February, 1977 ☐ 75 cents

Electronic Servicing

A HOWARD W. SAMS PUBLICATION

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SAMUEL SACHS
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PHILADELPHIA PA 19111

Weird TV Symptoms

Interpreting TV Alignment

CB Mike Repairs

February, 1977 ☐ Volume 27, No. 2

Electronic Servicing®

in this issue...

ABOUT THE COVER

An ordinary television module might look like this in a technician's nightmare after too many pizzas and a late-late horror movie. The trick photography is by Carl Babcoke.

DEPARTMENTS

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Electronic Servicing

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For More Details Circle (11) on Reply Card

electronicscanner

news of the industry

Twelve more NESDA PSM management schools are scheduled in major cities between February and August. An agreement has been reached with Forest Belt for the Profitable Service Management Schools to be held on the Sunday preceding the start of each Forest Belt "Training Workshop" for CB servicing. Cost of the one-day PSM school will be $20 to technicians attending the Training Workshops, or $30 each to others. Scheduling the two meetings together makes possible a saving in transportation for those who attend both. NESDA is at 1715 Expo Lane, Indianapolis, Indiana 46224, and Forest Belt can be reached at P.O. Box 68120, Indianapolis, Indiana 46268.

Robert E. Hertel (left) recently was presented with an E. F. Johnson CB radio transceiver by George H. Seferovich during ceremonies marking Mr. Hertel's retirement from Intertec Publishing Corporation, the publishers of Electronic Servicing. Intertec's new president is George Seferovich. Mr. Hertel joined the company in 1935 (when only one magazine was published), and was appointed president in 1940. Over the years, additional periodicals have been added. Nine magazines, many auto-shop manuals, and a variety of automotive technical books now keep the new rotary press busy. In 1962, Intertec became a subsidiary of Howard W. Sams & Co., Inc., originators of Photofacts and other Sams books.

(Continued on page 6)

What d'ya mean, you can't fix CBs?

Introducing the Sylvania ECG™ CB10-4 service kit.
26 semiconductors that can turn CB problems into profits.

Until now, the toughest problem in handling CB repair jobs was getting the right replacement part.

Now, we've put the solution to 1,047 of these parts problems in one kit that will fit right on your bench.

The CB10-4 kit has 23 transistors and 3 integrated circuits that are the most frequently needed replacements in transceivers and other CB equipment. And the interchangeability guide that comes with the kit tells you the right ones to use as replacements. With the CB10-4 most of your parts needs are right at your fingertips. And you can get the others in the same place you bought the kit—at your Sylvania distributor.

We're helping you make it.

GTE SYLVANIA

(Continued from page 4)

Coleco Industries, makers of Telstar, are considering a warranty for that video game against TV damage, according to an item in **Retailing Home Furnishings.** Coleco executives believe the game cannot damage picture tubes when it is used according to instructions, and the warranty would give the consumers confidence. There is some concern in the industry that stationary parts of any game's pattern might result in phosphor burns inside some picture tubes.

PerCom Report believes the government is preparing to set interference-rejection standards for the TV set manufacturers. The FCC has blamed poor TV receiver design for most cases of CB interference to both TV sound and picture. Although only about 100,000 complaints of CB interference were recorded in 1976, it's likely more than a million TV watchers were affected. Presently, CB interference is being handled on a case-by-case basis by the manufacturers. It's said that RCA and Zenith, as well as others, supply free TVI high-pass filters to their customers upon request.

More than 250 40-channel model CB radios met the FCC's rigid new standards by January 1, 1977 when 17 additional channels became available to the public. John Sodolski, Vice President of Electronic Industries Association's Communications Division, feels the expanded channels will make the original 23 channels more usable, especially in heavily-populated areas. He predicts a dual sales market for at least the next six months, because of attractive pricing of 23-channel units, and a strong demand for 40-channel models. Sodolski reported that in 1976, sales of CB radios exceeded the total of all sales during the previous 28 years. Another factor which should stimulate future CB sales is the elimination by the FCC of the $4 former license-application fee, as of January 1, 1977.

