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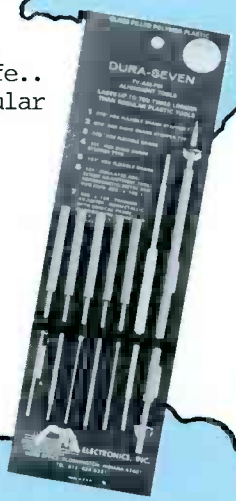

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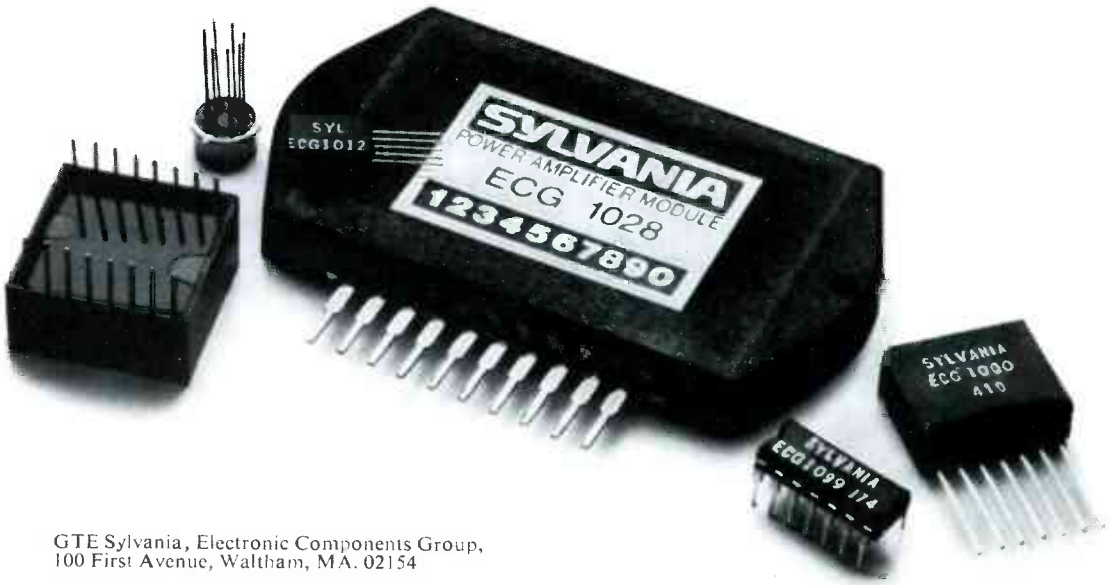

GTE Sylvania, Electronic Components Group,
100 First Avenue, Waltham, MA. 02154

November, 1974 □ Volume 24, No. 11

Electronic Servicing®

in this issue...

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news of the industry

Magnavox Company is resorting to the courts to get the kind of protection from Japanese television sets it has not been able to get from the U.S. Treasury, reports **Merchandising Week.** Magnavox and Zenith brought the original complaint in 1972, insisting that Tokyo unlawfully helped Japanese electronics firms crack the U.S. market (by handing out export subsidies that are banned by the General Agreement on Tariffs and Trade). Magnavox wants Washington to retaliate with an extra import duty to help wipe out the effects of the Japanese market. So far, the Treasury has failed to act, so Magnavox has filed in the U.S. District Court in Washington, asking that the Customs Bureau be ordered to add the counter-tariff.

Federal minimum standards for warranties on all kinds of consumer products, appears certain to become law this year. This legislation also includes expansion of Federal Trade Commission powers over business, which would allow the FTC to police even some local business operations. Federal standards defines a warranty as any undertaking in writing which agrees to refund, repair or replace any product which fails to meet specifications set forth in the sale of the product. The supplier of a warranty must disclose in writing whether the warranty is "full" or "limited". No warranty could be identified as "full" unless it promised repair, replacement, or refund to remedy defects. Any other type of warranty is a "limited" one. **Home Furnishings Daily** also reports that the identity of the supplier and purchaser of the warranty must be established, what the supplier will do to honor the warranty, what the consumer must do to secure fulfillment of the warranty, and what legal remedies are available to a dissatisfied customer.

Muzak Corporation plans to use satellites to beam recorded music to thousands of small earth stations, if tests under way prove successful. Four channels, one for each continental U.S. time zone, will be sent to the satellites for broadcast across the country. Receivers atop subscriber buildings will be tuned to one of the channels. A four-foot-diameter antenna, low-noise receiver, and down converter were mounted on a balcony of the Waldorf-Astoria in New York when the system was demonstrated. A signal was beamed to the satellite from RCA's ground station in Valley Forge, Pennsylvania.

The Anode, official publication of the Television Service Association of Arkansas, was selected from thirty other publications as the "Outstanding State Association Publication" at the NESDA convention in Hawaii.

Bert Wolf, who has contributed several articles to Electronic Servicing, has been named vice-president and general manager of the Distributor Sales Division of Jerrold Electronics Corporation. Wolf, a pioneer in both MATV and CATV, has been with Jerrold for 21 years.

Photo courtesy of Jerrold Electronics.

(Continued on page 6)

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Marvin Kramer, president of RCA Sales Corporation, reportedly is scheduled to be elected president of RCA Distributing, according to **Home Furnishings Daily**. Kramer's post reportedly will be abolished, and William E. Boss, vice-chairman of the Sales Corporation, will continue to head that organization. Another change in the company's electronics marketing organization, is the transfer of **Fred Darby**, vice-president of national accounts, to Kansas City, as manager of the RCA Distributing Company branch.

Greater productivity offers the most direct route to new and better products, less inflation, and more jobs, RCA Chairman Robert W. Sarnoff told the 30th International Convention of the International Brotherhood of Electrical Workers in Kansas City recently. He said conditions are now ripe for American companies that manufacture goods abroad for sale in the U.S. market, to move their operations back home. "Many formerly attractive foreign operations are now becoming more costly and less efficient than manufacturing at home," said Sarnoff.

The price tag of $70 million for Philco-Ford's domestic and international home electronics business, reportedly was the reason negotiations were terminated between Ford Motor Company and General Telephone & Electronics. According to **Home Furnishings Daily,** the talks ended in early August.

Zenith Radio Corporation seeks $900 million in damages, and a permanent injunction against 21 firms named in violations of U.S. antitrust laws and the Anti-dumping Act of 1916, reports **Home Furnishings Daily.** Twenty Japanese firms plus Motorola, Incorporated, have been charged. Motorola was named as aiding in the alleged conspiracy by selling its television manufacturing operation to Matsushita Electric Industrial earlier this year. Zenith's suit alleges the defendants engaged in unlawful combination in restraint of U.S., foreign, and interstate trade, and in a conspiracy to monopolize such trade.

North American Philips of Holland is now virtually in control of Magnavox, according to financial analysts, reports **Home Furnishings Daily.** While 56 percent of Magnavox's outstanding stock has been tendered, (which gives Philips control), Philips needs 80 percent to issue consolidated financial statements and gain various tax advantages. **HFD** reports that Philips, the largest consumer electronics manufacturer in the world, plans to build Magnavox into a dominant factor in the U.S. home electronics business. □

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SYMCURE

Symptoms and cures compiled from field reports of recurring troubles

Chassis—Curtis Mathes CMC-51
PHOTOFACT—1346-1

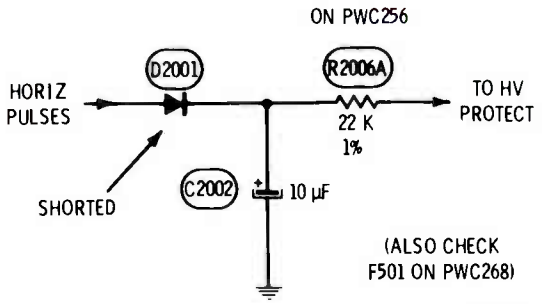


FIG. 1

Symptom—Snowy picture, reduced height, and low brightness
Cure—Check D2001, and replace if shorted. Also, check fuse F501 and replace if open

Chassis—Curtis Mathes C-51
PHOTOFACT—1346-1

Remove connector EE3 from power supply module PWC228. Connect a 140-ohm 150W resistor between EE3 and EE4 (ground). Jumper the base of TR603 Error Amp to ground. With line voltage of 120 volts, connect voltmeter from EE3 to ground and adjust VR602 Bias control for a reading of +125 volts. Remove jumper and adjust VR601 Voltage control for +112 volts. Remove test resistor and re-install EE3 connector.

Symptom—HV Protect activates falsely (no sound-no raster) with weak signal or between stations
Cure—Adjust +112 volt supply, as given

Chassis—Curtis Mathes CMC-51
PHOTOFACT—1346-1

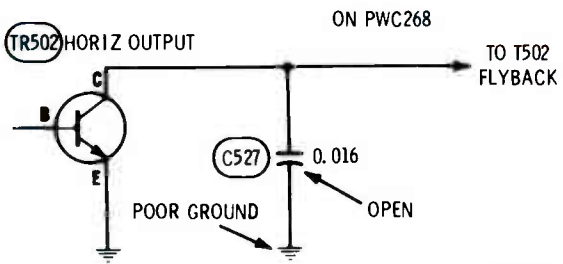
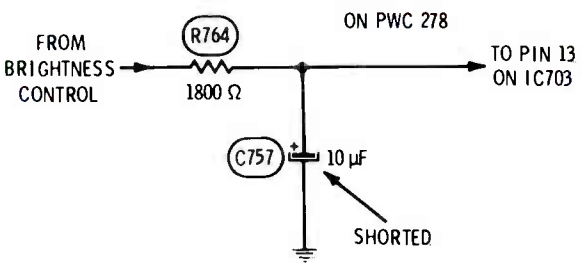


FIG 3

Symptom—Horiz output transistor fails periodically
Cure—Check C527, and replace if open. Also, check for bad ground at C527

Chassis—Curtis Mathes C-51
PHOTOFACT—1346-1



Symptom—Right half of lines missing in service position
Cure—Check C757, and replace if shorted

Chassis—Curtis Mathes C-51
PHOTOFACT—1346-1

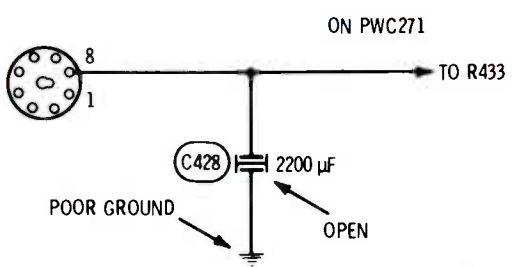


FIG 5

Symptom—Reduced height
Cure—Check C428, and replace if open

Chassis—Curtis Mathes
PHOTOFACT—1346-1

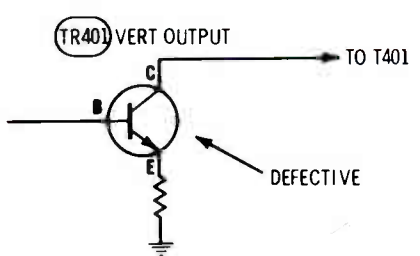


FIG 6

Symptom—Compression at bottom of picture
Cure—Often caused by a defective TR401 output transistor. JAN code 3-1 and later recommended

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James F. Beckham
120 Spring Street
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Needed: *Instruction book and schematic for a Hickok 0510, AF/RF oscillator. Will buy, or copy and return.*

Harold Elwood
517 Melrose Avenue
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Needed: *Instruction manual for Weston Selective Analyzer, model 665.*

Henry Rosenblatt
603 Commonwealth Avenue
Newton, Massachusetts 02159

Needed: *Record index size sensor for Sears/Silvertone changer, chassis number 528; numbers on turntable are 34611 and 5-7978K. Also need good used flyback for Philco chassis 18QT85, part number 32-10079-1 294, and IF coil for Philco antique AM-SW radio model 89, code 123. Also source for antique radio parts.*

Don Setliff Radio
Route 1, Box 2902
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Needed: *Schematic, service literature, parts availability, or any information on Westinghouse TG30 C17A audio/visual recorder made by Ikegamic Electronics of Long Island City, New York.*

Tom Zwinger
TZTV
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troubleshootingtips

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Vertical problem from HV regulator General Electric C-1 chassis
(Photofact 1100-2)

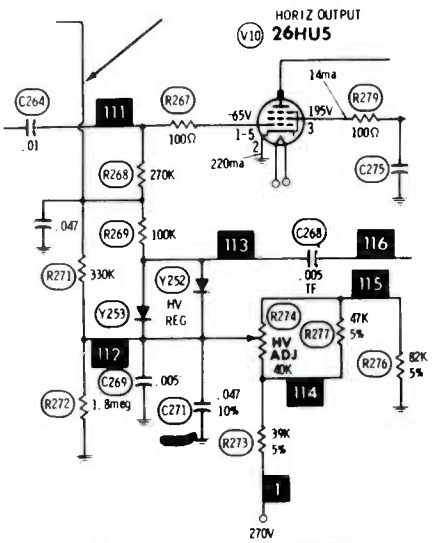
The customer complained of insufficient height and poor vertical linearity. When I tried the height and linearity controls, I found almost no effect from the linearity control. The control is supposed to vary the amount of negative voltage at the grid of the vertical-output tube. However, there was no negative voltage at the hot end.

I traced the wiring and components from that point and finally reached the HV regulator circuit which, also, was not operating. Negative voltage from the regulator is used to supply the vertical-linearity control.

After a few ohmmeter tests, I found Y252 diode was open. (Some sets have two in parallel, apparently to lessen the chances of an open diode.)

Replacement of the diode restored the HV regulation and allowed the vertical-lineary control to vary the linearity in the usual way.

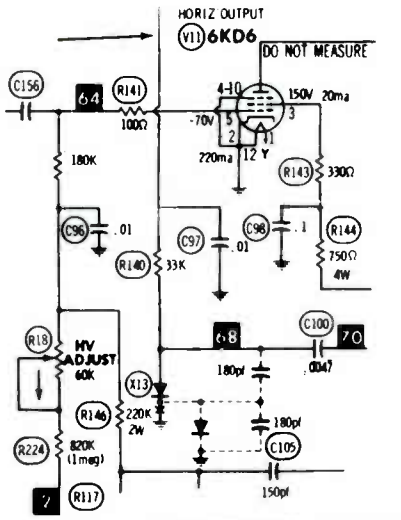
G. Hauber
Raleigh, North Carolina



Brightness problem from HV regulation?
Admiral K16 chassis
(Photofact 1204-1)

Brightness was excessive, and adjustment of the brightness control made very little change of brightness.

Analysis of the grid and cathode voltages of the picture tube suggested that the brightness problem originated in the video circuit. The 6AF9 grid was much too positive, and the voltage changed little from adjustment either of the brightness or the master-brightness controls.



Tracing the circuit, I found the negative voltage for the master brightness was supposed to come from rectification by X13 of horizontal pulses. At first, I presumed this was part of the HV-regulator circuit (as it was in the General Electric problem I described before), but a more careful look at the schematic showed another circuit with VDR R117 was used for HV regulation.

Additional testing in the X13 circuit proved that X13 was shorted, and a new one reduced the brightness to normal.

G. Hauber
Raleigh, North Carolina

Intermittent picture and sound Zenith 12B8C15 chassis
(Photofact 1165-2)

Both picture and sound would be lost after the receiver had been operating for a few minutes. This hinted of a thermal problem, perhaps in one of the transistors.

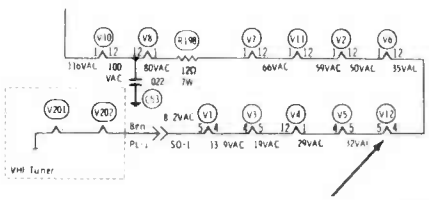
After the trouble started, I injected a signal at the input of the IF's, using a B&K 1077B. The

signal failed to come through. I went through the IF stages, but still no signal. AGC voltages were a little off, but not enough to cause a total loss of signal.

Much later, I noticed that, when the trouble started, some of the heaters in the series string became darker. Measuring the voltage drop across the heaters, I found an abnormally-high voltage across the heater of V12.

The problem was cured when I resoldered pins 4 and 5 of the V12 socket.

Eugene Meyer
St. Cloud, New Mexico



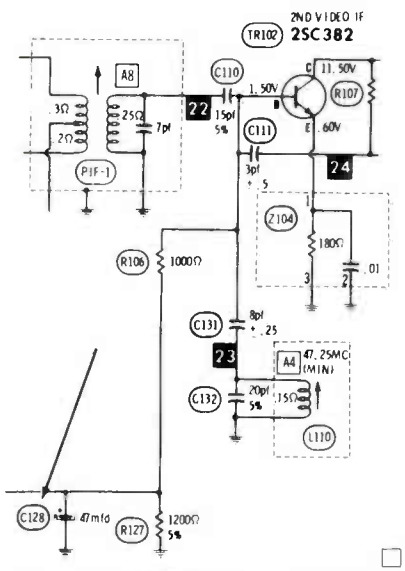
Overload and vertical lines Sears 562.10481
(Photofact 1107-2)

The symptoms were an overloaded, negative picture with six snivet-type lines on the left edge of the screen. Snow off channel was normal, and reception of weak signals was good.

A11 AGC voltages checked okay, and bridging the bypasses in the AGC circuit proved fruitless until I tried C128.

Replacement of C128 eliminated all the symptoms.

Edgar B. Hurston, Jr.
Hartford, Connecticut



Wife to widow in five easy steps

By Joseph Arkin

Many businessmen have changed the old adage of "All work and no play makes Jack a dull boy" to read "All work and no play makes jack." We might add that "All work and no play makes Jack's wife likely to become a widow."

If you have not yet applied for membership in the Coronary Club, you can do so (and begin qualifying your wife for the Widow's Auxiliary) by imitating the following characters.

Workhorse

You should become a workhorse by trying for success in the shortest possible time, and put work ahead of all personal considerations. Stay at the office or shop evenings, Saturdays and holidays. Or, at least take work home with you each night; that's a good way to keep fresh the worries of your working day. Also, stay up late working every night, because too much sleep might dull your senses.

Never say "No" to a request, no matter how "beat" you are, and don't ever delegate responsibility. You're the only one that can be counted on, so carry the ball at all times. Also, it's a poor policy to take a vacation; think of the lost business!

Weekend Athlete

It's far easier to kill yourself by having a good time than you might realize; especially if you've spent all week doing non-strenuous work. Join the thousands of others rushing to the "happy hunting grounds" by lifting weights, running a mile or two before Sunday breakfast, or by indulging in a fast game of basketball, handball, or touch football with the kids. If you feel that lack of supervised exercise is the reason for that spare tire around your middle, join a 3-hour calisthenics class at the local gym. But be sure you indulge only on the weekends.

Jet-Setter

When you travel, make sure you wear yourself to a frazzle. One way is to get up at the crack of dawn, drive to the city for a seminar or a day buying sets or parts, then drive until midnight getting back home, spending those tiring hours to save a few bucks on motel charges. If you should take a vacation, drive all day and half the night. Then on the last day, take a pill and lots of coffee and drive back home, even if it takes until 7 AM.

"NO. I'M SURE IT HAS NOTHING TO DO WITH WATERGATE."

Driver's Education

When you drive, make sure you teach all others a lesson on how to drive. Your motto should be: "I'll teach those dopes!" And don't do it calmly; get mad, roll down your window and shout at them. Pass slow drivers on either side, and cut in so you just barely miss their fenders. That'll show them what's what.

