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Electronic Servicing

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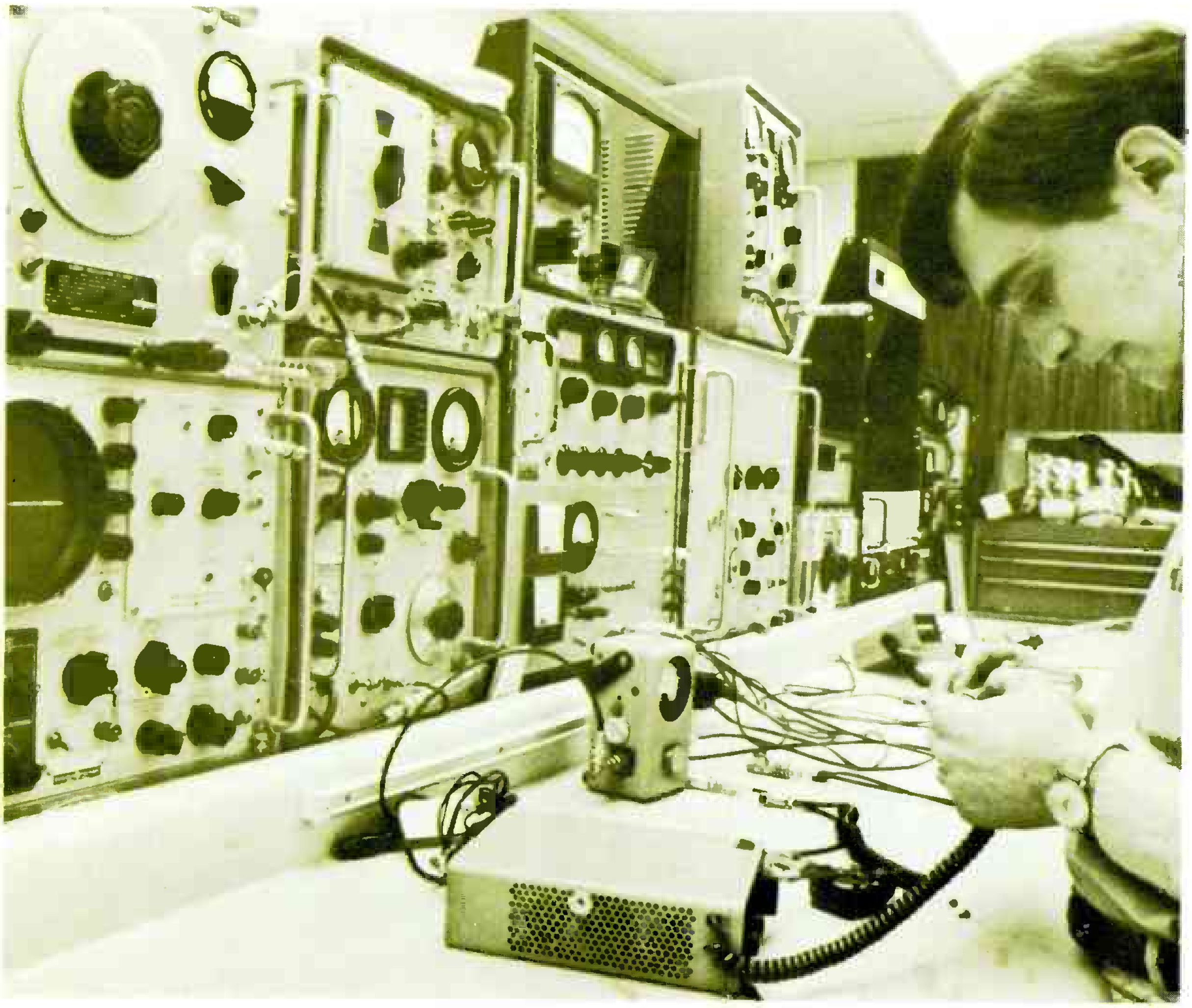

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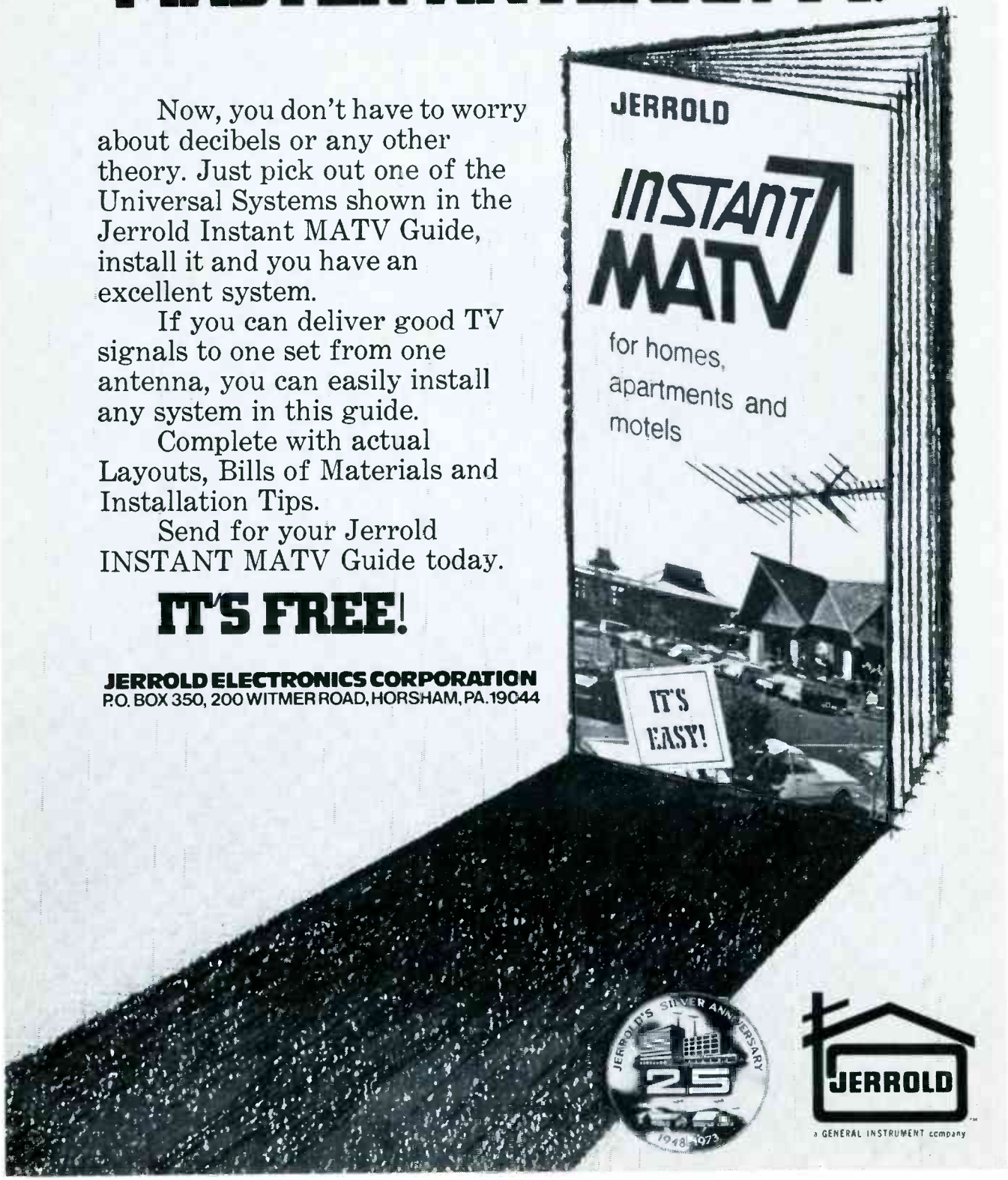

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LBO-310 3" SOLID STATE GENERAL PURPOSE SCOPE Unusually high sensitivity with bright display, sharp focus & excellent stability. Delivers 20mVp-p/div v't'l sensitivity with 600V max. input. Sweep frequency is in 4 ranges — 10Hz to 100KHz, cont. adjust. Also monitors waveforms to 100MHz and has provision for DC voltage/level checks. Compact, lightweight, it's an ideal time and money saver everywhere — for hobbyist, educators, production and service. $199.95

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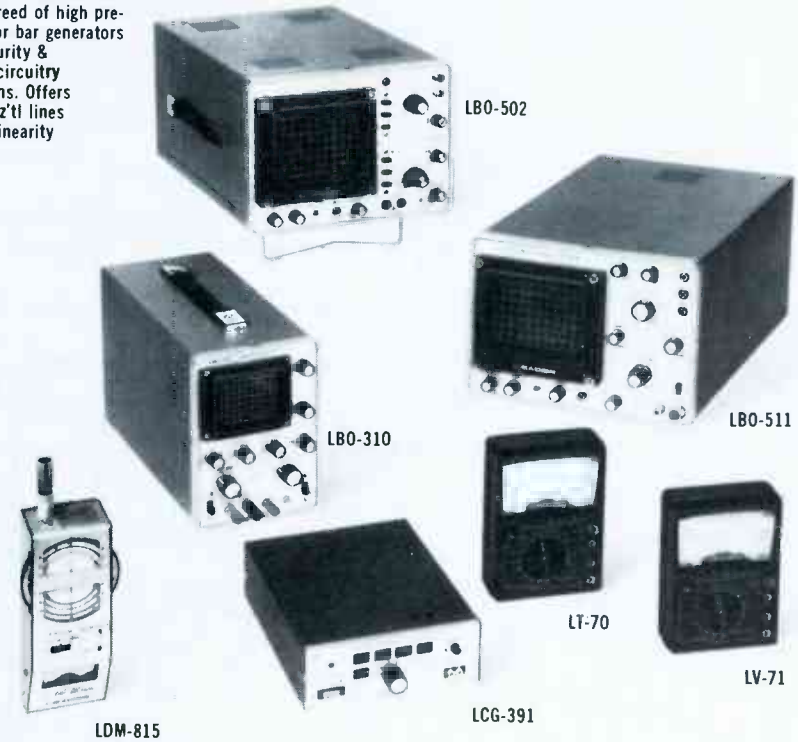

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June 1973 □ Volume 23, No. 6

Electronic Servicing®

in this issue...

DEPARTMENTS

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Robert E. Hertel, Publisher

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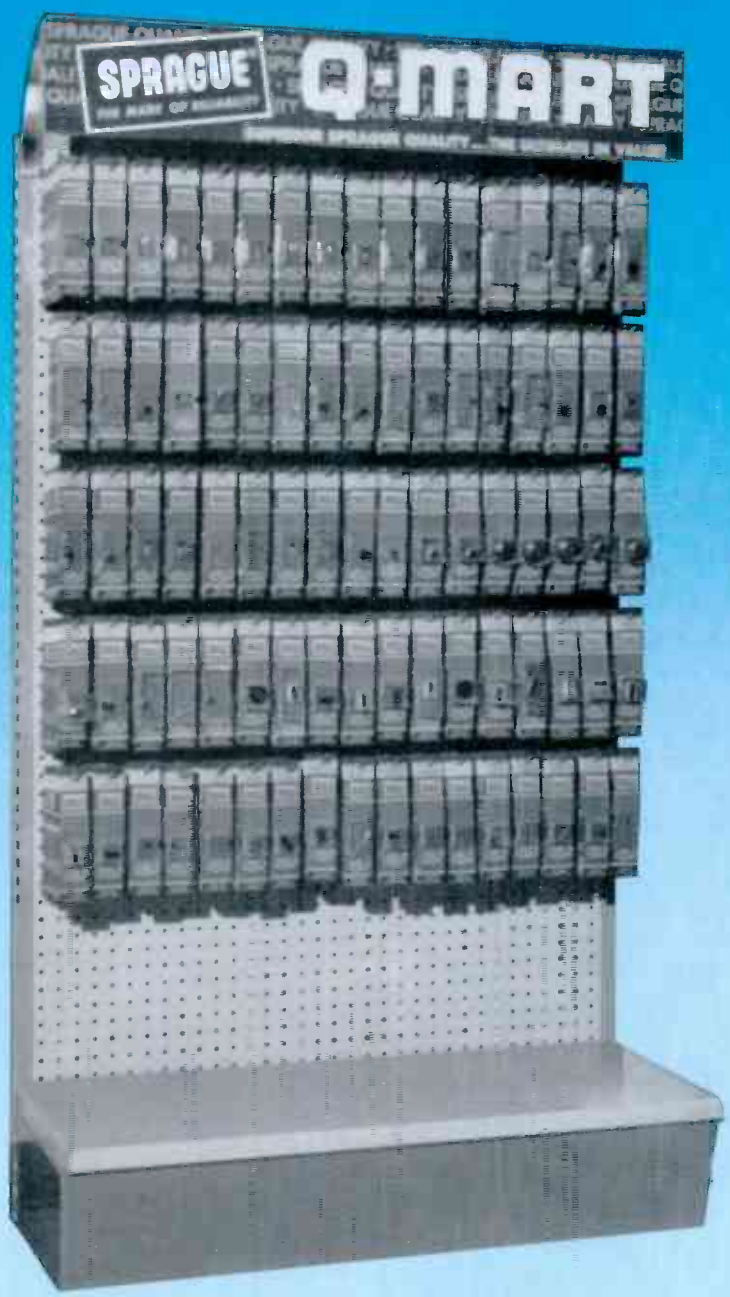

New SPRAGUE SEMICONDUCTOR Q-MART READY TO SERVE YOU!

Replacement Semiconductors for Service Technicians, Laboratories, Hobbyists, Experimenters

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news of the industry

A direct telegraph link between Peking and New York has been agreed to by the General Administration of Telecommunications of the People's Republic of China and Western Union International, Inc. The link is to be established as quickly as possible. Other services will include telex, data and leased channels when additional equipment is available later this year. Western Union International, Inc. supplied the equipment for the broadcasts from China during President's Nixon's visit there last year.

Philco-Ford now offers an in-home policy covering parts and labor for an additional $9.95 for 18- and 19-inch portable TV's. Also, according to **Home Furnishings Daily,** there is an optional second-year warranty on solid-state color consoles for $69.95.

More than 20 installers of TV-antenna systems recently attended a two-day seminar sponsored by the Blonder-Tongue Laboratories, and the Lectro Sales Company of Detroit. The seminar brought the franchised MATV/CATV installers up to date on the newest techniques, and familiarized them with B-T equipment.

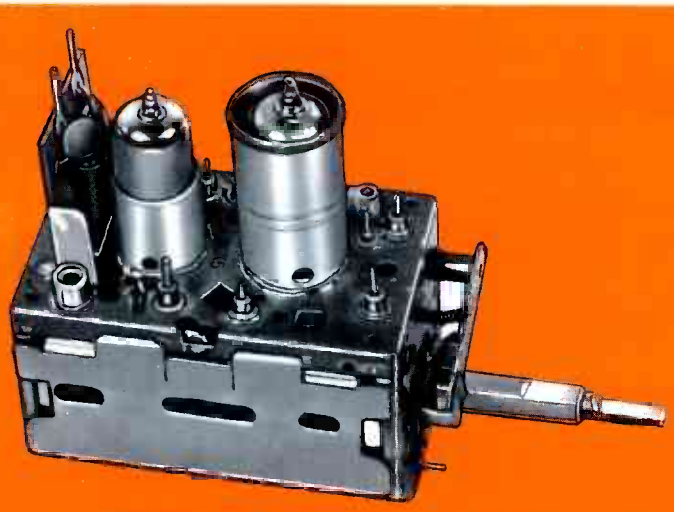
Toshiba (Tokyo Shibaura Electric Co.) **has introduced in Japan a new color receiver** using nine modules and ten circuit boards, as described in **Home Furnishings Daily.** No vertical and horizontal hold controls are necessary; a "countdown" method (probably digital) is used instead of adjustments. The factory says the consumers will be able to repair their own sets by merely replacing the modules. Other specifications include a 17-inch black-matrix tube (inline and 100-degree type), 11 IC's, 25 transistors and 67 diodes.

A controversy between Amana Refrigeration and Consumers Union over an article published by Consumers Union about possibly harmful radiations from microwave ovens is reported by **Home Furnishings Daily.** Amana has asked the Federal Trade Commission to secure substantiation of the facts given in the article. CU replied they are surprised because they furnish this type of information to any manufacturer who wants it.

The **Wall Street Journal** reports that **United Air Lines is testing a device emitting low-level X-rays to screen the luggage of passengers.** The device, developed by Bendix, emits weak and brief pulses of X-rays which are viewed on a TV-type screen. It's said magnetic tape and photographic film are not damaged by this exposure which is about 1/100,000 of that used in a single dental X-ray. Screening of one piece of luggage takes about 15 seconds compared with one to two minutes for a search by hand.

Seven companies are rushing to prepare their discrete 4-channel systems of FM broadcasting for field testing later this year. They all hope for approval by the FCC. As reported in **Merchandising Week,** all are members of the National Quadraphonic Radio Committee (NQRC) of the NEA. Quadrisonic stereo of the matrixed type is now being broadcast by many FM stations. Discrete quadrisonic requires four separate channels and any such system probably would be incompatible with the present 2-channel stereo.

(Continued on page 6)



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All shafts have a maximum length of 10½" which can be cut to 1½".

Specify heater type parallel and series 450mA or 600mA.

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Customized tuners are available at a cost of only $15.95; (with trade-in $12.95)

Send in your original tuner for comparison purposes.

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CALIFORNIA	SARKES TARZIAN, Inc. TUNER SERVICE DIVISION	
	10654 MAGNOLIA BLVD., North Hollywood, Calif. 91601	TEL: 213-769-2720
	1324 MARSTEN RD., Burlingame, Calif. 94010	TEL: 415-347-5728
	123 PHOENIX AVE., Modesto, Calif. 95351	TEL: 209-521-8051
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OREGON	1732 N.W. 25TH AVE., Portland, Ore. 97210	TEL: 503-222-9059
TENNESSEE	1215 SNAPPS FERRY RD., Greeneville, Tennessee 37743	TEL: 615-639-8451
	1703 LAMAR AVE., Memphis, Tennessee 38114	TEL: 901-278-4484
TEXAS	11540 GARLAND RD., Dallas, Texas 75228	TEL: 214-327-8413
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TSC

WATCH US GROW

For More Details Circle (5) on Reply Card

The first co-operative TV repair shop has just opened in New York City. Described in **Radio & Television Weekly,** the shop is operated by the Grand Street Consumers Co-operative Society, and it specializes in repairing TV receivers, radios, tape recorders, amplifiers and record players. At the end of the year, profits will be turned over to the Society.

Dr. Thomas K. Ishii, an engineering professor at Marquette University, according to **Home Furnishings Daily, has developed** over a period of five years **a clothes dryer operating by microwaves.** The microwave energy heats only the moisture and dries with about one-third the power of conventional machines. No commercial applications are planned just now.

The second annual meeting of the Technicians Advisory Council met in Chicago April 16th and 17th. The council is composed of independent service technicians and is sponsored by the Zenith Radio Corporation. "It is our corporate policy to insure that Zenith products provide the greatest reliability and performance," states Nathan Aram, Vice President of Consumer Affairs for Zenith, "and it is through such councils that we will receive the necessary feedback to improve upon our products." Council meetings will be open for discussion on any aspect of product development, engineering, production, quality assurance, service, and parts. Each Zenith distributor was asked to recommend one representative for membership on the Advisory Council, and 16 representatives participated.

New **from JVC America, Inc. is a 5-inch b-w solid-state TV which can operate from 9 "D" batteries,** or from 120-volts AC or 12-volts DC. The receiver has electric contactless tuning and weighs only 5.3 pounds. □

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

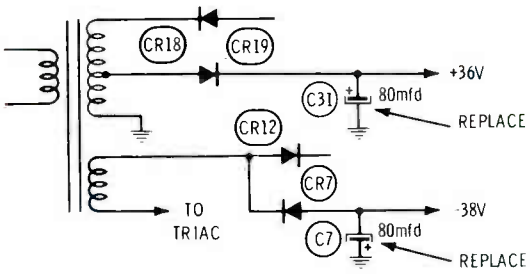
B&K Very good equipment at a very good price.

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

symcure

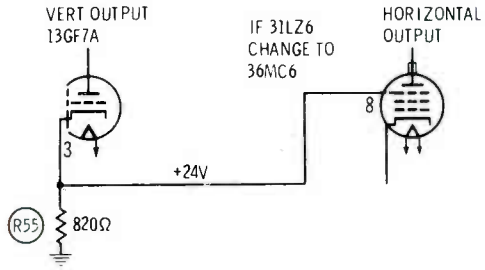
Symptoms and cures compiled from field reports of recurring troubles

Chassis—RCA CTC44
PHOTOFACT—1191-1



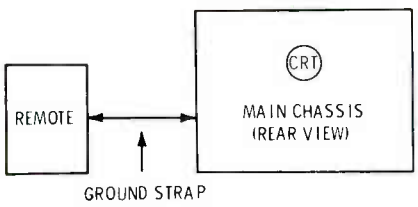
Symptom—Colored hum bar moves upward
Cure—Check C31 and C7 in remote; replace if open

Chassis—RCA CTC 55 (also CTC51, 52 & 53)
PHOTOFACT—1203-2



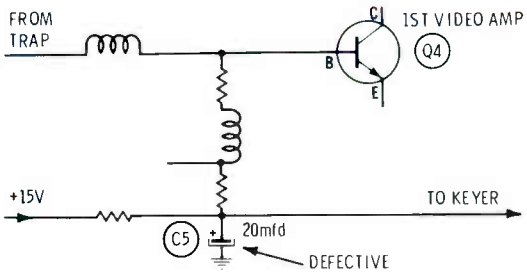
Symptom—Insufficient height, or intermittent height
Cure—If the horiz. output tube is a 31LZ6, change to 36MC6

Chassis—RCA CTC54
PHOTOFACT—1254-2



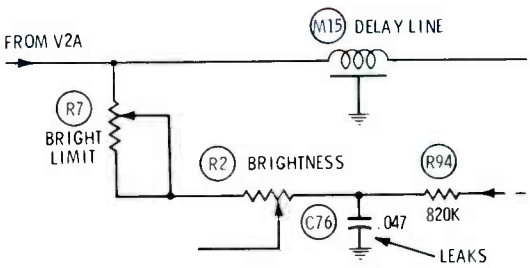
Symptom—Colored hum bar moves upward
Cure—Check for proper grounding between remote and main chassis

Chassis—RCA CTC40
PHOTOFACT—1030-2



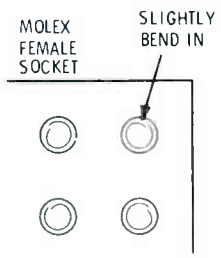
Symptom—Poor locking, sync bending
Cure—Check C5, and replace if defective

Chassis—RCA CTC39
PHOTOFACT—1246-2

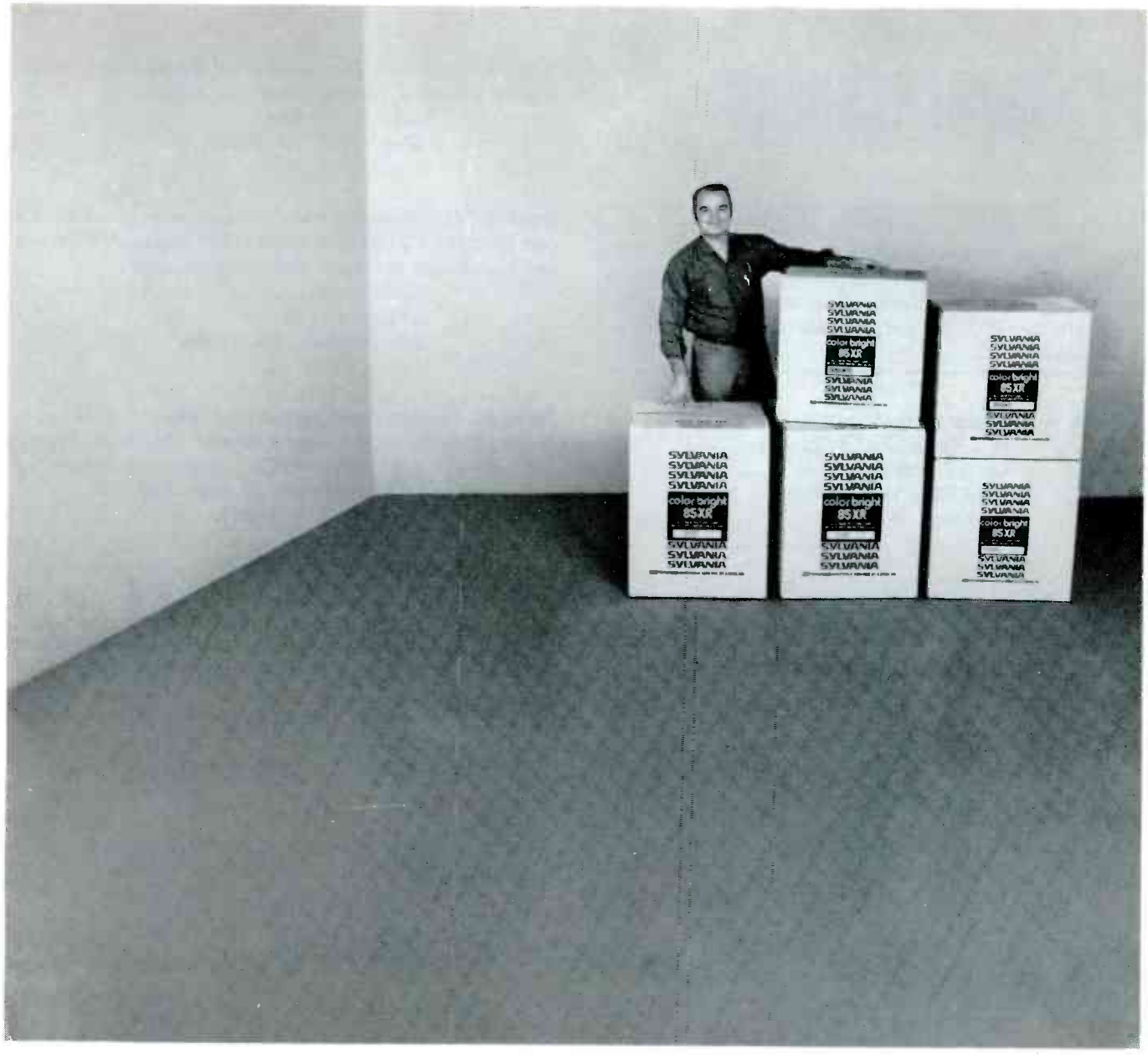


Symptom—Excessive brightness, little control
Cure—Check C76, and replace if leaking

Chassis—RCA CTC46
PHOTOFACT—1243-2



Symptom—Intermittent color when control bin is tilted
Cure—Tighten contacts of female Molex sockets, and tape sockets and plugs together.