Color TV sales to dealers for the first 47 weeks of 1976 were up 17% compared to those of the previous year, while B&W sales increased 2.7%, portable phono sales dropped 8.9%, and all categories of radios increased sales, especially auto radios with 37.5%.

W. S. "Bob" Harrison has been named as Director of Editorial Operations for Retailing Reviews, which is said to be the nation's largest publisher of regional electronic trade publications. Bob is well known in both NATESA and NESDA, having been a former Secretary-General for NATESA, and recently serving as a regional vice-president for NESDA. Harrison for two years was the editor of the "VEA Reporter", published by the Virginia Electronics Association. I'm sure we all wish Bob success in his new venture.

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- Customized tuners are available at a cost of only $14.95 and up (U.S.A. only) (U.S.A. only)
- Send in your original tuner for comparison purposes to any of the Centers listed below.

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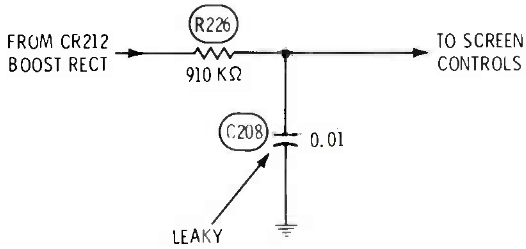
HEADQUARTERS	BLOOMINGTON, INDIANA 47401	537 South Walnut Street	Tel. 812-334-0411
ALABAMA	BIRMINGHAM, ALABAMA 35212	5623 1st Avenue North	Tel. 205-592-9150
ARIZONA	TUCSON, ARIZONA 85713	1528 S. 6th Ave.	Tel. 602-791-9243
CALIFORNIA	NORTH HOLLYWOOD, CALIF. 91601	10654 Magnolia Boulevard	Tel. 213-769-2720
	SAN MATEO, CALIF. 94402	600 S. Amphlett Blvd.	Tel. 415-348-3292
	MODESTO CALIF. 95351	123 Phoenix Avenue	Tel. 209-521-8051
FLORIDA	TAMPA, FLORIDA 33606	1505 Cypress Street	Tel. 813-253-0824
	FT. LAUDERDALE, FLORIDA 33309	3516 N.W. 10th Ave.	Tel. 305-566-4882
GEORGIA	ATLANTA, GA. 30310	646 Evans St. S.W.	Tel. 404-7[illegible]8-2232
ILLINOIS	URBANA, ILLINOIS 61801	908 E. Main Street	Tel. 217-384-2052
	SKOKIE, ILLINOIS 60076	5110 West Brown Street	Tel. 312-675-0230
INDIANA	INDIANAPOLIS, INDIANA 46204	112 West St. Clair Street	Tel. 317-632-3493
KENTUCKY	LOUISVILLE, KENTUCKY 40205	2244 Taylorsville Road	Tel. [illegible]-452-1191
LOUISIANA	SHREVEPORT, LOUISIANA 71104	2423 Southern Avenue	Tel. [illegible]-221-3027
MASSACHUSETTS	SPRINGFIELD, MASS. 01108	405 Dickinson St.	Tel. 413-788-8206
MISSOURI	ST. LOUIS, MISSOURI 63132	9577 Page Avenue	Tel. 314-429-0633
NEVADA	LAS VEGAS, NEVADA 89102	1412 Western Avenue	Tel. 702-384-4235
NEW JERSEY	TRENTON, NEW JERSEY 08638	1139 Pennsylvania Ave.	Tel. 609-393-0999
	JERSEY CITY, NEW JERSEY 07307	547-49 Tonnele Ave., Hwy. 1 & 9	Tel. 201-792-3730
NEW YORK	ROCHESTER, NEW YORK 14615	37 Pullman Ave.	Tel. 716-647-9180
N. CAROLINA	GREENSBORO, N.C. 27405	2914 E. Market Street	Tel. 919-273-6276
OHIO	CLEVELAND, OHIO 44109	4525 Pearl Road	Tel. 216-741-2314
OREGON	PORTLAND, OREGON 97210	1732 N.W. 25th Ave., P.O. Box 10141	Tel. 503-222-9059
PENNSYLVANIA	PITTSBURGH, PA. 15209	515 Grant Avenue	Tel. 412-821-4004
TENNESSEE	MEMPHIS, TENNESSEE 38111	3158 Barron Avenue	Tel. 901-458-2355
TEXAS	DALLAS, TEXAS 75218	11540 Garland Road	Tel. 214-327-8413
CANADA	ST. LAURENT, QUEBEC H4N-2L7	305 Decarie Boulevard	Tel. 514-748-8803
	CALGARY, ALBERTA T2H-1Y3	P.O. Box 5823, Stn. "A"	Tel. 403-243-0971