Flip your lights back up to high, if the other driver doesn't dim his lights. Give him a taste of his own medicine. Tailgate if the car up front is traveling a little too slow. After all, **you** can stop on a dime. Always stop for a few quick ones before you go; a few "stiff" drinks could make you the same way.

Meal-Misser

Another cheap ticket to the Coronary Club is to forget about regular and nutritionally-balanced meals. After all, three regular meals a day are great for kids; but you're a busy man. A restful meal is a waste of time for a man-on-the-go. Think of all the extra work you could get done at the bench or on calls if you don't stop for lunch. Of course, missing meals has a way of making you hungry in between regular mealtimes. So keep plenty of sweets and soft drinks to fool your stomach during the day. Reward a good job by stopping for a malt. And munching a bag of cookies helps ease the frustrations of dealing with a rude customer. Eat too much, drink too much, and smoke too much; those three activities might take you to an early grave, or at least a nice vacation in a hospital nursing a coronary. □

I'm just a *shade-tree* technician at heart!

By Wayne Lemons

With tongue in cheek, Wayne illustrates the excellent advice that technicians should always understand the limitations of their test equipment, and not permit it to lead them astray. It's possible for test equipment to give you **more** *information than you can handle!*

Those books and magazines I've been reading are full of new-fangled stuff to test TV's with. They must have finally brain-washed me, because I went to the parts house and put one of those triggered dual-trace scopes on a lay-awake-and-worry-how-to-pay-for-it plan. I figure it will be worthwhile just to dazzle a few of my paying customers and some of my snooty buddies who are in the business.

I suspect, though, that it's kind of like a photographer back home. He had a whole shed full of cameras, flash guns and things like that. I can tell you right now that he got about the same amount of good pictures as the average person would with an Instamatic. But when he has all that high-powered equipment, who's to tell him he doesn't take very good pictures? Not me!

My whole point is that if you're not a good photographer, you won't get any better pictures just because you have a $1000 camera. And if you're not a good technician, the only thing that'll help you is a gadget my Cousin Lem thought up. His idea was to point the machine at a bad TV set, slide the schematic in a slot, and right away the machine would write out something like: REPLACE C48, A 68 PF CAPACITOR IN THE HORIZONTAL CIRCUIT. CAPACITOR IS BROWN WITH BLUE AND GRAY DOTS. IT IS LOCATED TWO INCHES FROM REAR OF THE CHASSIS AND THREE INCHES FROM RIGHT SIDE OF CHASSIS, LOOKING FROM THE REAR. CAUTION: CAPACITOR LOOKS SOMETHING LIKE A RESISTOR, BUT IS A LITTLE LARGER. DO NOT REPLACE THE WRONG PART! Since it looks like more than a few years before Lem's machine goes into production, we'll just have to use our noggins instead.

Scope showed too much

Maybe I can show you what I mean. The other day I was called from under my shade tree by a couple of friends of mine who are in the TV repair business up town. They said they had a real hound-dog that was giving them fits, and would I come and get it fixed.

I changed to a clean pair of overalls, and meandered over to their shop. They pointed in the general direction of the chassis, and after I had pushed aside a couple of scopes, a fancy analyzer and other stuff like that, I was able to reach the chassis.

Next, I asked them what the trouble was, and they told me they were sure it was sync trouble and likely was starting in the video stages where the scope showed the signal was sort of jittery and not clean like it ought to be. They also said the dual-trace scope showed the horizontal oscillator and the horizontal sync were not staying exactly in phase. I had sort of figured that out from the picture, because it wasn't holding horizontal too well.

"Whoa, there," I said. "What I want to know is what the fellow who brought it in said was wrong."

That almost threw them for a loop, but after a bit they recalled that the fellow said when he first turned on the set every time, the picture tube didn't light up. But he found out it would light up if he

fiddled with the horizontal-hold control. Also, the hold was awful touchy and hard to keep the picture from jittering back and forth.

I asked what they had done so far. They told me that on their scopes the video signal was okay coming into the grid of the video amplifier, but that it didn't look too good at the plate. It seemed to them the sync pulses didn't stick out far enough above the video, and there was trash that oughtn't be there.

"Have you tried to set up the oscillator like the manufacturer says to do?" I meant the way of grounding the grid of the sync tube, shorting out the ringing (stabilizing) coil, and adjusting the horizontal hold control until the picture "floats" by. They had tried that, they said, but it hadn't acted quite right. They figured it was because of the sync problem. And besides, they had replaced the 3-legged phase-detector diode and the oscillator tube 2 or 3 times.

"It's got us kind of buffaloed," they admitted. "What do you think is wrong?"

"Well, I hate to be contrary, but I don't think you've got video amplifier, AGC, or even sync trouble."

"Why not?"

"I've been looking at the picture, and it's holding vertically tight as a drum. You can see on the schematic (Figure 1) that the vertical and horizontal sync both are taken off the same plate of the sync tube. Judging from that, and from the fact the fellow who owns the set seemed to have trouble with the horizontal oscillator, I figure we'll find the trouble there."

"Want to use one of these scopes?" they asked.

I looked at the schematic. It showed +3.5 volts at the pin-2 control grid. And since it is here that this kind of trouble often hides, I said, "I'd rather have a VTVM."

"We traded ours in on a new automatic ranging and polarity digital voltmeter."

"I guess that'll do," I said.

At pin 2, the voltage was about +9 and flickering up and down. This was more than twice what it should have been. I wondered why. Maybe one of the diodes in the phase detector was bad. I took a clip lead and shorted the center lead of the diodes to ground. The voltage at pin 2 went nearly to zero, and the horizontal oscillator stopped working. But that still didn't prove a diode was bad, because the sync was grounded out, too.

I took my dikes and clipped loose the two leads of the diodes that weren't grounded, and looked at the meter which was still connected to pin 2. The digits were jumping, but the average was about +9. I soldered the two leads back.

After another look at the circuit, I knew there was no way for a positive voltage to be there, unless a capacitor was leaking. There were only two capacitors that could do it. One was a .001 feeding the sampling pulse back to the diodes. The

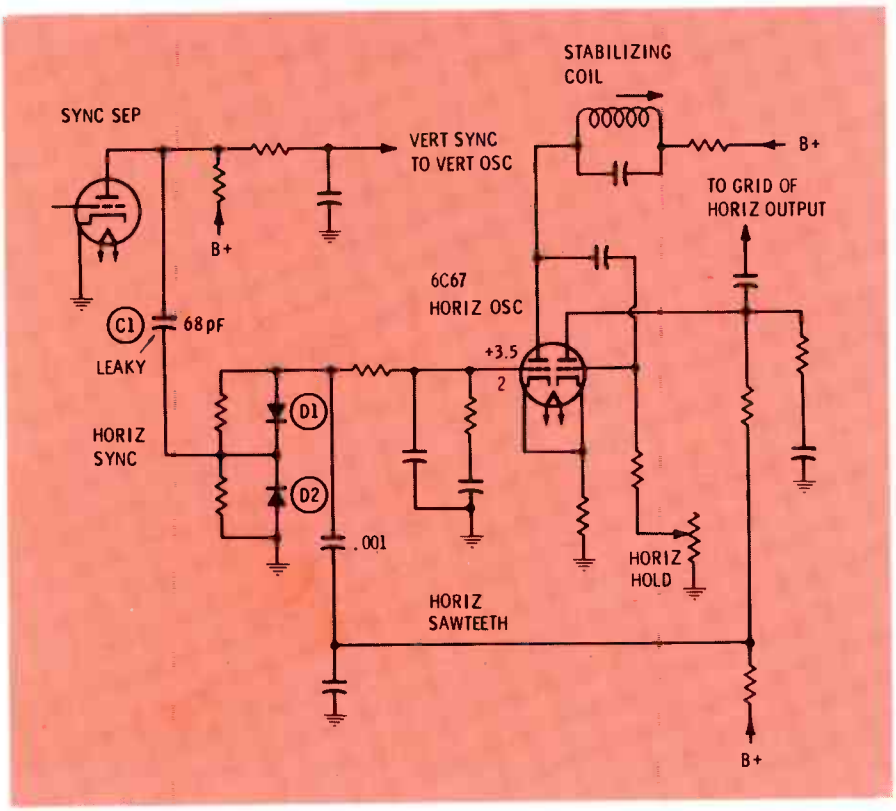


Fig. 1 Simplified schematic of the horizontal AFC and oscillator with the leaky capacitor that gave symptoms of a video trouble.

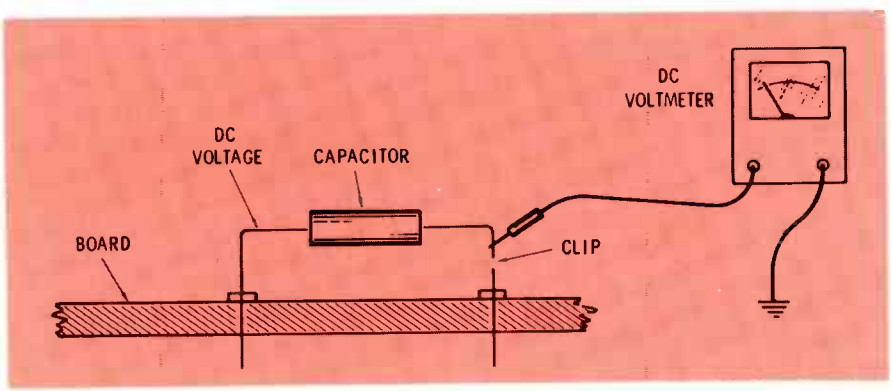


Fig. 2 This method of testing a capacitor for leakage has two advantages besides simplicity. Leakage is tested at approximately the working voltage in the set, and the test is very sensitive (too sensitive to be used with electrolytics). For an accurate reading of the leakage in ohms, use the formula: voltage across capacitor divided by voltage across meter equals leakage resistance of capacitor divided by meter resistance.

other was the 68 pF that feeds the horizontal sync pulses to the phase detector diodes.

In my experience I've found that small capacitors don't leak as often as bigger ones. So, I took my dikes and clipped the lead of the .001 where it fastened to the diodes. The voltmeter on pin 2 kept right on reading positive just about the same as it was. Next, I clipped the lead from the 68 pF at the center pin of the diodes. Sure enough, the reading dropped to nearly zero.

Just to make sure I had found the trouble, I touched the voltmeter probe to the lead of the 68 pF capacitor I had clipped. This time the digits spelled out +31 volts. Hardly any doubt now; the 68 pF capacitor was the one upsetting the horizontal circuit.

I hooked up the .001, put in a new 68 pF capacitor, set up the horizontal stabilizing coil the way I mentioned before, and the picture locked in solid as a brick.

Advice

The reason I'm writing this story is to point out that us shade-tree technicians aren't so uptight about all that design jazz we read about so much. We figure it should have been taken care of before the set was built and sold.

By and large, I figure my job is to look at the picture tube, or listen to the sound, and see if I can tell what's wrong (or at least where the trouble might be). I try to remember that a voltmeter's still a mighty nice tool to have if there is no DC voltage, or if it's too high or too low. (I kind of hate to admit it, but those digital voltmeters are mighty nice.)

And another thing, nobody has ever hit on anything better to find a leaky capacitor than a pair of dikes and a voltmeter. Just find which end has the highest voltage, clip the **other lead** loose from the circuit, and touch the voltmeter probe to the loose end of the capacitor. A good capacitor will make the pointer flip and drop to zero.

Editor's Note: *If your VTVM, FET meter or DMM has around 10 megohms resistance on DC voltage ranges, a capacitor leakage of 10 megohms will cause at the cut end about half the reading at the hot end. Or, a leakage of 100 megohms will produce about 10%. In fact, the test is so sensitive that most paper or Mylar types will give some indication, even when new and "perfect". If the leakage is no more than about 2% of the applied voltage, a capacitor probably has low enough leakage for use in almost any circuit. The test won't work with electrolytic types. They read as though shorted.*

By the way, I'm not knocking scopes, not by a long shot. They're good as signal tracers, for measuring frequency response and waveshapes, and all that. But you got to watch out that they don't show you more than you can figure out (at least until after you find the trouble).

For instance, in this case I told you about, the horizontal circuit was all on edge, shaky and wobbly. So, a lot of the circuits were trying to face up to the problem and hold the picture steady, but the sick horizontal circuit sent out a lot of disturbance to the other circuits so they didn't exactly appear healthy either.

This means you might get some confusing pictures on your scope that could lead you away from the real trouble.

It's like my granddaddy used to say, "Sonny, if you're walking home on a dark night, you'd best stay on the main road and don't take off on what looks like an inviting shortcut, because you are liable to end up in a swamp over your head in alligators!" I swear, that's what my granddaddy used to say. Of course, he came up here to the Ozark Mountains from down south someplace.

Editor's Note: *Those of us personally acquainted with Wayne Lemons know he is a sharp technician who appreciates the newest and best in test equipment. But his point is a good one; choose the test instrument that will give you an answer without steering you into a time-consuming detour among those "alligators".* □

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Forest H. Belt's

Workshop on cassette recorders Part 1

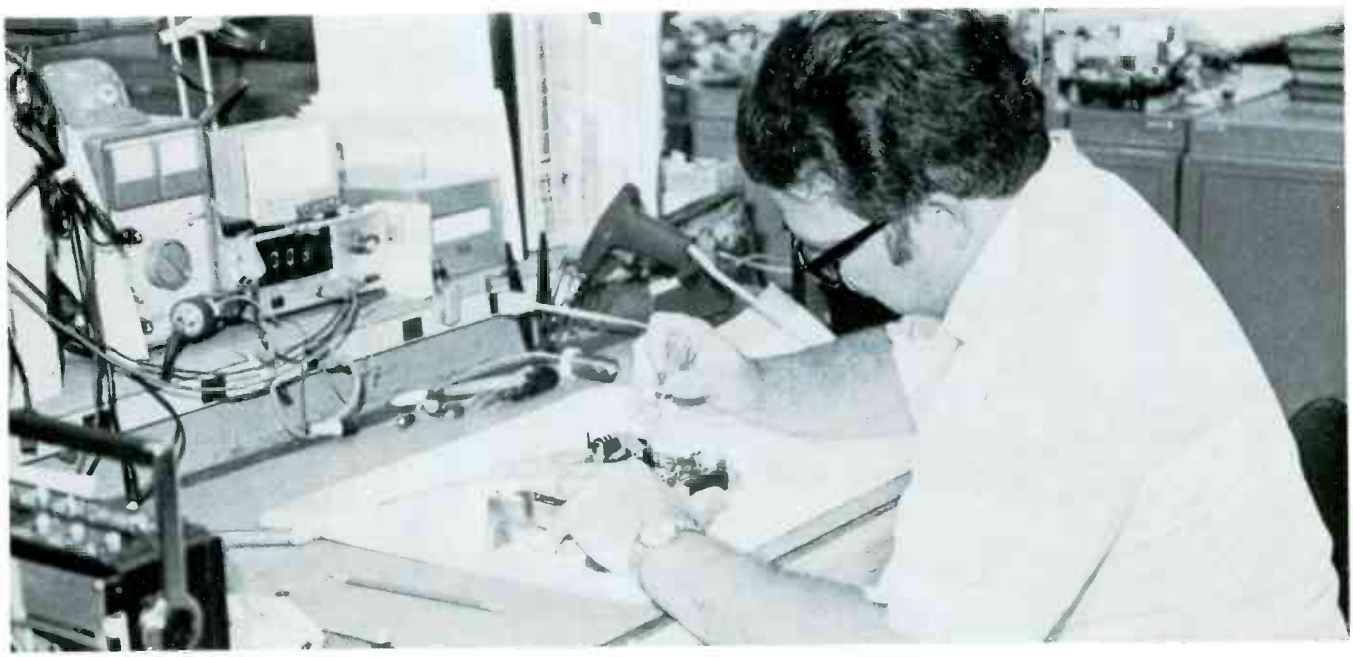
By Dewey C. Couch

Millions of cassette tape machines are sold in this country each year. New technological advances in magnetic tapes (and in the machines themselves) now make possible true Hi-Fi reproduction from the more sophisticated models. Others that have less fidelity fulfill a variety of purposes. Yes, cassette servicing has become a big business. You, too, can earn handsome profits in this branch of home-entertainment electronics.

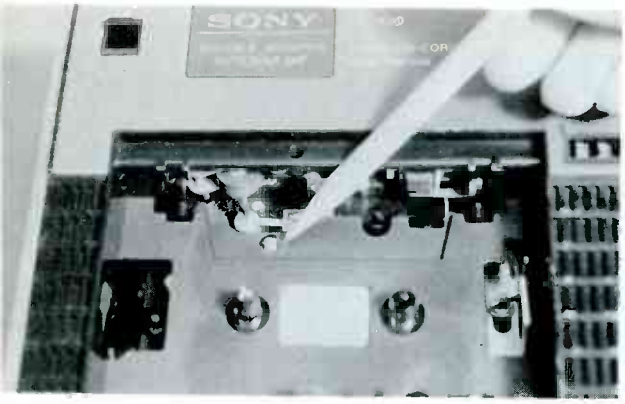
Troubleshooting cassette mechanisms might seem complex. Sometimes it's hard to see how all those idlers, levers, and slides work together. Yet, you can make servicing cassettes simple. All you need is a logical approach that adapts to any cassette mechanism.

As we've pointed out in other Workshops, you can't ordinarily conceive the whole job in one step. Seasoned technicians divide mechanical servicing into five stages: **cleaning, inspection, testing, adjustment,** *and* **diagnosis.** *This first session in the Cassette Workshop series elaborates the first two stages. You see the techniques of thorough cleaning and lubrication used by experienced techs. Many cassette troubles are eliminated during the cleaning process, without further testing. Others are found during visual inspection.*

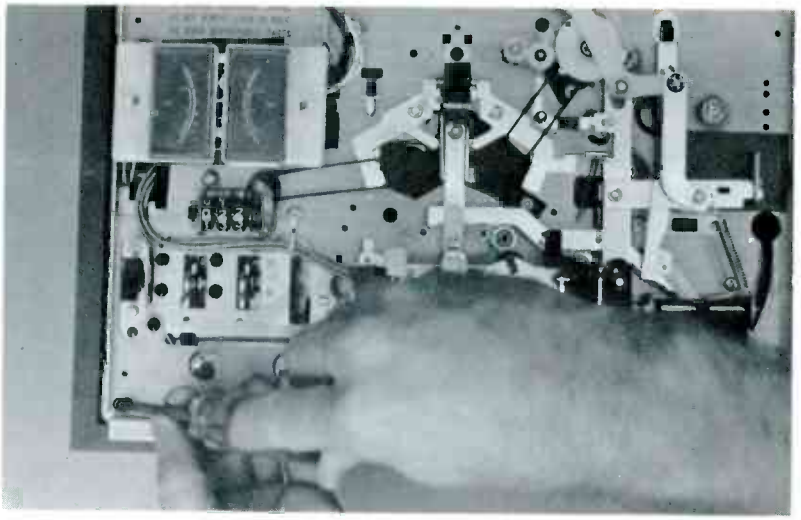
Session 2 shows and explains how adjusting, testing, and diagnosis track down all remaining faults, even those you didn't know about. Then, to strengthen your self-confidence in dealing with cassettes, Sessions 3 and 4 detail the workings of today's popular cassette mechanisms.