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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

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: *A #71 tube, may be a #71-A tube.*
P. J. Guay, Parts Manager
Lee's Electronics
1313 Geo. Wash. Way
Richland, Wash. 99352

Needed: *Schematic for U.S. Navy Oscilloscope USM 24C.*
Shukal TV & Electronics Serv.
3915 Centinela Ave.
Los Angeles, Calif. 90066

Needed: *Schematic and operating instructions for a model T-2 gated compression amplifier manufactured by Jay L. Warren, Inc. of Chicago.*
George I. Calvert
534 Pershing Avenue
San Antionio, Texas 78209

Needed: *Schematic and operating instructions for a Jackson 600 lab scope.*
Bill Hennen
324 Forest Ave.
Aurora, Ill. 60505

Needed: *Tube chart for a B&K Dyna-Quik, Model 500 tube tester.*
William R. Hansen
1133 California Ave.
Klamath Falls, Ore. 97601

Needed: *Schematics and operating manuals for Precise scope model 300.*
Frank Kolde CET
P.O. Box 2667
Anderson, Ind. 46014

Needed: *One Model 612 or 616 speaker for an American Bosch Magneto Corp. antique radio Model 28 or 29 serial no. 17299; reasonable.*
James E. Gregorich
117 2nd St. No.
Virginia, Minn. 55792

Needed: *Schematic for Continental Radio Corp. radio, Model 5400 U L, both battery and AC type.*
John E. Hudson
South Hill, Va. 23970

Needed: *Low-voltage power transformer for DeVry's combination VTVM and scope (1968 vintage). Will pay any reasonable price for direct replacement.*
Steve Topley
145 Quarry St.
Mt. Pleasant, Pa. 15666

Needed: *Convergence board and picture tube convergence assembly for Zenith Model #5315UD (Photofact 804-4); also, information about restoration of Atwater Kent Radios, Model 30 and Type TA.*
Sanborn T.V. Service
P.O. Box 483
Sanborn, N.Y. 14132

Needed: *Schematics for guitar and bass amplifiers made by Plush Sound Corporation of New York. Will buy or copy and return.*
William Mollenhauer
335 Boulevard
Pittman, New Jersey 08071

Needed: *A 49134738-T901 Power Transformer for a Belle Wood 9500.*
Lee's Electronics
1313 Geo. Wash. Way
Richland, Wash. 99352

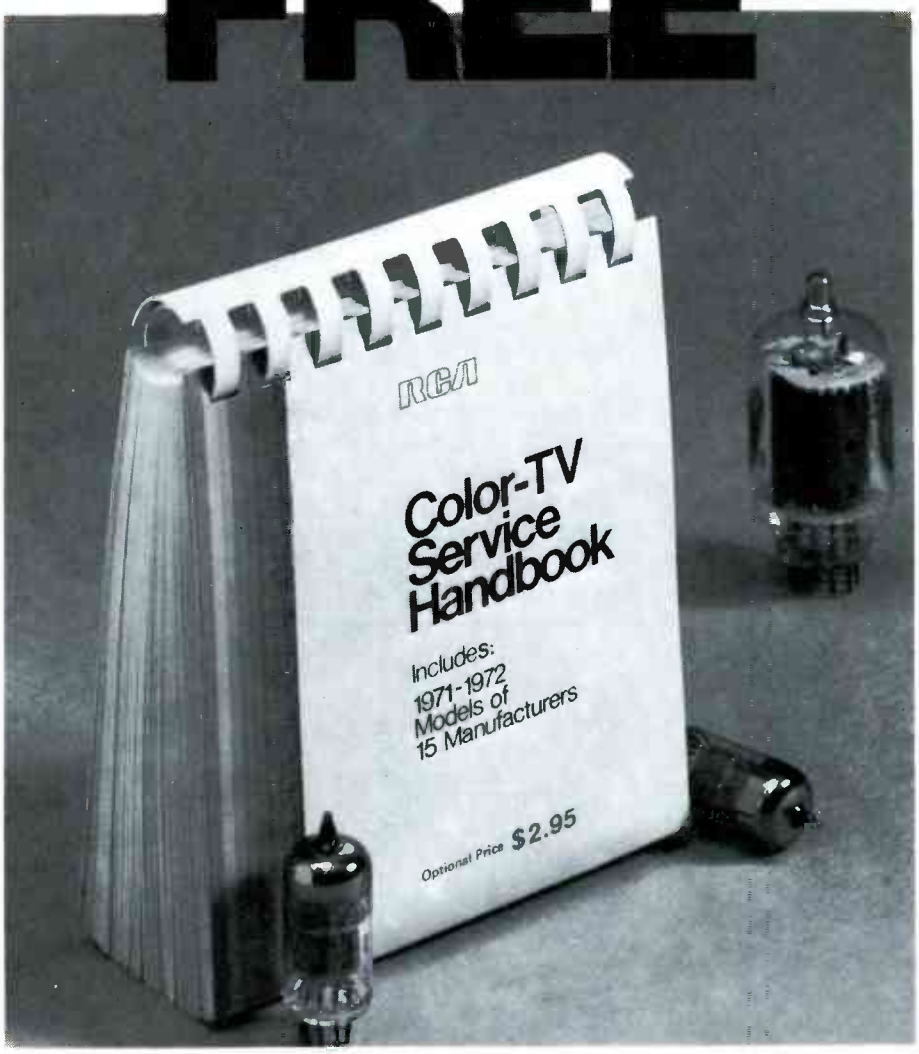
Needed: *Service data for Knight-Kit Model KG-221 FM Monitor Receiver made by Allied Radio. Also, need power transformer for a Heathkit Model DX-40 Transmitter.*
J. M. Adams
1402 W. 13th St.
Panama City, Fla. 32401

For Sale: *Copies of Electronic Servicing back to 1960, and other electronic magazines. Make offer.*
Wm. R. Egglesfield
16100 W. Chicago
Detroit, Mich. 48228

For Sale: *Issues of PF Reporter and Electronic Servicing dating back 16 years; make an offer.*
Carl Koepke T.V.
R.#2, 3997 Badger Rd.
Kewaskum, Wis. 53040

(Continued on page 52)

FREE



with your purchase of RCA entertainment receiving tubes

Now you can get RCA's brand new Color-TV Service Handbook, Volume 4, free of charge when you buy RCA entertainment receiving tubes *from your local participating RCA Distributor.*

Get 284 pages of practical service information on 1971 and 1972 color sets made by 15 manufacturers:
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You'll find everything from chassis layouts to step by step instructions for adjustments that can be performed in the home. You'll solve your late model color servicing problems faster and easier. For practical field-service information you can use every day, see your local participating RCA Distributor and ask for details on Volume 4 of RCA's Color-TV Service Handbook (1A1973).

RCA / Electronic Components
Harrison, N.J. 07029

RCA

For More Details Circle (8) *on Reply Card*

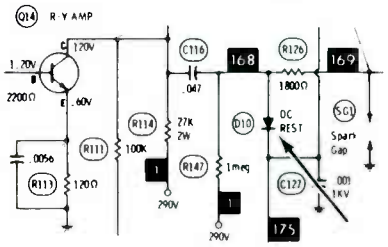
troubleshooting tips

Send in your helpful tips—we pay!

Smear of one color
Magnavox T952

(Photofact 1237-2)

When the color picture has a slight color haze and one color is dominant in the raster, check the DC restorer diodes (D10, C11 and D12) that are in the grid circuit of the picture tube.

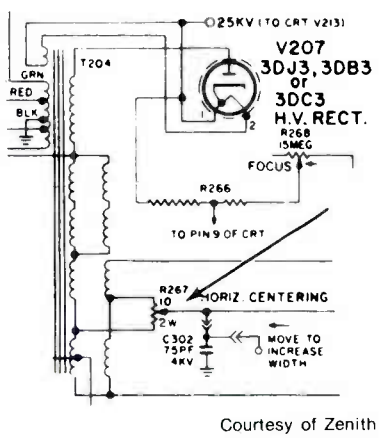


Often the diodes will test okay, so substitute them as a test. The brightest color in the raster usually indicates the bad diode. Or see which grid of the picture tube has the wrong waveform when the color is turned down.

C. W. Hume, CET
Greenville,
South Carolina

Burned smell
Zenith 12B14C50

In the past several months, I have had about half a dozen Zeniths with the same complaint: a "funny" smell.



Courtesy of Zenith

Diagnosis is not difficult, because following your nose leads you right to the high-voltage cage and the horizontal centering control.

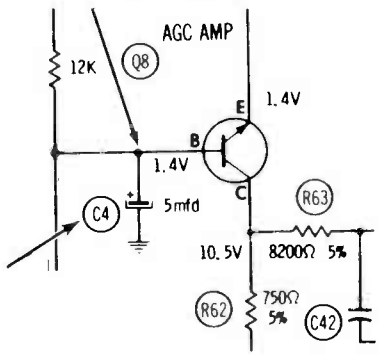
Usually, the fuse does not blow, and the set continues to operate.

Walter Sopicki
Lackawanna, New York

Left side of picture blanked out
RCA KCS169B b-w TV

(Photofact 984-2)

The left side of the picture (and raster) was blanked out. This usually is a filter capacitor, but the supply filters were okay.



Finally I started paralleling the small electrolytics and found C4 to be open. Horizontal pulses were getting into the AGC circuit.

Julian Chitta
Corpus Christi, Texas

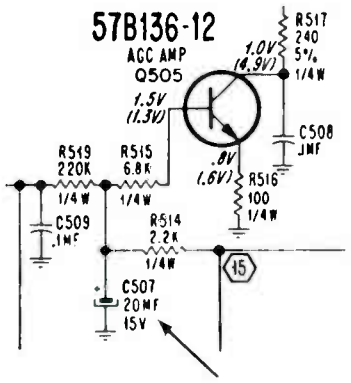
Dark picture without locking
Admiral 12K20

(Photofact 1281-1)

The symptoms were a distorted, dark picture with no locking, similar to those of loss of AGC.

When I connected the chassis to my test jig, I also noticed the left side of the picture was darker than the right. I remembered some cases in the past where this symptom was caused by an open filter, but bridging the power supply filters didn't help.

Next, I started checking DC voltages, and found those on Q504



Courtesy of Admiral)

to be normal. However, the base of Q505 was negative. I checked components around Q505 and found that C507 (20 mfd) was open.

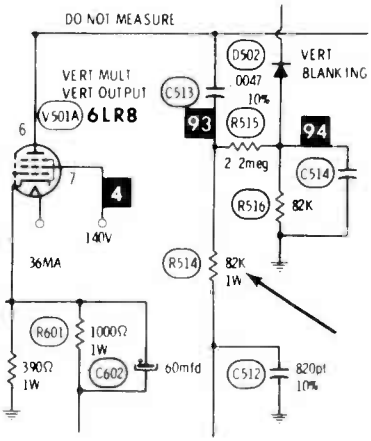
Mark Green
Mark Green TV
Pleasant Plain, Ohio

Linearity stretched at top
Magnavox T939

(Photofact 1109-1)

With the vertical-linearity control at minimum, the linearity was expanded at the top of the picture.

All waveforms and DC voltages in the vertical-sweep circuit checked okay.



Finally, ohmmeter tests showed R514 (82K) had increased to over 600K. Although the resistor was not burned, and appeared to be normal, replacing it cured the poor linearity.

Arthur S. Blumberg
Brooklyn, New York □

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Symbol HLD-00, Visual Indicating Fuseholder.

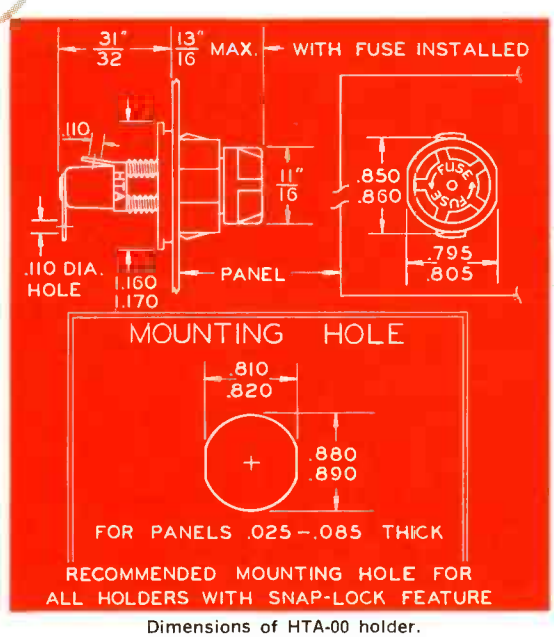
Symbol HKP-00, Standard Fuseholder.

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



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Advanced servicing of CB radio part 1

By FOREST H. BELT

Top-grade test instruments and expert know-how bring profits in this "orphan" business.

Fixed a Citizens-band radio recently? Probably not, unless it was your own. Very few technicians seem qualified, equipped, or inclined to service this ubiquitous communications phenomenon.

And that's a waste. More than 800,000 licensees operate upwards of 2,000,000 CB transceivers. They spend from $100 to $400 for each unit. Yet when a transceiver goes bad, the average CBer is forced to trade it off or simply relegate it to a shelf in the closet. Why? Usually, he can't find anyone nearby to repair it. In one area of more than a million people, there's not a single professional CB repair place to be found.

There are several reasons. Not all electronic technicians know how to service a transmitter. Even fewer understand or can deal with single-sideband, which has become popular in many CB models. Other features peculiar to CB transceivers (examples: frequency synthesizers, diode function-switching) offer a maze of unfamiliarity for the average technician. For service, CB radio has been left out in the cold.

Some who have dabbled in CB repair insist that the CB owner won't pay a decent price to have his transceiver serviced properly. Yet, the few real CB specialists I know earn more than the average TV technician. Customers flock to them. Their servicing rates are substantial but not exorbitant. Prices allow for an above-average wage, high-grade test instruments, reasonable overhead, and a good profit.

The secret to their success is twofold. (1) Knowledge of how CB transceivers actually work lets a CB technician troubleshoot efficiently. (2) Special high-quality test instruments detect dependably and accurately what is or is not going on in the transmitter, receiver, or power supply of a CB unit.

A third factor may have some bearing: These technicians don't fool around with CB sets for a spare-time activity; they make a full-time speciality of CB service. Their shops are professional (Figure 1), not one-bulb basement workshops.

This article, and a pair that follows in this series, bring you to the inside of those two "secrets". Any reasonably competent technician can learn what it takes to service Citizens Radio equipment **profitably**.

Test Equipment for CB

Right here at the start is where most would-be CB repairmen lose the game. To make money in CB servicing, and to do a competent job of aligning and adjusting, you need accurate generating and measuring equipment.

To acquaint you briefly, here's a list of measurements and adjustments you must be qualified and equipped to make:

- Frequency of each transmitter output channel;
- DC power in final amplifier of transmitter;
- RF output power of transmitter;
- Modulation percentage;
- Modulation quality;
- Carrier balance in single-sideband transmitter;
- Frequency synthesizer operation and accuracy;
- Accuracy of frequency for each receiver channel;
- Sensitivity of receiver;
- Squelch threshold sensitivity;
- Audio power output of receiver;
- RF alignment in receiver;
- High- and low-IF alignment in receiver; and
- Noise blanker operation.

Only highly stable and accurate instruments permit you to do this measuring and adjusting quickly and within the tolerances that assure legal and dependable operation. Yes, the kind of equipment to be described here costs money. But any other approach to CB repair is doomed from the start. You waste too much time diagnosing trouble, and the results of your servicing and adjustments are too nebulous to keep customers (and the Federal Communications Commission) satisfied.

Here's another list for you. This one shows what instruments you need to accomplish the major measurements and adjustments:

- Variable 117-volt AC isolation transformer;
- Variable DC power supply;
- Electronic voltmeter (ohmmeter, milliammeter);
- RF dummy load;
- RF wattmeter;
- Wideband oscilloscope;
- Frequency meter or counter;
- Audio generator;
- Audio wattmeter; and
- RF signal generator.

Now, I'll outline specifications for each instrument, and explain why some specs are so stringent. At the same time, I'll detail what you need to hook up each instrument for convenient use. Further, I'll describe some simple accessories you can put together to speed hookups and troubleshooting.

Bench Power Supplies

Don't plug an AC-powered CB base station into the bench outlet. Get the habit of using an isolated 117-volt AC supply. This avoids transients that might develop when you connect test leads from AC-powered instruments. Such spikes can damage transistors; particularly the oversensitive field-effect transistor.

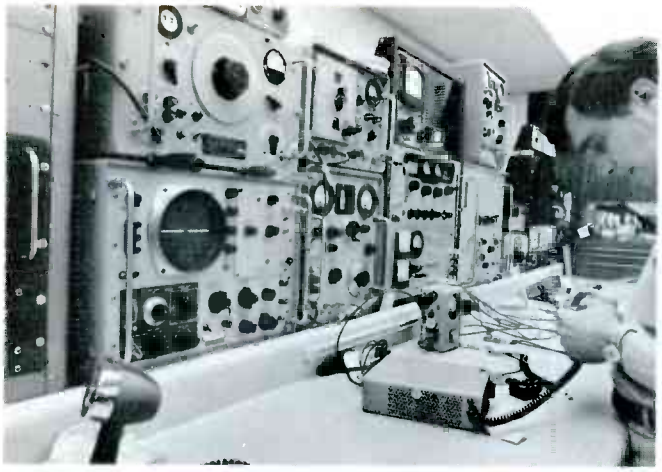


Fig. 1 A professional Citizens Band repair shop doesn't have to be as clean and organized as this one, but the better ones are. Good lighting helps, but the real clue to capability lies in the lineup of high-quality test instruments. A specialist needs them.

Fig. 3 Peak-reading wattmeter enables technician to measure power of single-sideband transmitter directly. You just talk into microphone during the test. Changeable elements cover many power and frequency variants. For CB, 25-watt 30-MHz element is enough.

Fig. 2 Bench power supplies should be adjustable, whether for AC (at left) or DC (right). This proves helpful in air-testing any finished repair; intermittents often show up during under- or over-voltage. Inset shows 12-volt supply for turning mobile into base.

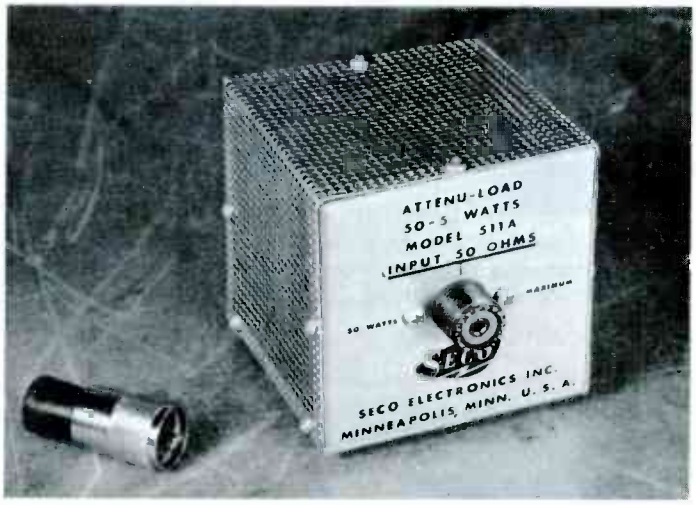


Fig. 4 Single-resistor 50-ohm dummy load at left overheats if you apply 4 watts of CB energy to it continuously. The larger unit, better for bench work, can stay cool handling up to 50 watts of RF.

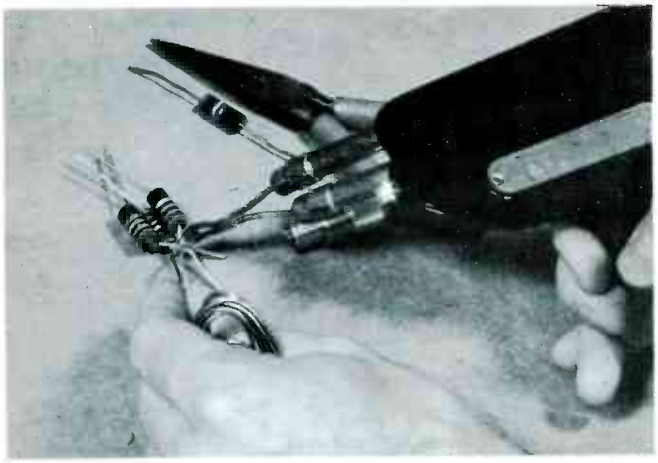
An adjustable isolation transformer, such as in Figure 2, has advantages. You can run the input voltage up and down to note the effect on operation. Often, borderline defects show up or break down completely upon application of moderate overvoltage. Don't go beyond 125 volts, though; that strains even normal parts. Transmitter measurements should be made with the bench supply at 120 volts AC.

