges; do not overscan.
5. Adjust the focus control for the best picture detail (not necessarily the sharpest scanning lines) on a black-and-white picture of moderate brightness and contrast.
6. Set the picture-peaking switch, if one is provided, for the most pleasing appearance of the picture.

Purity

The purity magnet is mainly for adjusting the center purity, and the yoke is used for edge purity. **Center convergence must be reasonably good before, as well as after, purity adjustments;** correct it as often as needed.

1. Attach a gun-killer switch to the three picture-tube grids and to ground. If the center convergence is more than ¼-inch out of adjustment, center converge on the picture from a TV station. Center converge with the blue gun turned off. Converge the red and green pictures in the center of the screen, and then switch the blue gun on. Move the blue picture up or down to converge with the red and green, then move the blue picture sideways (by using the blue lateral magnet assembly) until it converges in that direction with the red and green pictures. If the red and green pictures separate because of the blue lateral adjustment, the blue lateral assembly is inverted. Often this sequence must be repeated to obtain good center convergence. Keep the brightness fairly low during these adjustments.
2. Connect the bar-dot generator to the antenna terminals and set the pattern selector for dots. Adjust the fine tuning for sharp, stable dots on the screen. If the fine tuning is adjusted too near sound bars, the dots will appear to rotate in a circle.
3. Check for yoke tilt and correct if needed.
4. Turn the contrast low and the brightness high (but not high enough to cause blooming). Check the red, blue, and green fields for purity, one color at a time. If all three fields are pure, go on to the next section covering the gray-scale adjustments. If the colors are not pure, continue with Step 5.
5. Degauss the face of the picture tube with a degaussing coil. With the power to the coil on, bring the coil flat against the face of the tube and move it slowly around the circumference of the tube. Only a few seconds of degaussing are usually required. Do not shut off the power to the coil until it is at least six feet away from the CRT.
6. Switch the red gun on, and the blue and green guns off. Loosen the yoke mounting screws and slide the yoke either forward or backwards (whichever produces the smallest red area on the screen).
7. Adjust the two rings of the purity magnet (see Figure 4 for the kinescope components of a typical RCA chassis) to place the red **fireball** in the approximate center of the screen. Ignore neck shadow if any exists.
8. Slide the yoke forward or backward in the direction that makes the red area larger. Adjust the yoke for the best overall purity.
9. Recheck for yoke tilt, correct it if necessary, and tighten the yoke clamp or mounting.
10. Check center convergence, and correct it if necessary.
11. Check the purity of the red, blue, and green fields again. Readjust the yoke and purity magnet again, if necessary. Poor dynamic convergence can cause failure to achieve perfect purity. Adjust for the best purity possible by following the preceding sequence through twice. Following dynamic convergence check the purity again.

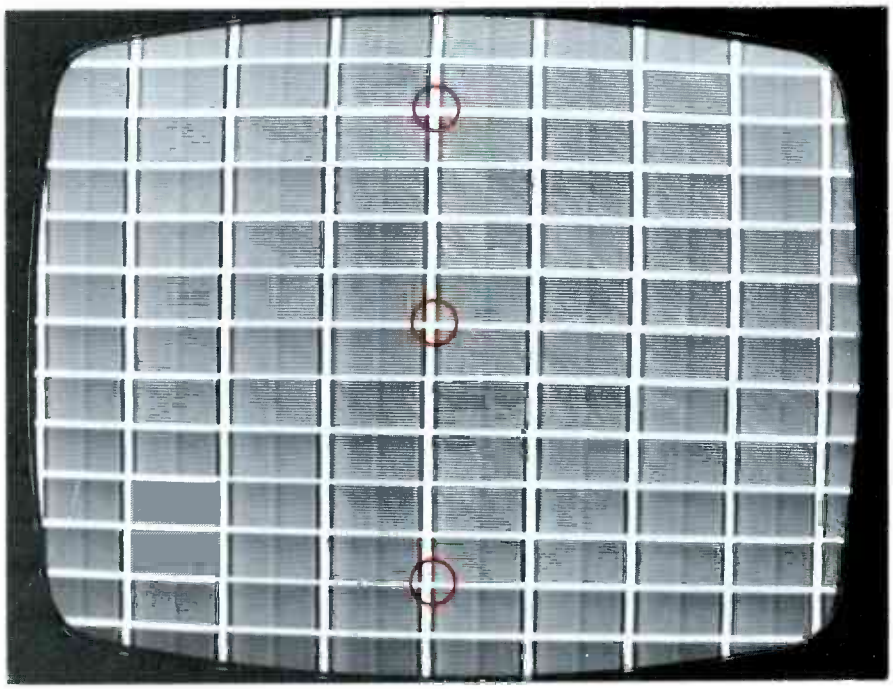


Fig. 5 Use only these three checkpoints when you perform center and vertical dynamic convergence.