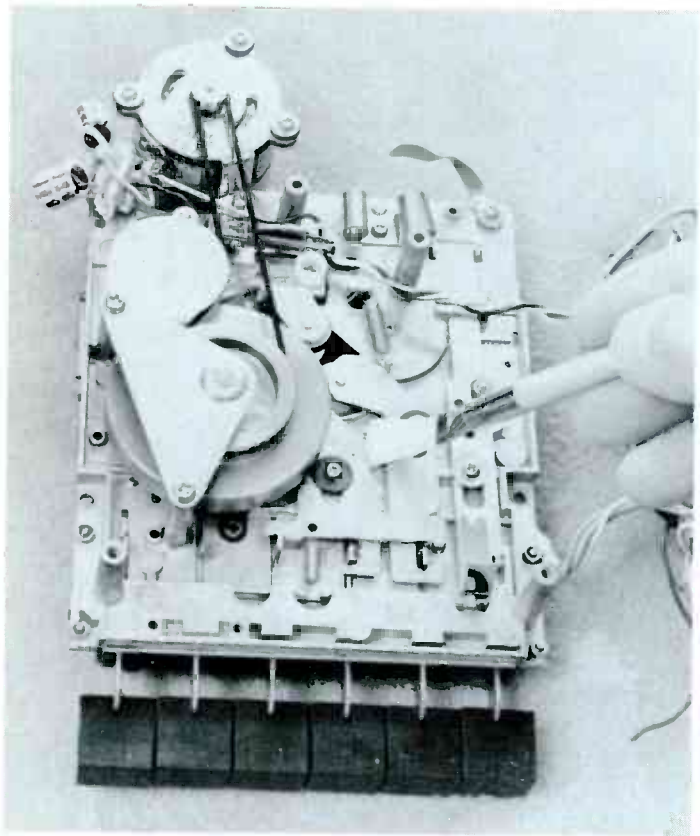
Step 1. Before you can service a cassette, you must remove the mechanism from its cabinet. Cassette mechanisms are mounted to their cases in a variety of ways. In most portables, screws hold them to the top cover (or control panel) from beneath. You have to remove the bottom cover first. Don't try to force it. If it doesn't slip off easily after you've removed all visible mounting screws, hunt for hidden screws in the battery and accessory compartments (or under a warranty-seal label).



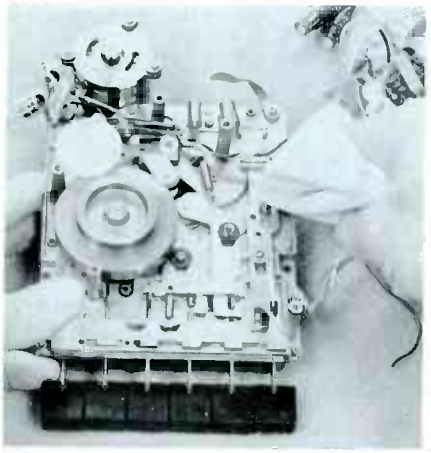
Step 2. Remove all knobs. Most are push-on types, but watch for set screws anyway, just to be sure. With portable models, you might have to take the handle off, too. Usually the screws that hold mechanisms to the cabinet are colored. **Be careful not to loosen any screws that might hold mechanism assemblies in place.** Look for hidden screws in the cassette well. When you're sure all mounting screws have been removed, carefully lift the mechanism free. Don't strain any wires that might connect the works to cabinet-mounted parts such as jacks, speakers, etc.



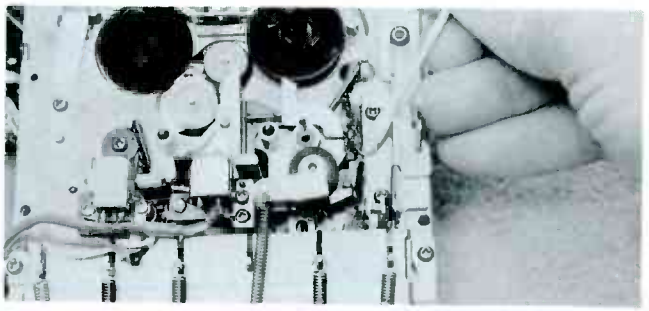
Step 3. With many cassette decks, you have to take the control panel off to get at the mounting screws. Expect one screw in each corner. Remove all screws that hold the top control panel, and remove all knobs. You might find screws in the cassette well, too. Once the panel is loose, lift it up and over any projecting parts, such as control shafts or levers. Don't bend or force the cover. Most are plastic and break easily.



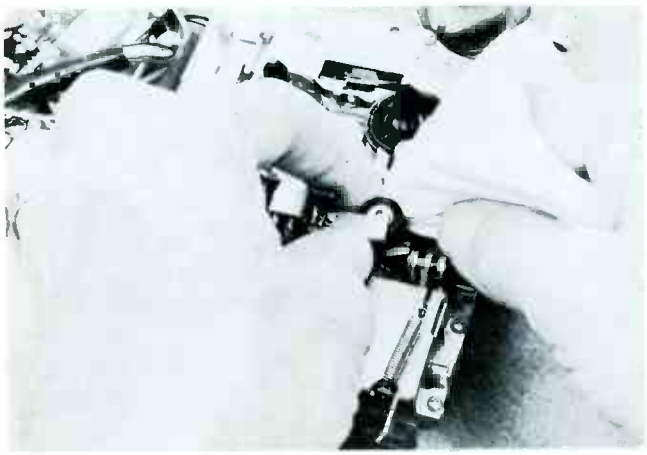
Step 4. Dust and lint collect on mechanical parts. Use a clean, soft-bristle brush to whisk away any loose grime clinging to parts and assemblies. Take care not to break any wires or knock any springs loose.



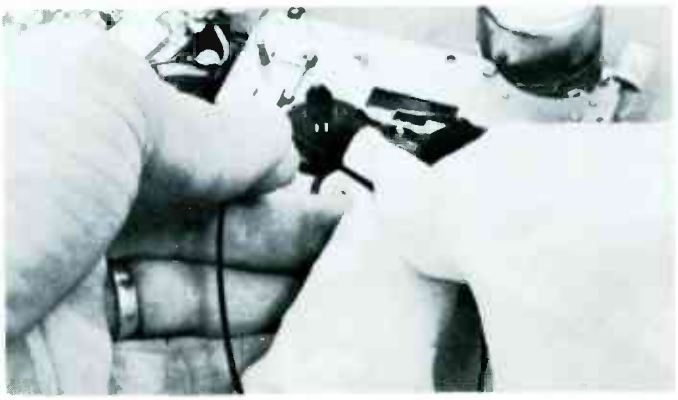
Step 5. Clean the baseplate, above and below, of any stuck dirt or old lubricant. Use a clean cloth and alcohol; isopropyl or rubbing alcohol is fine. The alcohol will loosen any caked lubricant that could hinder normal movement of parts or controls. Don't do any lubricating at this stage of servicing.



Step 6. Lubricants tend to hold dirt and build up accumulations on certain slides and levers. Evaporation then causes the mess to harden. Never use a metal tool, such as a screwdriver, to scratch the caked lubricant loose. You might score or warp the slide. That could cause excessive wear or binding. Try scraping with a small piece of wood or plastic (flat toothpicks or ice-cream sticks are handy for this). After you have cleaned the slides and levers of caked lubricant, use a Q-Tip or cotton ball soaked in alcohol to finish the job.

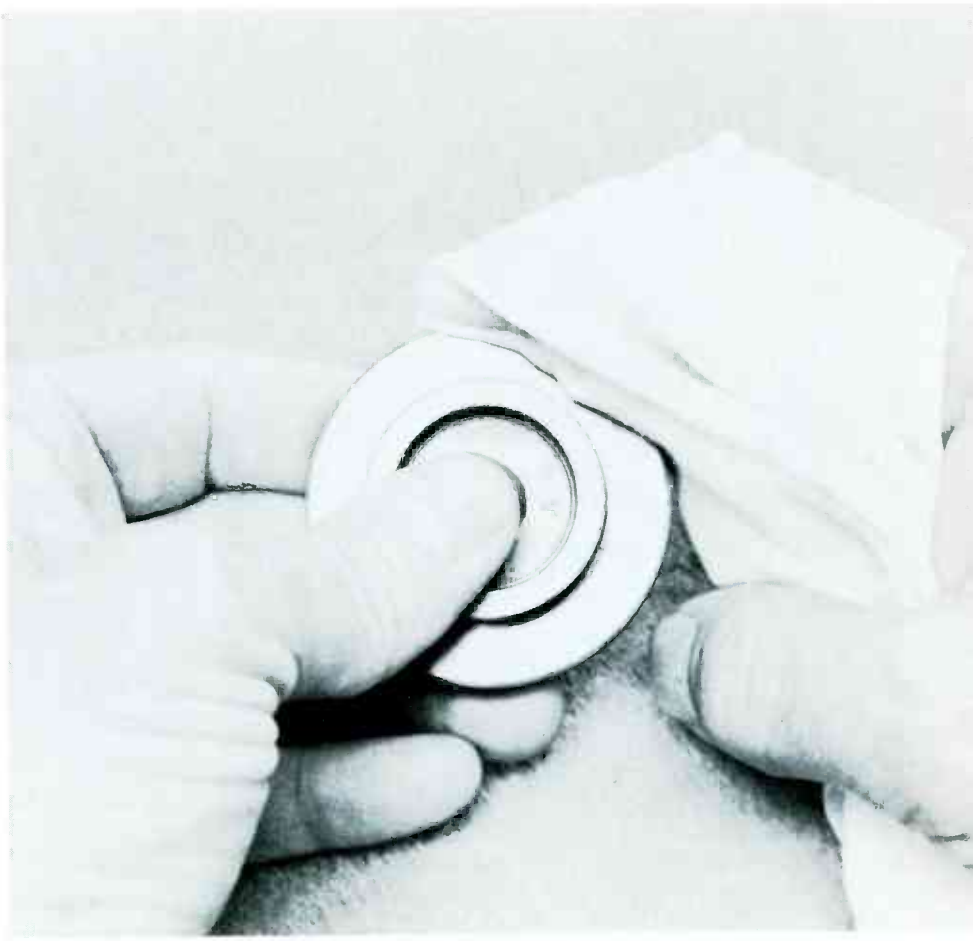


Step 7. Oxide particles from the tape collect on the rubber pressure roller. This deposit sometimes causes tape slippage. Use a fresh cloth and alcohol for cleaning here, too. If it's convenient, remove the pressure roller and soak it in alcohol for several minutes. Then wipe it dry with a clean cloth. Repeat the cleaning and drying several times.

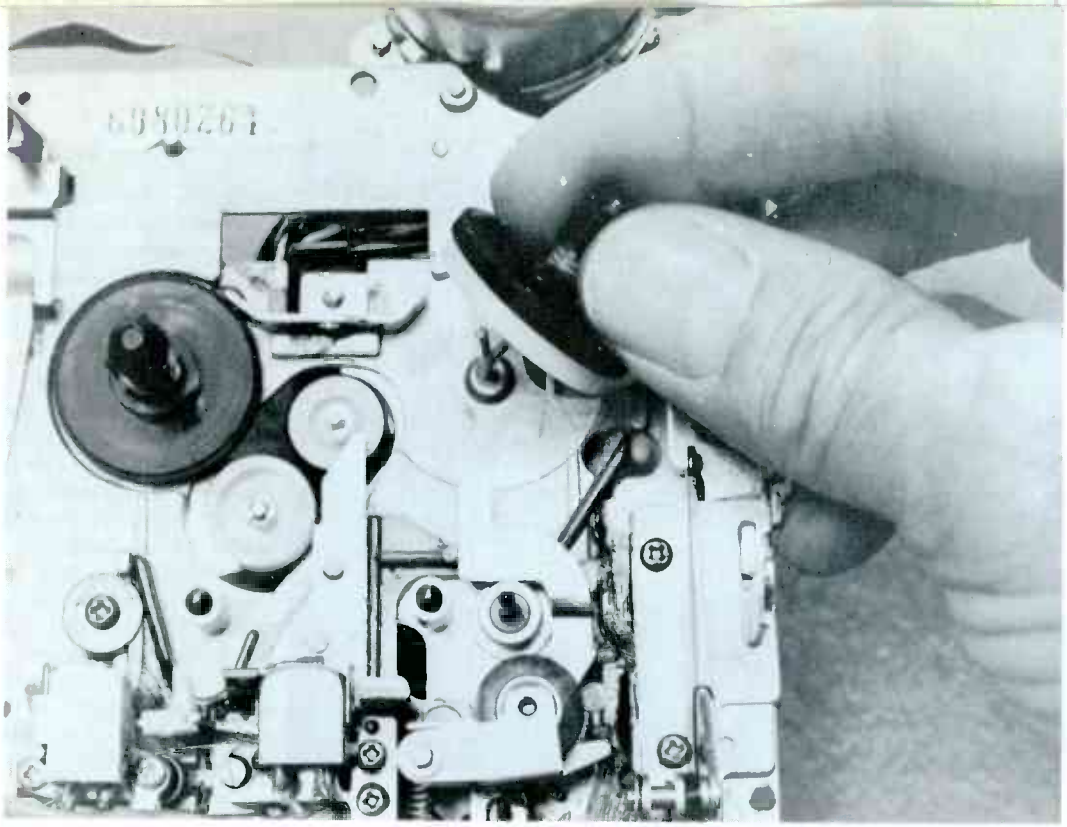


Step 8. Lubricants sometimes migrate and contaminate rubber belts and idlers. The result: slippage in the drive train, causing the "wow" sound in playbacks. Most belts come off easily. Remove them and use a clean cloth and alcohol to rid them of all lubricant and other foreign matter. Afterward, avoid touching with your fingers any rubber belts or drive surfaces. Even though your hands may be clean, the minute amount of body oil on your fingertips might contaminate drive parts enough to cause slippage at a later time.

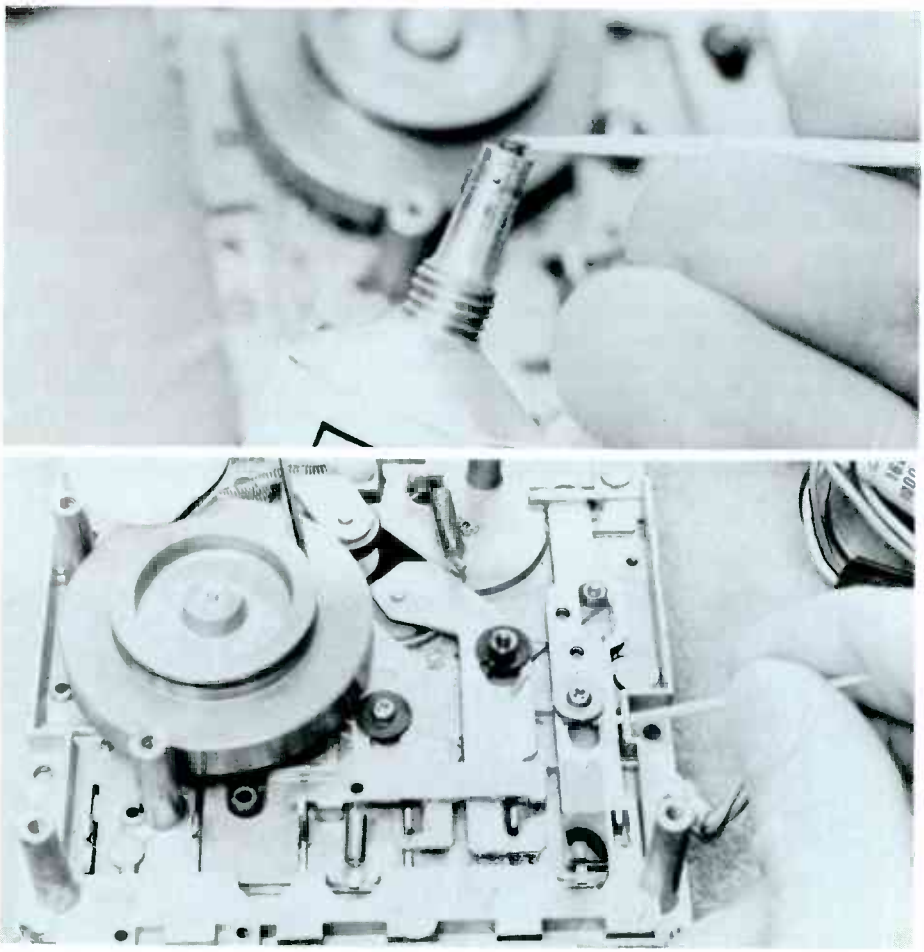
Step 9. Idler wheels, like rubber belts, over a long period can become contaminated with lubricant. You can't tell by looking at them. So remove all idlers and pulleys and clean them with alcohol. Make this a standard part of your servicing procedure. If you prefer to soak them in alcohol, that's okay, too. After you've reassembled them, go over the drive surfaces again with a Q-Tip and alcohol, just to be on the safe side.



Step 10. Remove the flywheel and clean it thoroughly with a cloth, especially the shaft and drive surfaces. Alcohol is the solvent for this, as usual. Use a clean cloth or Q-Tip.

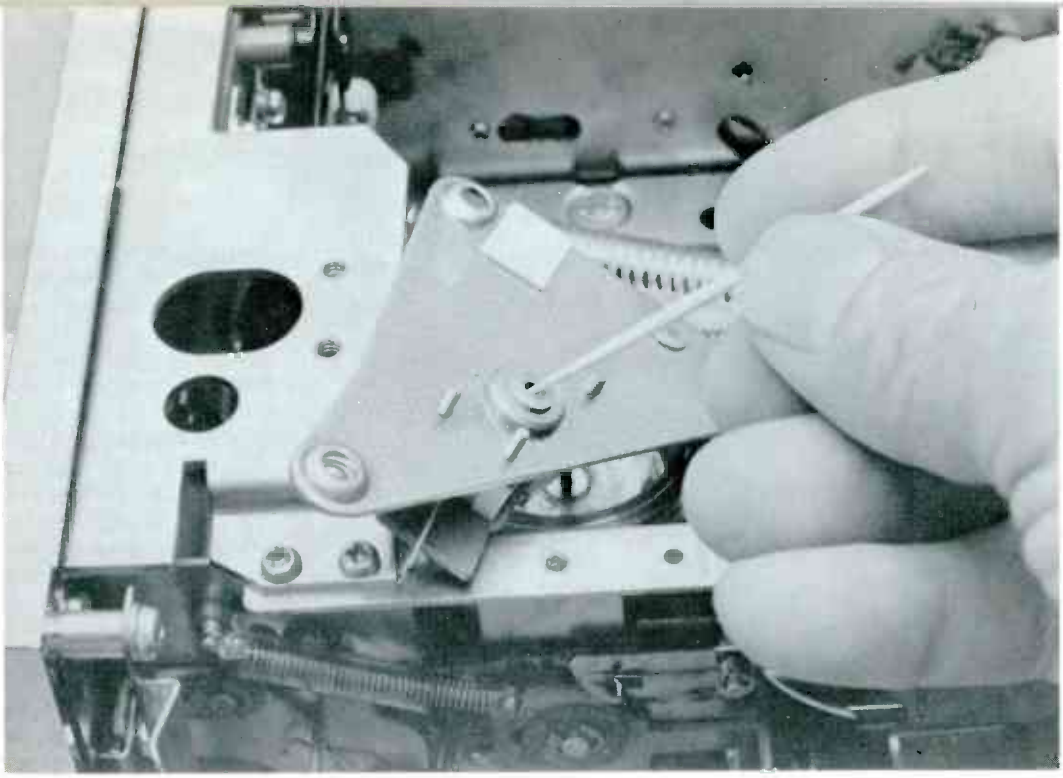


Step 11. When felt take-up drive clutches age, they mat down and harden, introducing another kind of slippage. Tape tangles are the usual symptom of this defect. Remove and disassemble the takeup spindle-and-clutch assembly. Soak it for 30 minutes or so in alcohol. Brush the felt lightly with moderately-stiff bristles to restore the felt to a soft, fluffy condition. Allow it to dry before you reassemble the spindle. If the felt looks at all worn, replace it. That precaution might save you a callback.