Your DC bench supply should be adjustable from 8 to 16 volts. Feed a 12-volt mobile unit 13.8 volts DC, normally. Meters for both voltage and current are handy, as in Fig. 2.

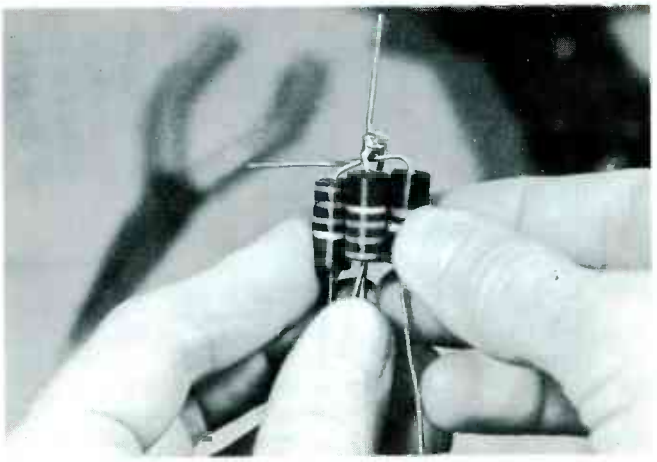
There aren't many 6-volt CB transceivers anymore. If you get one to service, feed it 6.8 volts DC.

For mobiles, you can manage with the less expensive device shown in the inset of Fig. 2. It's a small power supply designed to convert a mobile CB unit to base-station operation. Still, for best results, use

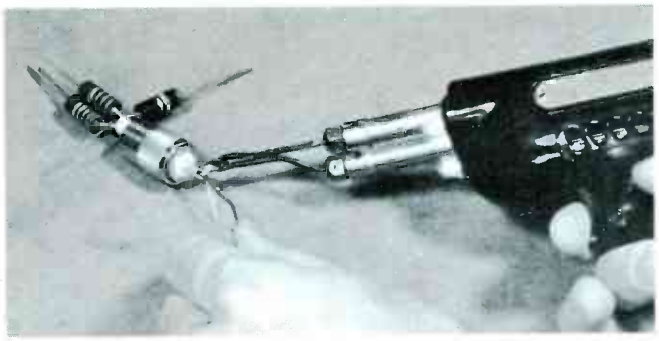
Fig. 5 Build your own CB dummy load with inexpensive parts. This design handles 4 watts easily, and includes a series resistor.



Connect two 150-ohm resistors to the third by wrapping their leads around its lead. Solder the joint.



Connect 10K resistor at same joint and solder as shown. Trim off leftovers, but leave one long wire at each end.



Slide spaghetti over the center wire (extend it first to 1½ inches). Push wire through center pin of PL-259 connector and solder. Don't overheat the joint inside.

Solder outer leads of 150-ohm resistors to shell of PL-259. Arrange as shown. Center wire is a direct output connection; 10K resistor prevents overloading test instrument (for example, frequency counter) input.

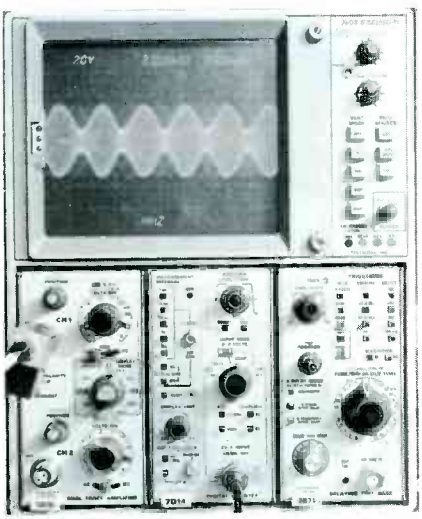


Fig. 6 Very wideband scope must accept up to 30 MHz in vertical amplifier without attenuation. That way you can look at quality of RF signal and modulation. Shows accurate modulation percentage.

a regular bench DC power supply.

Electronic Voltmeters

The field-effect transistor has replaced the vacuum tube as the principal element of electronic voltmeters. The FETVM outmodes the VTVM for most measurements in high-impedance circuits.

But there are drawbacks. Where high-energy RF fields exist, such as in and around a transmitter when it's keyed, the FETVM is susceptible to inaccuracy or even damage. You may want to shop around for a very accurate VTVM or for an FETVM that has shielding sufficient to protect it from stray RF.

Modern CB sets are solid-state. You deal often with bias values in tenths or hundredths of a volt. Your DC voltmeter must have ranges low enough to spread out such minute voltages to a readable scale.

An ohmmeter function is, of course, a necessity. You'll also need DC current ranges, a function mostly omitted from vacuum-tube voltmeters. Certain FETVMs include both AC and DC current-measuring ability. Many communications technicians keep an extra volt-ohm-milliammeter (VOM) handy for current measurements in the transmitter.

Dummy Load and RF Wattmeter

The Federal Communications Commission (FCC) specifies that CB transmitters must not feed more than 4 watts RF to the antenna. You need an accurate RF watt-

meter that handles amplitude-modulated (AM) signals up to about 20 watts.

Here is where the beginner CB technician tries to save money. He buys a cheap tester of the kind CBers use to monitor station output or VSWR. Those little units are okay for that, but not for high-accuracy measurements such as the FCC requires. After all, your Second- or First-Class License is on the line when you certify that a transmitter meets the emission regulations in the FCC Rules. You want to **know** what you're certifying.

A special peak-reading wattmeter for single-sideband output is illustrated in Fig. 3. It operates from batteries or AC. This instrument resembles the accurate Bird model 43 "Thru-Line" wattmeter, long popular with communications technicians. The 2—30 MHz 25-watt plug-in element covers CB testing.

On the bench, you need a dummy load to prevent interference around town from your testing. Tuning the transmitter with a dummy load gives you a picture of its operation unaffected by antenna and weather peculiarities. Actually, a dummy load makes unnecessary a wattmeter if you determine RF power by the indirect method (DC volts and current in the final stage).

You can buy "terminated wattmeters" that include their own 52-ohm dummy load. With the through-type wattmeter, you add a dummy load of your own on the antenna side of the instrument.

You can buy large or small dummy loads. Two are illustrated in Fig. 4. The tiny one is very inexpensive, but handles only 2 watts. It overheats in continuous bench use. The larger can handle up to 50 watts RF without overheating.

You can build your own CB dummy load. The one in Fig. 5 is inexpensive but quite versatile. You need only a PL-259 connector, three 150-ohm 2-watt resistors, a 10K resistor, and a small piece of insulating spaghetti.

Whether you buy one or build your own, do all your transmitter testing at the bench with a dummy load connected, not an antenna. Your measurement and adjustment results will be far more consistent.

An Oscilloscope for CB Troubleshooting

This may surprise you. An ordinary servicing scope has little use in CB diagnosis. Yet there is a type of oscilloscope you should have. It's a wideband triggered oscilloscope, widerband than you may be accustomed to for TV servicing. An example appears in Fig. 6.

A lot of money, you say? Perhaps true, in one sense. A triggered scope that accepts signals up to 30 MHz does cost more than even a high-quality TV-servicing scope. But the investment is repaid quickly in time saved and troubles spotted.

A bandwidth of 30 MHz or more is needed in the vertical amplifiers so you can connect the scope input right across the RF output dummy load. You can thus look directly at the quality of RF from the CB transmitter. More important, you can judge modulation percentage **and** quality, impossible with any other practical instrument. You can spot parasitic oscillations developing with or without modulation—again impossible unless you actually see the signal and its envelope.

You might spend as much as $2000 for this scope. It's worth every cent if you plan to make a profit servicing CB. Don't fool yourself that you can get by without high-grade instruments. Once you experience what they do for transmitter testing, you'll understand.

Measuring Frequency

The FCC requires that a CB transmitter remain within 0.005% of assigned frequency on any channel (all channels). That's 50

Fig. 7 Frequency meters that operate on the heterodyne principle are still most common. These are called digital because they have separate dials for each digit (or most) of the frequency.

Lampkin 107C has continuous-tuning dials.

Cushman CE-3 has switched frequency segments.

parts-per-million. Stated another way, no transmitted frequency should wander more than 1350 Hz from its assigned spot on the spectrum.

This is not a stringent requirement. But the limit must be adhered to. If not, communications are degraded. Worse, the transmitter causes interference to other CBers. That can draw an FCC citation for the owner—and for the technician who most recently worked on the transmitter.

Any good recent-design (even many older) frequency meters more than meet this specification. Of course, the more accurate the instrument, the closer you can adjust the frequency (in transmitters where frequency is adjustable). You can also spot crystals that are beginning to drift over a period of use. They only get worse.

Both the frequency meters illustrated in Fig. 7 are called "digital" instruments. The one at top, a Lampkin model 107C, claims the name from the fact that each dial contributes one digit to the overall frequency dialup. The readout is a parts-per-million meter on the front panel. The more expensive Cushman model CE-3 incorporates switch-selected digital frequency steps. Both instruments far exceed the tolerance requirements for Citizens Radio.

For use only in CB work, a digital frequency counter may be in the long run less expensive. A 50-MHz counter of very high accuracy (1 part-per-million) can be had for under $700. The automatic counter offers by far the quickest way to read frequencies. You just feed in the transmitter (or generator) signal and a lighted readout shows you the frequency. One such unit is pictured in Fig. 8, with a channel-4 CB signal fed to its input jack. As you make frequency adjustments in a transmitter, the readout immediately tells the result.

Important to know: A digital counter makes the fastest and surest tests of crystal alignment in a frequency synthesizer.

Audio Test Instruments

For quick, accurate, and profitable CB repairs you need two pieces of audio test equipment. One, an audio generator, gives you a signal for injecting into the microphone of the transmitter. A 1000-Hz sine signal makes the best modulation tests. You can use other frequencies, but nothing outside 200—2000 Hz. The generator can also inject signals for tracing trouble in receiver audio stages.

Accuracy isn't always critical, but the more accurate the instrument the better. For single-sideband testing, you need an accurate 1000-Hz signal. Your generator should at least be very stable. Then you can find the exact 1000-Hz dial calibration with your frequency counter and return to it easily for accurate single-sideband testing. (You'll learn later why the modulating frequency is important.)

Fig. 9 shows a handy way to inject the 1000 Hz into the transmitter. Just connect a 2-inch speaker to the generator output through a pair of wires (lamp cord is fine). From 0.3 to 5 volts of generator output may be needed to drive a transmitter to full modulation, depending on the microphone and on the transmitter itself. You can easily spot modulation problems on the output oscilloscope.

The other audio instrument that speeds CB repairs is an audio wattmeter. It allows you to measure output of the audio stages directly. You can do it with an AC voltmeter and an 8-ohm dummy load, but calculations take time. Later, when you're measuring receiver sensitivity, you'll see how time-saving this calibrated audio wattmeter can be.

RF Signal Generator

Several qualities of the signal generator you choose are critical to CB repairs. A key quality is stability. When you set the instrument to a frequency (your counter can check accuracy), you need it to stay there. Otherwise, you'll waste valuable alignment time readjusting the generator. Spend what you must to acquire a stable RF generator.

Fig. 8 Digital-readout counter may well become the most popular frequency meter for Citizens Band servicing. It has the advantage of simplicity of operation and virtually immediate indications.

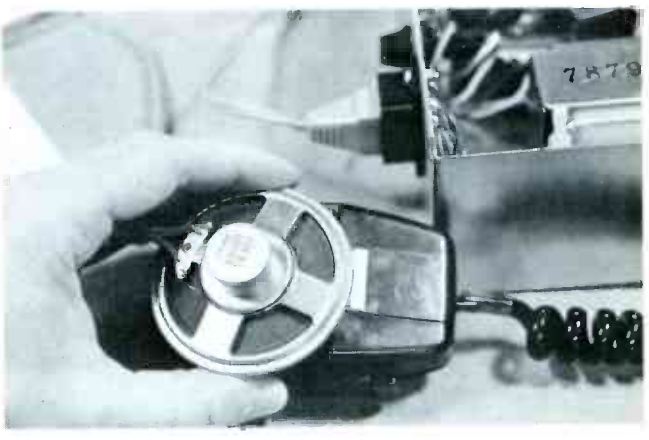


Fig. 9 Small speaker held over front of microphone as you press the push-to-talk button makes convenient way to feed 1000 Hz into transmitter. Reveals sensitivity of mike as well as condition of speech amplifiers and modulator of transmitter.

You'll need upwards of 100,000 microvolts of output. Not all RF generators put out that much. It takes that much signal to check AGC activity in the CB receiver. There should be little audio-output change throughout an RF-signal variation from 100 to 50,000 uV.

Frequency coverage of the generator should extend from 455 kHz to above 30 MHz, all on fundamentals. In between are the frequencies to check high-IF stages and sideband filters.

Most important: RF output from the generator must be accurately calibrated. You must be able to control the signal down to 0.1 microvolt or less. Any inaccuracy or leakage around the output attenuator renders the instrument unusable for sensitivity readings.

Also important: You should be able to set the amplitude modulation of the generator precisely at 30%. That's one parameter for accurate sensitivity measurements. If the generator produces other than a 1000-Hz modulation internally, you must also be able to modulate the generator externally from your audio generator.

Next Installments

You can spend up to $6000 for the proper instruments to service Citizens Band transceivers or, you can have excellent equipment and spend less than $4000. The greater expenditure brings certain conveniences you might find worth buying.

In the next installment you'll see that transmitters are not overly mysterious. Only certain complications offer any real challenge to the technician who knows electronic principles. These "advanced" trouble areas include the frequency synthesizer, single-sideband modulator, transmitter tuneup, and output loading. These are often misunderstood by the newcomer to CB servicing (and by many old-timers). The third and final installment deals with receivers. □

Introd

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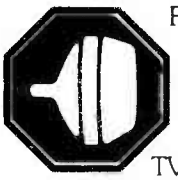

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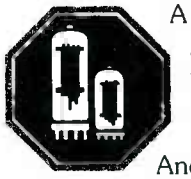

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For More Details Circle (11) *on Reply Card*

Universal color-TV setup procedures and troubleshooting tips part2

By Wayne Lemons and Carl Babcoke

Last month's information covered the equipment needed, tips before starting, color purity adjustments, and vertical convergence adjustments. Horizontal convergence, pincushion correction and troubleshooting tips are presented here.

Horizontal Dynamic Convergence

Three coils are used for the adjustments on the **right** side of the screen, and three potentiometers are used for adjustments on the **left**. Figure 6 shows the approximate locations of these controls on many boards. Some late-production convergence boards have a non-adjustable peaking coil used for blue shape or blue-droop correction. Other boards have an adjustable coil, but this coil should **not** be adjusted without a scope. An incorrectly adjusted "blue horiz shape" coil can cause overload and eventual failure from heating of the "left blue horiz lines" control (No. 12). The coil can be identified by the smaller size of the winding. Use the following method to adjust the "blue horiz shape" control. With the TV receiver operating normally, attach the vertical input of a scope between ground and the end of the coil which also connects to the "right blue horiz lines" coil and the blue convergence coil. A rounded sawtooth shape as shown in Figure 7 should be seen. Adjust the core of the "blue horiz shape" coil to place the harmonic "bump" at the 50% point.

1. Choose three horizontal checkpoints along the center horizontal line, as shown in Figure 8. One should be nearest to the center of the screen and the other two about 3 or 4 inches from the right and left sides.
2. Turn the blue gun off and leave the red and green guns on.
3. Adjust the "right R&G vertical lines" coil (No. 7) so the red and green **vertical** lines at the **right** checkpoint are converged.
4. Adjust the "left R&G vertical lines" control (No. 8) so the red and green **vertical** lines at the **left** checkpoint are converged.
5. Adjust the "right R&G horiz lines" coil (No. 9) so the red and green **horizontal** lines at the **right** checkpoint are converged.
6. Adjust the "left R&G horiz lines" control (No. 10) so the

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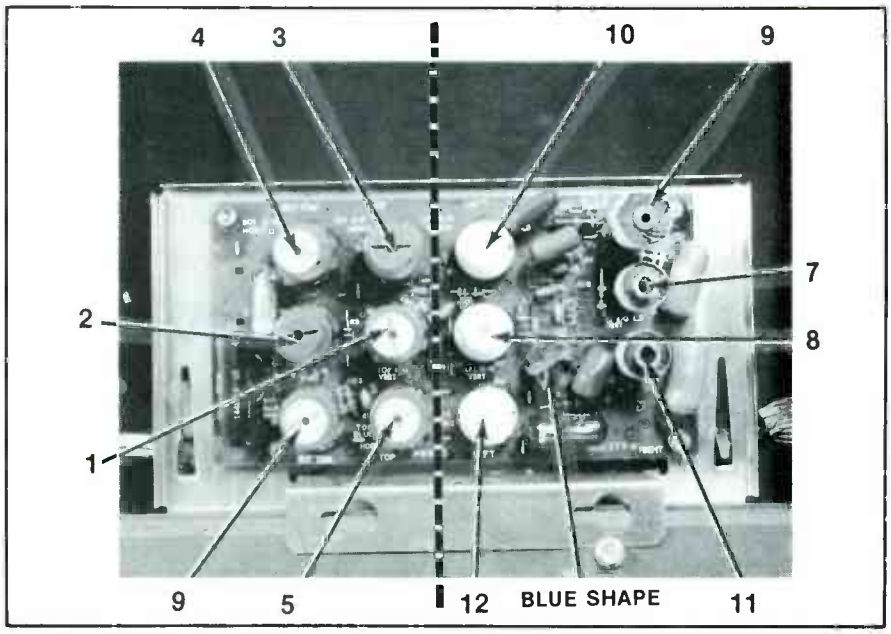

Fig. 6 A typical convergence board, this one used with the RCA Chassis CTC40.

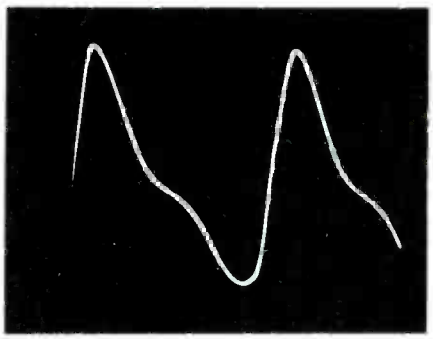

Fig. 7 Proper waveform obtained by adjustment of the "blue horiz shape" control. The harmonic bump should be at 50%.

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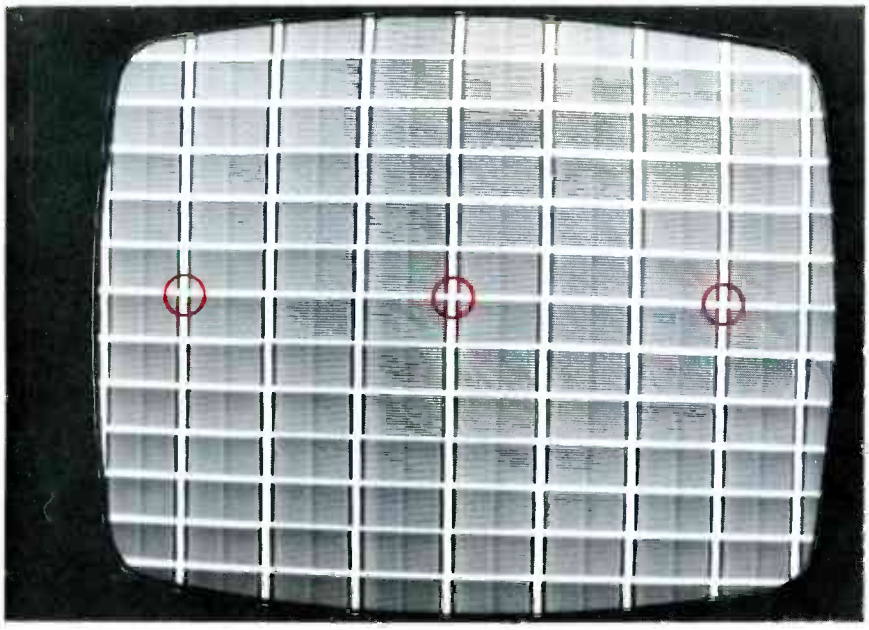

Fig. 8 Use these three checkpoints for center and horizontal-dynamic convergence adjustments.

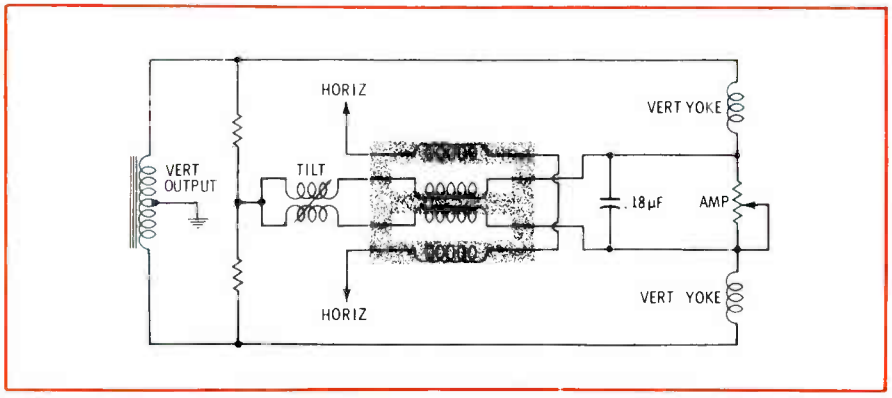

Fig. 9 This simplified schematic of the RCA CTC17 pincushion-correction circuit shows how an open in the PC transformer or the tilt coil can cause a trapezoidal raster. Yoke current for one coil flows through one of the damping resistors.

red and green **horizontal** lines at the **left** checkpoint are converged.

7. Turn the blue gun on and the green gun off.
8. Adjust the "right blue horiz lines" coil (No. 11) so the blue **horizontal** line at the **right** checkpoint converges with the red.
9. Adjust the "left blue horiz lines" control (No. 12) so the blue **horizontal** line at the **left** checkpoint converges with the red.
10. Center converge carefully. Repeat steps 2 through 9 until best convergence is achieved.

Pincushion-Correction Adjustments

Pincushioning is an unwanted byproduct of wide-angle deflection. Imagine a rectangular piece of rubber with a crosshatch painted on it. If all four corners were pulled away from the center, the corners would be stretched—this is pincushioning.

Pincushioning of the right and left sides is not so noticeable as top and bottom pincushioning; therefore, many models do not have any correction for side pincushioning. Of the few models that have side-pincushioning correction, even fewer have any adjustments.

The majority of color receivers use saturable-reactor magnetic components plus a tuned circuit to create sine waves from horizontal pulses. These sine waves are added to the vertical sweep to increase the height near the center of the horizontal scan. Since a sine wave is furnished for correction and parabola is needed, good correction cannot be obtained near the edges.

Use the following procedure for most pincushion-correction circuits:

1. Turn the "pincushion amp top-bot" control clockwise.
2. Switch on the crosshatch pattern at the bar-dot generator.
3. Adjust the "pincushion phasing" coil for maximum height in the center of the raster. (No change will result if the coil is detuned too far.)
4. Turn the "pincushion amp top-bot" control slightly counterclockwise to produce the straightest possible horizontal line at the top of the picture.
5. Alternately adjust the pin- "amp" and "phasing" controls for the straightest horizontal lines at the top of the picture, and for the same height at both right and left sides. The "amp" control affects the straightness of the lines, and the "phasing" control affects the height at the edges.

A Trapezoidal Raster Can Be Caused by Defective Pincushion Components

Open circuits in some of the pincushion-correction components can cause a trapezoidal raster which looks the same as that caused by an open or shorted vertical deflection-yoke winding.