Screen Color and Gray-Scale Tracking

1. Disconnect the bar-dot generator. Attach an antenna, tune in a station, leave the color control at minimum, turn any controls that affect the screen color to midpoint position, and adjust the contrast and brightness controls for a normal picture.
2. Slide (or pull) the "normal-service" switch to the service position. This gives one horizontal line that is not affected by the brightness control setting.
3. Slide the kine-bias switch, or turn the CRT bias control in the direction that produces the faintest line. Turn down all screen controls.
4. Turn up the screen controls, one at a time. If any control requires a setting higher than about ¾ to show a line, advance the kine-bias switch one position or increase the CRT bias control slightly. Repeat if necessary.
5. Turn the green and blue screen controls down, and turn the red screen control up to make a very **dim** line. Turn up green to make the line greenish yellow, then turn up the blue screen to make the line blue-gray. Readjust blue and green screens as needed, but do not disturb the red screen.
6. Return the "normal-service" switch to the normal position. Preset the blue drive control at about ¾ full on, and adjust the green drive control to produce a normal blue-white picture.
7. Alternately adjust the green and blue drive controls until the picture does not change color at high or low levels of brightness and contrast.

Vertical Dynamic Convergence

1. Change the bar-dot generator to the crosshatch pattern, remove the antenna, attach the generator to the antenna terminals, and tune the receiver.
2. Choose three checkpoints along the center vertical line as shown in Figure 5. One checkpoint should be nearest the center, and the other two about 2 or 3 inches from the top and bottom.
3. Carefully center converge, if necessary. Remember to use the dot pattern and keep the brightness low for accuracy.
4. Switch the blue gun off and leave the red and green guns on.
5. Locate the 6 vertical controls on the convergence board either from the markings on the board or from Fig. 6, if the physical layout is the same. The 6 controls on the left are for vertical dynamic convergence, and the three controls and three coils on the right are for horizontal dynamic convergence. Some receivers have a blue "shape" or "droop" coil that is adjustable. Do **not** adjust this coil except as instructed in the text. Adjust the "top R&G vert lines" control (No. 1) so the red and green **vertical** lines at the **top** checkpoint are converged.
6. Adjust the "bottom R&G vert lines" control (No. 2) so the red and green **vertical** lines at the **bottom** checkpoint are converged.
7. Adjust the "top R&G horiz lines" control (No. 3) so the red and green **horizontal** lines at the **top** checkpoint are converged.
8. Adjust the "bottom R&G horiz lines" control (No. 4) so the red and green **horizontal** lines at the **bottom** checkpoint are converged.
9. Switch the green gun off and the blue gun on.
10. Adjust the "top blue horiz lines" control (No. 5) so the blue **horizontal** line at the **top** checkpoint is converged with the red.
11. Adjust the "bottom blue horiz lines" control (No. 6) so the **horizontal** line at the **bottom** checkpoint is converged with the red.
12. Repeat steps 3 through 11 for best convergence. These adjustments interact. Therefore, they should be adjusted in pairs such as No. 1 and No. 2, No. 3 and No. 4, then No. 5 and No. 6.

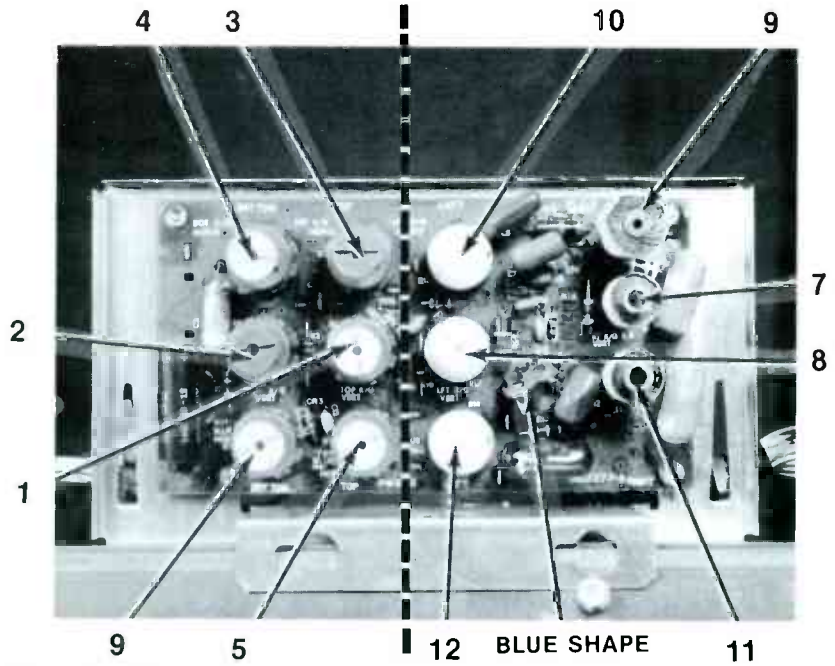


Fig. 6 Location of the controls on a typical convergence board, this one used with the RCA Chassis CTC 40.