WATCH US GROW

IF YOU WANT TO BRANCH OUT INTO THE TV TUNER REPAIR BUSINESS, WRITE TO THE BLOOMINGTON HEADQUARTERS ABOUT A FRANCHISE.

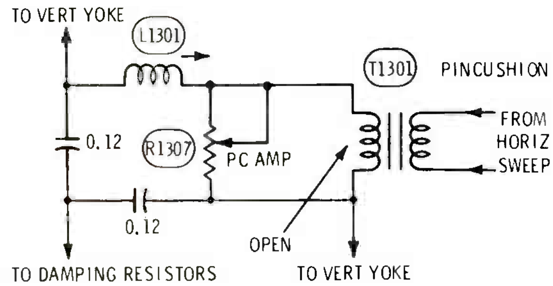
For More Details Circle (8) on Reply Card

Chassis—Zenith 19EC45 (17EC45, 19FC45, 19GC45, etc.)
PHOTOFACT—1377-3 and others



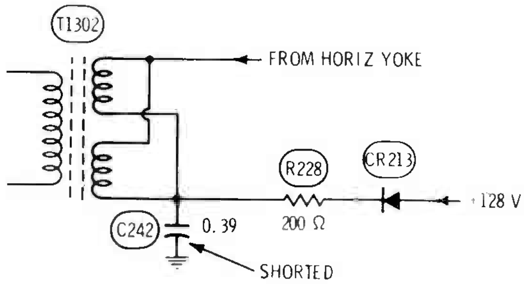
Symptom—Low brightness, low CRT screen voltages
Cure—Check C208, and replace it if leaky

Chassis—Zenith 19EC45 series
PHOTOFACT—1377-3 and others



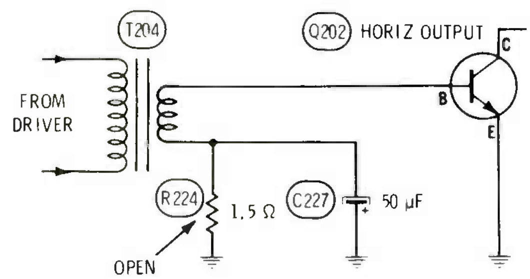
Symptom—Intermittent height
Cure—Check for open at terminals of T1301, replace transformer if intermittent

Chassis—Zenith 19EC45 series
PHOTOFACT—1377-3 and others



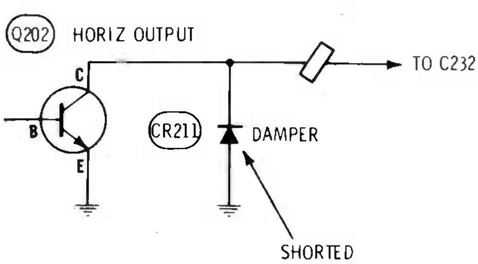
Symptom—Buzz in speaker, then breaker trips
Cure—Check C242, and replace it if leaky or shorted