Figure 9 shows a simplified schematic of the pincushion-correction circuit used in the RCA CTC17 chassis. An open circuit in either half of the tilt (phasing) coil or either winding around the center core of saturable reactor (modulator) will cause a trapezoidal raster. The normal path for one of

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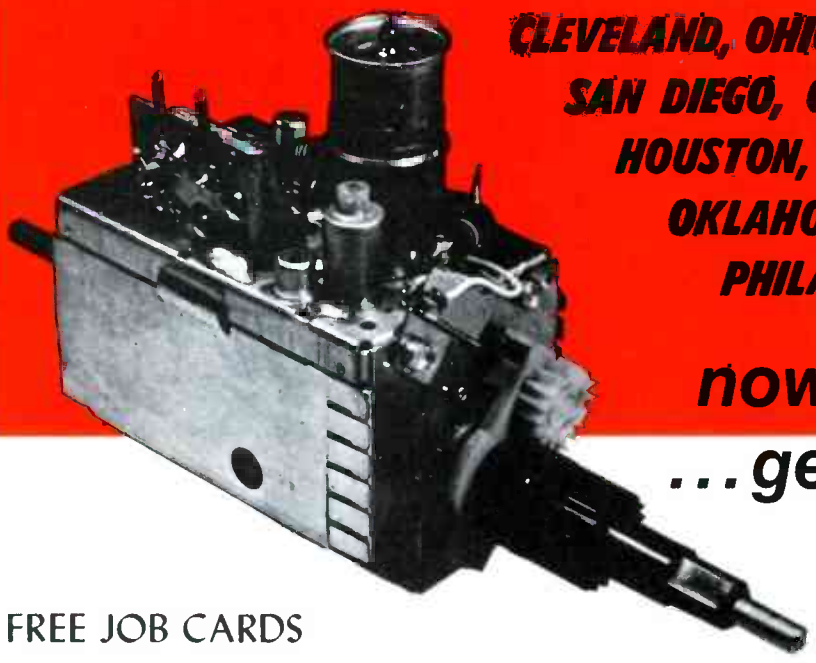

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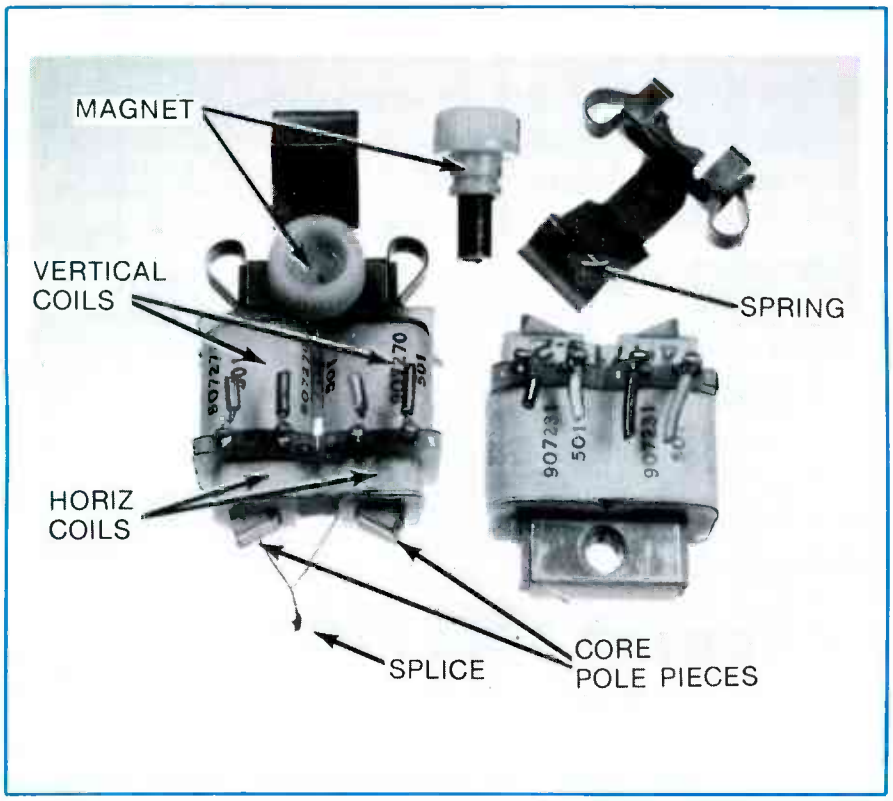

Fig. 10 Two coil-and-magnet assemblies from a convergence yoke. A loose magnet or bad coil connections can cause intermittent convergence.

the yoke winding is opened, and the continuity of the circuit is completed through one of the damping resistors.

A fast test for this type of defect is to adjust the "amp" control completely counterclockwise (this shorts out the pincushion-correction circuit). Restoration of a normal (but pincushioned) raster is proof of an open circuit in one of the pincushion-correction components.

Screen-Color Troubleshooting Tips

The screen color and gray-scale tracking procedure given previously works perfectly in nearly every case, except for three abnormal conditions.

1. The three guns in the color picture tube must be fairly well matched in emission, and they should not have shorts or leakages. A technician could be deceived into believing all three guns had sufficient emission, if the usual three dim lines are obtained during the step when the screen controls are adjusted. However, we must consider that the brightness of an entire raster is concentrated in these horizontal lines when the vertical sweep is eliminated. The cathode voltages of the picture tube are increased to a fixed voltage and this makes certain that the guns are biased far nearer cutoff than they are in normal operation. Therefore, the screen voltages are adjusted at an **extremely** low brightness level. This level is so low that a weak crt gun often will have enough emission to show a dim horizontal line during the screen control adjustments, but will not have enough emission for normal brightness with a full raster.

   The color picture tube should be tested for emission and shorts whenever good tracking is difficult to obtain.
2. The DC grid voltages on the picture tube, which are supplied by the chroma circuit, must be nearly equal. Turn down the color control and measure the voltage at the three picture-tube control grids with a VTVM or FET-meter. If the voltages differ by more than 10 to 15 volts, the grid circuits of the picture tube should be tested to find the reason. When the grid voltage differences are more than 20 volts, acceptable gray-scale tracking will be impossible.
3. Voltages to the three screen grids must each vary between the same minimum and maximum when the screen controls are adjusted from one extreme to the other. The picture-tube cathode voltages must be within 10 to 15 volts of each other. Heater voltage at the picture tube must be no lower than the rated 6.3-volts AC.

Center-Convergence Tips

Center convergence is accomplished by adjustments of four sets of permanent magnets. Failure to achieve center convergence might be caused by poor purity adjustments, weak or cracked magnets, or wrong placement of the convergence assembly (which includes the magnets) in relationship to the internal gun structures. This wrong placement includes the possibility that one or more of the powdered iron cores (Figure 10), which are common to both dynamic and center convergence, might be caught and thus prevented from touching the glass neck of the picture tube. Also, the entire convergence assembly might be located too far forward or backward, or might be rotated in a circular direction.

Each of the three coil and magnet assemblies that mount around the neck of the picture tube have a U-shaped, powdered-iron core (made in two parts); two series-connected horizontal coils; two series-connected vertical coils; and one rotary magnet. A spring is used to squeeze the two parts of the core tightly around the magnet to prevent slippage, and it is also used to press the assembly against the glass neck of the tube. A broken magnet will not move the electron beam

enough to allow center convergence, and a loose magnet can cause intermittent convergence. An open coil (perhaps open at the splice between windings) eliminates all dynamic convergence for that respective color. A typical assembly is shown dismantled in Figure 10.

Wrong adjustments or defective components in the dynamic convergence circuit also can prevent center convergence. Rapidly go through the dynamic convergence adjustments before becoming overly concerned about failure to achieve center convergence.

Dynamic-Convergence Tips

Perfect convergence is impossible around the extreme edges of the picture tube. Any attempt to improve the convergence at the outer edges of a 23-inch rectangular color picture tube will degrade the convergence in the more important center area.

This is the reason we specified checkpoints so distant from the edge of the picture tube. The few picture tube and convergence combinations that permit better-than-average convergence also will converge to maximum by use of the same checkpoints.

Ineffective Adjustments

When good convergence is impossible, first determine whether or not **all** the dynamic adjustments are insufficient, or if just one or two are borderline and the others normal.

If all the adjustments are below normal in action, the source of the problem usually is in the physical placement of the convergence assembly around the neck of the picture tube. This assembly might be too far foward, too far to the rear, or rotated around the neck of the tube. Check the service data for proper placement of this assembly, or compare the location with another in a normally functioning machine.

Failure to achieve convergence (or a borderline adjustment) of only one color, might be caused by an air gap between the neck of the picture tube and the ends of the powdered-iron cores which connect the magnetic paths. In some assemblies, it is possible for the core to snag on the plastic mounting so the tips of the core cannot touch the glass. This can be difficult to find.

Failure Of One Or Two Dynamic-Convergence Adjustments

The failure of one or two of the controls or coils on the convergence board to move the lines enough, when the other adjustments are normal, is usually caused by a defective component on the board or a defective coil assembly around the neck of the tube.

An intermittent control or coil might cause the adjustment to proceed correctly, but then suddenly jump to a wrong condition. Of course, an intermittent connection on the board might cause the same defect. Such defects are often easily found by mechanical manipulation (movement of the board and controls).

Shorted turns in one coil on a convergence board usually cause the defective coil to run noticeably warmer than the other coils. An open coil will show no action, or insufficient action, when it is adjusted.

A broken or cracked core in a coil will permit very little convergence action when it is adjusted. The use of a worn or wrong-size hex adjusting tool often will crack the core and cause it to "freeze". An allen wrench made of metal sometimes will remove the frozen core without damage to the coil. A core can be taken from another coil either for a test or as a permanent repair.

One assembly containing a center convergence rotary magnet, dynamic convergence coils, and a powdered-iron core (shown in Figure 10) is mounted near each gun of the picture tube. There are actually four coils in each assembly, two vertical and two horizontal. The two vertical coils are connected in series and the two horizontal coils are connected in series. Between each pair of coils is a soldered connection, and these joints plus those on the four terminal lugs can be the source of intermittent or partial loss of dynamic convergence.

At first thought, it seems logical that an open convergence coil (one of those around the neck of the picture tube) would result in the loss of all dynamic convergence for that color and thus be easy to analyze. That is true for blue coils, for they have only a single action. However, a single red-green control or coil on the convergence board supplies a correction signal to both the red and green coils which are part of the convergence yoke. If a red or green coil in the convergence yoke is open, it will have no effect when the convergence board adjustment is changed. But this is difficult to see on the crosshatch pattern, because one of the two colors will move. For example, if the red horizontal coil is open, adjustment of controls No. 7, No. 8, No. 9 or No. 10 will move the green, but not the red.

Whenever there is doubt about the coils in the convergence yoke, test them with an ohmmeter. The horizontal coils are very low in resistance, while the vertical coils are much higher. Although other continuity paths are in parallel with these coils, an open coil will give a much higher reading. Compare the readings of the same coils in all three assemblies; if one reading is much higher, the coil is open.

Intermittent Convergence

Since some of the components previously described can become intermittent, keep them in mind. A very elusive intermittent can be mechanical in origin. For example, loose center-convergence magnets can be moved by heat changes. Most assemblies have locking devices or some method of tightening the magnet holders to stop the movement.

Another type of intermittent can occur in one of the diodes used in the horizontal dynamic-convergence circuit on the convergence board. This is especially likely in the models that have four diodes inside one plastic case. Positive identification of such an intermittent diode is very difficult. Therefore, it is good business to replace this diode assembly whenever a complaint of intermittent convergence is registered. □

Digital logic part2

By Joseph J. Carr and Carl H. Babcoke

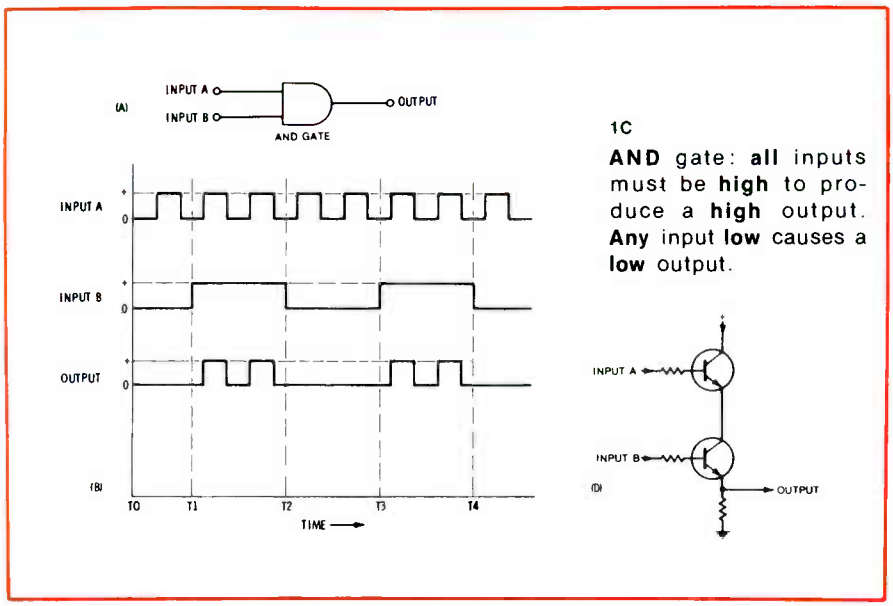

Fig. 1 Some characteristics of AND gates. **(A)** Conventional symbol for a two-input AND gate. **(B)** One possible combination of inputs, and the output produced. **(C)** A short definition of an AND gate. **(D)** One type of AND gate using transistors and resistors.

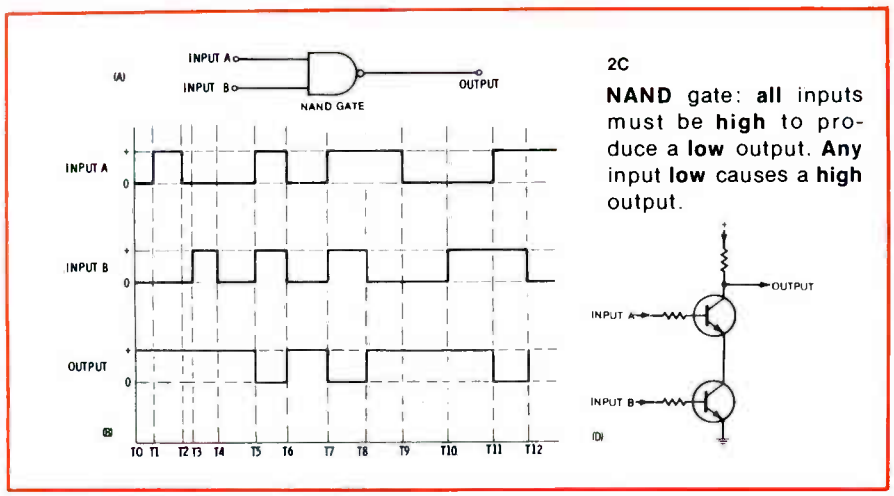

Fig. 2 Some characteristics of NAND gates. A NAND gate is the same as an AND gate with the output inverted 180 degrees. **(A)** Symbol for a two-input NAND gate. **(B)** One possible combination of inputs, and the output produced. **(C)** A short definition of NAND gates. **(D)** One type of NAND gate using transistors and resistors.

Digital circuits are beginning to invade both the home-entertainment instruments we service and the test equipment used in servicing. Right now, some television sets and FM receivers have digital type circuits. Also, all-digital versions of clocks and calculators are being sold. We believe the time is right for all technicians to learn the basic background facts behind digital logic, and the theory of practical digital instruments.

Analog Versus Digital Signals

In the past, the signals used in home-entertainment equipment have all been of the "analog" type. Analog circuits linearly amplify signals, and these signals can be of any reasonable amplitude and frequency. When we work with such signals, we are concerned about (and have tests for) gain, hum, noise, detection, bandwidth, alignment, and distortion. Most analog circuits have controls and adjustments, and small deviations from specified conditions can cause detrimental results.

By comparison, digital signals are very nearly the opposite. When the amplitude is above a certain minimum, the signal voltage either is there (high or 1 state) or it isn't (low or 0 state). Moderate amounts of noise, clipping, hum or changes of waveform usually have little effect on the results. Most digital circuits have no adjustments, and "tweaking" is not required to make them work properly. The solid-state devices operate at saturation or cutoff.

Coincidence Gates

Many digital circuits use gating stages, which were described briefly last month (showing the action as it

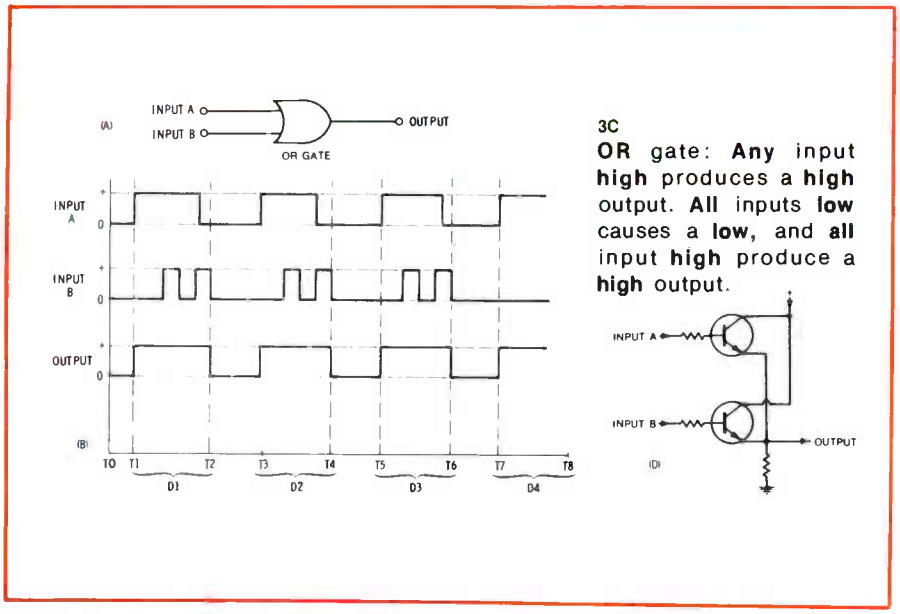

Fig. 3 Some characteristics of OR gates. **(A)** Symbol for a two-input OR gate. **(B)** One possible combination of inputs, and the output produced. **(C)** A short definition of OR gates. **(D)** One type of OR gate using transistors and resistors.

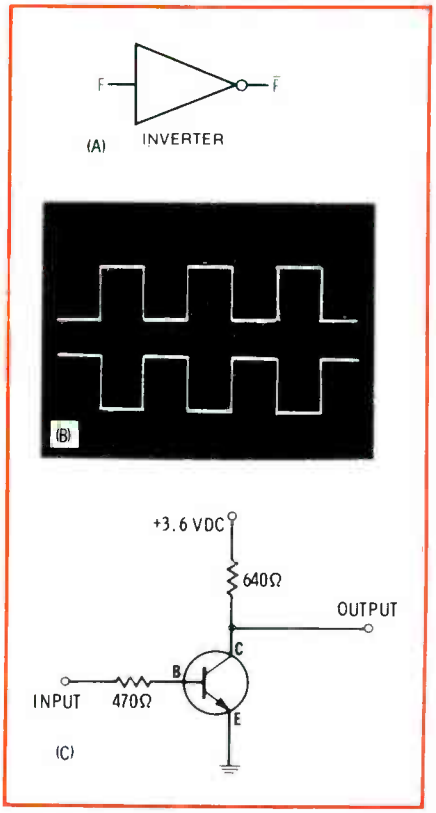

Fig. 5 An inverter changes the phase 180 degrees and maintains the output amplitude about the same as the input. **(A)** Symbol for an inverter. **(B)** Waveforms expected at input and output. **(C)** Schematic of a typical inverter.

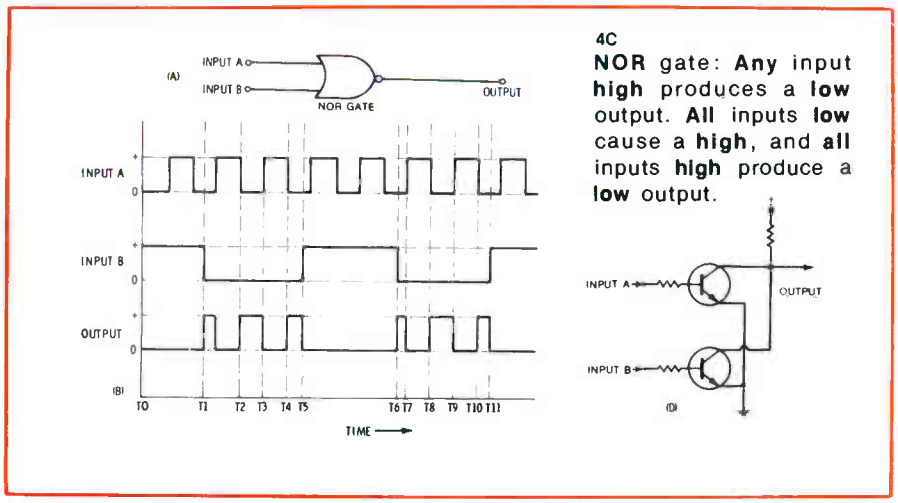

Fig. 4 Some characteristics of NOR gates. NOR gates are the same as OR gates with the outputs inverted 180 degrees. **(A)** Symbol for a two-input NOR gate. **(B)** One possible combination of inputs, and the output produced. **(C)** A short definition of NOR gates. **(D)** One type of NOR gate using transistors and resistors.

might be performed using switches). Of course, switches can be used to give educational demonstrations of digital logic, but are not practical for other applications. At this time, IC's are used almost exclusively. It's not as easy to learn the operation of circuits using IC's as it is with transistors or diodes. Therefore, Figures 1 through 5 show four gates and one inverter which have transistors.

The easy way to tie our everyday transistor logic to digital logic is to think of the "high" or "1" states as forward bias for the bases of the transistors, and as the cutoff state of the collectors.