Next Month

Part 2 will give the procedure for horizontal convergence, pincushion correction, and many troubleshooting tips to help with those cases where the adjustments are not effective. □

News from the

SERVICE ASSOCIATIONS

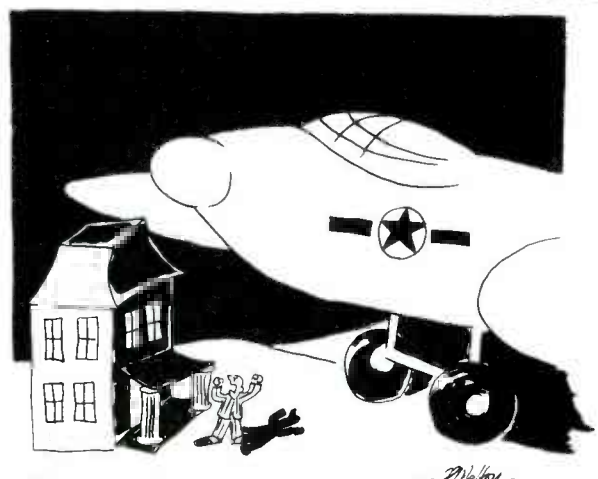
According to the NEA News letter for February, the total number of electronic dealers (shops) rose from an estimated 63,087 in 1970 to 74,400 in 1973. The total number of technicians, both full- and part-time, is placed at 204,000, which figures out to be 2.74 technicians per shop. Also, there is one technician per 1,000 people; the same ratio as observed in previous years. These figures are based on information from the various state license boards (where such boards exist).

The NEA board reports that 299 NEA members, 116 NATESA members, 126 ETA Louisiana members and 199 miscellaneous guests and sponsors attended the combined convention at New Orleans last August. Also, the NEA board authorized hiring a full-time JESUP coordinator and a full-time business management coordinator. Dean Mock of IESA (Indiana) presented a plan to inspect and rate technical information, in the same way equipment is now rated under the serviceability program.

Opposition is increasing against the New York State proposal to register or license television technicians. As reported in **Home Furnishings Daily,** Warren Baker, secretary of the Electronics and Appliances Service Associations Council has stated the proposed legislation would hurt rather than help the consumer. As an example, the provision specifies a written estimate, and that the technician can demand a fee for the estimate, providing the fee does not exceed 10-percent of the total costs. But what is 10-percent of nothing in case the estimate is refused? At the other extreme, suppose a shady operator would estimate the cost of repair at $300. If this estimate was refused, would the man charge $30 for the estimate? Baker says another clause that would be detrimental is the return of **all** old parts to the customer; some are dangerous in unskilled hands. For example the real danger of implosions from old picture tubes. Also, during warranty periods, the old parts must be sent back to the manufacturer and are not available to return to the customer.

Frank Moch, Executive Director of NATESA, has successfully blunted a planned expose by WBBM-TV, the Channel-2 CBS outlet in Chicago. The TV-station engineers "bugged" nine TV receivers, damaged the

same part in each one, and sent the sets to nine different TV shops for repairs. Advertisements in Chicago newspapers stated in letters nearly two-inches high: "Would you pay $30 to have a 75¢ TV part replaced?" Frank Moch contacted the station and was granted a long filmed interview, from which a few minutes was taken for broadcast use. Frank took strong issue with the 75¢ price, saying this was wholesale price and all businesses are entitled to a markup. Secondly, he questioned the competence and authority of broadcast technicians to know all the ramifications of TV repairs, and even more their knowledge of business expenses and business practices. Also, he questioned any opposition to the replacement of complete modules in solid-state receivers. During the broadcast, the phone number of the NATESA headquarters was given. Frank reports that about 1,500 phone calls and nearly 300 letters have been received since then. Most inquirers wanting information about legitimate shops were given names from the NATESA referral list.



"Margaret! That radar range goes back first thing in the morning!"

"I use my rear-view mirror to adjust the picture."

bookreview

Color-TV Servicing Made Easy, Volume 3
Authors: Wayne Lemons and Carl Babcoke
Publisher: Howard W. Sams & Co., Inc., Indianapolis, Indiana
Size: 8½ inches x 11 inches, 288 pages
Price: $6.95, Book Number 20875

Up-to-date information on circuits and innovations introduced by the TV industry since the previous volumes is available in this book. New circuits are discussed along with specific service techniques for troubleshooting them.

The first four chapters cover service information that pertains to all makes of color TV. Chapter 1 covers general circuit descriptions and troubleshooting hints. The 2nd chapter explains servicing high-voltage regulators, with the 3rd chapter covering ATC circuits. Universal setup procedures and troubleshooting hints are given in Chapter 4.

The remaining 21 chapters cover color receivers of individual manufacturers and include tube and control layouts, tube complements, field adjustments and troubleshooting hints. New circuitry is also discussed for various chassis series.