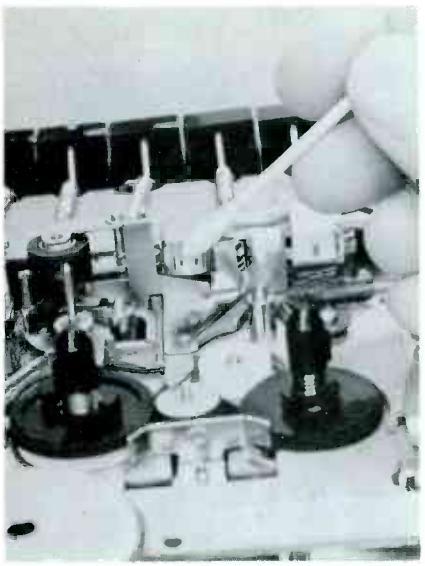


Step 12. After all the cleaning is done, apply a thin layer of Phonolube or similar fine grease to the slide surfaces that contact other assemblies or the baseplate. Don't overlubricate; a little goes a long way (in more ways than one). Never use oil. It migrates and soon contaminates drive surfaces.

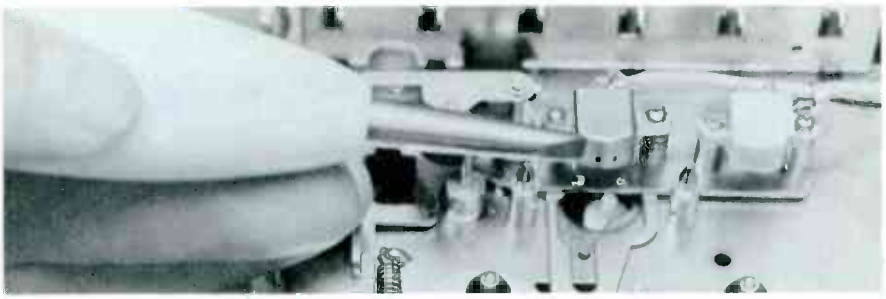
Step 13. Before you reassemble idlers and pulleys, dab a tiny bit of lube on their spindles only. Don't apply it in the center holes. Slip the idler onto the shaft and turn it several times as you seat it. That distributes the fine grease along the entire shaft or spindle. Swab away any that oozes out around the center hole, using alcohol on a Q-Tip.



Step 14. The flywheel bearings in most cassette machines are self-lubricating. However, in some models, the flywheel needs yearly lubrication—especially the lower bearing. Apply a small bit of grease to the inside of the lower bearing before you reassemble the flywheel retainer bracket. Use a toothpick as applicator. If the upper bearing, at the capstan, takes lubrication (this is rare), replace the seal securely, and then clean the capstan thoroughly with alcohol. Lubricate, but **don't** overdue it.

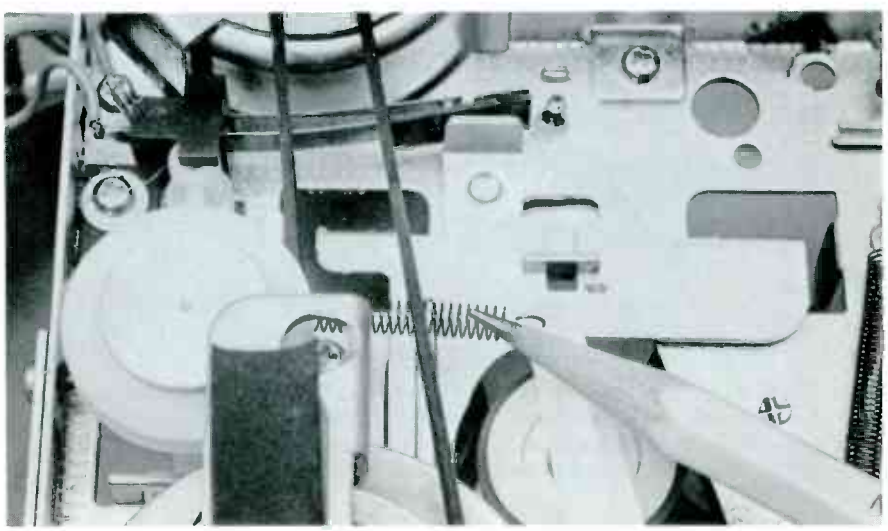


Step 15. Oxide deposits from the tape build up on the faces of record/play and erase heads. You may hear squeaks or erratic volume when you play a tape. Also, this condition is hard on tapes. Use a Q-Tip and alcohol to remove the oxide layer. NEVER use a metal tool, even with cotton on it. You might score the head; even a minute scratch fouls up performance and wears out tapes. Too, the metal tool might magnetize the head.



Step 16. Tape heads have a tendency to accumulate residual magnetism. This can be blamed on the transients caused by switching the heads from play to record, from repeated contacts with magnetized tapes, and from magnetized tools used too near the heads. Always demagnetize the heads as a **final** step of your servicing procedure. Turn on the degaussing tool and move it round and round near the heads. But **never** let it touch the head faces; it likely would scratch the smooth surfaces. Scratches scrape oxide from the tapes, ruining them in time, and causing oxide build-up on capstan and heads. Before you turn off the degausser, move it at least two feet from the heads (so the collapsing field can't re-magnetize them).

Step 17. Before you begin testing the machine's operations, inspect it thoroughly. Hunt for loose wires that might interfere with the movement of levers, slides, or other assemblies. Look for springs and linkages that have come loose. Also check for bent slides and levers.



Step 18. Front-panel controls usually consist of pushbuttons or a function knob, a pause button, a record button, and an eject button or knob. Verify free movement for all these controls and pushbuttons. None should bind, nor should there be any excess play or looseness. See if all controls and buttons do what they're supposed to do.

Next Month

This concludes our first Cassette Workshop session. You've seen major assemblies typical of many cassette recorders. You've learned to clean, lubricate, and inspect the mechanism. The next Workshop session goes deeper into servicing procedure: testing and adjustments. You'll see how to track down specific faults and how to adjust various assemblies to insure proper operation. The third and fourth sessions then guide you through the three most-common basic cassette mechanisms. □

Expanding into CB service

By Leo G. Sands

Millions of Citizen's Band (CB) transceivers have been purchased, and it's estimated 50,000 more are sold each month. In time, the number of CB radios might exceed the number of TV receivers. It's logical to expect the installation and service of these units also to be a huge industry. However, a general shortage of competent repair stations has stunted that part of the business. Many CB units are operating poorly, while others are not being used, or have been junked.

The logical source of CB service is the several thousand shops which repair commercial mobile radios. Unfortunately, there are too few of them, and many prefer to do business with industrial and public-safety organizations instead of individual customers.

Operators of TV-repair shops would seem to be the next best source of CB service. Yet, not enough TV shops will repair CB equipment, even if they are asked.

Here are some of the reasons given for refusing to service CB units:

- TV repairs pay better;
- I don't want to buy a lot of expensive equipment;
- I don't want to install radios in cars; and
- It's too much trouble to study and get the FCC license.

Let's discuss these reasons, and see if they are valid.

Pricing CB Repairs

The returns from a recent survey indicated a typical rate of $16 per hour for CB repair labor. This seems compatible with charges for TV service. Therefore, it appears practical to operate from your TV price list until you accumulate sufficient records of income and expenses to make possible an accurate pricing system.

In addition to income from labor, there are many possibilities of profit from sales of parts and accessories. More information about this aspect later.

Necessary Equipment

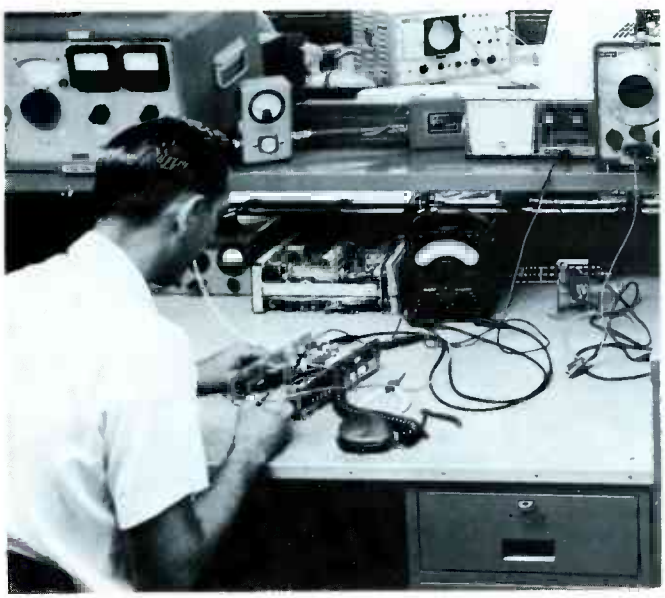
In addition to the test equipment required for TV servicing, you will need the following:

- a frequency meter, or electronic counter, capable of measuring frequencies up to 27.26 MHz with an accuracy of .0025% or better;
- an RF wattmeter with built-in 50-ohm dummy load, or Standing-Wave-Ratio (SWR) meter with external 50-ohm dummy load, capable of indicating up to 5-watts RMS of power;
- a 23-channel CB transceiver, modified for tapping the last IF stage for scope connection to permit observation of AM and Single-Sideband (SSB) signal envelopes; and
- a variable-voltage DC power supply for operation of 12-volt mobile units on the bench.

Both the frequency meter and power supply are useful for other jobs around the shop, so only the transceiver and RF wattmeter are for CB work alone.

Mobile Installations

The installation part of CB busi-



The receiver section of a CB transceiver is being checked on the bench.
Courtesy of Pearce-Simpson Corporation

One example of a direct-reading frequency counter.
Courtesy of Syston-Donner Corporation

It's preferable to have one instrument measure VSWR, power in watts, and percentage of modulation.
Courtesy of Fanon-Courier Corporation

A 23-channel AM/SSB base-station transceiver (such as this one by Pearce-Simpson) can be used with a scope to check off-the-air carrier waveforms.

ness is optional. If you have the equipment and are not opposed to that kind of work, you can make a profit. However, many CB owners prefer to do their own installations, and then take the car to a service shop if they have problems. In such cases, you can make money correcting the owner's mistakes, and by eliminating ignition noise.

Repairs often are handled the same way. The owner removes the transceiver, brings it to your shop, and comes back for it after the repair.

The FCC License

FCC rules require any technician who repairs or adjusts the transmitting portion of a CB transceiver to have either a Second-Class Radiotelephone Operator license, or a First Class license.

Although many technicians dread the ordeal of taking the examination, the problems are more psychological than actual. If you thoroughly understand color TV, or have passed the CET examination, you should have no big difficulty in passing the FCC exam.

The worst problem is that the exam is designed to cover **all** categories of jobs for which the holder of such a license is eligible. For example, many of the questions are about high-powered transmitters employing tubes, radio station operating practices, and other things not relevant to servicing CB equipment. There are few questions about transistors and other modern subjects.

Several license-exam manuals are on the market, and it's advisable to study one thoroughly before taking the exam.

One bright spot is that any number of technicians can work on CB radios under the direct supervision of one who is a license holder.

Practical Servicing

Servicing CB transceivers is far less difficult than servicing TV's. Of course, there's a lot of circuitry on circuit boards crammed into a small space, but most are relatively-simple basic circuits.

If you know how to align and troubleshoot solid-state radio receivers, you should have little trouble mastering the servicing of CB units.

And many sources of printed material are available to reduce wasted time while you learn. Schematics usually can be obtained from the manufacturers, and the most popular schematics and service data are available in 52 volumes of the Photofact CB Radio Series. Also offered by Howard W. Sams is the book number 20722 entitled "CB Radio Servicing Guide." Or if you want a complete course, there's one from CB Radio Repair Course, Inc., 15 South Overmyer Drive, Oklahoma City, Oklahoma 73127.

The first literature you should obtain is the FCC Rules and Regulations, Volume VI, Part 95. Send $3.50 to:

Superintendent Of Documents
U.S. Government Printing Office
Washington, DC 20402

Replacement Parts

Component parts for current and fairly-recent models are usually available from the manufacturer or distributor. However, it may be difficult or impossible to obtain non-standard parts for CB transceivers no longer on the market. Most receiver coils and IF transformers can be substituted by J. W. Miller or other brand equivalents.

Effective in September, 1974, all new transceivers sold or first licensed must be FCC type-accepted. Most older models have not been type-accepted. Any defective parts in type-accepted transceivers must be replaced **only** with factory-furnished or factory-approved parts. This does not apply to the older non-type-accepted transceivers. However, after September 23, 1977, only type-accepted transceivers legally can be operated.

Going After Business

After you have obtained the equipment and the technical information necessary to repair CB radios, you must let your pro-

spective customers know your services are available. The following are tested ways of reaching CB customers.

Buy an ad in the telephone directory "yellow pages" under "Radio Communication Equipment and Service." Occasionally, run a small ad in your local newspaper. Place a sign in the shop window. Then, as soon as the local CB'ers start coming to you for repair service, they will tell others if they like your work. After they talk about it over the air, many others in the area will know about your CB repair service. These radio commercials reach the audience you need, and they are free.

Many communities have a REACT (Radio Emergency Associated Citizens Teams), or an ALERT (Affiliated League of Emergency Radio Teams) organization whose members provide public-service communications on a voluntary basis. Almost any local CB operator can tell you if there is such a team, and where to contact its officers.

You can send cards or bulletins by mail to CB owners. Names and addresses of newly-licensed operators in your area can be purchased from J. B. Carney, 15 South Overmyer Drive, Oklahoma City, Oklahoma 73127. When requesting a quotation of the prices of mailing lists, specify ZIP codes of the territory you want to cover.

Another way to get customers is to write to the national service managers of CB equipment manufacturers and distributors and advise them you are available for CB servicing. Manufacturers need local service to keep the customers satisfied with the equipment. Although some manufacturers and distributors operate their own national or regional service centers, their customers prefer not to have the equipment gone for weeks.

If repairs will require more than a few days because it's necessary to order parts, it's an excellent idea to keep extra transceivers on hand for loan to your customers.

Set Up Your Own CB Station

A good sales-promotion idea is to set up a CB base station at your shop so customers can call you over

TABLE I

CB EQUIPMENT MANUFACTURERS

Beltek
c/o Pal Electronics Co.
P.O. Box 778
Westminster, CA 92683

Browning Labs, Inc.
P.O. Box 310
Laconia, NH 03246

Cobra Division
Dynascan Corp.
1801 W. Belle Plaine
Chicago, IL 60613

Fanon/Courier Corp.
990 S. Fair Oaks Ave.
Pasadena, CA 91105

American Trading Corp.
29245 Stephenson Highway
Madison Hts., MI 48071

Metronix Corp.
8237 Remmet Ave.
Canoga Park, CA 91304

Hy-Gain Corporation
8601 Northeast Highway 6
Lincoln, NE 68501

E. F. Johnson Company
229 Tenth Ave. SW
Waseca, MN 56091

Kris, Inc.
One Echo Plaza
Cedarburg, WI 53012

Lafayette Radio Electronics Corp.
P.O. Box 450
Syosset, L. I., N.Y. 11791

Mark Products
5439 W. Fargo Ave.
Skokie, IL 60076

Midland Electronics Co.
100 West 12th St.
No. Kansas City, MO 64123

Pace Division
Pathcom, Inc.
24049 S. Frampton Ave.
Harbor City, CA 90710

Pearce-Simpson
Div. Gladding Corp.
PO Box 800
Biscayne Annex
Miami, FL 33152

J.C. Penney Company, Inc.
1301 Avenue of Americas
New York, NY 10019

Radio Shack
2617 West Seventh St.
Ft. Worth, TX 76101

Royce Electronics Corp.
1142 Clay St.
North Kansas City, MO 64116

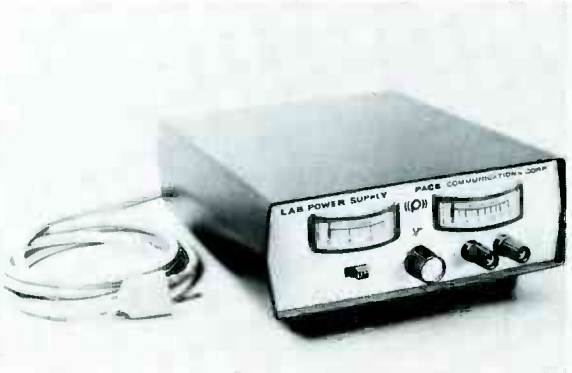
Linear Systems, Inc.
220 Airport Blvd.
Watsonville, CA 95076

Siltronix
P.O. Box 80787
San Diego, CA 92138

Sonar Radio Corp.
73 Wortman Ave.
Brooklyn, NY 11207

Teaberry Electronics Corp.
No. Shadeland
Indianapolis, IN 46226

Tram Corporation
P.O. Box 187
Winnisquam, NH 03289



A typical variable-output 12-volt DC power supply for operation of mobile units on the test bench.
Courtesy of Pace Division of Pathcom

the air when one of their units needs repairs, or when they might have a question. You will need a CB transceiver, an antenna system and a CB station license.

To obtain a station license, write to the Federal Communications Commission, Washington, DC 20554 and ask for a Form 505. After filling out the form, send it and a check for $20 to the FCC at Gettysburg, Pennsylvania. One license covers any number of your transceivers, and is good for five years, unless revoked earlier for violation of FCC rules.

It is not unlawful to communicate via CB radio with customers or prospective customers just so long as you don't broadcast blatant commercials. Motels, for example, use CB radios for accepting reservations from motorists. After you install a CB base station, let your customers know which channel you will be monitoring.

Your Responsibility

Although the licensee of a CB transceiver is responsible to the FCC regarding compliance with FCC technical standards, your customer properly looks to you to insure that compliance.

You should keep comprehensive records of all work you perform, noting specific repairs and adjustments, when made and by whom. Of course, you should record the make, model and serial number of each transceiver serviced, as well as the customer's name, address, and station license call sign. When you measure transmitter frequencies, the actual frequency should be recorded; just "OK" will not do. If your customer is cited for a technical rule violation, an FCC engineer might want to examine your records.

Additional Income

Because the equipment is small in size, most customers will bring defective transceivers to the shop for repairs. However, there are times when house calls are necessary. For example, a CB owner who has no technical knowledge installed his own antenna system, but doesn't know how to tune it correctly. This requires a house call and the use of a SWR meter.

Also, when a CB base station interferes with television reception nearby, a house call usually is required to determine if the CB unit has a defect. CB radios are well shielded and use coax lead wire, therefore a low-pass filter usually is all that is needed to make certain no illegal harmonics are broadcast. Of course, just as with amateur-radio operation, most cases of interference with TV reception are the fault of the TV's, not the radio transmitters.

In addition to profit from service labor and the sales of repair parts, there is money also to be made by selling replacement and higher-performance antennas (both mobile and base), as well as lower-loss coaxial cable, TVI filters, microphones and other accessories.

Income further can be increased by installing both base stations and mobile radios, either for retail customers or for local dealers. Suppressing ignition noise in cars is another profitable sideline.

Sell your customers on the need for periodic check-ups. Although not required by FCC rules, CB transmitting frequencies should be measured at least once a year, or oftener. Also, because mobile units are subjected to mechanical shock, vibration and wide variations of temperature, they should be realigned every few months.