Understand, then memorize

In order to obtain the most from the material that follows, it's good

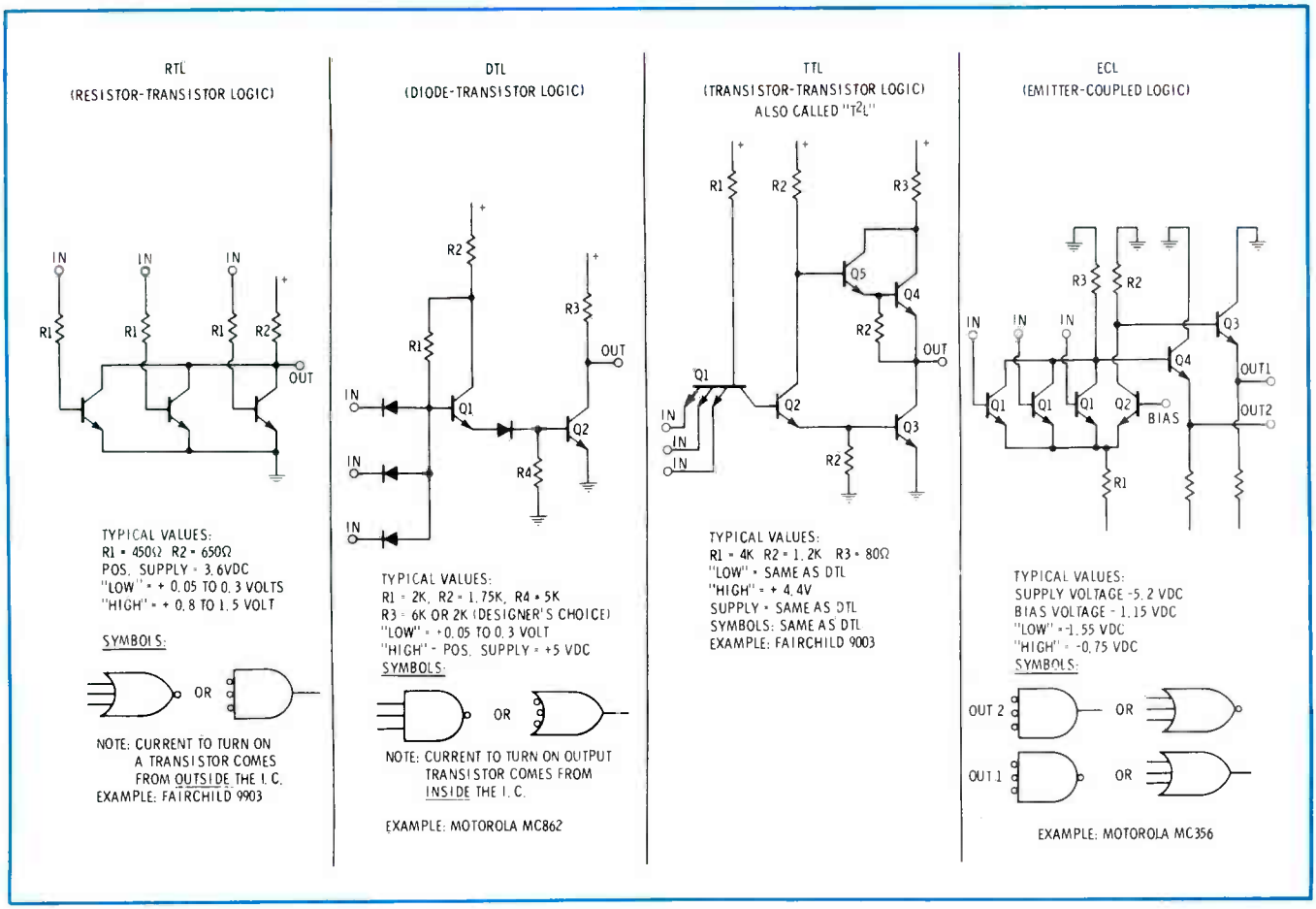

Fig. 6 Four basic types or families of logic gates found in IC's.

to be sure you understand thoroughly the operation of the five basic gates. But, it's even better to go the next step and memorize the circuits and the operation so you can draw and write down the data yourself. If this sounds like school home work, it is. However, it is work that can pay excellent dividends later on. Understanding of complex logic circuits can come **only** after we successfully relate electronic theory to the **language** of digital circuitry.

Logic Families

Gates are nearly always a part of IC's in modern equipment, because compactness and lower prices are desirable. And, although an AND gate is still an AND gate, or a NOR gate is still a NOR gate, there are several different "families" of logic IC's. The principle ones are RTL, DTL, HTL, ECL and COSMOS. Four of these are described in Figure 6.

RTL (Resistor-Transistor Logic)

Inside the IC's of this family are only resistors and transistors. Operation is fairly slow, the transistors saturate, and the immunity against noise is not very good. On the plus side are the twin features of low cost and ruggedness. If the supply voltage does not exceed 3.6 volts, no combination of load or shorts can damage the chip.

DTL (Diode-Transistor Logic)

This is one of the earlier types of circuits used even before IC's were developed, and is an improvement on the older diode logic. Although DTL's can operate at higher repetition rates than can RTL's, they are considered to be slow-speed units. Supply voltage usually is +5 volts.

HTL (High-Threshold Logic)

The HTL's are nearly identical to DTL's, except the diodes are zeners instead of the usual low-voltage silicons. Their main use is in some industrial applications where they must perform in a high electrical noise environment. Supply voltage is a high +15 volts.

TTL (Transistor-Transistor Logic)

Chief advantages of TTL's are higher-speed operation and improved noise immunity. They can drive capacitive loads without serious deterioration of the square waves. Supply voltage is usually 5 volts, but a .1 (or larger) bypass capacitor is recommended at the IC B+ terminal if operation in the 20- to 30-MHz range is desired.

ECL (Emitter-Coupled Logic)

ECL-type IC's are one of the fastest-operating units available. They are different from the ones just described because the transistors do not saturate. (A saturated transistor requires extra time to be driven out of saturation.) ECL's often are called "AC-coupled" logic. ECL flip-flops can be driven

at repetition rates exceeding 300 MHz.

COSMOS (Complementary-Symmetry Metal-Oxide Semiconductor)

That mouthful is the name given to the IC's having two MOSFET's in the output of each unit. One MOSFET is a P-type, the other a N-type and they are connected in complementary symmetry. Operation is medium-to-high-speed, and the noise immunity is excellent. This type has now supplanted TTL types for industrial uses.

Preferred IC's for experiments

If you would like to experiment with IC logic circuits, we recommend the RTL types of chip, because they are rugged and low cost. Second choice is the TTL family. There are two reasons for this choice, the very low price, and the many interesting special-purpose IC's. In addition to the usual gates, inverters and flip-flops, you can obtain also decade (divide-by-ten) counters/scalers, display decoders and digital phase detectors.

One definite advantage in designing or using experimental IC circuits is the easy method of determining the input-drive levels. If you have ever tried to design a complete analog audio amplifier, you know the difficulties of arriving at the correct driving voltages and currents for each stage. The manufacturers of the IC's already have done this for you, because the inputs all have the same rating.

In the manufacturer's specifications are the "fan-in" and "fan-out" figures, which are simple integers. For example, a typical gate might have a fan-in of three and an output capability (fan-out) of 16. This indicates it has three inputs and can drive up to 5 paralleled gates (total of 15 inputs).

Remote on-off

A basic RTL gate can be used as an analog (linear) amplifier, if the unused gates are grounded, and a positive voltage and a signal voltage applied to one gate, as shown in Figure 7A.

By connecting input "B" to the source of a control voltage (Figure 7B), the amplification can be turned on and off as illustrated by the drawing in Figure 7C. The control circuit can be heavily bypassed to eliminate noise.

No doubt several applications for this circuit occur to you. Audio squelch in two-way radios is one possible usage.

Waveform Shapers

Not all digital waveforms are correct for the intended use. Perhaps the signal is a sine wave (or a distorted sine wave from a transducer) when a fast-rise square wave is needed. Or perhaps a narrower pulse is required. Other circuits, such as Schmitt triggers and monostable multivibrators, are used to reshape these signal waveforms.

The schematics of Schmitt triggers and monostable multivibrators can be very similar, and this might mislead a technician into believing they do the same job. Not so. Although both have a regenerative "snap" action, the input waveforms are different, and so are the output waveforms.

Schmitt triggers

The purpose of Schmitt triggers is to produce square waves from almost any other waveshape, with-

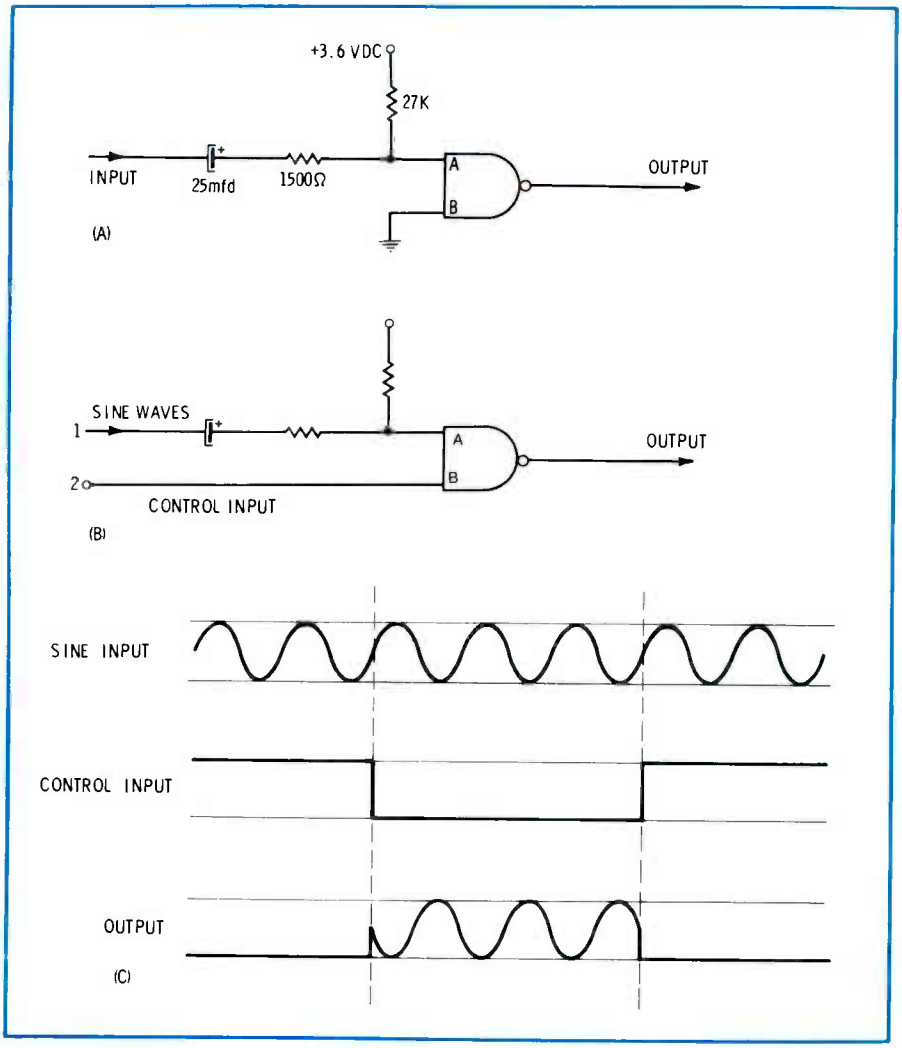

Fig. 7 An RTL gate can be used for linear amplification. **(A)** Amplification without gating requires grounding input B. **(B)** Gating of the analog signal can be obtained by applying the gating signal to input B. **(C)** Example of the output with a square wave gating signal and a sine-wave analog signal.

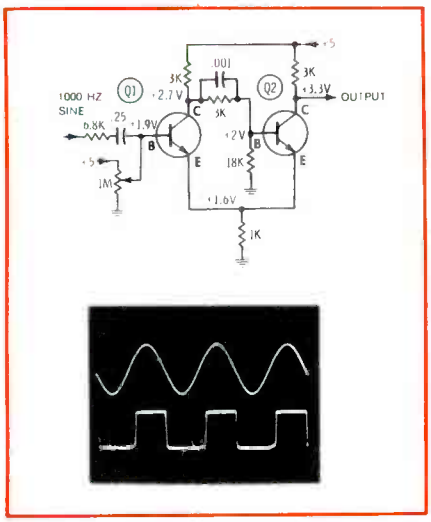

Fig. 8 One type of Schmitt trigger circuit, which gives a square-wave output regardless of the input waveform. The circuit is essentially a direct-coupled emitter-coupled multivibrator, and it doesn't oscillate because of the direct coupling. The .001 capacitor is just to help the triggering at high frequencies.

out changing the frequency.

Although there are many different types of Schmitt triggers, the most common solid-state version is the emitter-coupled type (Figure 8). This particular schematic was obtained experimentally by breadboarding the components in our Electronic Servicing laboratory. We don't claim it to be the ultimate in such circuits. But it does illustrate the operation.

When it is fed an excessive-amplitude input signal, an ordinary two-stage amplifier can distort sine waves into near-square waves. However, the rise and fall times are too slow for many applications. Schmitt triggers have this squaring action in addition to a regenerative function that speeds up any voltage change. Both effects add together to produce faster rise times.

Here is a step-by-step action of the circuit of Figure 6 when supplied with a sine-wave input of more than 3 volts p-p:

- Without an input signal, Q1 is biased to saturation. Because there is little Q1 collector voltage to supply Q2's base, and, because the emitter voltage is high because of Q1's current, Q2 is biased to cutoff. This is a stable condition which will prevail until changed by input voltage.
- When the input sine wave starts to trace the negative peak, the negative-going voltage reduces the forward bias of Q1, increases Q1's collector voltage, and with it the base voltage of Q2. Q2 begins to draw current with the resulting decrease of collector voltage. This much is normal action. Ignore the .001 capacitor; it only helps high-frequency triggering.
- However, the emitter voltage changes also, and it is common to both transistors. When Q1 draws less current, the emitter voltage drops, and this also acts as increased forward bias of Q2. This is the extra "snap" action, and it produces a very fast change of output voltage.
- Later, when the positive peak of the sine wave arrives at Q1, the actions are just the reverse of those described.

The net results of all this activity are an increase in the rise and fall times of the square waves at the output of Q2, and good operation with very small input signals.

Monostable multivibrators

We all know something about multivibrators. However, most of the ones used in television receivers are astable (not-stable) multivibrators which oscillate continuously whether or not there is a trigger. But, there are other kinds that do not oscillate.

Monostable multivibrators have two states, one stable and one unstable. **When a triggering signal changes the circuit to the unstable state, it remains there for a specified length of time, then returns to the stable state,** where it remains until the next trigger arrives. This is a unique feature.

Circuit operation is easier to understand if we stick to saturation and cutoff conditions; gain of the transistors is not a primary factor here. Figure 9 shows an experimental monostable multivibrator we built to check basic operation. Here's the way the circuit operates:

- The low-value base resistor (R1 10K) of Q2 biases it into saturation. The collector and emitter are nearly the same voltage because of the high current.
- Q1 is biased to cutoff because the base voltage is insufficient and the emitter voltage is high because of Q2's current.
- These two conditions represent the stable state when there is no trigger, and also after the circuit has operated and the unstable state has passed.
- When the positive-going edge of a square wave used as input trigger reaches the base of Q1 it biases Q1 into saturation.
- Prior to this time, the C1 coupling capacitor has been charged to about 2.3 volts (5 volts supply less 2.7 Q2 base voltage). When Q1 saturates, the 5-volt end of the capacitor is effectively connected to the common emitter circuit.
- At this time, the effect of the charge coming from C1 is the same as applying a reverse bias of 2.3 volts between base and emitter of Q2. The bias rapidly cuts off Q2, producing a positive-going output at the collector.
- However, this condition cannot continue, because the charge in the capacitor is discharged through the 10K resistor and back to B+. After the charge is dissipated, the circuit reverts to the original state with Q1 cutoff and Q2 saturated. It remains that way until triggered again.
- How long the circuit remains in the unstable condition with Q1 saturated and Q2 cutoff depends on the **time constant** of R1 and C1. The longer the time constant the longer the circuit remains in the unstable state, and the wider the pulse at the output.

The scope waveforms in Figure 7 show the width of the pulse with different values of C1.

Not only can the width of the pulse be changed by the values chosen for a monostable multivibrator (sometimes called a "one shot" multi), but the circuit cannot be triggered again until it has returned to the stable state. Any triggers occurring in the meantime are ignored. This characteristic can be

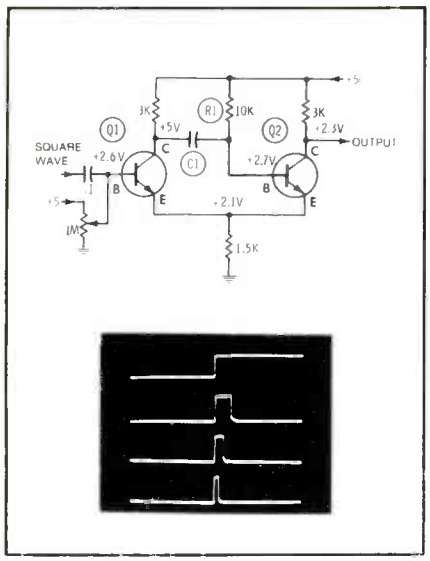

Fig. 9 Example of a monostable (one-shot) multivibrator. It doesn't oscillate (although it resembles cathode-coupled horizontal oscillators) because Q1 is insufficiently biased until there is an input trigger. The only stable state is with Q1 cutoff and Q2 saturated. When a square-wave triggering pulse is received, these conditions are reversed for a period of time determined by the time constant of C1 and R1, then the circuit reverts to the original state and waits for the next trigger. **Schematic** of an experimental one-shot multi. **Waveforms** obtained by changing the value of C1. Top trace shows nearly two cycles of the input triggering signal, second from the top shows the output pulse when C1 was .01, third from the top is the waveform when C1 was .005, and the bottom trace was produced by changing C1 to .0025.

used to make a "bounce-less" switch.

All relay and manually-operated switches stutter when closed, thereby making several closings and openings each time instead of just one. A counting circuit would record each one and thus introduce errors. By using a switch or relay to trigger a "one-shot" multivibrator, keying without contact bounce is obtained.

Next Month

Decade counters, and some of the test equipment circuits using digital logic, are discussed next month. □

A business tax calendar

By Robert G. Amick

What tax forms to file or pay, when to file or pay them, and who has to file and pay have been questions haunting small-businessmen for years. The following calendar is intended to serve as a reminder of these important dates. We suggest you write them on the corresponding day of a large calendar and keep them for reference.

Date	Form	Who	Requirement
JANUARY, 1973			
15	1040	Individuals	Balance due of estimated tax for 1972
31	1040	Individuals	Return and payment due for those not paying balance by January 15
	W-2 W-2P	Employers	Last day to give each employee the W-2 statement of income and taxes withheld in 1972
	508	Employers	Employers deposit federal unemployment tax payment (if applicable)
	941	Employers	Report and pay balance of income and social-security taxes for 4th quarter of 1972
FEBRUARY, 1973			
10	941	Employers	Return on income and social-security tax for 4th quarter of 1972, where payment was made January 31.
	940	Employers	Annual return due on unemployment tax (if applicable) when tax deposits have already been made
28	1096 1099 1087 W-3 W-3P	All businesses	Annual information return covering reportable payments of dividends, interest, rents, royalties, annuities, pensions and other fixed or determinable income

Date	Form	Who	Requirement
MARCH, 1973			
15	1120	Corporations	File 1972 income tax return
APRIL, 1973			
15	1040	Individuals	File income tax returns for 1972 income
	1040ES	Individuals	Declaration of 1973 estimated income tax with at least 25% payment of estimated tax
	1065	Partnerships	File 1972 income tax return
	503	Corporations	Pay 25% of estimated 1973 income tax
30	941	Employers	Report and pay 1st quarter 1973 income and social-security tax withholdings
	508	Employers	Pay federal unemployment tax for 1st quarter of 1973, where applicable
MAY, 1973			
10	941	Employers	File 1973 1st quarter return on income and social-security taxes withheld, if paid by April 30
15	4848	Employers	Annual report of status of pension, annuity, stock bonus, profit sharing or other funded deferred compensation plans
JUNE, 1973			
15	1040ES	Individuals	Second installment of 1973 estimated income tax due
	503	Corporations	Balance of 1972 income tax, second installment (25%) of estimated 1973 tax

Date	Form	Who	Requirement
JULY, 1973			
31	941	Employers	Report and payment of 2nd quarter income and social-security taxes withheld
	508	Employers	Return and payment of 2nd quarter unemployment tax (where applicable)
AUGUST, 1973			
10	941	Employers	Return for 2nd quarter income and social-security taxes withheld, where paid by July 31
SEPTEMBER, 1973			
15	1040ES	Individuals	3rd-quarter installment of 1973 estimated tax
	503	Corporations	Third installment of 1973 estimated tax
OCTOBER, 1973			
31	941	Employers	Report and pay income and social-security taxes withheld for 3rd quarter of 1973
	508	Employers	Report and pay 3rd quarter federal unemployment tax (where applicable)
NOVEMBER, 1973			
1-30	W-4	Employers	From each employee, obtain new statement of withholding exemptions
10	941	Employers	Report and pay 3rd quarter income and social-security tax withholdings
DECEMBER, 1973			
15	503	Corporations	Pay final 25% of 1973 estimated income tax

Note:
These dates are prescribed by law, but when a date falls on a Saturday, Sunday or holiday, the deadline automatically moves to the first business day following. □

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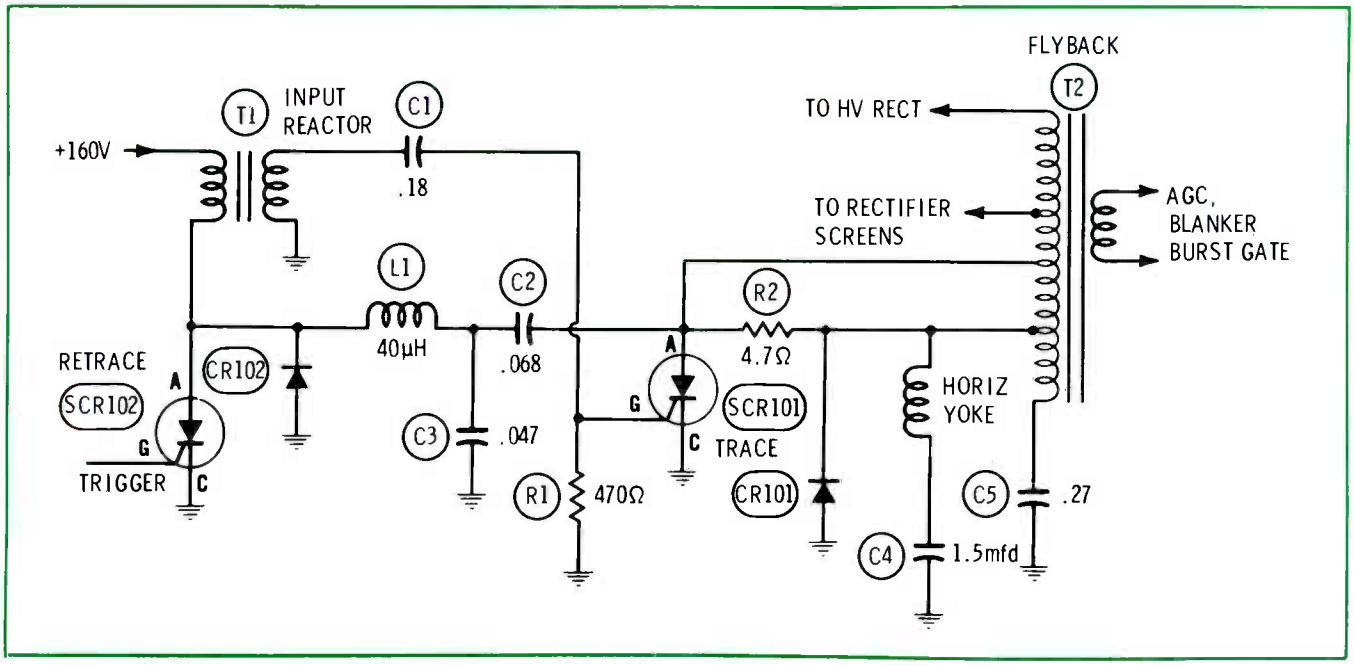


Fig. 1. Essential components of a SCR deflection system.

Servicing SCR deflection part 1

By Bruce Anderson

Servicing SCR circuits is quite different from servicing either tube circuits or transistorized sweep circuits. In this first of three parts, the basic theory is lightly covered, plus the beginning steps necessary for troubleshooting.

The SCR horizontal-deflection system was introduced by RCA nearly five years ago in their CTC-40 chassis. This was the first of their solid-state chassis, although it did use a vacuum-tube high-voltage rectifier. Since then, they have used variations of the original SCR circuit in all but one of their line of all-solid-state receivers.

Basically, all of these SCR deflection systems work the same, but there have been some variations over the years. In this series of articles we will cover the fundamentals of the circuit, the general approach to servicing it, and finally, the peculiarities of troubleshooting the circuits used in each of the chassis.

Circuit Operation

It isn't absolutely essential to understand every facet of the operation of the SCR system in order to troubleshoot and service it. Still, some general idea of its operation will help in analyzing symptoms. Since this system is radically different from either a vacuum-tube or a transistor deflection system, it is necessary to develop a "feel" for the circuit.