Automobile Electronics Servicing Guide, First Edition
Author: Joseph J. Carr
Publisher: Howard W. Sams & Co., Inc.
Size: 8½ inches x 11 inches, 128 pages
Price: $4.95, Book 20927

This book is for the technician who wants to be proficient in all aspects of automobile-electronics servicing. It begins with a basic review of superheterodyne theory and continues through circuits, stages and sections of complete tape players (both cassette and eight-track), as well as AM, FM and FM stereo. The first seven chapters are devoted to the electronic and mechanical aspects of the automobile radio with chapters 8 through 10 discussing tape players. The remainder of the book covers servicing topics such as bench test equipment, troubleshooting, alignment, noise suppression and reception problems. □

test equipment report

Features and/or specifications listed are obtained from manufacturers reports. For more information about any product listed, circle the associated number on the reader service card in this issue.

Portable Multimeter

Product: Model 262C by the United Systems Corporation.

Features: The portable digital multimeter has a 3-1/2 digit LED display and a basic accuracy of .05%. It can operate from standard line voltage or on an 8-hour battery. There is also a self-check battery-status indicator. The complete unit with battery is housed in an all-metal case.

Price: The price for Model 262C is $345.00.

For More Details Circle (60) *on Reply Card*

Power Supplies

Product: PRS series DC power supplies, Models PRS 12-25, PRS 12-50 by EPSCO, Inc.

Features: The PRS series DC power supplies feature a load regulation of 0.01% with .0001 volts ripple over a wide voltage range. Solid-state circuitry, internal reference circuitry, plus other performance and operating innovations qualify these power supplies for transistor circuit design, for equipment operation in industry, and for general-purpose classroom and laboratory work. The PRS series also has overload protection, a D'Arsonval meter calibrated for voltage and current, and current-limiting burnout protection.

Specifications: Model PRS 12-25 output is 0-25 VDC, 0-500 MA. Model PRS 12-50 output is 0-50 VDC, 0-250 MA. Both operate from 105-125 VAC, 50/60 Hz.

Size and Weight: The size of the cabinets of both models measures 5-1/4 X 3-1/4 X 9-1/8 inches. Each model weighs 7 pounds.

For More Details Circle (61) *on Reply Card*

Universal Bridge

Product: Model 4265A universal bridge by Hewlett-Packard.

Features: Model 4265A AC bridge measures L, C and R at 1 KHz to an accuracy of 0.2% of reading. Dissipation factor (D) and quality factor

(Q) also are measured. Results are read on a four-digit in-line display. The handle doubles as a tilt-stand so that the front panel can be set to an angle of either 40 or 60 degrees. With an external oscillator, the measurement can be extended from 50 Hz to 10 KHz. An external DC power supply and a null detector can be used for DC resistance measurements of inductors and capacitors.

Specifications: Inductance is measured from 0.1 uH to 1111 H and capacitance is measured from 0.1 pF to 1111 uF, both in seven ranges. Seven ranges of resistance measurements cover from 0.1 milliohms to 1.111 megohms. Q, measured at 1 KHz for series L or parallel C, is from 1 to 10. D, for parallel L or series C, is from 0.001 to 1. Both Q and D are measured to an accuracy of 5%.

Price: Model 4265A is priced at less than $540.00.

For More Details Circle (62) *on Reply Card*

Three-In-One Tester

Product: Model HM-310 VOM/Transistor/Capacitance Tester by H. M. Electronics, Inc.

Features: The HM-310 is a self-contained three-in-one VOM/Transistor/Capacitance Tester featuring 100 K-ohms per volt, taut-band meter movement, 3" mirrored scale, and burn-out protection. Measurements are AC and DC volts, resistance, AC and DC current, dB, capacitance, and transistor Alpha, Beta and leakage current.

Size and Weight: The size of the tester is 2-1/2 inches X 5-1/16 inches x 6-1/2 inches, and it weighs 2 lbs.

Price: Model HM-310 is listed at $59.95. □

For More Details Circle (63) *on Reply Card*

catalogs literature

Circle appropriate number on Service Card.

100. ARIES, Inc.—has released a 10-page catalog describing their do-it-yourself kits in the following categories: audio, computing, hobby, test instruments, timing, and general. An order blank and shipping information are included.

101. Channel Master—has published a 1973 antenna-systems product guide. The 48-page book provides data on VHF/UHF/FM antennas, kits, mounting hardware, wire, chemicals, masting, rotators, amplifiers, and converters. Some MATV antennas are also included.

102. Channel Master—offers a MATV Systems Planning Manual which explains the principles of such a system. Ten sections cover theory, definitions of MATV terms, and the fundamentals of planning and installing systems of different sizes. Required equipment is illustrated and explained. Charts and drawings showing typical systems are included.

103. Diamond Tool and Horseshoe Co.—is distributing a full-line 28-page tool catalog No. W30. It details over 300 styles of hand tools, including pliers, snips, wrenches, nippers and specialized tools for electronics, refrigeration, automotive and industrial uses. The most popular tools are mounted on skin-pack cards for retail selling, and six new dealer displays for these cards are described.

104. GC Electronics—features nearly 5,000 items in seven different product lines in the FR-73-74 general-line catalog. The 312-page catalog has lists under the following product divisions: GC Electronics, Walsco, Electrocraft, Ultron-Magic Color, Telco, Audiotex and Calectro.