Base station work includes the assembly and erection of the antenna.

Don't Encourage Illegal Activity

Unfortunately, some CB operators use their equipment in ways that are illegal. Originally, the CB band was set aside for individual businesses or families to communicate between their own stations, and **only** those. Since that time the rules have been relaxed slightly, permitting brief exchanges of essential messages between stations having different call signs.

However, the CB band is **not** to be used for communicating more than 150 miles, and is **not** for "chit-chat, idle conversation, discussion of equipment, or hobby-type communications," as stated in the application Form 505.

There are other technical limitations on antenna height, power output and amount of modulation. Unfortunately, some CB operators have taken advantage of the difficulty in enforcing the rules and have added powerful linear amplifiers, taller towers and other illegal items of equipment. You, a technically-trained citizen, should **not** help install such equipment, encourage its use, or give advice as to how it can be used.

Summary

Only lack of competent repair services and the extra clutter of the channels by illegal operation hold back the rapid growth of Citizen's Band radio. The repair rates are good, and the requirements of education and equipment are moderate. Therefore, you might find CB repairs to be a very profitable sideline for your present business. □

Installation of a CB radio transceiver is similar to installing an auto radio.

Tracking down HV regulator problems

By Robert L. Goodman

These actual case histories show various types of high-voltage regulators, how to troubleshoot them, and some picture symptoms produced by typical parts failures, plus one example of narrow width.

Snap, Crackle and Pop

It wasn't a breakfast food, but this Zenith color set with a 20Y1C50 chassis would snap, crackle and pop when first turned on. The picture had plenty of brightness, but was slightly blurred (Figure 1). High voltage measured 30 KV at normal brightness. Size of the picture changed somewhat as the brightness was varied. These symptoms pointed toward a loss of HV regulation.

Circuit analysis

The regulator circuit (Figure 2) is of the pulse-type using a 6HS5 tube. Basically, the high voltage is regulated by maintaining a constant AC load in the flyback circuit. Although there is some voltage drop across the tertiary winding of the flyback, and the forward resistance of the rectifier tube that is not compensated for, quite good HV regulation can be attained by keeping a constant amplitude of pulses at the damper. Amplitude of the pulses to the HV rectifier tracks quite well with the amplitude of the damper pulses.

Control voltage for regulation logically should be obtained by way of a voltage divider from the DC high voltage. But the resistors are expensive, require insulation against HV, and often are subject to extra failures. Years ago it was discovered that, when the DC high voltage was changed because of a different picture-tube current, the B-boost varies closely in step. Therefore, most shunt-regulator circuits (both AC and DC types) obtain their control voltages from the B-boost supply. (Certain parts defects can upset the tracking of DC HV and B-boost. For example, an open yoke in a tube circuit produces too much B-boost and insufficient HV).

At maximum brightness, no reduction of HV is desired; so the HV-Adjust control and the associated resistors should supply the control grid of V14 with a voltage barely sufficient to cut off the plate current. If the brightness is reduced, B-boost rises, decreasing the cutoff bias of V14, and the tube draws some current during each horizontal pulse.

This is a closed-loop system, so it is self-compensating to a large degree (following initial adjustment of the HV-Adjust control). Ideally, the AC load on the flyback should be constant for any reasonable value of picture-tube current.

There is one important consideration: regulator current must flow **only** during the same small portion of each pulse as that of the HV rectifier. Any current flowing during the entire cycle, would adversely affect the width and linearity. Narrowing the pulses of regulator current is the job of C93 and the pulses from the horizontal oscillator. The small value sharpens the pulses, and the instantaneous grid bias is determined by the DC bias **and** the amplitude of the horizontal pulses through C93. Addition of C94 reduces the amplitude of pulses without changing the waveshape (C93 and C94 form a capacitive voltage divider).

These facts are necessary for us to understand why it is not practical to adjust the regulator for a certain DC grid bias, or measure the DC voltage drop across the

Fig. 1 Picture on the Zenith was nearly normal, except the focus was not sharp, and the size changed with brightness.

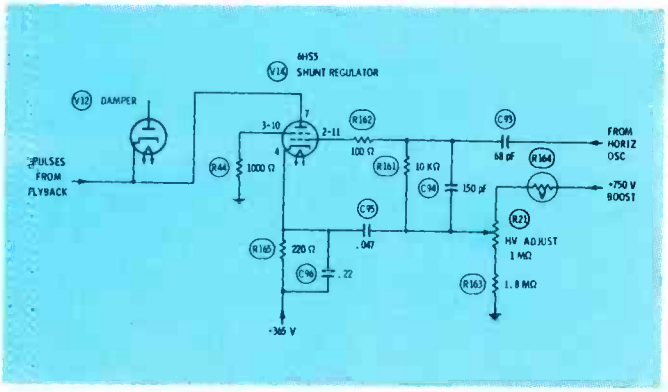


Fig. 2 HV regulator in the Zenith 20Y1C50 color chassis (Photofact 981-2) is of the low-voltage pulse-shunt type. Flyback pulse amplitude is regulated, resulting in regulation of the DC high voltage and the sweep width.

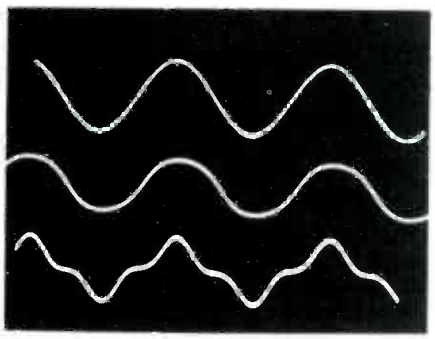


Fig. 3 Varistors (Voltage Dependent Resistors, or VDR's) are non-polarized voltage regulators of moderate action. Top trace is the waveshape of the sine waves used to test a VDR. For the center trace, the sine waves were supplied through a resistor, and the rounded tops and bottoms prove that the VDR current increased at the voltage peaks. Bottom trace is the current waveform, showing increased current at the tips of the sine waves. Notice the current is the same for positive tips as for negative ones. Varistor action is gradual, causing no sharp corners, such as those produced by diodes.

Fig. 4 This narrow raster appeared on the screen of a General Electric with an MA color chassis, when the series yoke capacitor was open.

cathode resistor (as is done with DC-shunt systems). Instead, performance of the regulator usually is judged by its effect on the high voltage.

One more component needs an explanation, and that is R164, which is a varistor, or Voltage-Dependent Resistor (VDR). A VDR reduces resistance when the voltage across it is increased. In other words, it acts as a kind of voltage regulator (see Figure 3). So, R164 passes on to the grid of the regulator **more** of any change of B-boost voltage than would be possible if R164 were a linear type.

Troubleshooting

The initial diagnosis was loss of HV regulation, and this was confirmed when grounding the grid of the regulator tube failed to change the high voltage. Some of the defects that can prevent regulation are:

- loss of pulses at the grid, perhaps from an open C93, or shorted C94 (use a scope to measure the pulses);
- open R165, cathode resistor; or
- any bad part that reduces the DC positive voltage supplied to the grid. This assumes that the regulator tube is not defective, the socket does not have an open, and the heater is lit.

Caution. Pin 7 of V14 has the same DC and pulse amplitude as the cathode of the damper. Therefore, do **NOT** attempt to measure the voltage there; the pulse amplitude could ruin your meter or scope.

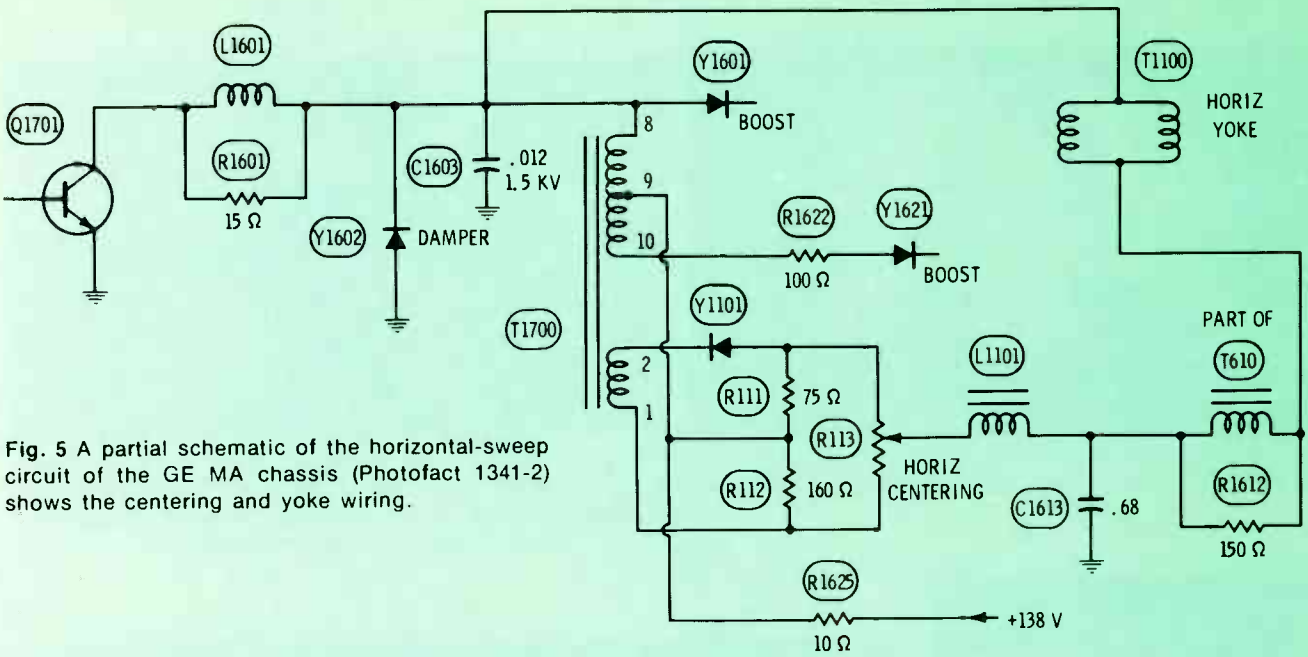


Fig. 5 A partial schematic of the horizontal-sweep circuit of the GE MA chassis (Photofact 1341-2) shows the centering and yoke wiring.

In this case, everything checked normal, except the grid voltage was not sufficiently positive. Ohmmeter tests revealed that the varistor, R164, was open. A new part and a touch-up of the HV-Adjust control finished the job.

Other side of the problem

It's just as likely for the shunt regulator to draw excessive current and eliminate or reduce the high voltage. First, operate the receiver with V14 removed from the socket. A change to excessive HV proves regulator current was responsible. Then you should check for conditions opposite the ones previously given. For example, a shorted C95 reduces the grid bias to nearly zero, and the tube over-conducts. Strangely enough, an open C95 also causes excessive conduction because it produces the same effect as an open C94, increasing the amplitude of pulses at the grid. Other possible defects are leakage in C93 or an increased value of R163.

Narrow Picture

A narrow raster appeared on the screen of the MA/MB chassis General Electric color receiver (Figure 4). That was the only symptom; sound and video both were good.

Circuit analysis

The horizontal-output stage is reasonably typical of non-SCR circuits (Figure 5 taken from Photofact 1341-2), because there is a single output transistor paralleled by a damper diode and a flyback transformer. C1613 is the yoke-tuning capacitor, and the value is moderately critical.

One difference from other similar stages is the horizontal-centering circuit. Diode Y1101 scan-rectifies the pulses from one winding of the flyback (T1700), producing a negative voltage which moves the picture sideways when the horizontal-centering control is adjusted. L1101 blocks the pulses from the transformer, but passes the DC necessary to change the centering. R1612 and the one winding of T610 shown in Figure 5 are a part of the pincushion circuit.

Notice that the horizontal-yoke coils are in parallel, the usual arrangement for transistor circuits. Therefore, shorted turns in one coil reduces the width or kills the HV instead of showing a trapezoidal picture.

Troubleshooting

A replacement yoke was handy, so it was installed temporarily. The width was not increased.

Drive signal to the base of the horizontal output transistor was normal, as was the +138 volt supply. Waveshape and amplitude of pulses at the collector of Q1701 were wrong, but did not appear to indicate shorted turns in the flyback transformer (low-amplitude, narrowed pulses should result from shorted turns there).

As a test, a .47 paper capacitor was connected from ground to R1612, and immediately the picture widened almost to normal width. **C1613 was open.** Some width had been obtained because of the AC return through L1101 and the centering circuit.

Other defects

In other repair jobs, C1613 was shorted, causing loss of raster and tripping of the circuit breaker. An open horizontal-width coil (not shown; it is in the MB chassis only) also can cause loss of width.

If Y1101 centering diode is open or shorted, the picture is shifted to one side, and the centering control action is wrong.

No Regulation

The picture on the screen of a Zenith with the 15Y6C15 chassis appeared to be normal. However, the picture size changed excessively

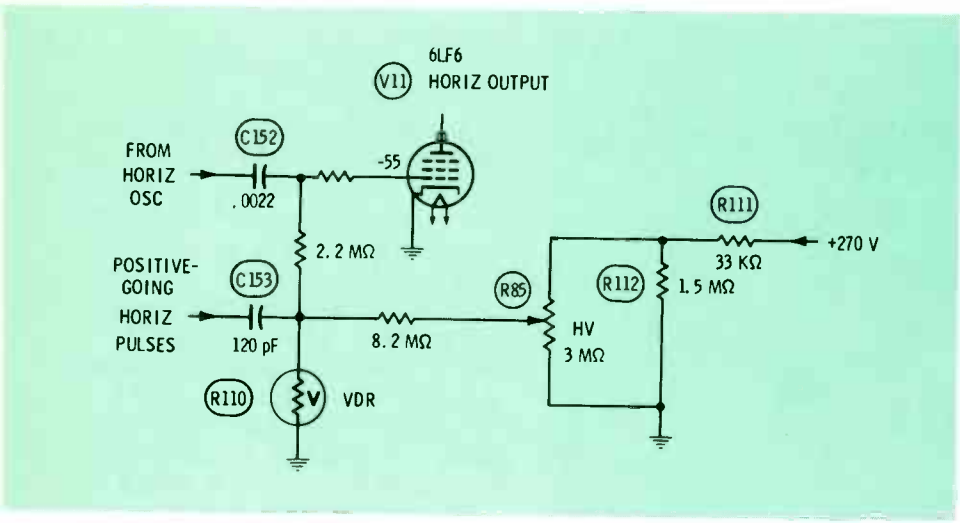


Fig. 6 The Zenith 15Y6C15 sweep circuit increases the negative grid voltage of the horizontal-output tube to reduce the sweep width and high voltage. A VDR is used instead of a diode to "rectify" the pulses and produce a negative control voltage. **Don't use a diode to replace the varistor!** There would be too much negative voltage, causing a narrow picture, and the diode probably would short out quickly.

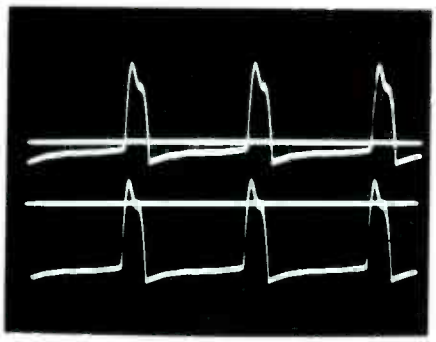


Fig. 7 Here's a simplified explanation of how a varistor (that draws the same current from either positive or negative voltages) can generate a negative DC voltage in a shunt-type rectifier circuit originally designed for a diode. The top waveform is a dual-trace one using a scope's inherent ability to display a correct zero-voltage line. Any parts of the waveform above the line are positive, and the parts below are negative in voltage. Wattage of the waveforms above the zero line equals that below the line. However, a varistor operates from voltage. Therefore, if you add a varistor from capacitor to ground (see Figure 6), the varistor draws much more current on the positive tips than it does on the wider, less-tall negative portions. The effect is to **ground** the tips of the pulses, which moves the zero-voltage line nearer the tips, as shown in the bottom waveform. A DC meter applied to this waveform reads a negative voltage. Rectification using a diode operates even on symmetrical waveshapes such as sine waves and square waves. **A varistor "rectifies" only pulses.** Negative-going pulses produce positive DC in this same circuit.

when the brightness control was adjusted between a dim and a bright picture. The strange part of the symptom was that the width was better at high brightness; just the reverse of width troubles caused by weak horizontal sweep power. This is a sign of HV regulation that is over-controlling, and the diagnosis was confirmed by measurement of the HV at the picture tube; the HV was higher when the picture was brighter.

Circuit Analysis

In this model, HV regulation is accomplished by changes of the output-tube grid bias (Figure 6). Maximum sweep power and high voltage are obtained when the grid bias of V11 is the same as that produced alone by grid rectification of the signal from the horizontal oscillator. Any voltage more negative than that at the grid, limits the maximum plate current, resulting in less sweep and HV power.

Stripped to the essentials, the circuit of Figure 6 "rectifies" pulses coming from the flyback and generates a negative voltage that varies with the amplitude of those pulses. It's a closed-loop action; the higher pulse amplitude causes more negative voltage; and the more negative voltage the lower the amplitude of the pulses. Thus the amplitude of the flyback pulses is regulated. And because the HV varies nearly in step with the flyback pulses, the HV also is regulated.

Why the varistor?

Substitute a diode with its cathode grounded for the varistor (Voltage Dependent Resistor), and the combination of C153 and the diode becomes a shunt-type of peak-reading rectifier circuit, producing negative DC voltage. However, the waveforms of Figure 3 prove a varistor responds the same to either positive or negative voltages, unlike a diode, which conducts only during one polarity.

The natural question is: how can negative DC voltage be generated by a rectifier circuit when the diode is replaced by a varistor? The answer involves the **waveshape** of the signal. If **sine waves** of 15,734 Hz were fed to C153, no DC voltage could be produced by R110 and C153. But, **positive-going** pulses permit a specialized kind of "rectification", resulting in a negative voltage. The remainder of the explanation is found in Figure 7. (Negative-going pulses—without any change of parts or circuit—would produce **positive** voltage. Therefore, make certain of the polarity of pulses.)

Why the positive voltage?

C153 and R110 alone would supply negative voltage to the grid circuit of V11. However, the voltage would change exactly in step with the amplitude of the pulses. This is not enough change of voltage for effective control of the HV. The design solution is to supply **too much** negative voltage, buck out part of it with a steady DC voltage, and apply the remainder to the output grid, reducing the sweep power.