The SCR belongs to the same family of solid-state devices as the triac and the PUT. All of them are constructed so that they do not normally conduct unless they are turned on by a keying pulse or trigger. But once turned on, they remain in conduction until the cathode-anode voltage is reduced to practically zero. The point to remember is that a conducting SCR cannot be turned off by application of negative bias to the gate.

Two other characteristics of the SCR are important; one makes it a very useful device, and the other presents some tricky design problems. First, it can conduct very high currents with very little voltage drop. In other words, its output impedance is very low, and this makes it an ideal device for driving a yoke without the use of a matching transformer. On the other side of the ledger, it requires several microseconds for the SCR to return to a stable "off" condition after current has been stopped. Reapply voltage too soon and it will conduct spontaneously. However, this time can be shortened by applying a negative gate voltage while the anode current is cut off.

Figure 1 shows the essential elements of the SCR deflection system. In addition to the circuit elements shown here, various chassis have some or all of the following auxiliary circuits: voltage regulation, linearity correction, pincushion correction, over-voltage shutdown, and supply-voltage take-offs. These take-offs include screen voltage, focus voltage, high voltage, and B+. In one chassis it even supplies filament voltage for the picture tube. They will be discussed after the basics have been mastered.

Power supply

The supply voltage for the system

is about + 160 volts in all chassis, whether or not they use a power transformer. This is a convenient voltage, since it can be generated in portables by a half-wave rectifier connected to the AC line. In consoles, a 1:1 isolation transformer is used. The DC current drain varies from about 200 milliamperes at zero brightness to around 500 milliamperes at maximum brightness.

Drive

The first interesting difference between this and a vacuum-tube deflection system is that this system does not overload if drive from the horizontal oscillator is interrupted. Loss of trigger to SCR102 allows it to stay cut off, and this is the only DC path from B+ to ground. Therefore, no trigger, no current.

Capacitor discharge

Normally, the horizontal oscillator generates trigger pulses at the line rate of 15,734 Hz. Each trigger has a duration of about 6 or 7 microseconds, and these turn on the SCR. Conduction of SCR102 discharges C2 through the flyback transformer, via C5, and through the yoke via C4.

The length of time required to discharge C2 is determined by the resonant series frequency of C2, L1, C4, and the yoke. These are tuned so that the current through C2 increases from zero to maximum (about 11 to 18 amperes, depending on the chassis), decreases back to zero, and then rises to maximum in the opposite direction during the retrace time.

Naturally, SCR102 cannot conduct during the last part of this cycle, but CR102 can. It is during this time that SCR102 cuts off, because the anode is slightly negative. Long before the yoke current can reverse again, the trigger is removed from SCR102, so the capacitor, C2, again can charge towards B+. Therefore, SCR102 and CR102 are both out of the circuit except during retrace.

Trace yoke current

The large yoke current which is flowing at the end of retrace has a continuing path through CR101 and C4. It decays and reaches zero in about 25 microseconds. During this interval, the current through T1, which is charging C2, induces a positive gate voltage in the secondary of T1, and this puts forward bias on the gate of SCR101.

When the yoke current through CR101 has reached zero, it reverses and flows through SCR101. Again, it reaches maximum in about 25 microseconds. Thus, in about 50 microseconds, yoke current decreases from maximum (4 to 6 amperes, depending on the chassis) to zero, reverses, and reaches maximum in the opposite direction. This yoke current produces a horizontal scan line. At the end of scanning time, the next trigger from the horizontal oscillator drives SCR102 into conduction and the next retrace interval begins.

Effective B +

One other characteristic of the circuit should be noted: since C2 charges to B+ through an inductance, the charging circuit tends to ring. Because of this ringing, the voltage across C2 will rise to nearly twice B+ at some point in time. T1 is designed so that the ringing frequency causes the capacitor voltage to reach maximum (about 320 volts) just before the beginning of retrace. Therefore, the **effective** B+ is almost twice the output of the power supply.

General Servicing Approaches

Once he knows the basic operation of the system, the clever technician can take advantage of its characteristics in troubleshooting it. For a starter, what will happen if SCR101 is shorted? Think it over for a moment before continuing.

If SCR101 or CR101 shorts, the circuit is reduced to the one shown in Figure 2. None of the components beyond C2 need to be considered, because their inputs are shorted to ground. Naturally, there can be neither high voltage nor deflection. There **will not** be an overload on the power supply, so the circuit breaker will not trip.

C2 and C3 will charge to about twice B+ just as before. Only now, when SCR102 is triggered,

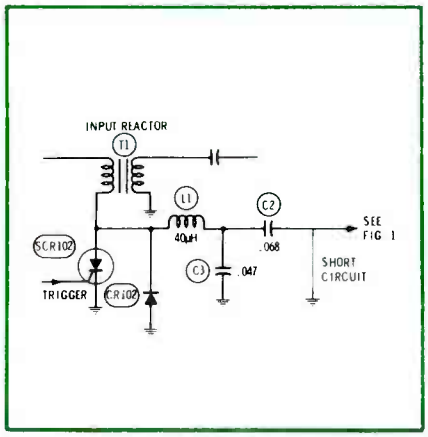


Fig. 2. Equivalent circuit for a shorted SCR 101 or CR 101.

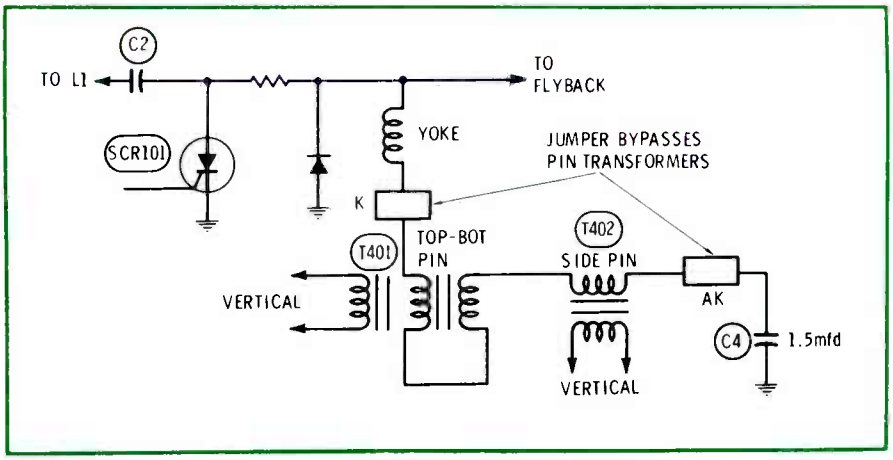


Fig. 3. Details of pincushion transformers in earlier SCR systems.

they discharge through the short circuit rather than the yoke. Current from C2 and C3 passes through L1 and the SCR to ground, increasing from zero to maximum and then decreasing back to zero. Then it reverses and passes through CR101, cutting off SCR102 in the process. It rises to a maximum and decays to zero, and since SCR102 cannot conduct a second time, the capacitors begin to be recharged by B+. The current drain from the power supply is less than normal because very little energy is lost in a reactive circuit.

In the most recent RCA chassis that uses SCR's (the CTC62) the on-off switch shorts the circuit as shown here to turn the set off. In earlier chassis, a good technique to determine the origin of an overload is to introduce a short as shown in Figure 2. **Caution: Turn off the set before connecting the jumper; otherwise, the breaker might trip.** This tendency to trip the breaker was eliminated in the CTC62.

Suppose a jumper has been connected to short the circuit as shown in Figure 2, but the circuit breaker continues to trip each time the set is turned on. What next?

The most likely cause of trouble is a shorted SCR102 or CR102, but it could be C2 or C3. There also are some "hash filter" capacitors in the circuit which might cause the trouble; or T1 might be shorted to ground. With the set off, connect an ohmmeter from the anode of SCR102 to ground. Be sure the negative meter lead is grounded; otherwise it will read the forward resistance of CR102. The resistance should be 20K ohms or more. If it isn't, start looking for the shorted component.

There is a slight possibility that the gate of SCR102 is being biased on continuously. Disconnect the triggering signal from the gate. If this clears the overload, check the oscillator circuit. If the circuit breaker still trips, the trouble isn't in the horizontal deflection circuit.

Shorts

Although a short in or across SCR101, or CR101 doesn't trip the breaker or cause further damage, sustained overloads in the yoke or flyback areas may cause additional problems. For example, operating the instrument with a shorted screen-supply rectifier eventually may overheat the flyback transformer and damage it. A shorted high-voltage rectifier, however, probably won't hurt anything else. The impedance of the high-voltage winding of the transformer is high so not enough power can go into the short to cause damage. Still, the shorted high-voltage rectifier will get noticeably warm to the touch.

A quick check which tells a lot about the location of a fault is to measure the DC voltage at the anode (case) of SCR101. (Actually, the meter is indicating flyback pulse amplitude at this point.) In normal operation, the voltage reads about 50 to 60 volts DC. If it measures zero, it's likely that either SCR101 or CR101 is shorted, although loss of oscillator trigger to the system could be the trouble. If the voltage is low, but not zero, look for a shorted load on the flyback transformer, leaky or shorted C4 or C5, etc.

Opens

The big problem arises when there is an open anywhere in the load circuit. The worst-case open is one in the yoke circuit. Since the yoke circuit is the lower-impedance branch of the load, opening it drastically raises the load impedance. The result is that the voltages across SCR101 and CR101 rise too high and will probably zap one or the other of these devices.

An open in the primary of the flyback is not too serious, but it might cause additional failures. In the CTC40 chassis, it was recommended that the flyback transformer could be eliminated from the circuit for testing by disconnecting it from C5; **but only if the line voltage was reduced to 100 volts or less.** With this lead disconnected and normal line voltage, the normal, 500-volt flyback pulses on the SCR and diode rise to over 600 volts; not spectacularly high, but enough to sometimes zap one or the other of the devices.

It's one thing to know roughly what will cause repeated failures of either SCR101 or CR101; preventing this from happening on the bench is mostly a matter of caution. Any time either of these devices is shorted or open, it is a very good idea to look for the reason for the failure before trying a new one. To do otherwise is to invite a second failure.

The first step is to check continuity of the yoke and flyback primary circuits. Since both of these return to ground through capacitors, it is necessary to check from point to point, not simply from input to ground. In the earlier chassis, CTC 40, 44, 46, 47, 49, 54, and 59, the pincushion circuit is in series with the yoke. Be sure that there is no open in this area. It can be bypassed by connecting a jumper from the lower end of the yoke to C5 (Figure 3). In the CTC48 the

pincushion circuitry is connected in parallel with the flyback primary. Bypassing it in this chassis will short the flyback, but the chassis can be operated with pincushion circuits disconnected.

Intermittent opens are the real bugaboo when the trouble is repeated failure of SCR101 and CR101. Some of the locations we have heard about or seen are: CR101 loose in its retaining clips, loose connections in the yoke socket, loose screws holding SCR101 in its socket, and cold solder joints where T1 (Figure 1) is soldered to the circuit boards. Another cause is a pinhole through the mica insulator between SCR101 and its heat sink. The arc which forms intermittently can also zap either the SCR or the diode.

Summary

In this first article of the series on troubleshooting the SCR deflection system, only the basic circuit components and the fundamental approaches to servicing have been discussed. While a detailed discussion of how this unusual deflection system operates is academically interesting, a grasp of the "high points" is enough to enable us to service it effectively. If the following are remembered, most troubleshooting problems can be solved with a few meter measurements and common logic.

- Once something turns on an SCR, it will stay on until the anode voltage is removed.
- Shorts beyond the storage capacitor, C2 of Fig. 1, seldom cause the circuit breaker to trip, except possibly at the moment the short first occurs.
- SCR's are low-impedance devices and they can conduct enough current to trip the circuit breaker, if they are continuously gated on.
- Opens in the load circuits, particularly the yoke circuit, cause the AC voltages to rise. Excessive voltage is very apt to damage either the SCR's or the diodes.

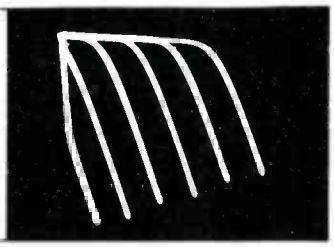
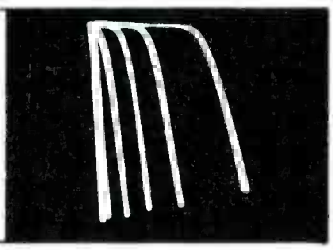
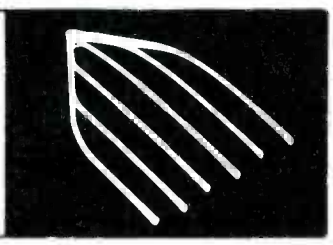
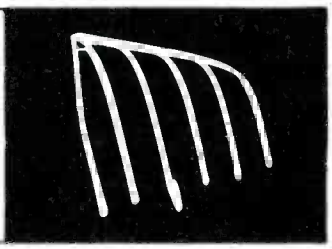
In the article to follow, variations of the basic circuit will be introduced, and methods of troubleshooting the system as it is used in specific chassis will be considered. □

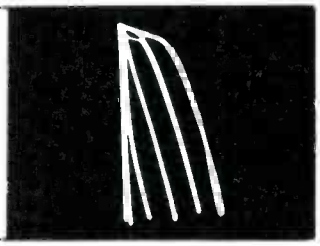
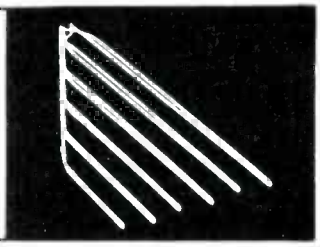
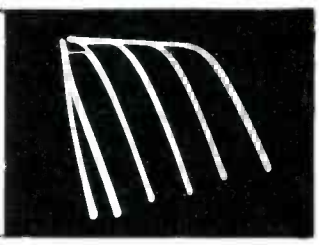
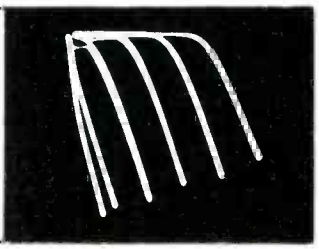
SIGNATURE PATTERNS

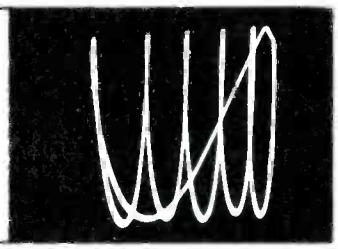
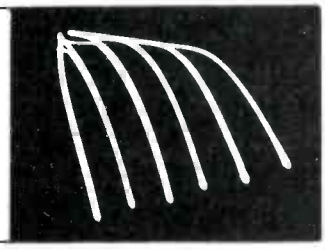
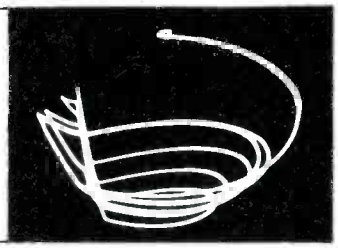
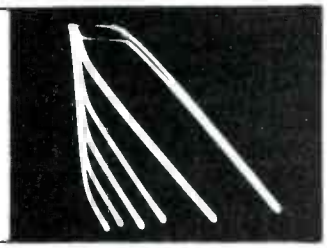
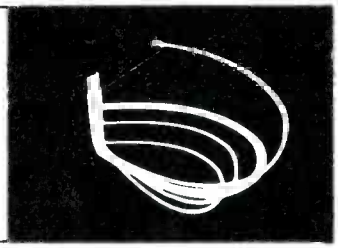
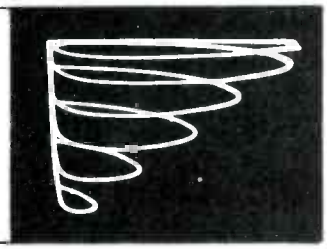
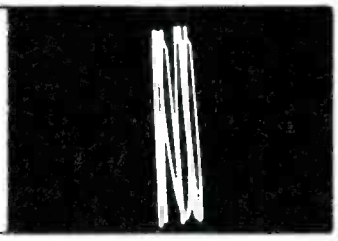
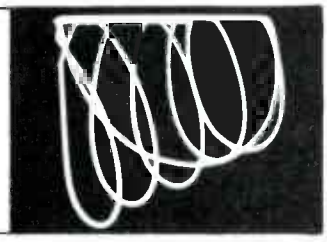
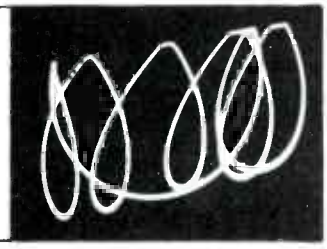
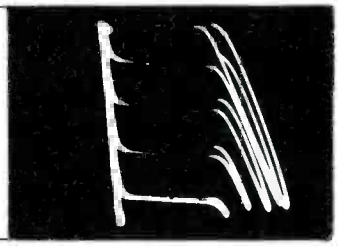
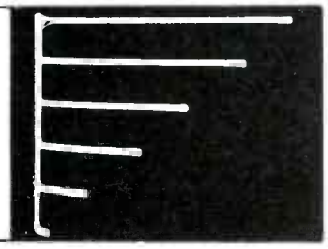
Made On Jud Williams Model A Curve Tracer

ZENITH CHASSIS 25DC56

MANUFACTURER	ZENITH
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q101 1ST IF **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 20uA	
Q102 2ND IF **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 100uA	
Q103 SOUND AMP **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 100uA	
Q104 3RD IF **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 20uA	
Q105 1ST VIDEO **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 200uA	

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q202 BLANKER **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 20uA	
Q203 2ND VIDEO **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 10uA	
Q204 3RD VIDEO **POLARITY** PNP **SWEEP VOLTAGE** 20V **BASE CURRENT** 200uA	
Q205 BLUE OUT **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 50uA	
Q206 RED OUT **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 50uA	

MANUFACTURER	ZENITH	MODEL OR CHASSIS	25DC56
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS	TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q201 BRIGHT LIM **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 500uA		Q207 GREEN OUT **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 50uA	
Q208 SOUND OUT **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 50uA		Q802 HORIZ OSC **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 50uA	
Q210 VERT OUT **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 500uA		Q803 HORIZ DRIVE **POLARITY** NPN **SWEEP VOLTAGE** 50V **BASE CURRENT** 10uA	
Q212 REG **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 50uA		Q804 SHAPER **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 10uA	
Q216 HORIZ OUT **POLARITY** **SWEEP VOLTAGE** **BASE CURRENT**	CHECK DIODE JUNCTIONS. LOW BASE/EMITTER RESISTANCE PREVENTS SIGNATURE PATTERN.	Q703 VERT OSC **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 10uA	
Q217 VERT BLANK **POLARITY** NPN **SWEEP VOLTAGE** 20V **BASE CURRENT** 20uA		Q704 VERT DRIVE **POLARITY** NPN **SWEEP VOLTAGE** 30V **BASE CURRENT** 10uA	

(*Continued on page 52*)

Learn to use "thumbnails"

By Ronald Merrell

Last month, in our article about getting started in advertising, we mentioned sketching out your ad with a salesman. Such a sketch is called a "thumbnail". In this article, we'll show you what a thumbnail looks like and how it translates into a printed ad. Also, we'll present some ideas about ad elements and how they should be used.

The word "thumbnail" is an old one meaning brief or concise, and that definition fits the sketch made of a proposed ad. We will use the term because it is part of the language of the printing/advertising business. When you speak about thumbnails to the ad salesman he'll realize you know what you want.

An ad can be constructed in many ways. But by sketching out small-scale versions of your ad, you will find one or two that are more pleasing to you.

If you don't sit down with the salesman and sketch out your proposed ad, its layout will be left up to the advertising department. Chances are, they would produce a reasonable ad, but (1) you won't have any idea how it will look until it appears in print, (2) it might have the emphasis on the wrong element, and (3) you might not like the layout at all.

So, thumbnails give you ideas for how the ad might look. However, expect that you will need some experience in seeing the thumbnail come to life on the printed page before you can cut down the time spent experimenting with thumbnails. Later, after you have this experience, perhaps you will need only to sketch out one or two before finding what you want.

Actual-Size Sketch

These small thumbnails give you a place to visualize the arrangement of the various elements of the ad. The elements are:

- the headline, illustration or picture,
- the message,
- name, address and phone number, and
- the logo.

The logo might be a distinctive mark used on your shop stationery or on your shop window or signs. It symbolizes you and your shop.

Small ads are best laid out differently than the large ones. After you have selected a thumbnail, sketch it at the actual size it will be. You don't need artistic ability, but arrange all the elements so you can see how it looks.

Headlines

Unfortunately, most small ads don't take advantage of the headline. In the strictest sense, a headline **must** include a verb or action word. "Don't miss the big game" is a headline that might have drawing power during the football season. Another headline is "We service all brands". But, during the football season, which headline would be more likely to generate business?

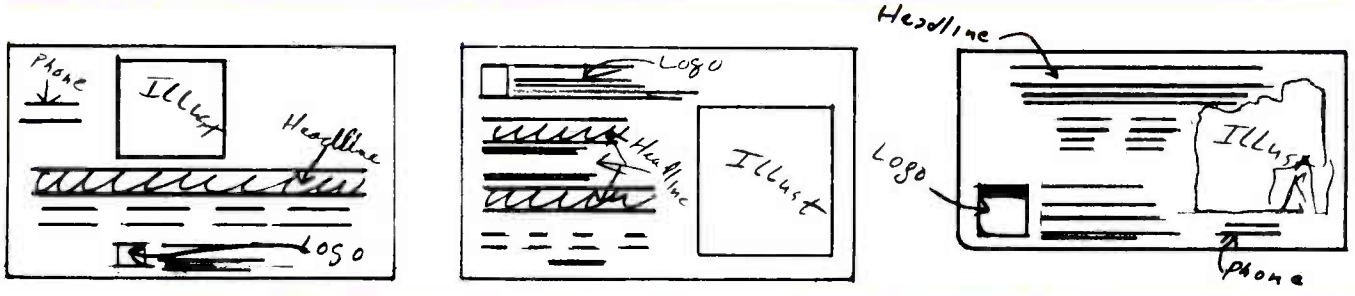
Worse yet, an ad without a headline becomes merely an announcement ad. And, announcement ads only let the reader know that you are in business. Because most ads of small service shops are announcement type, why not beat the game and try the headline-type ad? In other words, while the other shops are just saying they're in business, your ad should be inspiring the customers to take advantage of your service.

For example, you could encourage them to have their ailing set repaired before it goes completely bad and thus require a larger bill. Other service-oriented businesses stress preventive maintenance, it should work also for you.

Headlines in Yellow Pages

Although advertising for seasonal promotions usually isn't done in the Yellow Pages, headlines can be used there to put more action into the listings. Compare some of the ads in your local newspaper with the dull announcement-type ads typical of those in the TV-service listings of the Yellow Pages. Then ask yourself what a reader sees and

At first glance these illustrations may seem more like scribbles and scratches. But these are the beginnings of possible ads...call them thumbnails. Note that what we really have done here is to move the elements around. For the purpose of explaining the process, we'll select the thumbnail on the right.



thinks when he reads ads like those.

Many managers of successful businesses believe they get most of their calls from listings in the Yellow Pages. How many more could they get with a real selling ad placed among the weak ones? Competition is fierce. The shops fight for first listings, and many customers choose a shop according to the nearest one. A superior ad should give you the edge you need. And a good headline is the first step in obtaining a better ad.

The Message Of The Small Ad

Typically, small ads are too crowded. The shop owner tries to get the most out of his money. Especially if the ad uses only a few inches of space. This is a serious mistake.