105. Howard W. Sams & Co., Inc.—has released their 1973 Technical and Scientific Book Catalog which describes over 400 popular hardbound and paperback books. Electronics, electricity, amateur radio, audio & hi-fi, mathematics, plus Audel do-it-yourself books on appliances, mechanical power, and sheet metal are among the many topics covered. The authors who are experts and professionals write in easy-to-understand language and use understandable show-how photographs and drawings.

106. International Correspondence Schools—has available a catalog describing its new home-study Electronics Technology Programs Specially-developed training aids and instruments including a wide-band oscilloscope, VOM, transistor projects, electrical/electronic measurement setups, and training in the use of an oscilloscope are provided for students in the programs. Students may choose from several areas such as Broadcast/Communications, Industrial, Computer, Telephone, CATV/MATV, Hi-Fi/Stereo, Solid-State/IC Electronics, Television Service Technician and FCC Radiotelephone License. The FCC License Program prepares students for the 1st, 2nd, or 3rd Class FCC Radiotelephone License.

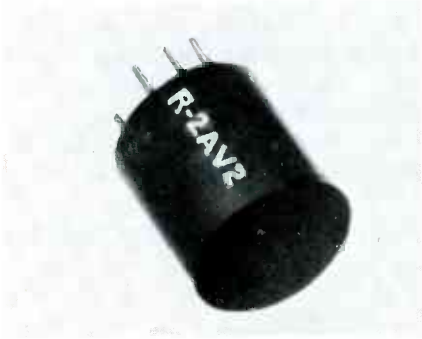
107. ITT Cannon Electric—announces a technical brochure on CATV connectors. The 12-page CATV-1 includes 33 photographs, outline drawings, and technical specifications for ITT Cannon's new line of seized-center-conductor series, cable-feedthrough series, adapters, and miscellaneous fittings. □

productreport

for further information on any of the following items, circle the associated number on the reader service card.

Focus Rectifier

Product: R2AV2 Solid-Tube by Electronic Devices, Inc.



Features: R2AV2 is a solid-state focus rectifier for direct, plug-in replacement of vacuum tubes 2AV2, 2BA2 and 1V2 in color television receivers. The R2AV2 eliminates a potential source of x-radiation, runs cool and is longer lived than the vacuum tubes it replaces. Peak-inverse voltage of the R2AV2 is 9 KV, peak repetitive forward current is 100mA, and average forward current is 5 mA. Voltage drop at 5 mA is 20 volts.

For More Details Circle (64) *on Reply Card*

Component Kit

Product: XL-100 component kit by RCA Parts and Accessories.

Features: The new kit was designed to give technicians better servicing capabilities for the RCA XL-100 solid-state color TV chassis. The kit contains a variety of transistors, diodes and resistors, plus one circuit breaker – 27 components in all. A special parts-location diagram and a separate cross-reference chart make it easy for technicians to use the kit effectively.

Price: XL-100 sells for $49.50.

For More Details Circle (65) *on Reply Card*

Inspection Flashlight

Product: Inspection Flashlight by Brodie System, Inc.

Features: This lightweight tool with 360-degree flexibility is recommended for repairs and adjustments in those hard-to-see spaces. Included as standard equipment with the flashlight are three spring-loaded extensions to 26-1/2 inches, two interchangeable mirrors, batteries, and a durable vinyl case.

Price: The Inspection Flashlight sells for $29.95.

For More Details Circle (66) *on Reply Card*

Pencil-Type Eraser

Product: 3-in-1 Eraser by Fancourt Industries, Inc.

Features: The 3-in-1 Eraser has 3 interchangeable rubber heads each having a different abrasive. These are some of the specific applications: fine-grit abrasive for micro-deburring and cleaning of thin, hard coatings, and residual chemicals on PCB connections; medium-grit abrasive for erasing solder spots and heat marks on PCBs and components; coarse-grit abrasive for quick cleaning of rust, corrosion and stains on metal, plastics, glass or ceramic surfaces. The case is steel-plated with a spring clasp for carrying, and the extra heads store inside. It can be adapted to a drill press for high-speed cleaning.

Size: The 3-in-1 Eraser is 5 inches long by 3/8 inches in diameter.

Price: It sells for $2.50 and samples are available for $1.75 each.

For More Details Circle (67) *on Reply Card*

High Voltage Putty

Product: High Voltage Putty by Oneida Electronics Mfg. Inc.

(Continued on page 58)

Features: The long-lasting putty molds around uneven objects to stop arcing in high-voltage television transformers, anodes, tube sockets, filament wire, and wherever high-voltage arcing is a problem.

Size: It is packaged in 6-inch lengths, and is available on a card with 24 packages or a half card with 12 packages.

For More Details Circle (68) *on Reply Card*

Counterfeit Bill Detector

Product: Counterspy by Althea Products.

Features: Counterspy detects the difference between the paper used by counterfeiters and the paper in genuine bills. This prevents possible losses from bills that are accurately printed. The unit is designed either for countertop or for cash-register mounting.
Price: Counterspy sells for $24.95.