Let's study two hypothetical examples. Suppose no positive voltage came through the 8.2 megohm resistor, and the amplitude of pulses

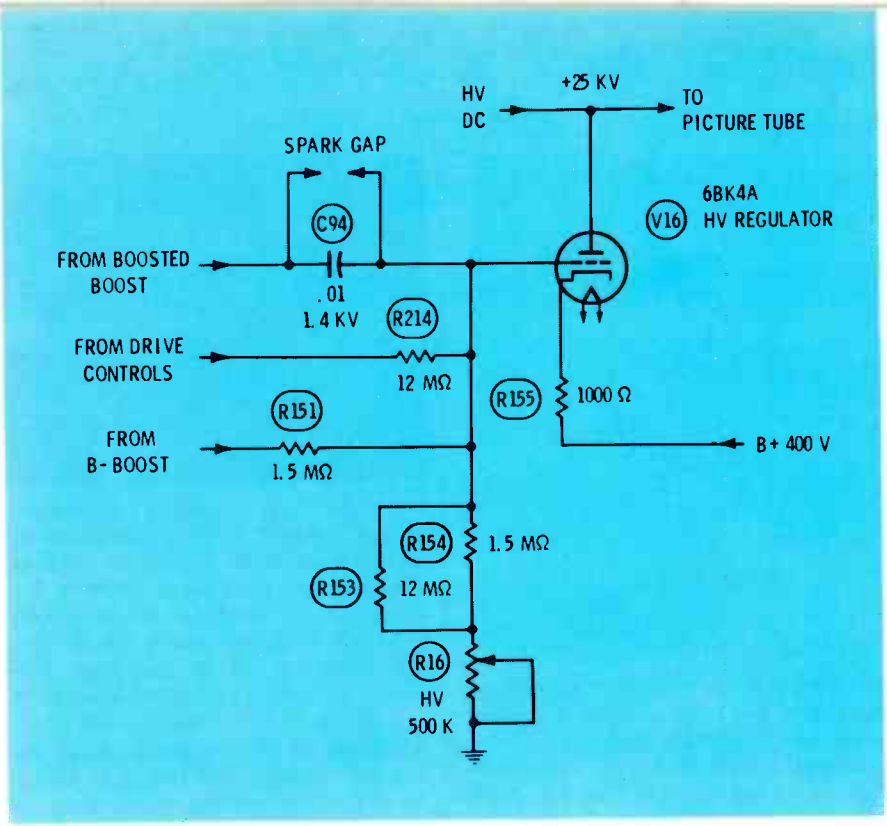


Fig. 8 The RCA CTC17 chassis has a 6BK4A tube which regulates the high voltage by maintaining the same DC current through the HV rectifier. When the picture tube requires less current, the regulator tube draws more, etc. Bias of the 6BK4A is extremely critical for best operation.

produced -55 volts at R110. This is the same as the normal grid bias, and would make no change of sweep. A 10% increase of pulse amplitude also would raise the DC voltage 10%, increasing the grid bias of the output tube to -60.5 volts. Such a small change of voltage could not provide good HV regulation; more change is needed.

In the second example, the different flyback supplies more amplitude of pulses "rectified" by R110 to produce -200 volts. A fixed voltage of +145 through the 8.2 megohm resistor cancels all but -55 volts, leaving the grid bias unchanged. If the pulse amplitude is increased 10%, the negative voltage also increases 10% (up to -220 volts) and the 20 volt increase is passed on to the grid, resulting in a bias of -75 volts. This magnitude of change can give effective regulation.

In practice, the positive and negative voltages are balanced to equal the normal grid bias of the output tube when the picture has maximum brightness. Then, any decrease of brightness brings increased pulse amplitude, more negative voltage to increase the bias, and results in a reduction of sweep power and high voltage.

Three sources of bias

Remember that the bias of the horizontal-output tube comes from three different voltages: a negative voltage produced by grid rectification of the oscillator signal that is applied to the grid, a variable negative voltage from the varistor "rectifier", and a fixed positive voltage (at least it is fixed following adjustment of the HV control) coming from the B+ supply.

Troubleshooting

Voltage readings at the grid of the horizontal-output tube at both high and low brightness showed a wide variation in the wrong direction. With a dim picture, the bias was about -80 volts, and was only about -60 after the brightness was increased.

These voltages indicated excessive negative voltage at the grid, probably because of insufficient positive bucking voltage, or (less likely) too much rectified voltage at the varistor.

Additional DC voltage checks showed too much negative voltage at the varistor side of the 8.2 megohm resistor, and too little positive voltage at the other terminal. R111 had +270 volts at the B+ end and almost nothing at the other. **R111 was open**, and installation of a new one restored the HV regulation.

Other defects

An open in either the 8.2 megohm resistor or the top end of the HV control would have given the same symptoms, and almost the same voltage readings at the output grid.

Defects eliminating the negative voltage (such as an open C153, or an open varistor) would have stopped all HV regulation. Other symptoms would have been more subtle. The negative grid bias might have been reduced by a couple of volts, but the plate current would be increased significantly.

Picture Narrowed On Left

Crosshatch patterns showed the linearity was pinched at the left edge of the picture on the RCA which used a CTC17 chassis. In addition, focus was not very sharp and the picture would bloom out at high brightness settings. To make matters worse, at times the operation would return to normal.

Circuit analysis

Circuit theory tells us that compression of the horizontal sweep on the left probably is caused by excessive HV current that has reduced the amplitude of flyback pulses; and weakened the damper current, which supplies the sweep for the left half of the raster.

Except for leakage from high voltage to chassis, there are only two paths for the DC HV current. One is to the picture tube, and the other is through the HV DC shunt-regulator tube.

Operation of the brightness control obviously changed the picture-tube current, and the compression still remained even when the raster was dark. Therefore, only regulator current was a suspect.

Figure 8 shows the CTC17 regulator circuit. The theory of operation is quite simple. At maximum brightness the 6BK4A should be biased to cutoff so it draws no current from the high voltage. When the picture tube draws no current (unlighted raster) the regu-

(*Continued on page 47*)

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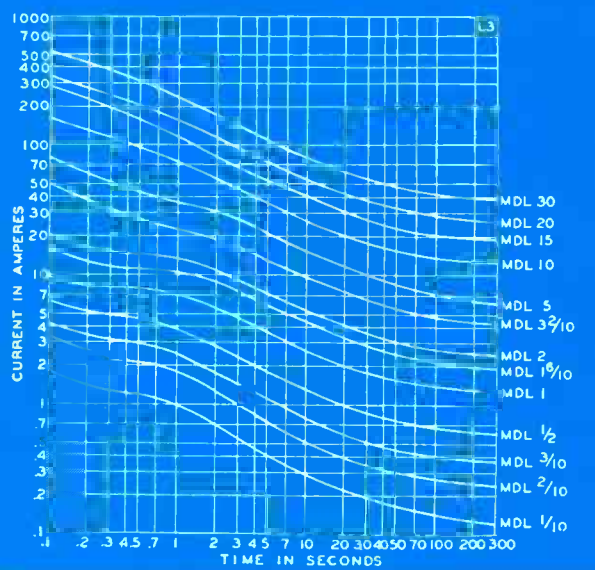
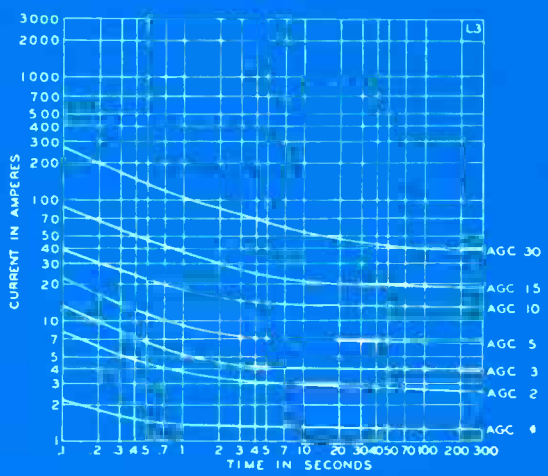


Time-current characteristics of BUSS® fast-acting fuses



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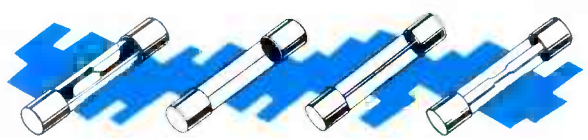
250 or less	**MDX**	1-1/4, 1-1/2, 1-6/10, 1-8/10 or 2
125 or less	**MDL**	1-2/10, 1-1/4, 1-1/2, 1-6/10, 2, 2-1/2, or 2-8/10
125 or less	**MDX**	3, 3-2/10, 4, 5, 6-1/4 or 7
32 or less	**MDL**	3, 3-2/10, 4, 5, 6-1/4, 8, 10, 15, 20, 25 or 30



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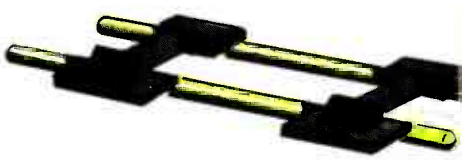

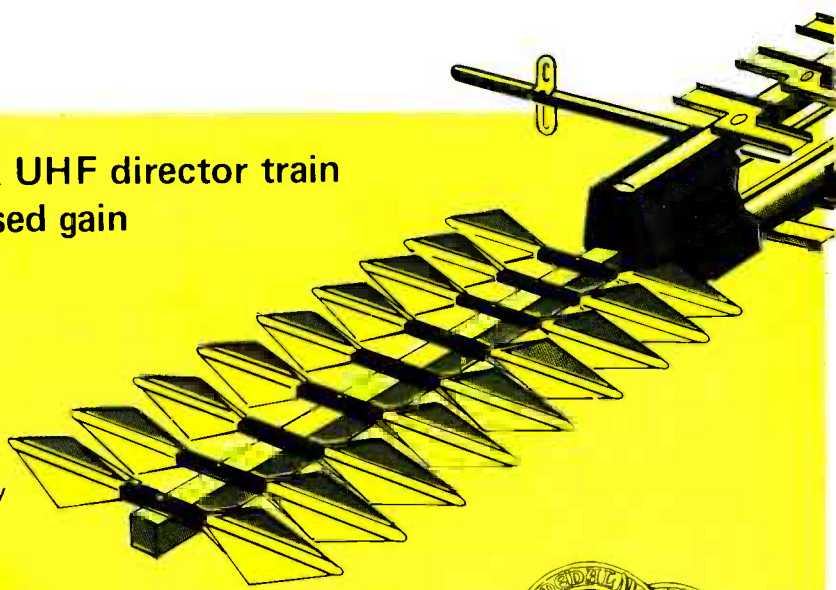

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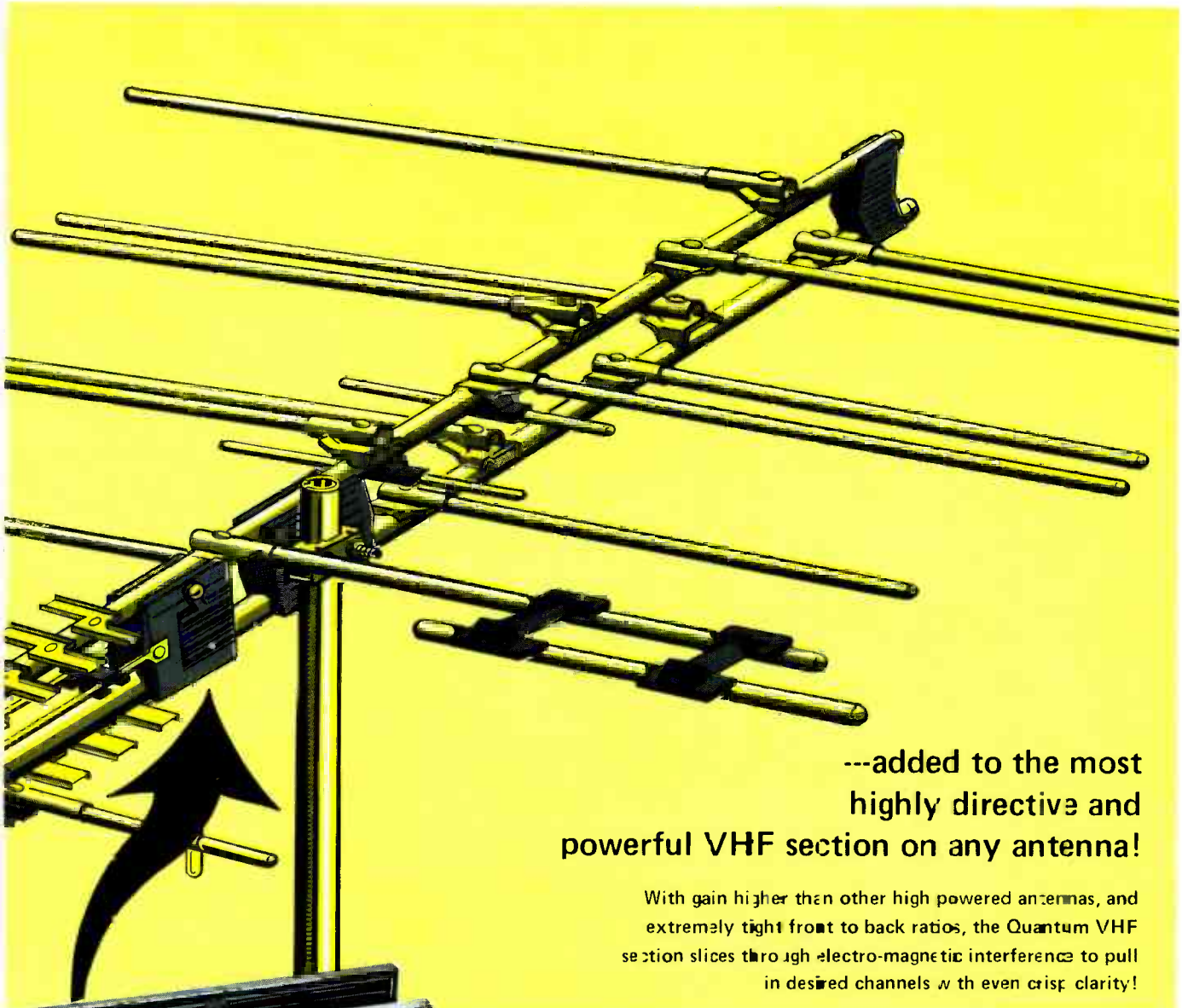

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Base/collector leakage makes little change, but base/emitter leakage might change the polarity of the reading from one edge of the scale to the other! In that event, all three positions of the collector-locating switch will give about the same reading. This is an interesting effect; however, such defects should have been located by means of the previous tests.

Finger Probes

Included with the instrument is a cable assembly with a 3-circuit phone plug connecting to two cables. One of the cables has three color-coded clips to grasp the leads of out-of-circuit transistors, while the other has three color-coded finger probes (Figure 3).

The finger probes evidently have been constructed from plastic guitar picks to which the probes have been fastened with epoxy.

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Other Solid-State Tests

The Wayne instruction booklet explains how to test transistors that have internal diodes between certain elements, those in direct-coupled circuits, SCR's, zeners, tunnel diodes, MOSFET's and other devices.

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We tested perhaps 30 transistors using the Wayne WT2A tester, and obtained a high percentage of accurate readings.

Many of these transistors were ones previously checked by use of beta testers, curve tracers, and ohmmeter tests. They are kept in the lab for tests such as these. Except for a couple that had avalanche at certain DC collector voltages, or distortion at high or low bias, the Wayne tester discovered the defective ones. The indication of relative beta was helpful.

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All things considered, the Wayne WT2A solid-state tester should prove a valuable aid for either service-call or shop servicing. □

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Fig. 1 The Wayne WT2A transistor tester is shown with a small transistor plugged into one socket, and with the switches adjusted for locating the base.

Fig. 2 This closeup of the meter face shows the areas that indicate silicon or germanium material, PNP or NPN polarity, germanium leakage, relative gain, and in-circuit good/bad scale.

Fig. 3 The three finger probes have sharp tips, making it easy to penetrate insulation or corrosion, and allowing solid contacts with points on the circuits boards. One-hand operation frees the other hand to operate the switches of the tester.

red, white, and black, corresponding to the markings on the sockets and the color code of the clip leads and finger probes.

Step 3—C/E short test

Rotate the TEST switch to the "S" (short) position to check for C/E leakage and shorts. The previous B/E leakage test gives higher meter readings for more serious leakages. This C/E test is just the opposite: the lower the resistance reading of the leakage, the less meter deflection is obtained. For example, 50 ohms of C/E leakage on the HI POWER setting reduced the reading to one-half, while about 2.4K reduced the LO reading to one-half. B/C leakage also reduces the reading by the same amount.

A reading near zero indicates an open or shorted C/E junction, or B/C leakage. In either event, the transistor is defective.

Silicon or germanium? PNP or NPN?

Two other transistor characteristics are shown by the position of the meter pointer during the reading with the switch at "S": whether the material is silicon or germanium, and whether the polarity of the transistor is PNP or NPN. Near the right edge of the scale are two blue areas labelled "Si" and "Ge"; those are for NPN types. At the left edge, two similar areas show where PNP types should read. **Caution:** Excessive C/E leakage can cause a germanium type to read as though it were a silicon. And a silicon with leakage might prevent the pointer from reaching the "Si" area.

For example, a C/E leakage of 1.5K (on the LO POWER range) made a germanium read in the silicon area. And on the HI range, a leakage of 47 ohms, moved the pointer to silicon. Leakages worse than 4.7K on LO and 100 ohms on HI moved the silicon reading out of the "Si" area.

However, the following step for balance of the B/E and B/C junctions can be used to determine germanium or silicon, even when there is a dead short between collector and emitter.

Step 4—Junction balance

Alternate the TEST switch between D1 and D2 positions. The readings should be almost identical (with a non-defective transistor, the readings should be the same as the "S" position). Unequal readings indicate possible distortion in a linear amplifier stage.

At the D1 position, base/collector leakage reduces the reading, and base/emitter leakage reduces the reading on the D2 position of the TEST switch. An open element produces a zero reading. Diodes should be tested at the D2 positior

Silicon or germanium with leakage

If internal leakage has made identification of silicon or germanium questionable, most types can be identified correctly by noticing the readings when the TEST switch is alternated between the D1 and D2 positions. With the switch set to give the **highest** reading, the meter pointer probably will point accurately to silicon or germanium.

Step 5—Locating the collector

Rotate the TEST switch to the "CL" (collector-locating) position. Slide the COLLECTOR switch to each of the three positions, and leave it at the one giving the **highest** meter reading. The color listed beside that position identifies the collector lead.

Current gain

In addition to locating the collector lead, the test also provides a rough indication of relative current gain (when used out-of-circuit). A conversion graph is included in the instruction booklet to change the 0-50 meter scale numbers into DC beta. Silicon and germanium require different curves on the graph.

Leakage affects CL readings

Opens or serious leakages should have been identified before the collector-locating step. However, some peculiar meter readings can be obtained by simulating leakage. Collector-emitter leakage reduces

the reading. On the HI POWER setting, about 50 ohms leakage decreases the reading to about one-half; a 2.4K leakage with the LO POWER position also halves the reading.

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Add-A-Meter

Add-A-Meter, model HVM 3900, is designed to provide continuous monitoring of the CRT anode voltage of a chassis under test without needing any additional connections. The meter, from **Telematic,** enables the technician to adjust high voltage to manufacturer's specifications, avoiding over-voltage and possible X-radiation. Self-contained, this model can be mounted anywhere as an easy add-on to any test rig. The HVM 3900 consists of a 3-1/2 inch high precision meter with self-shielded movement. Full scale reading is 35 kv with an accuracy of 2 percent.

For More Details Circle (40) on Reply Card

Single- and Dual-Trace Scopes

Two new scopes, Model TO-55 single-trace and Model TO-60 dual-trace, are offered by **Lectrotech, Inc.**

Automatic features include astigmatism correction and automatic selection of TV vertical and horizontal triggering. Vertical sensitivity of both instruments has been increased to 10 millivolts/cm. Vertical bandwidth of the TO-55 is 10 MHz, while the dual-trace model has a 15 MHz response. All switching is done in the 1-2-5 step sequence to provide maximum resolution on all ranges.