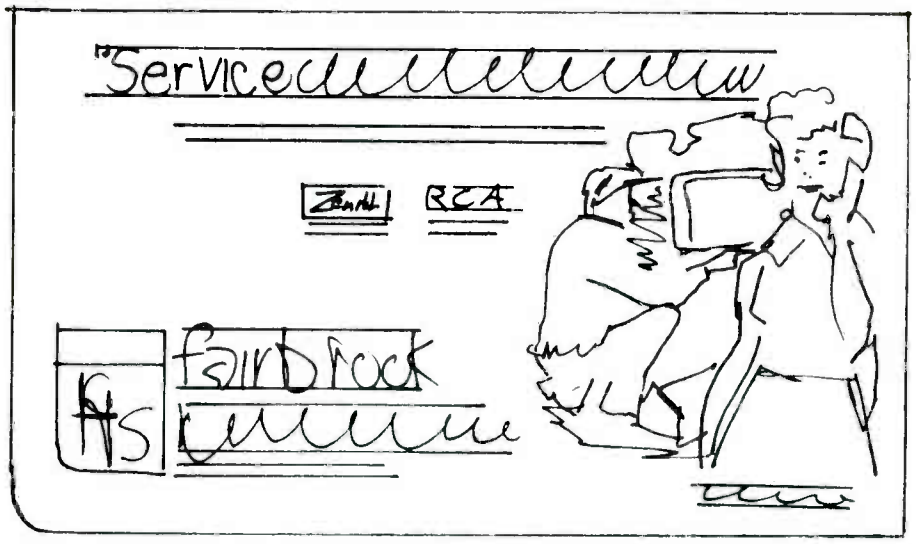
Small ads can be very effective, but the elements must not burden the reader. For example, if the headline and the message (called "copy") are too long, the print must be very small. The smaller sizes are more difficult to read, especially for those whose eyes are not so keen as yours. It's very unlikely the average reader would wade through all those many words under the handicap of the small print size. And, if he doesn't read it, you've wasted your money and the ad.

The AIDA Principle

Two previous articles in **Electronic servicing** have discussed the AIDA principle. Translated, it means Attention, Interest, Desire, and Action. No sales action should be without these elements.

Many ads take the reader through Attention, Interest and Desire, but then stop before inspiring him to Action. The Action must be **now**.

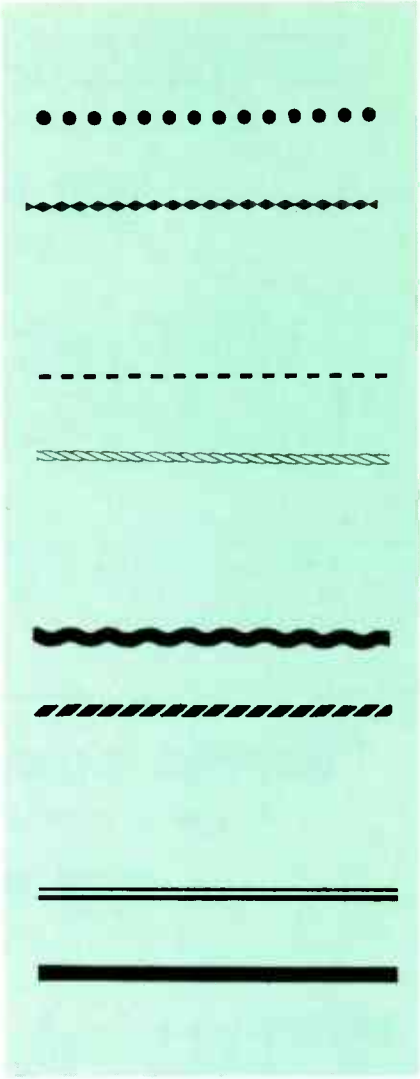
It's not likely you will grasp the reader's attention without an attractive ad. It's certain a small ad with a tiny illustration and many lines of very-small print will not be effective. Rare is the person who



Once we have a thumbnail that appeals to us, we re-sketch it in full size to see how large the type and illustrations will be. The top sketch has been depicted in the middle illustration. It comes close to looking like the final printed version. This is a Yellow Pages type ad.

The bottom illustration is a newspaper type ad. Note that the headline is not a general appeal. It says something like, "Don't Miss The Big Game". Also note that there is a space between the headline and logo for the ad message.

Here we've taken the main elements of the original thumbnail and changed them into a vertical ad. Not very interesting, is it? From the text information, what's wrong with this ad? Scratch out your own thumbnail of this one and see what improvements you can make.



Here are some examples of borders that can be used with your ad. Can you find one that would work well with your ad? Or...you can be like all the rest and just use straight lines.

reads everything in a paper.

Keep the message (copy) short and powerful. Make every word count. And tell the salesman you want the print to be large enough that it can be read easily. Keep in mind that the message is where you build Interest and Desire. Remember these things if you would have an ad that is better than your competitors.

Illustrations

The sample ads in this article picture a technician on the job in a home. If this is part of the service you offer, such a picture will help tell your story while it attracts attention to the ad.

Some advertisers get so carried away with the illustration or picture that they give it too much space in the ad. Well, then, how large should it be? First of all, it should be big enough to be easily understood.

If the picture features a technician or a set owner, make certain they either look directly at the reader or at the message of the ad. People are attracted to people, so they often make the best subjects for illustrations. However, a person looking away from the ad just naturally forces the reader also to look away. Ad experts try to calculate how the reader's eyes will move through the ad. It's a point you also should keep in mind.

The headline and the illustration are the main attention-getters; make them work **together**.

Other Points To Remember

Really good ads seldom have headlines printed all in capital letters. Each word can start with a capital, but use lower case for the remainder. Why? Because readership studies have shown that all-capitals are more difficult to read than a mixture of capitals and lower case. Mention this to the ad salesman.

While we're talking about attention-getters, something needs to be said about the border of your ad. Even a casual glance at the ads in any newspaper or Yellow Pages will show you how little thought has been given to this subject. Ask your salesman what kinds of borders are available. We've given some examples here. With these and the suggestions from the salesman you should be able to find one that will help your ad gain the attention it deserves.

Give The Reader The Data He Needs For Action

After you have attracted the reader and stimulated his interest and desire, you must give him the information about how to reach you. What is your address, your phone number and the hours when your shop is open?

Understandably enough, the telephone numbers in the Yellow Pages often are in the largest type of the ad. In any event, make sure the important numbers are not buried under too many words.

The Logo

Usually, your logo is the last thing to go into the ad. Far too many advertisers place the logo at the top of the ad. This—more properly—is where the headline belongs. Flow of the ad should go from "what's available" to "why you should get it from us", and finally "where you can contact us".

Conclusion

The examples given here are not intended to be perfect or the only considerations ever to be given. But they should help you to ask (and answer) some of these questions:

- Do you use headlines, and are they good ones?
- Does the illustration get attention?
- Does the message tell what is unique about your service?
- Is the ad easy to read rapidly? □

We'd like to sell you a product that isn't working.

Color television took years to perfect. But the potential was there.

We have a product with great potential. Perhaps you've heard our name, but not known what we do. We're the National Alliance of Businessmen. We're in business to help America's disadvantaged citizens. Products of the ghetto, poverty, poor education and life's bad breaks. Our purpose is to make the American system work, by seeing that everyone who wants to work can become a fully participating citizen.

If you read on, you'll see why 30,000 NAB participating companies have found it good business to employ and train a million disadvantaged persons. Why thousands of talented executives have been loaned to us by America's leading corporations.

We were formed by presidential mandate to serve as a catalyst between government and business. Business provides the jobs and government finds the persons to be hired and trained. Most companies pay the training cost themselves. Companies that cannot afford to take on the task of employing and training the hard-core unemployed can be given financial support by the government. We think this partnership between business and government is a good way for our society to deal with its problems.

We have programs that deal with the hard-core unemployed. Hiring, training and retraining the disadvantaged across America. Transforming the disadvantaged into full citizens —people with hope, training and the experience that helps them move within our society.

Our youth programs represent the preventive side of the Alliance. If we can keep kids in school, they'll be less likely to fall into the continuing cycle of poverty. So we have programs to give disadvantaged youth summer and year-round employment and training, and others designed for career guidance, motivation and practical business education.

And because thousands of Vietnam-era veterans are having trouble finding jobs, we have responded to a presidential request to find jobs for hundreds of thousands of Vietnam-era veterans.

With 500 full-time loaned executives manning offices in 164 cities, we are fully committed to helping the nation solve one of its most pressing problems.

As President Nixon has said:
"The National Alliance of Businessmen has displayed a remarkable capability to mobilize the American business community in response to a national problem."

We have a product to sell. And programs that make it easy to buy. Contact the National Alliance of Businessmen. Help us get our product and our country working.

The National Alliance of Businessmen.

The Jobs People
1730 K Street, N.W., Washington, D.C. 20006

bookreview

RCA Solid-State Servicing (TSG-1673A)
Author: RCA Institutes, Inc.
Publisher: RCA Distributor Products, Harrison, New Jersey
Size: 5¼ inches x 8 inches, 352 pages
Price: $3.95

This service-technicians manual shows how to deal with solid state trouble-shooting problems in color and black-and-white TV receivers, FM stereo or mono and AM radio receivers, hi-fi and tape-recorder amplifiers. Information includes actual in-circuit test equipment hookups and field alignment and adjustment procedures. The book also offers semiconductor know-how, solid-state circuit operation and service techniques for the service technician in solid-state electronics. Chapters are organized for both reading and reference and are related to specific areas of solid-state applications.

Easy Guide To Boat Radio
Author: Forest H. Belt
Publisher: Howard W. Sams & Co., Inc., Indianapolis, Indiana
Size: 5½ inches x 8½ inches, 160 pages
Price: $3.50

Marine radio is an effective and fast communication used on our congested waterways. This book advises how to find and select a boat radio, how to install it and how to use the radio once it is installed. Both the new and the old FCC rules and regulations are explained along with care and repair of boat radios. One chapter deals with the different types of antennas and installations. Others discuss communicating by boat radio, water safety and convenience, and winter storage for your boat radio. The concluding chapter explains one of the most important aspects of the marine radio—how to find top-grade repair service. □

photofactbulletin

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

ADMIRAL
7P280 (Ch. NA10-1A) 1319-1

GENERAL ELECTRIC
C4600A/B, PBC4600B 1317-4

MGA
CS-192 1319-2

MGA
BT-122 1321-1

MIDLAND
15-126B 1316-1

MIDLAND
15-090 1317-1

MOTOROLA
Chassis ASTS-934, STS-934, YSTS-934 1316-2
Remote Control Receiver TRR-11, Transmitter TRT-9 ..... 1316-2-A

MOTOROLA
Chassis AE14TS-465, E14TS-465, ZDE14TS-465 1318-1
Remote Control Receiver TRR-12, Transmitter TRT-10 ..... 1318-1-A

MOTOROLA
Chassis AFD/FA/FB/FC/FE/FG/YAFD18TS-929, FA/FB/FC16TS-929 1320-1
Remote Control Receiver TRR-1, Transmitter TRT-9 ..... 1320-1-A

PANASONIC
CT-603/C, CT-604, CT-606/C 1317-2

PANASONIC
CT-250 1318-2

PANASONIC
CT-395VR 1321-2
Tuners Used in Model CT-395VR 1321-2-A
Remote Control Receiver TNQB303R, Transmitter TNQB303T 1321-2-B

PENNCREST
2852, 2857 1319-3

SEARS
564.41102100, 564.41221100, 564.41221101 1317-3

SEARS SILVERTONE
528.43101011 thru 528.43101039, 528.43111011 thru 528.43111039, 528.43121011 thru 528.43121039 1321-3

SHARP
C-922W 1318-3

SONY
TV-51OU (USA Serial #48000 and later, Canada Serial #10201 and later) 1320-2

TELEDYNE PACKARD BELL
1C620WL, 1C622WL 1320-3

TRUETONE
GEC4310A-37 (2DC4310) 1316-3

Reader's Exchange

(Continued from page 10)

Needed: *Photofact manuals AR1, AR2, AR3, AR10 and AR11; cash or trade for late-model auto equipment.*

Auto Radio Center
2123 Milton
New Orleans, Louisiana 70125

Editor's note: *Although AR1 to AR18, TR1 to TR5 and TSM1 to TSM23 books are no longer in print, all of the models covered in those discontinued numbers are included in the regular Photofacts. Just look them up individually in the 1973 Photofact Index.*

Needed: *Schematic for a Nond Memofax recorder manufactured by Dictofax A/S Copenhagen, Denmark. Also, need address where the recording cylinders can be purchased.*

Chris Jorgensen
41778 Fremont Boulevard
Fremont, California 94538

Needed: *Model 295-C Video Multimarker for RCA TV/FM Sweep Generator type WR-69A.*

James E. Brugh
1132 Sperling Dr.
Pittsburgh, Pa. 15221

Needed: *Schematic and assembly operating manual for the PACO Model MX-100 Multiplex Adapter.*

C. W. Linden
4268 No. Carruth Ave.
Fresno, Calif. 93708

Needed: *Power transformer with 2500-volt secondary for scope; heater winding not needed.*

Don Setliff Radio
Rt. 1 Box 2902
Culloden, W. Va. 25510 □

Signature Patterns

(Continued from page 43)

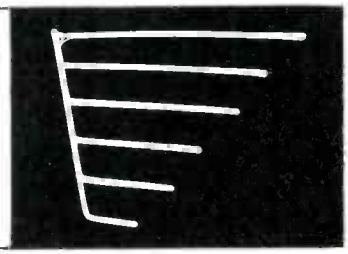
MANUFACTURER	MODEL OR CHASSIS
ZENITH 25DC56	Q101 1ST IF
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	**SIGNATURE PATTERNS**

Q801 HORIZ AFC

POLARITY NPN

SWEEP VOLTAGE 30V

BASE CURRENT 10uA



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.

Solid-State Tester

Product: Model WT2 Transistor-Diode Tester by Wayne Electronics.

Features: This instrument tests diodes and transistors both in-circuit and out-of-circuit. A set-up book is not required. Four simple-to-operate switches allow rapid analysis of a transistor or diode. Gain or beta is not measured; instead, WT2 tests for leakage, emitter-to-base and base-to-collector diode characteristics, emitter-to-collector shorts, determines PNP or NPN polarity, and identifies the type of component (silicon or germanium). Three in-circuit finger probes may be used for one-hand probing, or three clip leads are available. It is AC-operated and comes complete with test leads and finger probes.

Size and Weight: The WT2 Tester measures 6-3/4 X 5-1/4 X 3 inches and weighs 3 pounds.

Price: Wayne WT2 sells for $79.95.

For More Details Circle (50) on Reply Card

Digital Multimeter

Product: Model 8310 by California Instruments.

Features: Digital Multimeter No. 8310 has automatic ranging, polarity, zeroing, and out-of-ranges indication. The 8310 uses an up-down ranging logic which increases reading speed and provides for accurate readings. Both positive and negative DC-voltage measurements are made automatically without the necessity of reversing the input leads for negative input signals. Circuitry providing automatic-zeroing capability assures long-term stability and minimizes recalibration. Visual out-of-range indication is provided by the continuous flashing of the 3-1/2 digital display which alerts the operator when the measurement capability

(Continued on page 54)

Test Equipment

(Continued from page 53)

of the 8310 has been exceeded. The basic instrument includes AC volts, DC volts, and ohmmeter ranges. Optional accessories include AC and DC current shunts, and AC and DC high-voltage probes. The model is shielded in an all-aluminum case and has a carrying handle which can serve as an adjustable stand.

Weight: The multimeter weighs 4-3/4 pounds.

Price: Model 8310 is listed at $345.00.

For More Details Circle (51) *on Reply Card*

Volt-Ohm-Milliammeter

Product: B&K Model 120P VOM by Dynascan Corporation.

Features: The 120P offers a .25 volt DC range and a 50 micro-ampere DC current range as well as 20,000 ohms per volt sensitivity and 2% accuracy on DC. In addition, it has a resettable electronic-overload protection circuit. The meter movement is a taut-band, self-shielding annular type that helps to withstand shock and vibrations. A transit position on the range switch also protects the instrument during transportation.

Specifications: Ranges covered by the 120P are as follows: DCV: 0-1000 V in 8 ranges; DC current: 0-10 amperes in 6 ranges; ACV: 0-1000 V RMS, with 3% accuracy and frequency response of ±1 dB to 100 KHz through 50 VAC, to 20 KHz on 250 VAC range; AC output volts: 0-250 VAC in 4 ranges; ohms: Rx1, Rx100, Rx10,000; and it also reads decibels.

Size and Weight: The 120P measures 5-1/4 X 7 X 3-1/8 inches. Net weight is 3 pounds.

Price: Selling price of Model 120P is $69.95 which includes test leads, batteries and instruction manual.

For More Details Circle (52) *on Reply Card*

Pocket Calculator Kit

Product: Four-function pocket calculator kit, IC-2009 by Heathkit.

Features: This calculator is battery-powered and self-contained. It offers an 8-digit LED display with full floating decimal. A Constant key permits chain calculations. A Clear-Entry key allows removal of an entry from the display window without disturbing prior calculations. It has a plug-in keyboard and display boards, plus a complete troubleshooting section in the instruction manual making self-service easy and economical.

Price: The Pocket Calculator sells for $92.50.

For More Details Circle (53) *on Reply Card*

Yoke Adapters and Convergence Loads

Product: REDI-RACK, a yoke-adaptor package by Telematic.

Features: This product provides an assortment of yoke adaptors and convergence loads most used in color-TV service work in conjunction with any make of test jig. The package is complete with mounting boards, hooks and a complete cross-reference to thousands of color TV chassis. Free subscription for service data and reference material is available upon request.

Price: REDI-RACK package is priced at $99.10.

For More Details Circle (54) *on Reply Card*

FET Meter

Product: Laboratory and General Service Tester model 801 by the Triplett Corporation.

Features: The Model 801 FET volt-ohm-milliammeter has a low-power ohms feature for testing solid-state circuits, plus a conventional-ohms circuit for checking forward and reverse resistance of semiconductors.

Specifications: Model 801 has a sensitivity of .005 AC volts full scale at 10 Megohm input resistance. It offers 73 ranges for measuring AC-DC voltages, resistance and AC-DC currents. The meter has a 25-microamperes movement and approximately 7-1/2" scale length.

Price: Model 801 tester is priced at $210.00.

For More Details Circle (55) *on Reply Card*

"Three-Meter" Picture Tube Tester

Product: WT-333A picture-tube tester by RCA Corporation.

Features: In addition to the usual tests for shorts, leakages, and gas, the WT-333A simultaneously tests for emission, and emission-tracking with variable voltages of each gun by the use of three meters. With adapters, it can be used also to test all types of b-w picture tubes. The instrument is housed in a high-impact plastic case, and it operates from line voltages of 108 to 132 volts AC.

Price: The WT-333A picture-tube tester sells for $169.00. □

For More Details Circle (56) *on Reply Card*

Moving?

Send your new address to:

ELECTRONIC SERVICING

Circulation

1014 Wyandotte St.

Kansas City, Missouri 64105

product report

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

Motion Detector

Product: Model V220MD video motion detector by Vicon Industries.
Features: The detector is a high-sensitivity solid-state system developed to sense both dark-to-light and light-to-dark changes over the full field of a video camera display. It has a bypass mode which permits removal of the sensor from the video loop, a manual mode which remains closed until reset,

and an auto mode which automatically resets after six seconds following an alarm. An on-off switch is provided to turn off the audible alarm, yet maintains the alarm light in the on position until reset. Model V220MD also has a sensitivity setting which permits an operator to adjust proper sensitivity by rotating the knob until a null meter centers.

For More Details Circle (57) *on Reply Card*

Alarm Systems Telephone Dialer

Product: R2 Dialtronic by Mountain West Alarm Supply Co.
Features: This product permits fast, silent communication of pre-recorded alarm voice messages over existing phone line to police, fire department, or any other designated party. It responds to inputs from either fire- or burglar-alarm detectors, or both. Two channels permit the sending of separate messages for two types of emergencies. Up to 6 separate parties may be contacted on each channel. A self-contained programmer permits recording of both phone numbers

and voice messages at the owner's convenience. Battery pack provides power independently from the 115 VAC power.
Size: The heavy-guage steel box measures 12" wide x 10½" deep x 4½" high, and weighs 18 lbs.

For More Details Circle (58) *on Reply Card*

Calculator

Product: Model 370 all-electric shirt-pocket calculator by Melcor Electronics Corp.
Features: This calculator features a pressure-sensitive keyboard with "buttons" which don't move. This 8-digit readout calculator is totally designed and manufactured in the United States.

Size: The Melcor 370 measures 5-7/8x3/4" weighs only 6½ oz.
Price: Suggested retail price, including AC adaptor and 9-volt battery is $99.95.

For More Details Circle (59) *on Reply Card*

Open End Wrench

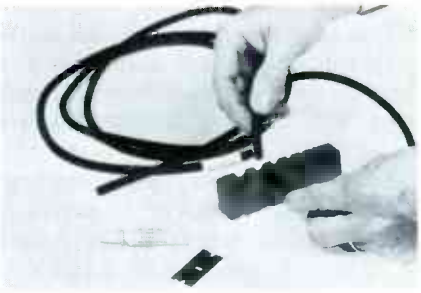
Product: Helix Wrench by John Joppas Techni-Products.

Features: This adjustable open-end wrench features a new slide adjustment located on the side of the wrench body. It is a thinner tool that permits work in places that before might have been unreachable. It is precision engineered and assembled with the body and jaw assemblies machined from stainless steel. The thumb-operated slide adjustment drives the jaw through a high-ratio work-to-bevel-to-worm gear train for easy adjustment in small increments.

Size: The nominal body size is rated at eight inches and jaw adjusts continuously from 0" to 15/16".
Price: Price of the wrench is $10.95.
For More Details Circle (60) *on Reply Card*

"O" Ring Kit

Product: Model ORK-3 Kit from Oneida Electronics Mfg., Inc.
Features: "O" ring belts of almost any practical size can be produced from the kit. This is said to eliminate downtime while awaiting replacement belts and to minimize the stocking of large quantities of exact-replacement sizes. Included in the kits are an assortment of 40 feet of the five most-popular sizes of Nitrile (Buna N), which has good resistance to the action of oils, gasolines and acids. Four diameters, 1/16 inch to 1/4 inch, are supplied, all having an alignment stripe. The Super Instant-Weld adhesive furnished is said to have rapid-bonding and high-strength. Also included is a universal jig for



making butt or 45-degree joints.
Price: The ORK-3 "O" Ring Kit sells for $19.95.
For More Details Circle (61) *on Reply Card*

Disaster Alarm Kit

Product: Disaster Alarm Kit by Radio Shack.
Features: This alarm detects gas and smoke by a sensing semiconductor which activates an alarm buzzer. It detects natural gas, methane gas, carbon monoxide, iso-butane or any of the ionized gases and smoke in any area where there is any possibility of a potentially-dangerous gas leak. The kit comes with easy-to-follow assembly instructions and a decorator-styled white plastic case.
Size: The size of the kit is 4x7¼x2".
Price: The cost is $19.95.
For More Details Circle (62) *on Reply Card*

No-Noise Kit

Product: Archer Car-Stereo Noise Eliminator Kit No. 270-020 by Radio Shack.
Features: The Archer Car-Stereo Noise Eliminator Kit helps eliminate alternator whine and ignition noise from your car stereo tape player or FM radio. It is also effective for stopping noise on CB radios, VHF monitors or other auto-radio installations. Special tools are not required for installation of the kit, which consists of a choke coil and capacitor.
Price: Radio Shack Kit No. 270-020 is priced at $1.69.
For More Details Circle (63) *on Reply Card*
(Continued on page 58)

(Continued from page 57)

Work Benches

Product: Models A, B and D by Bay Products Division.