For More Details Circle (69) *on Reply Card*

UHF Converters as Replacement Tuners

Product: Model 503 UHF converter, "Venus," by Gavin Instruments, Inc.
Features: Model 503 is a two-transistor UHF converter with amplified circuitry for long-distance channel reception. Gavin also offers Model 502, "Saturn," which has single-transistor circuitry for suburban locations, as well as Model 501, "Jupiter," for local reception in cities. All three models feature ultrascope fine tuning, a luminaire dial for channel selection, and an AC convenience outlet.
Prices: Model 503 is listed at $39.95; Model 502 is $26.90; and Model 501 is $19.95.

For More Details Circle (70) *on Reply Card*

High-Voltage Rectifier

Product: Model R-12C in the Solid-Tube line by Electronic Devices, Inc.
Features: R-12C is a solid-state high-voltage rectifier designed for direct replacement of Motorola, Electrohome, Zenith and GE "stick" rectifiers in color television receivers.

Specifications: Ratings for the R-12C high-voltage rectifier include a peak inverse voltage of 45KV, peak repetitive forward current of 200mA, an average forward current of 5mA, and a voltage drop of 75 volts at 50mA.
Price: The suggested list price of the R-12C is $9.95.

For More Details Circle (71) *on Reply Card*

For more information about above products use reader service card

audio systems report

Features and/or specifications listed are obtained from manufacturers reports. For more information about any product listed, circle the associated number on the reader service card in this issue.

Stereo Headphones

Product: Model SH-850 by Lear Jet Stereo, Inc.

Features: Lightweight stereo headphones model SH-850 are available for use in the home or auto. They feature full high and low end high-fidelity stereo sound, fully-adjustable dual-crown band, soft-sound chamber cushioner, and a tangle-proof expander cord.

Price: Model SH-850 is designed to be sold at $24.95 list.

For More Details Circle (72) *on Reply Card*

Head Demagnetizer

Product: Model QM-202 by the Recorder-Care Division of Nortronics Company, Inc.

Features: Model QM-202 generates a controlled 60-Hz magnetic field which is strong enough to effectively demagnetize, without being so strong that additional residual magnetism is created. The primary reason for demagnetizing pole pieces and faces of recorder playback heads is to prevent hiss, noise and possible erasure which can be caused by a magnetized head. It also prevents partial erasure of recorded tapes. Model QM-202 features a flexible probe which will bend to reach usually inaccessible recorder/player parts, and is padded to prevent head damage.

For More Details Circle (73) *on Reply Card*

Sound Baffle Systems

Product: The 4+ line of sound baffle systems by Soundolier, Inc.

Features: The 4+ line of baffles is highlighted by the Model X-44. This contemporary enclosure harmonizes with modern lighting fixtures to present an integrated overall appearance. Variations of this enclosure can be ordered for bi-directional or surface mounting. The 4+ line of baffles and enclosures offer the architect and designer complete flexibility in a new, attractive and compact package. The baffles are available in satin aluminum/black, bronze green/black, dura bronze/black and satin white/black or custom colors on request. A complete line of accessory-mounting hardware, enclosures and brackets are also available.

For More Details Circle (74) *on Reply Card*

Wireless Intercom

Product: Archerkit Wireless Intercom Kit No. 28-3383 by Radio Shack.

Features: The Archerkit wireless intercom can be plugged into standard AC outlets in the same house, or in separate buildings served by the same power line transformer, to provide instant communications. The units can be wall-mounted or moved around as needed. Each unit has a thumbwheel volume control, pilot light, talk button and lock button for hands-free conversation or monitoring.

Size: Each unit measures 3-7/8 inches X 5-1/4 inches X 1-3/4 inches.

Price: The Archerkit Intercom Kit No. 28-3383 with all parts and step-by-step assembly instructions is priced at $22.95 a pair. □

For More Details Circle (75) *on Reply Card*

audio systems report

Features and/or specifications listed are obtained from manufacturers' reports. For more information about any product listed, circle the associated number on the reader service card in this issue.

VHF Broadband Amplifier

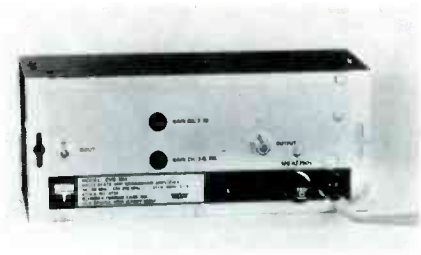
Product: Model CVB-30A by Blonder-Tongue Laboratories.

Features: Model CVB-30A is a solid-state VHF/FM amplifier designed for medium-sized MATV systems. It features separate gain controls for high and low band channels permitting individual balancing of both bands to compensate for higher cable losses in high-band service. This additional flexibility also helps to reduce cross-modulation interference. An inductively-coupled emitter-feedback circuit provides a wide dynamic range for both strong and weak signals. The input circuit is protected from lightning, and the power supply is fused.

Specifications: With both gain controls fully open, full gain is typically 35 dB for the low TV channels and FM, and 33 dB for channels 7 through 13. Input and output impedances are 75 ohms and a typical noise figure is 8 dB. Output capability is +52 dBmV per channel for seven-channel operation.