For More Details Circle (41) on Reply Card

Electronic Frequency Counter-Timer

Simpson Electric Company has announced the availability of an electronic frequency counter-timer, model 7016. The model has a frequency range of 5 Hz to 50 MHz with gate times of 10 microsecond, (0.1 kHz resolution), 0.1 second, 1.0 second, and 10 second (0.1 Hz resolution). It has a total display range of 1 to 1999999, and an accuracy of ±1 count. A compact, lightweight unit (4 inches high, 8-1/2 inches wide, and weighing 6-1/2 pounds), 7016 is engineered for line operation and accurate readings over long periods of use.

For More Details Circle (42) on Reply Card

High Accuracy Digital Multimeter

Dynascan's latest entry in the DVM field is the B&K model 282. A 3-1/2 digit model, the 282 features DC accuracy of 0.5 percent, which reportedly is 6 to 13 times greater than the accuracy of typical analog meters. The model offers automatic polarity and automatically-positioned decimal point, positive out-of-range indication, 100% overrange capability on all ranges, 1mV resolution, 10 megohms input impedance on both ACV and DCV, full overload protection on all ranges, and 100 percent solid-state circuitry. It reads DC and AC volts, to 1000V, DC and AC current to 1000 mA, and resistance to 10 megohms. The flat display is large and non-blinking. A 3-position handle doubles as a stand for eye-level viewing at close or long range. Size of the 282 is 3-1/2X7X9 inches and the selling price is $200.00.

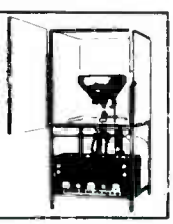
For More Details Circle (43) on Reply Card

FM Signal Generator

Gaw Company, Incorporated has introduced a low-cost FM signal generator, model 1012. It's features include digital frequency read-out, 8 frequency ranges, low frequency output for IF alignment, internal-external modulation, external counter to beyond 20 MHz, electronic fine tuning, double shielding, spectral purity, and less than 100 Hz residual FM.

For More Details Circle (44) on Reply Card

For More Details Circle (18) on Reply Card



For More Details Circle (15) on Reply Card

productreport

These features supplied by the manufacturers are listed at no-charge to them as a service to our readers. If you want factory bulletins, circle the corresponding number on the Reply Card and mail it to us.

Double-Insulated Soldering Iron

Safe, easy-to-use, compact design, and light weight are features of the Double Insulated D-I Line from **Ungar Industrial.** The heater and handle, with a two-conductor cord set and safety plug, are double-insulated and meet the latest safety standards.

The design includes 4 stainless-steel heaters and 3 heat ranges for flexibility on the job. The handle is molded of plastic with finger-ease cool grip.

The #555 Double-Insulated 2-wire handle accepts thread-in #300 series heaters with simple-to-change heat requirements. A 45-watt integral heater with built-in iron-plated chisel tip for heavy-duty applications is also available.

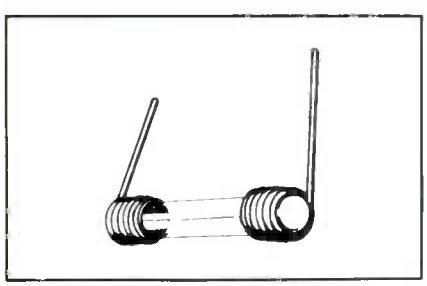
More than 40 tips plus a wide selection of de-soldering accessories are available.

For More Details Circle (45) on Reply Card

Pigtail Fuse Adapter

Workman Electronic Products has introduced model 33-125 adapter to convert pigtail fuses to standard 3-AG fuses. To use the adapter, connect spring ends to the lead wires, then insert fuse ends into the spring coils.

Model 33-125 is available in a package of 12, as well as a display card with 12 packages.



For More Details Circle (46) on Reply Card

(*continued on next page*)

productreport

(continued from previous page)

Soldering Vacuum Pump

Snortini, model MV 124, from **Edsyn, Incorporated** is a pocket-sized, pencil-like, hand-operated vacuum pump designed to aid desoldering of miniature components. The small soft-action tip of the Snortini allows easy control of tool positioning with minimal recoil during the vacuum stroke. Operation and maintenance instructions are engraved on the plunger assembly. The vacuum pump is priced at $3.95.

For More Details Circle (47) on Reply Card

Moisture Remover

DPL, an aerosol compound that displaces moisture, lubricates, and provides a protective barrier against moisture and dirt has been introduced by **Chemtronics, Incorporated**. DPL is designed for use on all types of electrical and electronic equipment. It prevents moisture from interfering with operation and restores operation once moisture has caused problems. For example, auto ignition systems sometimes fail after being soaked by a rain storm. Spraying DPL on a wet ignition system forces the moisture out, replacing it with a protective coating.

In addition, DPL acts as an inert lubricant for moving parts, and protects all metal against corrosion due to moisture or a salty atmosphere. It can also be used as a penetrating oil to loosen rust and to free frozen parts. It is non-conductive and will not harm plastic or rubber parts.

The price of a 4 oz. spray can is $1.44. DPL is available in three sizes.

For More Details Circle (48) on Reply Card

"Snap On" Home Alarm

The **Master Lock Company** is offering a line of "Snap On" Home-Alarm Sets for economical fire and burglary protection. Fast and easy installation is emphasized in the product line. There are no wires to cut, strip, solder or splice. The power source is a standard 6-volt or 12-volt battery.

Each alarm set includes a solid-state control center; an electronic super-siren with separate signals for fire or burglary; a key switch which permits the system to be turned on or off from outside the home; intrusion detectors for doors or windows; fire detectors; 20-foot extension cords; installation manual; and identifying warning decals.

The basic set retails for $69.95, and a deluxe version sells for $99.50.

For More Details Circle (49) on Reply Card

Five-Core Solder

Multicore Solders has introduced a mildly-activated rosin core solder designed for high-speed soldering of electronic assemblies. Ersin Multicore 381 RMA is said to leave a completely non-conductive and insulating flux residue, and has wetting properties nearly equal to those of Type RA (activated) core solders. Multicore 381 is available in most wire diameters in 1/2, 1, and 5 pound reels.

For More Details Circle (50) on Reply Card

(continued from page 34)

lator tube should bleed from the DC high voltage to the +400 volt source the same amount of current as drawn by the picture tube at maximum brightness. In other words, the high voltage is regulated by keeping a constant DC current drain on the HV rectifier tube. This is called DC-shunt regulation.

Control voltage for the 6BK4A is obtained from a voltage divider (R151, R154 and R16 control) connected from B-boost to ground, and the cathode goes through a 1k resistor to the +400 volt supply. In practice, the HV control is adjusted so (at maximum brightness of the picture tube) the regulator tube is barely cut off. Of course, this should not be adjusted until after the efficiency coil has been set, and any other repairs made.

Few technicians know the correct bias for 6BK4 tubes. Only about -13 or-14 volts of bias (total cathode-to-grid voltage) is enough to stop all plate current, and about -2 or -3 volts of bias causes a plate current of 1.5 milliamperes. This bias is very critical. Therefore, the usual tolerances of ±10% measured from the ground are not sufficiently accurate. **Measure the bias of the 6BK4 from cathode to grid.**

Troubleshooting

A fast test to determine if the shunt-regulator tube is drawing excessive current is to ground the grid, thus placing about 400 volts of cutoff bias on it. If the width, focus, or amount of HV increases to normal, it's a good bet the regulator is drawing too much current.

A surprise awaited me when I grounded the grid this time, for there was a loud pop and a spark. Normally, the spark is too small to be seen. After I removed the screwdriver ground, the high voltage disappeared, and the raster was gone. I had made the situation worse!

Next, with the power off, I removed the cap of the 6BK4 and insulated it from the chassis. This time the set came on with a bright picture and no compression on the left. Evidently the regulator current was responsible for both symptoms.

While the tube was out of the socket, I measured the grid voltage and found it around 1,000 volts. C94 checked almost zero ohms. Intermittent leakage in the capacitor had been changed into a short by the grounded-grid test. Notice that the capacitor also is a spark gap. It appears a saw was used to slit one edge during manufacturing. Always replace such capacitors with ones having a spark gap.

Other defects

It's advisable to measure R155 (1,000-ohm cathode resistor) in each of these receivers you service. Excessive current, perhaps from a gassy regulator tube, can overheat the resistor and cause a large change of resistance value. Some resistors have burned into two parts.

The long-term stability of R151 and R154 is very critical, because the tube bias is equally critical. Therefore, it's wise to use a replacement of higher wattage than the original, or to select a deposited-carbon type.

R214 and its connection to the video-output stage makes possible regulation that's better than perfect (at least to changes from adjustments of the brightness control). Many receivers will measure about 500 volts more of HV when the brightness control is turned up for a bright picture. Video defects and voltages have some effect on the regulation, but not enough to affect seriously any troubleshooting procedures.

Summary

Regardless of the type of circuit, loss of all high-voltage regulation causes the same general symptoms of picture-size changing in step with the brightness, arcs or frying sounds, plus excessive high voltage when the brightness is dim. Often these symptoms are subtle and easily overlooked. However, X-rays probably are emitted from the picture tube during dark scenes; therefore, loss of HV regulation must be taken seriously.

Too-much regulation produces such obvious symptoms as a narrow picture with poor linearity, smeared focus, or blooming. Methods were given for temporarily controlling the regulation to determine if it might be the source of the symptoms.

Keep these tips in mind, for many symptoms of regulator defects can masquerade as horizontal-sweep troubles. □

audio systems report

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New Features For Talk-A-Phone

Improved, and new features are now available in the **Talk-A-Phone** Chief intercommunication system which is said to have virtually a "built-in brain".

Logic and control circuits, which eliminate the manual stand-by position on the talk-listen bar are standard in the Chief. The logic circuit electronically determines when any station is busy, activates the incoming calls, signals the receiving station, places the call which the user has selected and automatically returns the unit to the stand-by position on completion of the call. It senses the line to determine whether the receiving station is private or non-private and connects the call accordingly.

Optional is the LD (Long Distance) feature, which provides for communication over miles of cable line without loss of volume. LD models can now function privately or non-privately.

For More Details Circle (51) on Reply Card

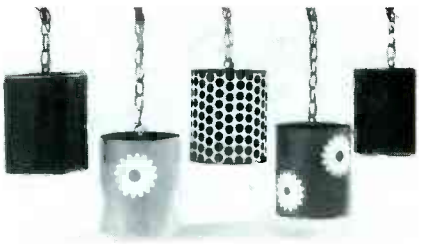
Record-Cleaning Device

First offering in a line of record-care products from **Vor Industries** is Vac-O-Rec, an electric-powered, automatic-action, record-cleaning device. Dust particles in the grooves are loosened by natural-mohair brushes while the record is rotated in an electrostatic field, which attracts the dust away from the record. Any electrostatic charge remaining on the record would attract other dust, so the voltage gradually is reduced from about 20,000 volts to zero to eliminate any residual electrostatic charge.

For More Details Circle (52) on Reply Card

Accent Speakers

Audio Accents, a product line from **Innovative Audio Systems,** consists of speakers in drum-shaped enclosures that can be hung like swag lamps anywhere an extension speaker is needed. Each speaker is supplied with 50 feet of cord to allow flexibility in placement. Six colors are available. The retail price of the speakers is $29.95.



For More Details Circle (53) on Reply Card

Megaphone

A new addition to the **Fanon** megaphone line is the Model MV-5S, a combination loudspeaker and warning signal system contained in a sturdy high-impact ABS plastic bell and housing and delivering five watts rated output (six watts peak power.)

The Model MV-5S features a weatherproof built-in dynamic microphone, adjustable volume control and balanced pistol grip design with trigger talk/signal switch. Power is furnished by six standard "C" batteries carried in the unit.

The MV-5S can be used in boating, sports, industry and in security applications for crowd control. The built-in signal horn alarm serves as a warning alert, starting signal, fog horn or "Mayday" call.

For More Details Circle (54) on Reply Card

antenna systems report

These features supplied by the manufacturers are listed at no-charge to them as a service to our readers. If you want factory bulletins, circle the corresponding number on the Reply Card and mail it to us.

Distribution Amplifier

An extended-frequency range MATV-CATV distribution amplifier has been developed by the **AVA Electronics Corporation.** Model A-110-4 is miniature-sized, having 10 dB gain and built-in lightning protection. It may be used to compensate for the cable loss of long drops, or utilized in small multiple-dwelling installations. With a single 75-ohm input and four 75-ohm outputs, the unit also is a VHF broadband amplifier. Input either can be from TV receiving antennas, or a CATV system. Model A-110-4 is priced at $24.90.

For More Details Circle (55) on Reply Card

Cable Master Switch

ACA has added to their line of products the Cable Master, an easily-installed switching device that mounts on the back of the TV set, enabling the customer to choose between watching programs from the cable system, or from his own antenna. In most cases, local channels can be received with better color quality and less snow by using a good outdoor antenna instead of the cable. This difference of quality is important because about 90% of most viewing time is spent watching local channels, those best received with antennas. With the Cable Master, the customer can have both the extra channels and features of cable, plus better reception of local channels.

Model CM-10 for 300-ohm antenna lists for $13.95, and Model CM-50 with an input for 75-ohm antenna lists for $14.50.

For More Details Circle (56) on Reply Card

Fringe Antenna

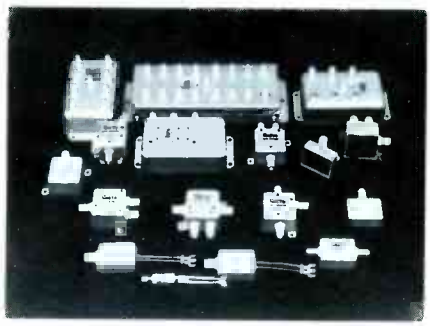
RCA has engineered a Permacolor UHF/VHF-FM outdoor antenna, Model 4BG48. This type is an all-channel model that brings in deep-fringe reception of color, b-w, and FM programs. Durability is improved by solidly-riveted permanent connections of flexible aluminum between elements and feed lines. Its blue and gold plastic finish acts as a long-lasting weather protector.

Other features of the 4BG48 Permacolor antenna include special polypropylene insulators, break-off elements for FM broadcast reception control, and rugged V-shaped mast clamps. It is pre-assembled and packaged so that all elements unfold easily and lock positively into place. The antenna is constructed with a double boom for extra strength and rigidity. The product sells for $99.95.

For More Details Circle (57) on Reply Card

Indoor Splitters, Taps and Transformers

A complete line of indoor hybrid splitters, directional taps and transformers have been introduced by **Cerro Communication Products.** The indoor hybrid splitters are used to hook up additional sets in homes, and feature a completely-sealed housing that prevents signal leakage, 5-300 MHz bandwidth, low loss, and high isolation. Sizes range from 2- to 16-way splitters. Additional features include rugged construction for trouble-free performance and the availability of universal mountings. The indoor directional taps also are housed in a completely-sealed enclosure, offer a flat response from 5-to 300-MHz, and are available for wallplate, raceway, and box mounting. Other features include high directivity/low loss, and compact design for easy installation. Transformers are available in two sizes. Model MTD is a heavy duty, twin-lead transformer that is cased in plated steel. Model MTS is of rugged standard weight with twin leads that comes in an aluminum casing. Both match from 75-to 300-ohm, and both have plastic sheath insulation, flat response, excellent balance (35 dB), minimum direct pick-up, and AC isolation.



For More Details Circle (58) on Reply Card

photofactbulletin

PHOTOFACT BULLETIN lists new PHOTOFACT coverage issued during the last month for new TV chassis.

ADMIRAL
Chassis M2408-2, M2412-2 1436-1

BROADMOOR
2512 1436-2

CATALINA
122-4000 1440-1

JC PENNEY
2335A, 2338B 1436-3

JC PENNEY
4911C (855-2002), 4912C (855-2044)
4917B (855-2093), 4918B, 4924A
(855-2309) 1439-1

K MART
SKP1920 1438-1

PANASONIC
Chassis N929B 1437-1

PHILCO-FORD
Chassis 4BP24 1438-2

RCA
Chassis CTC68AK/AN 1437-2

RCA
Chassis CTC72B/N/R 1439-2

RCA
Chassis KCS185H 1440-2

SONY
TV-760 1439-3

TELEDYNE
3C194WL 1440-3

WARDS AIRLINE
GAI-12344A, GAI-12744a 1437-3

WARDS AIRLINE
GAI-17725A/B/C, GAI-17735A/B/C,
GAI-17753A/B/C 1438-3

bookreview

How To Troubleshoot & Repair Electronic Test Equipment (TAB book 680)
Author: Mannie Horowitz
Publisher: Tab Books, Blue Ridge Summit, Pennsylvania 17214
Size: 252 pages, 143 illustrations
Price: $9.95 hardbound, $6.95 paperback

"Technician, cure your own equipment" is the watchword of this volume, written by a designer of test equipment. Therefore, author Horowitz includes in this book practical, ready-to-use data on the repair of power supplies, multimeters, oscilloscopes, audio and rf signal generators, sweep generators, and tube and semiconductor testers. No complex math or circuit theory is included. Because the theory that is presented is simplified, this book does not require study, but may be used from the very minute it's opened. Traditionally, understanding test gear has been difficult because of the maze of switching circuits that are used. In this volume, circuitry is clarified, and for each piece of equipment, there is an illustrated explanation of the basic circuits it contains. There's also a complete trouble analysis of each circuit, telling what can go wrong and what the probability of it is. Next comes an explanation of how the basic circuits are integrated into a complete circuit by the switching circuitry, and up-to-the-minute test procedures for an actual example are explained.

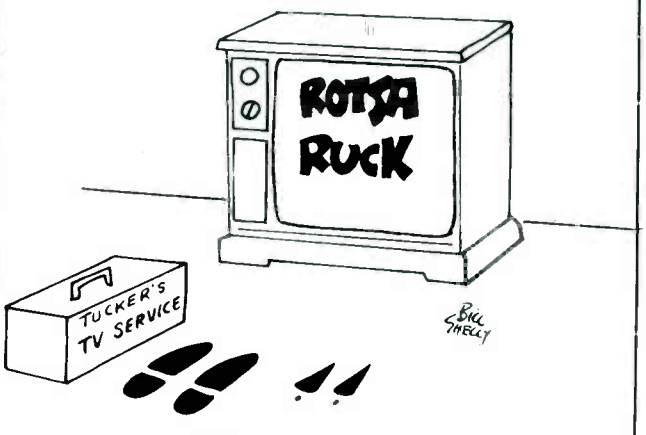
Contents: Tubes, Semiconductors, Tube and Semiconductor Defects, Switches, Power Supplies, Voltmeters, Ohmmeters, Ammeters, Trouble-shooting Meter Circuits, Servicing Oscilloscopes, Servicing Audio Generators, Repairing RF Signal Generators, Sweep Generator Principles and Repairs, Tube Testers, Semiconductor Tester Operation and Repair.