Features: Legs and cross members are one-piece channel formed, made from heavy-duty 13-gauge steel. Arc welding of all parts creates a rigid structure which can withstand hard use and maximum loading without anchoring to the floor or wall. U.S. Plywood fibre-face Novoply provides a 1½-inch one-piece, pre-drilled top with two smooth work surfaces (called the Economy work top), and will support 400 pounds-per-square-foot. All metal parts are phosphatized against rust and finished in gray baked enamel. Hardware and assembly instructions are included.

Sizes: Available in 4-foot, 5-foot, and 6-foot widths; 24-inch, 30-inch and 36-inch depths. Standard bench height is 30 and 34 inches; adjusting channels provide one-inch height adjustments up to 3 inches. Model "A" includes top, legs and stringer; Model "B" adds a 12-inch shelf; and Model "D" has a 12-inch shelf, edgeboards and a 14-inch X 20-inch ball-bearing drawer.

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

Paste Solder

Product: Multicore Paste Solder XM 27.298 by Multicore Solders.

Features: This solder paste contains high purity, low oxidation state, 60 Sn/40 per-alloyed solder powder suspended in a formulated activated rosin flux which prevents flux and solder segregation. The material functions as a fluid preform and can be pre-placed in controlled amounts and shapes with adhesion of the solder and flux to the component parts. It can also be used as a temporary adhesive to hold parts in place during processing. It is supplied in a syringe for ease in application.

Size: The solder is available in 500 gm plastic jars and 25 gm refillable syringes.

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

Transistor/Capacitor Removal Aids

Product: Quick Picks by GC Electronics.

Features: This set of seven tools comes in a plastic carrying case. The tools fit over 25 different outlines of transistors or can capacitors. The magnetic tools leave hands free to desolder leads, and they are color coded for easy selection.

Price: $9.95 is the suggested retail price.

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

Got A Troubleshooting Tip?

If you've recently run across an unusual trouble symptom, send a thorough description of it and the solution to:

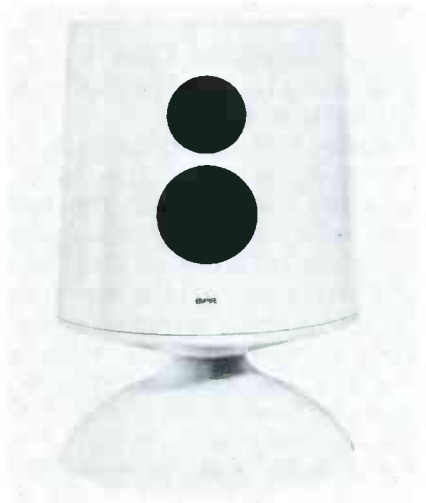
Troubleshooting Tip,
Electronic Servicing
1014 Wyandotte St.
Kansas City, Mo. 64105

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.

Indoor-Outdoor Speakers

Product: Jupiter Series Speaker Model 6500 by the Empire Scientific Corp.
Features: Jupiter Model 6500 is a 3-way speaker system with a down-facing woofer and wide-angle-lens



pedestal. Because the enclosure is made of Uniroyal Rubicast and has weatherproofed drivers, the Jupiter can be used outdoors as well as indoors.
Price: Jupiter Series Speaker Model 6500 has a list price of $139.95.
For More Details Circle (67) *on Reply Card*

Microphone Floor Stand

Product: Model MS-50 microphone floor stand by Atlas Sound, a division of American Trading and Production Corporation.
Features: Model MS-50 features the Atlas Sound wear-proof grip-action clutch. It also has a scuff-resistant steel base with protective pads and anti-tip provisions for stability. To prolong an "as new" appearance, the stand-base and the lower half of the cold-rolled steel tube assembly are color-coordinated in gloamed black, and the upper tube is chrome-plated. Each stand has a lifetime guarantee and is packaged complete in a unit-pack carton.
Size and Weight: The MS-50 has an adjustable height from 35 inches to 63 inches and a base size of 14-1/2 inches. It weighs 6-1/2 pounds.
Price: Model MS-50 has a retail net price of $8.75.
For More Details Circle (68) *on Reply Card*

Bulk Eraser

Product: Model QM-211 bulk eraser by the Recorder-Care Division of Nortronics Company, Inc.
Features: Model QM-211 bulk eraser generates a 60-Hz magnetic field which will completely erase recorded reels, cassettes and 8-track cartridges of up to 1/2-inch tape width. The unit features a sensitive Microswitch that is activated with fingertip pressure and de-activated as soon as the eraser is put down. This function provides a safe-guard that prevents burn-out by accidently leaving the eraser in the "ON" position. Styling is both

functional and practical. The easy-to-hold housing is made of unbreakable Cycolac™ Other features include a coiled power cord and detailed instructions for proper use.
For More Details Circle (69) *on Reply Card*

Tape Storage Cabinets

Product: Models BS-T and BS-C by The Duotone Company.
Features: The BS-T 8-track and the BS-C cassette cases have wood-grained sides and top panels with red-cushioned interiors to protect the tapes. The front panels have the look of rare book bindings and are gold-stamped on soft leather-like material.
(Continued on page 60)

Audio Systems

(*Continued from page 59*)

The bookcase storage units are available in brown, black, maroon or green.

Prices: Model BS-T 8-track case retails for $12.95 and Model BS-C cassette case is priced at $12.95.

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

Four-Channel Headset

Product: Four-channel quadriphonic headset from the Mura Corporation.

Features: This headset has cushioned earpads and headband and is lightweight. It has four mylar cone speakers for full frequency response and a stereo 4-channel switch which allows the listener to use the same headset for either stereo or quadriphonic sound of

tonal quality. The set includes a 10' coiled cord with color coated plugs for easy identification.

Price: The headset is priced at $19.95.

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

Speaker System Kit

Product: Archerkit 10" Speaker System from Radio Shack.

Features: This kit may be assembled with a screwdriver, pliers, and a soldering iron. The three-way system has a bass-reflex type enclosure constructed of 3/4" hardwood with a 10" woofer, cone-type 6" midrange, 3-1/4" tweeter, and electrical crossover. Impedance is 8 ohms. Response is given as 40-18,000 Hz; power capacity, 40 watts peak.

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

Alignment Tape

Product: AT-120 alignment tape by Nortronics Co., Inc.

Features: This tape is designed for all ¼-inch, reel-to-reel tape recorder/players, and has 7.5 IPS full-track master recording with equalization and levels in accordance with NAB standards. It features tones necessary to maintain recorder performance such as head azimuth, recording level, frequency response, tape speed and drive flutter. Concise instructions are supplied.

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

Phono Cables

Product: Compact "low-profile" phono plug cable by Switchcraft, Inc.

Features: These cables are designed with a right-angle configuration and option of short (3/32-inch) and long (17/32-inch) handles giving the technician versatility in selecting a plug which suits his connecting applications. The cables are available with a choice of high-quality phenolic, nylon, glass-filled teflon or polypropylene insulation; molded tenite butyrate handles. They come in a choice of ten colors.

Size: Any practical length can be specified for cables up to .200-inch diameter, including RG types. Each system measures 14x22x9".

Price: The unit sells for $49.95.

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

Tape Deck

Product: 494 Four- and Two-Channel Three-Head tape deck by Radio Shack.

Features: It records and plays four separate channels for quadriphonic performance and is also compatible with conventional stereo equipment. This tape deck features four recording level meters with individual controls, as well as a master recording-level control, separate four- and two-channel record buttons, and switch selection of 7-1/2, 3-3/4 and 1-7/8 IPS tape speeds. Three heads and a tape-monitor switch allow instant A/B comparison of source material with the recorded signal. Tape-bias switch selects either standard or low-noise tape, and preamp level controls allow you to adjust output level to match other components in your system without having to readjust system volume when switching between program sources. The unit has four front-panel microphone jacks and jacks for standard stereo or four-channel headphones.

Price: The tape deck is priced at $229.95. □

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

Send Your Own Photo-Tip To The Editor Yes— We Pay

antenna 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-UHF Line Amplifiers

Product: Models LE-215, LE-225, LE-285 and LE-485 by the Winegard Company.

Features: The four LE-series line amplifiers are designed to overcome problems caused by long trunk lines and remote antenna installations. They add signal gain in the trunk line where it is needed most. Model LE-215 amplifies VHF signals +15 dB and UHF signals with negligible loss. It also features a built-in 3 dB tilt compensator to correct for the nonlinear

attenuation characteristics of coaxial cable. The LE-285 amplifies VHF +15 dB and UHF +18 dB and has a built-in tilt compensator. The LE-485 amplifies UHF signals an average of +18 dB, and passes VHF signals without gain. The high-input level, good VSWR and low-noise allow a large number of these to be cascaded if necessary to overcome extra high losses. Model LE-225 amplifies VHF channels 2-13 an average of +25 dB and has a UHF by-pass. It features a 10 dB continuously-variable gain control and a 5 dB variable-tilt control for precise adjustment of signals in systems with cascaded amplifiers. These features are especially needed for good color TV reception. Models can be used separately or combined.

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

Distribution Amplifiers

Product: All-channel UHF-VHF distribution amplifiers, models 1021 and 1031 by Kay-Townes Antenna Company.

Features: Model 1021 has a 25-db VHF and 33-db UHF gain with an average match of 14 db at both inputs and output. Output capability exceeds +56 dBmv and +51 dBmv. Model 1031 features high UHF gain at +41 dB and +33 dB at VHF designed to meet most difficult or fringe-area MATV system applications. The two models are protected from static lightning by dual-diode and shunt-coil circuitry.

Price: Model 1021 is priced at $118.00 and model 1031 is priced at $157.00.

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

Band-Pass Filter

Product: Catel BPF-2000 band pass by Catel.

Features: It offers an advanced hi-pass/low-pass design television filter where high attenuation of adjacent channels is important. It features eight or ten pole design,

high-Q inductors and high-quality capacitors, and also provide upper adjacent sound-carrier rejection of -45 dB and lower adjacent picture-carrier rejection of -50 dB. Designed for rack mounting, it has a rugged enclosure of extruded aluminum which supports the glass epoxy printed circuit board and fully protects all circuit elements.

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

Mini-State Antenna System

Product: Miniaturized solid state UHF/VHF outdoor home TV antenna by RCA.

Features: Model 5MS440 is a remotely controlled, rotatable antenna system which has a preamplifier with interference filters. The antenna array is mounted on a circular platform that can be electrically rotated 360 degrees. The entire mechanism is encased in a "radome" that is only 21" in diameter and 7" high.

Size: The total weight of the antenna system is less than 6 lbs.

For More Details Circle (79) *on Reply Card*

TV/FM Antennas

Product: Super VU-Finder TV/FM all channel antenna by Jerrold Electronics Corp.

Features: The antenna is made of heavy gauge aluminum with a golden armor coating to minimize corrosion. It uses positive-locking fold-out elements, a single U-Bolt mast-locking assembly and center-of-gravity balance. Each VU-Finder has a high vertical-capture-area UHF corner-reflector Yagi with a VHF Paralog, providing high gain, sharp directivity, high front-to-back ratios and a match on all UHF, VHF and FM channels. Each antenna line is electrically grounded to the mast. There are six models available.

For More Details Circle (80) *on Reply Card*

Yagi Antennas

Product: Single-channel yagi TV and FM antenna by Blonder-Tongue.

Features: The EY series which includes thirteen models, is designed for areas where the viewer is located between several TV stations with signals coming from different directions. It features wideband, 6-MHz response to ensure good reception. Gain is 7dB over a tuned dipole and the double-fold 300-ohm driven element provides an exact match to the downlead and to mixing networks or preamplifiers. It provides front-to-back ratios as high as 16 dB and beam widths which range from 56 to 65 degrees.

For More Details Circle (81) *on Reply Card*

Antenna Mast

Product: "Golden Duratube" telescoping antenna mast by Channel Master.

Features: This mast is constructed of a process steel which is bonded inside and out with oxide primer and is then over-coated with a golden acrylic finish that stays clean and resists corrosion. Its contoured guy rings eliminate sharp, wire-fraying edges.

Size: "Golden Duratube" comes in 20, 30, 40 and 50-foot lengths.

For More Details Circle (82) *on Reply Card*

Indoor TV Antenna

Product: "Rocket" TV mounted antenna by Saxton Products, Inc.

Features: This antenna features 4-section brass dipoles mounted on ball-swivel joints to enable positioning in all directions. Dipoles can be concealed when not in use. It is designed for flush mounting to the back of the cabinet of any TV set and comes fully assembled with lead-in wires and terminals. Mounting screws and instruction are included with each polybag-packed unit. □

For More Details Circle (83) *on Reply Card*

catalogs literature

Circle appropriate number on Reader Service Card.

104. The Mura Corporation—has an information brochure on low-voltage low-current miniature lamps. The four-page brochure contains photos, diagrams, and complete specifications for such "Muralites" as standard lamp assemblies, Bi Pin assemblies, lens caps, fuse type, pigtail type neon, and high-brightness lamps.

106. Nortronics Company, Inc.—has available the 2nd Edition of their Design Digest for Digital Magnetic Recording Heads. It contains over forty pages of technical and applications information, and is illustrated with photographs, diagrams, tables, graphs and circuit diagrams. Also, the product section is supported by full specifications and mechanical drawings showing dimensions in both inches and millimeters.

108. Jerrold Electronics Corp.—explains the patented Jerrold J-Jacks system which permits distribution of UHF, VHF, FM, closed circuit video, and audio signals simultaneously throughout a school or hospital. They also have 2-way signal-carrying capability. The circuitry is on modular plug-in units, providing flexibility in modifying the function of a particular outlet by plugging in a new module. The 12-page brochure covers the designs and installations of J-Jacks systems.

109. Kole Enterprises, Inc.—has announced a 1973 "Factory-To-User" catalog of corrugated bins, accessories and business equipment. Included are 32 sizes corrugated stock/parts bins and accessories, many varieties of flat and vertical storage, transfer and magazine files and shipping cartons. Special features include big bins, stacker bins, kolor koded totes and mini-kor file folders, made of a very fine miniature corrugated material. Also shown is a selection of steel shelving and other related business equipment.

112. RCA Parts and Accessories—is distributing a 12-page brochure illustrating the various cables and adapters used with the RCA Industry Compatible Test Jig (ICTJ) Program. RCA Color TV Test Jigs can be used to service color TV sets of 41 manufacturers. An RCA ICTJ cross reference chart listing all the cables included in the program by description and numerical order is supplied with the brochure.

113. Raytheon Company—introduces a pocket-size guide about the "Sizzling 66" line which provides direct replacement for over 5000 solid-state components in foreign-made TV's, stereos, AM/FM radios, tape decks and cassette players. Each foreign semiconductor is listed along with its Raytheon RE replacement. The guide also contains specifications, outline drawings, and terminal arrangements for each RE unit.

114. Russell Industries, Inc.—has available a 9-page catalog No. AC-73 giving some illustrations for antenna rods and assemblies plus an application chart. A cross-referenced center foldout lists replacement rods for portable AM/FM radios and TV's walkie-talkies, indoor FM, UHF, automobiles and scanners.

115. Simpson Electric Company—features a complete line of instruments in a new 16-page catalog No. 369. The instruments include digital - electronic counter / timers, digital VOM's, solid-state electronic multimeters, a variety of miniature strip chart recorders, multi-range chart recorders, an RLC Bridge, low-cost secondary standards, multi-range precision milli-

ohmmeters, and multi-range DC standards.

116. Sprague Products Company—has released a 52-page Semiconductor Replacement Manual K-500. Containing over 30,000 OEM part numbers listed alpha-numerically which can be replaced by Sprague's new line of 82 popular semiconductor devices, the manual also includes performance characteristics, outline drawings and pertinent parameters for the entire Sprague line.

117. Winegard Company—has released a newly-revised consumer products catalog No. CP-2. The 24 pages contain illustrations and descriptions of more than 230 products. Included among the products are TV and FM antennas, preamplifiers, couplers, band separators, and wire.

118. Winegard Company—No. 109 is a 36-page commercial products catalog. Illustrations, descriptions and specifications for over 250 products are presented. Some products listed are Ultra-Plex strip amplifiers, power panels, splitters, drop taps, line amplifiers, and tilt compensators. Commercial systems equipment for MATV, CCTV, ITV, ETC, CATV, NATV, and Sub-Channel are also covered.

119. Xcelite, Inc.—has available a new product bulletin which contains complete information, including prices, on their attache-style tool case, Model TC-200/ST and another model, TC-100/ST. Described and illustrated are the case and assortment of tools for each model, dimensions and design features, plus suggested uses for the pockets and extra tool space provided in each case. A description and model number for each tool furnished with the tool kits is furnished in tabular form.

120. Mallory Distributor Products Co.—has available a brochure concerning security products which include smoke/fire alarms, car alarms, closed-circuit alarms, personal alarms and ultrasonic alarms. This brochure, 9-654, covers over 45 security products and accessories.

121. Watts Business Forms, Inc.—has a revised 1973 edition of the Watts Stock Business and Tax Forms catalog. It features newly designed forms with B-color custom-look printing at stock-form prices, custom-design letterheads, business cards and forms for every industry and use.

122. JSH Electronics, Inc.—is distributing a price list for communication tubes which includes special purpose tubes, cathode ray tubes, receiving tubes and solid state tube replacements. It covers major brands and is eight pages long.

123. Vaco Products Co.—has available a 16-page publication illustrating a selection of screw-holding drivers, nut drivers, reversible drivers, offset drivers and many more. This brochure of tools and "fixin' things" is numbered SD-168.

124. Mountain West Alarm Supply Co.—has in stock M-73, an 80-page catalog which describes 400 intrusion and fire-alarm products, many of which are UL listed. It features 8 pages of "application notes" for alarm equipment with some information on general-alarm systems.

125. General Electric Co.—has available a bulletin, GEA-8429A, describing the type AK-4 and AK-5 hook-on volt-ammeters for testing maintenance of alternating current circuitry. □

ELECTRONIC SERVICING

is **your** magazine!

If you would like to see an article about a particular subject directly related to servicing consumer or communications electronic products, send us your suggestion.

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. FS, 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

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

"BUILD A PRECISE AC VOLTAGE SOURCE for calibrating scopes and meters, with parts from junk box. Complete plans $2.00. Total Electronics, 27 Sunrise, Hawthorne, N.J. 07506." 6-73-3t

YEARLY SUBSCRIPTIONS, Radio Electronics $5.00, Popular Electronics $3.50, J.E.I., $26.00, TV Guide $5.88. Pollock Publications, Little Silver, N.J. 6-73-1t

B & K 415, SWEEP/MARKER GENERATOR. new $310.00; 1 pay shipping. Young's TV, P.O. Box 17007 Holladay, Utah 84117. 6-73-1t

PICTURE TUBE REBUILDING MACHINE by Lakeside, make offer. R. L. Nelson, 3602 Mt. Aclare, San Diego, Calif. 92111. 6-73-1t

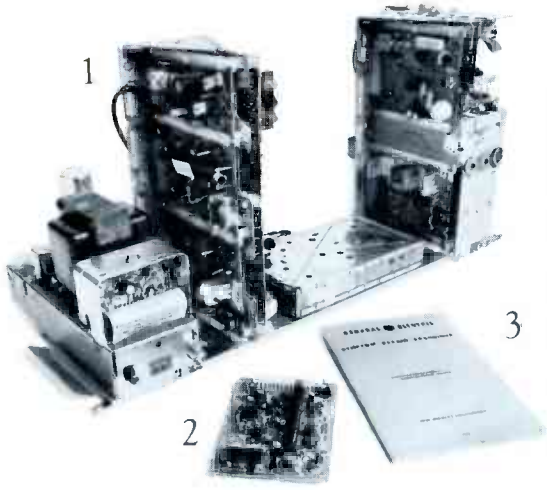
TRANSISTOR TESTER in/out circuit, attaches to any scope (no rewiring) saves valuable service time, no guess work. Simple instructions on how to build from spare parts. Send $3.00 and self addressed stamped envelope. No C.O.D.'s, please. J. Electronics, P.O. Box 5142, Beaumont, Texas 77702. 6-73-2t

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

We're making it our business to make your business easier.



We've made the commitment to make General Electric the most serviceable TV in the industry. We began by bringing in panels of independent service experts to tell us how. And we listened. These are some of the results:

1. A CHASSIS STANDARDIZATION PROGRAM. The more standard chassis we make, the fewer you have to familiarize yourself with. So we're building more standard chassis. For example, our J chassis can be found in 19, 16 and 10-inch diagonal screen sizes.

2. GE's MODULAR SOLID-STATE SETS SERVICE LIKE TUBE SETS. They're designed for one-call service in the home; and, believe it or not, are easier to service than a tube set. Also like a tube set, you can actually trouble shoot the problem while the set is operating. Then you have a choice. Either change the module or repair it.

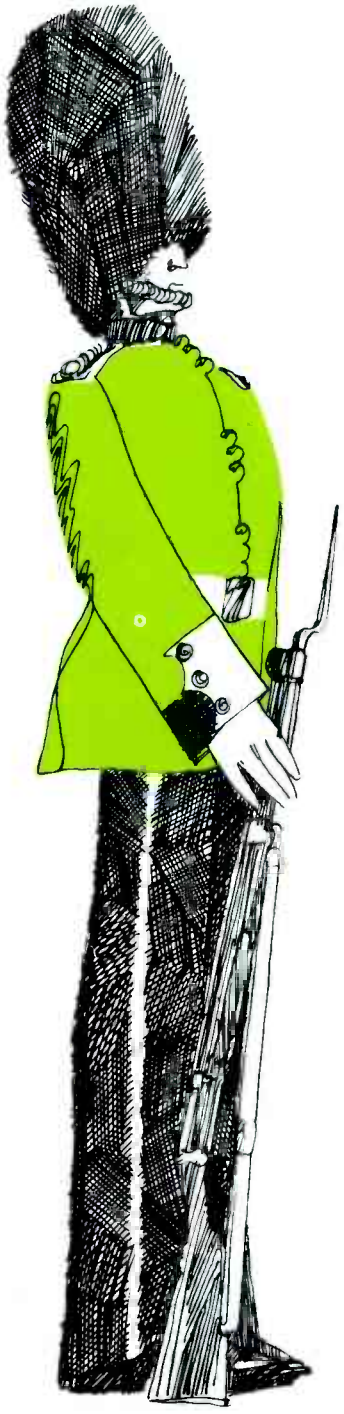
3. AN STC PROGRAM DESIGNED TO TAKE THE "TOUGH" OUT OF "TOUGH DOG" SERVICE. The "S" stands for Symptom Repair Manual. It lists 60% of all faults and how to find them. The "T" stands for Trouble Shooting Flow Charts. These charts will take you through the next logical sequence of checks to find unlisted faults. These two service aids are designed to cope with 95% of all GE television problems. They were created to keep you from getting to "C"—time consuming Circuit Analysis.

4. A SERVICEABILITY DESIGN AWARD COVERING THREE CHASSIS. All three received a 90%+ NEA serviceability rating. And all three have special design features. Like modules, plug-in transistors and replaceable main circuit boards. The compact portables can be opened like a book for servicing.

There's a lot more. For additional information about the STC Program or any GE service question, call collect or write: "Dutch" Meyer, General Electric, Portsmouth, Va. (703) 484-3521.

4

GENERAL ELECTRIC



24 hour watch

Everyday. All over the world. On millions of television sets, our sentry stands. The new Littelfuse Circuit Breaker. Meeting industry's new safety requirements of SE-O insulating materials, our breaker is demanded by virtually all set manufacturers. It's the perfect replacement part too!

Contact your nearest Littelfuse source. He'll show you the 19 available models with a variety of packaging choices.

24 hour watch. All over the world. It's a big assignment. But the Littelfuse Sentry is one of television's brightest stars.

LITTELFUSE

Littelfuse, Inc. Subsidiary of Tracor, Inc.
800 E. Northwest Highway, Des Plaines, Ill. 60016

For More Details Circle (3) *on Reply Card*