Price: The Model CVB-30A nets at $57.70.

For More Details Circle (76) *on Reply Card*



Two-Output Port Directional Coupler

Product: Model M5320-2 by MPI Company for reducing set-to-set coupling.

Features: Model M5320-2 is part of the series of two-output port directional couplers using integrated hybrid splitters. All units featuring high-permeability ferrites and printed circuit boards are assembled in radiation-proof, diecast metal housings and come complete with cable fittings.

Specifications: The units in Series M-5300 are low-loss precision power dividers for 75 ohm lines, and provide a flat frequency response over the entire frequency band of 5 to 300 MHz. Production models having isolations of 10, 16, and 20 dB are available.

For More Details Circle (77) *on Reply Card*

TV Outlet

Product: Model T-77A by Winegard Company.

Features: The T-77A is a 75-ohm 82-channel TV outlet. A no-loss feed-thru connector is attached to a telephone-type wall plate. Input and output impedances are 75 ohms. The outlet is packaged in a preprinted autobag with 24 in a carton. Plaster straps are included. Model T-77AB is ivory and model T-77AB is brown.

For More Details Circle (78) *on Reply Card*

photofact™ bulletin

Photofact Bulletin lists new **Photofact** coverage issued during the last month for new TV chassis.

CORONADO
TV22-1031A 1311-1

HITACHI
I-29, I-49 1312-1

MIDLAND
15-239 1308-1
15-005 1314-1

PANASONIC
CT-396 1313-1

PENNCREST
2872 1314-2

PHILCO-FORD
B451BBK, B461BWA (Ch. 3BM23) 1309-1
Chassis 2CN20, 2CP30, 2CP31 1311-2
Chassis 21KT40 (Late Prod), 21KT41P/SP 1313-2

RCA
AR125F (Ch. KCS177XF) 1313-3

SANYO
91C18 1315-1

SEARS
564.41230100 1308-2
528.41880100 thru 528.41880109 1310-1

SONY
Chassis SCC-17A-A/-17A-B/-17B-A/-17B-B 1309-2

SYLVANIA
CE2181W, CE2187WH, CE2189W (Ch. D15-6) 1314-3

TELEDYNE PACKARD BELL
1C222WL 1312-2
2M321BG, 2M323WL,
2M521BG, 2M523WL 1315-2

TRUETONE
MIC4319A-37 (2DC4319) 1310-2

WARDS AIRLINE
GEN-12743A 1309-3

XAM
19BW73, 22BW73 1308-3
D12BW73, 12BW73 1310-3

ZENITH
Chassis 19DC12 1311-3
Chassis 25DC57 1315-3
Tuner For Chassis 25DC57 ..... 1315-3-A
Remote Control Receiver S-91768 ..... 1315-3-B
Remote Control Receiver S-93744 ..... 1315-3-C

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is **your** magazine!

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We value your comments and criticism.—Ed.

The MARKETPLACE

This classified section is available to electronic technicians and owners or managers of service shops who have for sale surplus supplies and equipment or who are seeking employment or recruiting employees.

Advertising Rates
in the Classified
Section are:

- 25 cents per word (minimum $3.00)
- "Blind" ads $2.00 additional
- All letters capitalized 35 cents per word

Each ad insertion must be accompanied by a check for the full cost of the ad.

Deadline for acceptance is 30 days prior to the date of the issue in which the ad is to be published.

This classified section is not open to the regular paid product advertising of manufacturers.

FOR SALE

UNUSUAL SURPLUS electronics and parts catalog, thousands of items. $1. ETCO, Dept. ES, Box 741, Montreal, Canada. 2-73-10-t

PICTURE TUBE & FLYBACK HIGH VOLTAGE TESTER ONLY $1.98 SCHEK TV WAND CO. 8101 Schrider St., Silver Spring, Maryland 20910. 2-73-6t

WAHL BATTERY OPERATED SOLDERING IRONS. In stock at Audiotechniques Inc, 142 Hamilton Ave, Stamford, Ct. 06902 (203) 359-2312 4-73-2t

TV & RADIO TUBES 36c EA.!! Free color catalog. Cornell, 4221 University, San Diego, California 92105 4-73-5t

USE YOUR SCOPE (any model, no rewiring) to test transistors in/out circuit. Simple instructions $1.00. Schek Technical Services, 8101 Schrider St., Silver Spring, Maryland 20910. 2-73-8t

SAMS PHOTOFACT numbering one through 971 plus TSM series. CB series and TR series. Filing included (cabinets) Please make offer. Ross Distributing Co., Inc., 112 South First West, Preston, Idaho, 83263 5-73-1t

ARI TO AR 6 SERVICE MANUALS, Signal Radio Service, 41778 Fremont, Blvd., Fremont, Calif. 94538 5-73-1t

EDUCATION INSTRUCTION

REPAIR TV TUNERS—High Earnings; Complete Course Details, 12 Repair Tricks, Many Plans, Two Lessons, all for $1. Refundable. Frank Bocek, Box 3236 Enterprise, Redding, Calif. 96001. 5-73-5t

advertisers' index

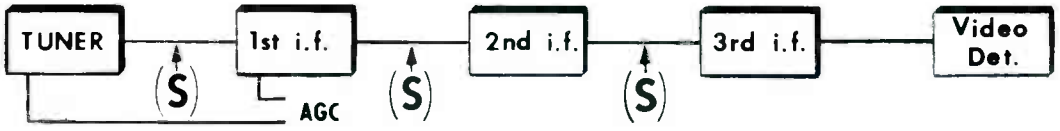
The all NEW

TV TUNER SUBBER™

Mark IV

Latest, all solid state version of the sensational signal circuit analyzing timesaver originated by Castle.