Chassis—Zenith 19EC45 series
PHOTOFACT—1377-3 and others



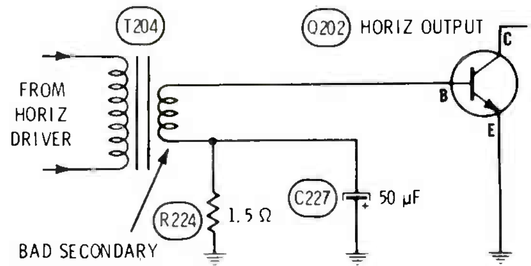
Symptom—No HV, no overload
Cure—Check R224, and replace it if open

Chassis—Zenith 19EC45 series
PHOTOFACT—1377-3 and others



Symptom—Buzz in speaker, no HV, breaker trips
Cure—Check damper diode CR211, and replace it if shorted

Chassis—Zenith 19EC45 series
PHOTOFACT—1377-3 and others



Symptom—Double stationary bend in vertical lines
Cure—Check T204 for increased secondary resistance, replace if over one ohm □

troubleshooting tips

Send in your helpful tips—we pay!

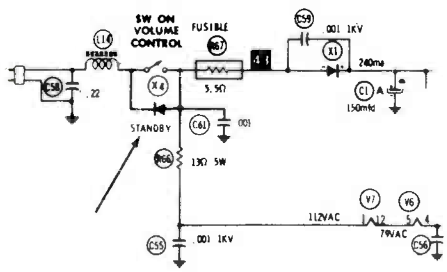
TV won't turn off
Admiral B&W Model 9P210
(Photofact 1188-1)

A few weeks ago, a lady brought a small Admiral portable TV to the shop and asked about the "instant-on" feature. A friend had told her it wasted electricity, and she wanted to know if there was a way I could disconnect it.

I searched for a defeat or "vacation" switch, but there was none. Finally, I told her I would have to make a minimum charge if I opened the set and checked the circuit. She decided it wasn't that important.

Well, yesterday the lady came back with the same television. But now the set would not turn off, and she was tired of plugging and unplugging it. As she was leaving, she asked me to remove the instant-on wiring, since the set required work, anyway.

After I removed the back, I decided to give the on/off switch a visual inspection before I pulled the Photofact, expecting to order a new switch. Right across the switch terminals was a diode (X4), probably part of the instant-on circuit. Now, a diode is just as likely to short as a switch is (or more so). Since I was going to take it out



anyway, I clipped out the diode, and tried the set. To my surprise, the on/off switch worked perfectly and the instant-on was defeated. The repair was over.

I call this case **"My Easiest Repair"**.

Lynn Wogencraft
Oceanside, California

Editor's Note: This instant-on circuit is the most simple of all. When the switch is off, X4 rectifies the line voltage, producing negative half-wave DC at its anode. This unfiltered voltage gives the heating of one-half of the normal AC voltage, so the tubes are partially hot and ready for a quick warmup. However, the negative DC voltage cannot go through power-supply rectifier X1; therefore, the set is dead. When the switch is turned on, diode X4 is shorted out, full AC is applied to X1 and to the tube heaters, for normal operation.

reader's exchange

There is no charge for listing in *Reader's Exchange*, but we reserve the right to edit all copy. If you can help with a request, write direct to the reader, *not to Electronic Servicing*.