ABC'S Of Zener Diodes
Author: Rufus P. Turner
Publisher: Howard W. Sams & Co., Inc. 4300 West 62nd Street, Indianapolis, Indiana 46206
Size: 5 1/2 X 8 1/2 inches, 96 pages
Price: $3.95 softbound

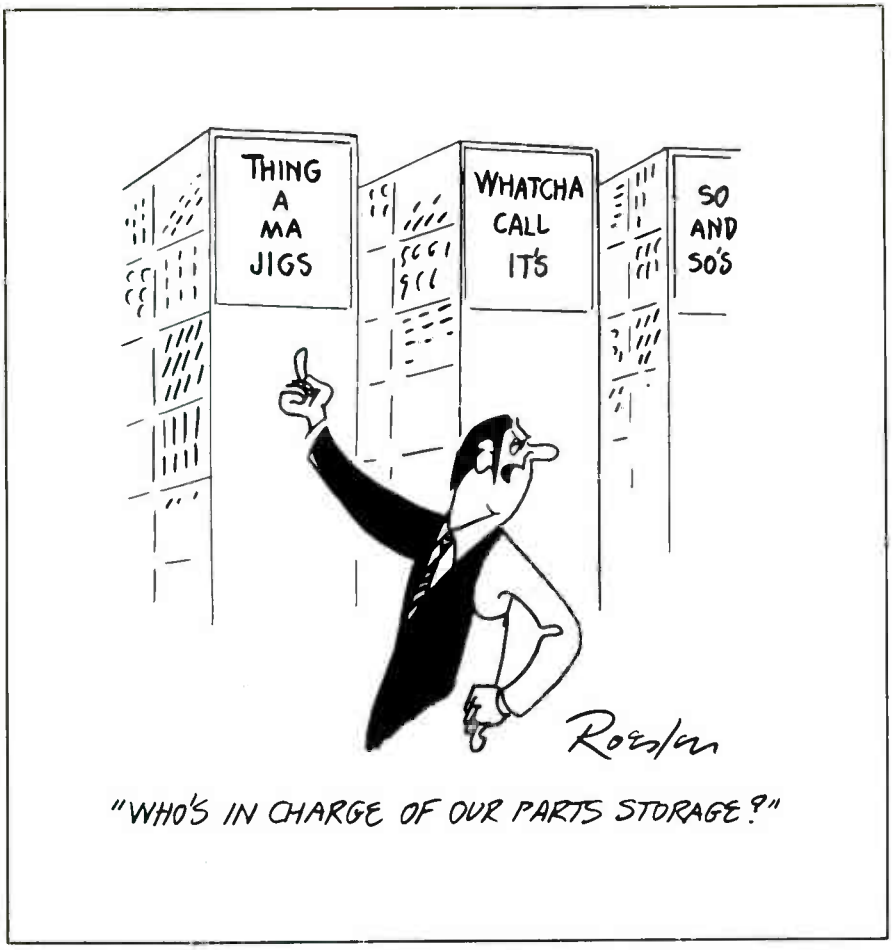
Increased use of zener diodes in the growing automotive-electronics field, plus the inclusion of zener diodes in the rapidly-developing metal-oxide-semiconductor (MOS) technology, are just two reasons for learning the "abc's" of zener diodes. Turner gives an essentials-only explanation of fundamentals such as breakdown voltage, knee of curve, reverse-leakage current and zener impedance, which are all defined clearly and concisely. Illustrative examples show how to select a zener diode for use as a voltage regulator using an easy-to-follow, step-by-step procedure. Practical dc and ac power-supply applications are also presented. Turner includes miscellaneous applications such as a zener-switching circuit, an interstage coupling device, a zener diode as a voltage-variable capacitor, a loudspeaker protector, plus others.

Contents: Zener Diode Fundamentals, DC Power Supply Applications, AC Power Supply Applications, Miscellaneous Applications, Testing Zener Diodes. □

"Picture tube is a little weak, probably all it needs is a booster!"



"Nothing to worry about... it happens with these Japanese sets."



Let us send you 33 proven ways to conserve energy in your business

We would like to tell you how Energy Management can help maintain your company's profitability. Send for your "33 Ways" booklet and we will send you something else: "How to Start an Energy Management Program."

To: U.S. Department of Commerce
Office of Energy Programs
Washington, D.C. 20230

Please send me your two free booklets on "33 Ways to Conserve Energy" and "How to Start An Energy Management Program."

Name _____

Title _____

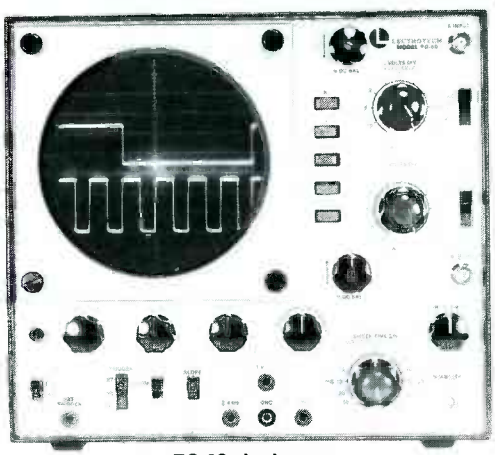
Company _____

Address _____

City _____ State____ ZIP____

Type of Business _____

the new automatics . . .

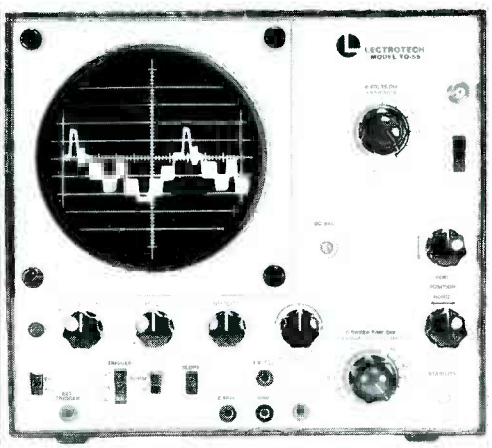


TO-60 dual-trace

TO-60 automatic dual-trace triggered sweep oscilloscope
Bandwidth: DC 15 MHz
10 mV sensitivity **$489.50**

TO-55 automatic single-trace triggered sweep oscilloscope
Bandwidth: DC 10 MHz
10 mV sensitivity **$379.50**

Made in U.S.A.



TO-55 single-trace

Two outstanding new five inch oscilloscopes with exceptional stability, featuring:

• **Automatic Triggering** • **Automatic Astigmatism** • **Automatic Horizontal Sweep** • **Automatic TV Trigger Selection** • All Switching 1-2-5 Sequence • Vertical Amplifier Sensitivity: .01 volts/div. • Horizontal Sweep Speed .2 Sec.–.5 μ Sec./div. • 5x Magnifier • All Solid State • TO-60 Dual Trace Capability: Channel "A", Channel "B", A-B Chopped, A-B Alternate, Sum of A & B.

See your distributor or write:

LECTROTECH, INC.
5810 N. Western Avenue, Chicago, Illinois 60659 (312) 769-6262

Available in Canada from Superior Electronics Inc.

For More Details Circle (27) on Reply Card

catalogs literature

Circle appropriate number on Reader Service Card.

100. Brookstone Company—offers its second 1974 catalog of hard-to-find tools. The 60-page catalog features 76 new products in addition to the thousands of other items available from the firm.

101. Sprague Electric Company—has introduced a comprehensive revision of their Semiconductor Manual and Replacement Guide. The 64-page manual K-500A lists over 38,000 of the most popular domestic and foreign OEM semiconductor part numbers and their recommended replacement with 137 of Sprague's RT, TVCM, and ZT series semiconductors. All listings are alpha-numerical for simplified use of the manual. Also included is an extensive product guide section.

102. Tab Books—offers its 1974 catalog, describing over 300 current and forthcoming books, plus 14 electronic book/kits. Subject areas include basic electronic technology, CATV and MATV, medical electronics, radio receiver servicing, television servicing, test equipment, communications and CB radio, plus transistors and semiconductors.

103. Telematic—makes available their 1974 catalog of test jigs, replacement parts and service accessories. The 16-page catalog offers many new items for the service market.

104. Mountain West Alarm Supply Company—has announced an alarm equipment catalog, A-75. The 96-page catalog describes over 450 intrusion-and fire-alarm products. Equipment offered ranges from simple kits with instructions, to the latest ultrasonic, radar, and infrared intrusion detectors.

105. RCA Electronic Components—has released a revised product guide describing picture tubes for the renewal market. The guide, PIX-300H, includes a directory which lists replacements for 975 industry types, plus over 85 foreign types. Basing diagrams, pictorial views illustrating safety feature constructions, and keys to tube sizes in the old, new, and foreign type designation systems are covered.

106. International Rectifier Corporation—makes available the 1974 edition of the semiconductor cross-reference and transistor data book. The 70-page brochure lists over 44,500 parts and corresponding replacements. The parts are indexed in straight alpha-numeric sequence for easy location. Also included are transistor specifications, showing polarity, case style, maximum current, typical bandwidth and gain, and price information.

107. Eico Electronic Instrument Company has released a 6-page condensed catalog featuring its line of electronic test and measuring instruments. Over 100 electronic kits and factory-assembled instruments, including oscilloscopes, VTVM's, VOM's, generators, tube/transistor testers, and power supplies, are listed.

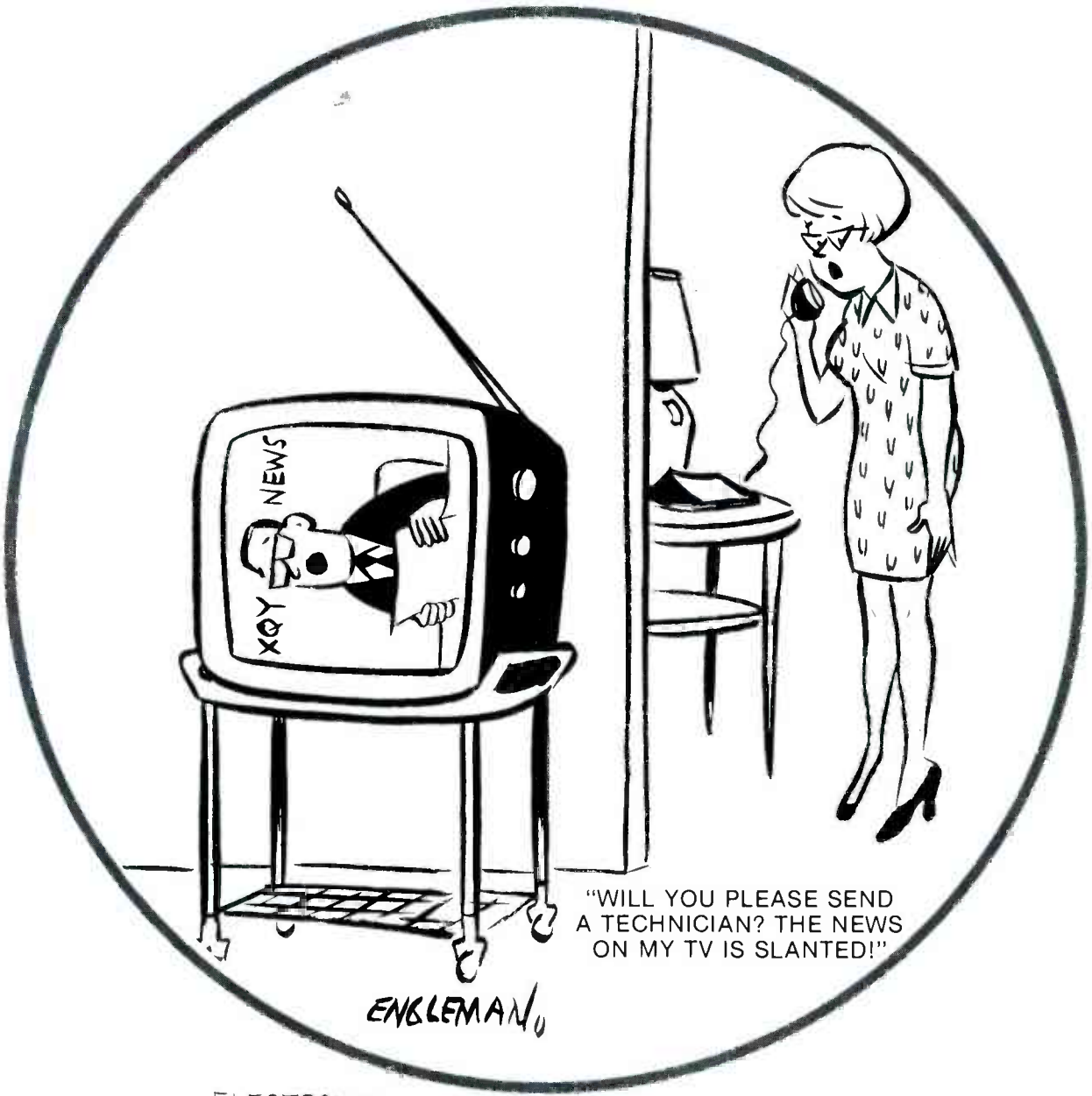
108. Fordham Radio Supply Company—has made available a 48-page illustrated, discount mail-order catalog, designed as a quick-reference ordering guide. Included are tools, service and repair kits, tubes, test equipment, phono cartridges and needles, speakers and microphones, antennas, components and other servicing aids. All products are shown with their discounted prices.

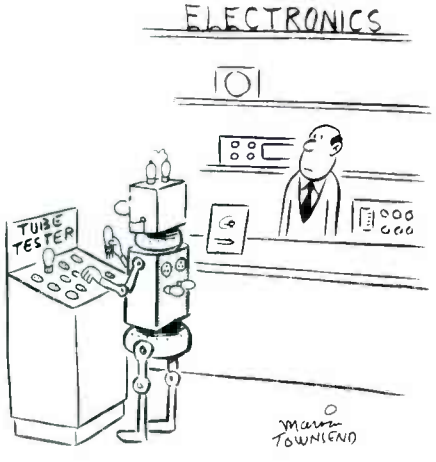
109. Jensen Tools and Alloys—offers a tool catalog with descriptions of over 2,500 items. The 112-page handbook includes sections covering tool kits, solder, technical data on tool selection, and tool "terms".

110. Bernard Franklin Company—announces a rack catalog which includes technical information for the bulk storage rack. The rack is intended for large items too big or bulky for standard shelving. Models include heights to 12 feet, depths to 4 feet, and beams to 10 feet.

111. Radio Shack—introduces a 1975 Electronics Catalog 250, which listed hundreds of specialized electronics items, parts and accessories, tools, tubes and transisters, wire and cable, home security products, intercoms, microphones, timers, batteries, and a library of books on electronics and related subjects. The 164-page catalog has 100 full-color pages and introduces many products. □

cartoon corner





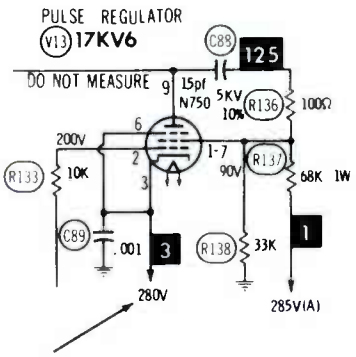
troubleshootingtips

Send in your helpful tips—we pay!

Blooming at low brightness RCA CTC22AA chassis (Photofact 988-2)

The TV came to the shop with the complaint of poor sharpness and continual breaker-tripping. This sort of problem usually is caused by a bad horizontal-output tube, which draws too much current. One part of the circuit breaker is in the cathode circuit of the HOT, thus causing the tripping.

Replacement of the 24JE6A output tube stopped the breaker-tripping, but another symptom appeared. Changing channels sometimes caused a decrease of high voltage, and with the service switch in the "service" position, the horizontal line was narrow and the high voltage was low.



After some checking, I traced the trouble to an open in R204, a 680-ohm, 2-watt resistor in the cathode circuit of the pulse regulator tube. This part is not shown on the partial schematic, but the cathode was bypassed to ground by a 40 microfared filter and clamped to the +280 volt supply through the resistor, which connected to the +285 supply. Also not shown are the many circuits (horizontal oscillator, AFC tube, AGC screen, sync/chroma amplifier and sync separator) obtaining power from the same cathode.

Without R204 to supply DC voltage to those other stages, the power was obtained solely by conduction of the pulses through the pulse regulator tube. However, most of the time the cathode current was not sufficient to satisfy the requirements; therefore, the +280 voltage dropped. Notice that the +280 supply is connected to the regulator cathode, and a drop of this voltage decreased the bias, causing excessive regulator current and high-voltage blooming. This is another example of the interconnection of circuits that make logical troubleshooting more difficult. Looking back at it, a fast test would have been to ground the grid of the regulator and note any improvement which would have proved a defect in the regulator circuit.

Carl M. Colombo
Woburn, Massachusetts

Foldover and vertical bars Sylvania D12 (Photofact 1143-1)

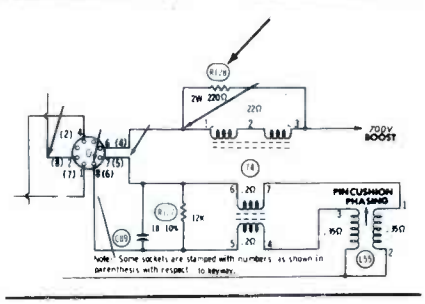
The symptoms were foldover on the left side of the picture and three vertical bars near the left edge, otherwise the performance was normal.

First, I removed the horizontal oscillator tube and substituted grid drive from my Analyst. There was no improvement, so that proved the trouble was not in the horizontal-oscillator circuit.

After much searching, I found R128 had changed to 2 megohms (virtually an open circuit).

Installation of a new resistor restored the operation to normal. However, I would suggest using a 5-watt resistor as a replacement.

Richard Sanderford
Raleigh, North Carolina



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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)
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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.

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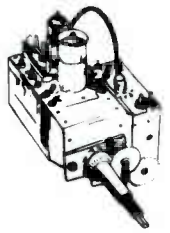
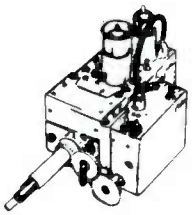


Universal Replacements from $8.95



These universal replacement tuners are all equipped with memory fine tuning and uhf position with plug input for uhf tuner. They come complete with hardware and component kit to adapt for use in thousands of popular TV receivers.

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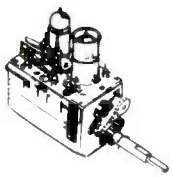
CR7XL	Series 600mA	2½"	12"	41.25	11.00
CR9XL	Series 450mA	2½"	12"	41.25	11.00



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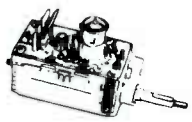
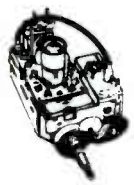


Castle custom replacements made to fit in place of original tuner. Purchase outright . . . no exchange needed. Write for current list of Castle replacements, or request the part number you require (use number on ORIGINAL TUNER ONLY; do not use service literature numbers). Available for many of the popular models of following manufacturers: Admiral, Curtis Mathes, Emerson, GE, Heathkit, Magnavox, Motorola, Muntz, Philco, RCA, Sears, Sylvania, Westinghouse, Zenith and many private labels.



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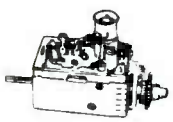
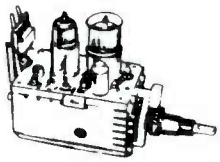
Service on all makes and models, vhf or uhf, including transistor and color tuners . . . one price $9.95 Overhaul includes parts, except tubes and transistors.





Remember! **Castle overhaul service is as near as your post office**

Simply send us the defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint. Your tuner will be expertly overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.

Dismantle tandem uhf and vhf tuners and send in defective unit only. Remove all accessories . . . or dismantling charge will apply.

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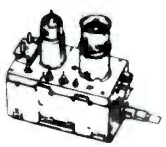
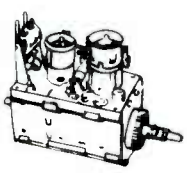


When our inspection reveals that original tuner is unfit for overhaul, and it is not available from our stock of outright replacements, we offer to make a custom replacement on exchange basis. Charge for this service is $15.95 for uhf tuner and $17.95 for vhf tuner.

If custom replacement cannot be made we will custom rebuild the original tuner at the exchange replacement price.



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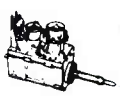

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