Invaluable for locating the break in the tuner and i.f. signal chain or analyzing agc system defects in tube TV receivers . . . essential for speedy location of signal circuit defects in modular IC, solid state and hybrid TV receivers.



Subber Mk. IV permits injection of substitute 40MHz signal at points (S) in signal amplifier chain. Permits signal injection after the agc controlled stages to simplify testing for agc defects.

- Works with any 40MHz receiver . . . color or black and white . . . solid state, tube or hybrid.
- High level, low impedance output furnishes signal usable at input of final i.f. stage.
- Special output circuit works equally well into first i.f. input of late model, link coupled systems and older, low "C" bandpass coupled systems.
- Antenna input and i.f. output electrically isolated; no "hot" chassis hazards.
- No need to disconnect supply leads from suspected tuner being tested. Substitutes the VHF tuner and tests the UHF tuner.
- Tunes all 12 VHF channels, has preset (memory) fine tuning on all channels.
- Higher overall gain than previous models with wide range gain reduction control of 60db.
- Completely self contained and battery operated, uses popular batteries available everywhere. Simple battery replacement; battery compartment in rear of custom molded case.
- Reduced current consumption extends battery life to as much as double that of previous models. Bright LED indicator warns when unit is ON.
- Use on the bench or in the home . . . anywhere.
- Comes complete with extension cables, batteries and instructions.

TV TUNER SUBBER™ Mark IV net $45.95

Contact your distributor.

Include $1.50 shipping and handling on prepaid mail orders: we will ship C.O.D.

Pioneers of TV Tuner Overhauling

CASTLE TV TUNER SERVICE, INC.

5701 N. Western Ave., Chicago, Illinois 60645 • Phone: (312) – 561-6354

For More Details Circle (3) on Reply Card

Announcing the RCA MINI-STATE Antenna System

The profitable new achievement in antenna technology.

The Mini-State is brand new from RCA. It's the first true miniaturized rotating antenna system on the market. *It works . . . and works well!*

This system is specifically made for your metropolitan and suburban customers who want the quality reception of an outdoor-type antenna, in a beautifully compact unit suitable for homes and apartments.

Measuring just 21" across and 7" high, the Mini-State is completely enclosed in an attractive sturdy plastic case that's weatherproof and resistant to dust and dirt. It weighs just 6 pounds and can be mounted almost anywhere: rooftop, chimney, window, attic and closet.

The RCA Mini-State's uni-directional pattern, VHF slotted ring and multi-element UHF design, combined with its completely integrated solid state circuitry, provides excellent reception on all channels, and helps avoid interference and ghosts.

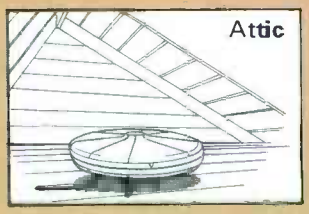
Mini-State model 5MS440, with built-in rotator, allows your customers to zero-in for best reception on any channel. Exclusive direction indicator light on the hand held control unit tells them where the antenna is aimed.

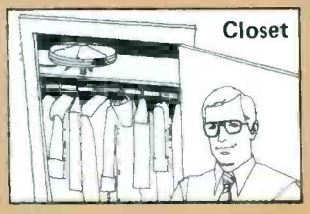
The RCA Mini-State rotating antenna system includes: The antenna with built-in amplifier. Built-in rotator and hand held remote control unit. A 120 volt AC power supply. A VHF-UHF antenna matching transformer. An outdoor mast clamp. Legs which can be snapped into place for indoor use.

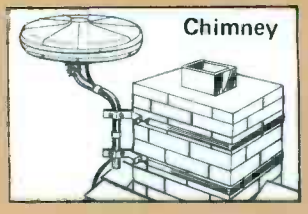
Although regular coaxial and rotator cable may be used, a unique combined coaxial and rotator cable is available in prefabricated lengths for quick, easy installation. (A fixed non-rotating model 5MS330 is also available.)

Yes, this new RCA Mini-State antenna system can mean maxi-profits for you. See your RCA Parts and Accessories distributor today, or contact RCA Parts and Accessories, P.O. Box 100, Deptford, N.J. 08096. Make sure you're in on the ground floor of this profitable new era in TV antenna systems.

RCA







For More Details Circle (2) on Reply Card