Needed: *Schematic and service data with parts list for Golden Shield Radio, Model 9180.*
Jack Goldsmith
Radio & TV Instructor
B.O.C.E.S. Court Street Road
Syracuse, New York 13206

Needed: *Service information or manual for a Mark SSB-46 Sidewinder CB transceiver. Will buy original or a copy.*
Horn's Radio Service
466 Bostwick Avenue
Janesville, Wisconsin 53545

Needed: *Set-up book or chart for Century "Fast Check" tube tester, Model FC-1. Will buy, or copy and return.*
Norman C. Barno
649 Sherrie Lane
Lorain, Ohio 44053

Needed: *One #8FT-014-1 flyback transformer for a small Broadmoor B&W portable TV; new or used in good condition. Send price.*
Frodge TV & Radio Shop
41 E. Main Street
Mt. Sterling, Kentucky 40353

For Sale: *Sencore color-bar generator Model #CG126. Has dots, crosshatch, vertical bars, horizontal bars, and color bars; $40.*
William B. David
209 Fir Avenue NW
Montgomery, Minnesota 56069

Needed: *Schematic and service information for Monarch walkie-talkies, Model TC-12 100 MW transceiver. Will buy, or copy and return.*
Jim Watkins
6760 Chambersburg Rd.
Dayton, Ohio 45424

Needed: *These tubes for old radios: 7AF7, FM-1000, 7F8, 7H7, 6Q7G, and 25Z5. Send price and method of payment.*
George Kubica, Jr.
610 Garden Street
Little Falls, New York 13365

For Sale: (*or trade for oscilloscope*): *Heathkit post-marker sweep generator Model IG-57A, $165; Heathkit color-bar generator Model IG-28, $90, used very little.*
Joseph E. Strenk
RD 2 Box X
Rhinebeck, New York 12572

Needed: *Instruction and service manuals for Roberts tape recorder Model 770. Will buy, or copy and return.*
Bill Yarborough
106 East Calhoun Street
Clinton, South Carolina 29325

For Sale: *RCA WR50B RF generator, $50; 110 receiving tubes, $650 list, will sell for $110. Send for tube list.*
John Durkin
4231 Ely Avenue
Bronx, New York 10466

Needed: *Schematic for Airline record player, Model GEN-6012A, Production Code #2104. Will copy and return.*
John Brouzakis
RD 2 Box 602B
Charleroi, Pennsylvania 15022

Needed: *Schematic for stereomatic 9900 8-track tape player, serial #9079148. Will copy and return.*
John Brouzakis
RD 2 Box 602B
Charleroi, Pennsylvania 15022

Needed: *Service manual for a B&K 1450 scope. Will buy, or copy and return.*
Eugene Bingle
18944 Woodland
Harper Woods, Michigan 48225

Needed: *Schematic for Scorebrain Score Board 31200, manufactured in Macon, Georgia.*
Charles Clemens, Instructor
Radio and Television
Raleigh County Vocational Technical Center
229 Second Street
Beckley, West Virginia 25801

Needed: *Knight KG-2000 oscilloscope for parts. Must have good power supply.*
Thomas Walls
6360 Montgomery Avenue
Philadelphia, Pennsylvania 19151

Needed: *An RCA Model WV98A Senior Voltohmyst in new condition, and reasonable.*
Paul Capito
637 West 21 Street
Erie, Pennsylvania 16502

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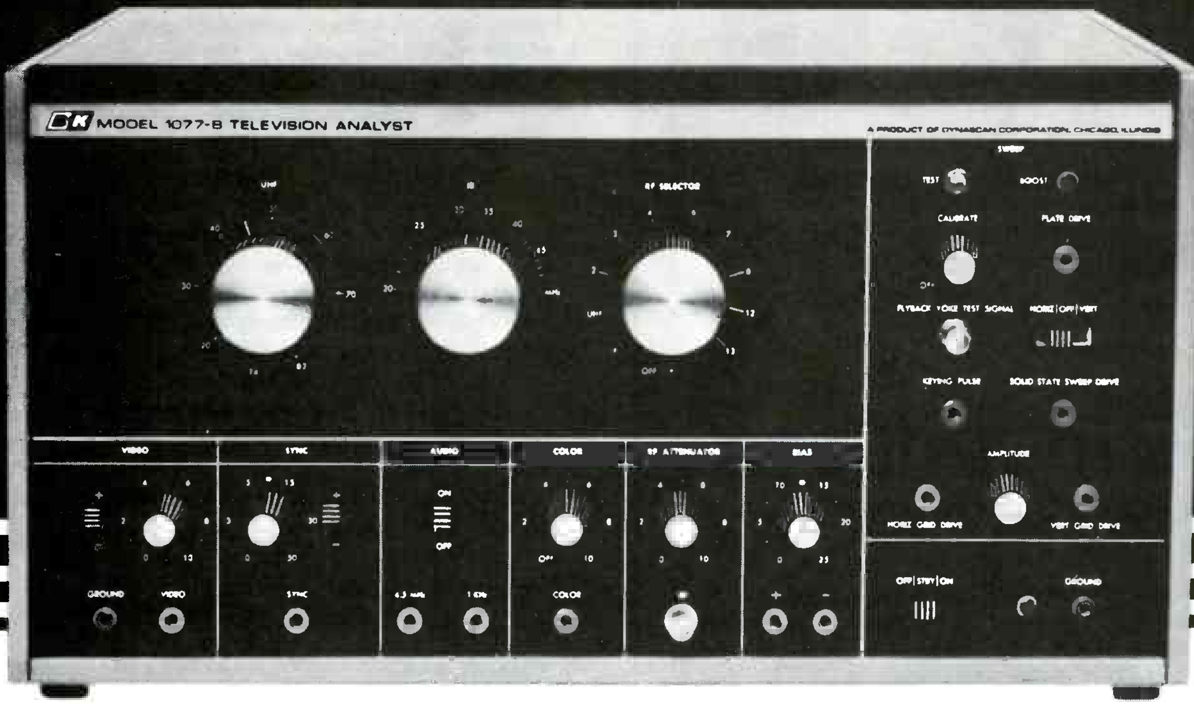
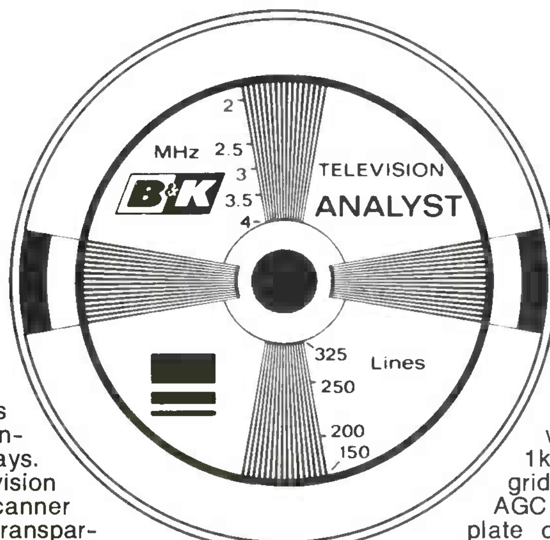
the only prime time test pattern.



Model 1077B
$530



Remember the test pattern? Here's how to use that old standby to cut your troubleshooting time in half.

Broadcast test patterns are available only at very inconvenient times these days. So our Model 1077B Television Analyst has a flying-spot scanner that transforms any 3"x4" transparency into a broadcast-format TV picture. We even supply you with a test pattern slide.

A test pattern provides valuable information about picture size, linearity, focus, resolution, ringing (overshoot), low-frequency phase shift (smear) and frequency response. Unless the TV receiver isn't working, of course.

That's why the 1077B provides signal-substitution outputs to let you inject the test pattern anywhere in the chain from the flyback all the way back to the antenna terminals. You can pinpoint the problem in minutes instead of hours, checking the quality of each stage as you go.

Outputs include: IF, 8 VHF channels, all UHF channels, video, sync, 4.5MHz sound subcarrier with 1kHz FM modulation, 1kHz audio, chroma, vertical grid drive, horizontal grid drive, AGC keying pulse, horizontal plate drive, horizontal solid-state sweep drive, vertical plate drive and vertical solid state sweep drive.

There's also a built-in dot/bar/crosshatch generator for color TV chroma and convergence adjustments. Plus positive or negative bias supply and B+ boost indication. All level controls are conveniently located on the front panel.

There's nothing else like it.

Ask your distributor for Model 1077B, the latest in over 25 years of television analysts—in stock now or write Dynascan.

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Complete Line of Analog and Digital Multimeters, Oscilloscopes, Signal Generators, Semiconductor Testers, Power Supplies, Probes, Tube Testers and Substitution Boxes.

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Reader's Exchange
continued from page 10

Needed: *Instruction book and schematic for B&K Model 1070 Dyna-Sweep circuit analyzer. Will pay for copying, or will copy and return.*
Talice J. Tolitsky
14497 Maple Ridge
Detroit, Michigan 48205

For Sale: *RCA Senior Voltohmyst Model WV98C, $75; Sencore tube tester Model TC142, $20; Heath color-bar generator Model IC28, $60; Heath capacitor and resistor sub boxes Models IN37 & IN47, $7; 12-inch degaussing coil, $5. All mint condition.*
Richard R. Markette
7500 N. Elmhurst Rd., Lot 55
Des Plaines, Illinois 60018

Needed: *One 50-Hz idler wheel assembly for Glaser Steers record changer.*
John F. Galea
27557 Echo Valley W. #252
Farmington Hills, Michigan 48018

Needed: *Flyback transformer #53X401B, 1002235 for Coronado Model TV2-9448A, a 19-inch B&W TV.*
Rae D. Henneman
Rt. 5 Box 218 Elm Lane
Chippewa Falls, Wisconsin 54729

For Sale: *Knight KG687 solid-state sweep marker generator; Knight KG686 RF generator, solid-state; and Heath IM-17 FET VOM. Will trade for solid-state 3-inch or 5-inch scope.*
Ed Tanrath
3035 LaSalle Avenue
Rockford, Illinois 61111

Needed: *Flyback #98A131-6 for Admiral 6H10 chassis.*
Ed Tanrath
3035 LaSalle Avenue
Rockford, Illinois 61111

For Sale: *185 new tubes & caddie. Retail value $1200, will sell for $400.*
Richard R. Markette
7500 N. Elmhurst Rd., Lot 55
Des Plaines, Illinois 60018

Needed: *Schematic and other service data for Atwater Kent Model 84. Will copy, or buy.*
Tom Hodgdon
3 Gardner Avenue
Andover, Massachusetts 01810

Needed: *1-25AC5 tube for an old GE radio.*
BJ's Television and Appliances
East 15522 Sprague
Veradale, Washington 99037

continued on page 14

Reader's Exchange
continued from page 12

For Sale: *National Radio Institute course "Complete Communications." Excellent condition, make offer.*

W. B. Cash
1947 Plantation Lane
Chamblee, Georgia 30341

Needed: *Operating instructions for a Precision sweep generator, Model E-400. Will buy, or copy and return.*

Henry L. Cooke
34 Mulberry Street
Reading, Pennsylvania 19601

Needed: *Schematics for these H.H. Scott solid-state P.C. Boards: 019-1107-059 preamp board; 019-1107-060 tone control board; and 019-1107-155 power amplifier board. (These were purchased from Delta Electronics in Amesbury, Massachusetts.)*

George S. Stewart
8035 Gough Street
Baltimore, Maryland 21224

For Sale: *Sencore PS-148 oscilloscope, $150; Sencore TF-17 transistor FET tester, $50. Both are in mint condition.*

Pete Ristau
39-A Sutton Street
Brooklyn, New York 11222

For Sale: *Heathkit IG-28 color bar-dot generator; $85; oscilloscope, $125; design console $100.*

A. F. Limback
12527 Sandpiper Road
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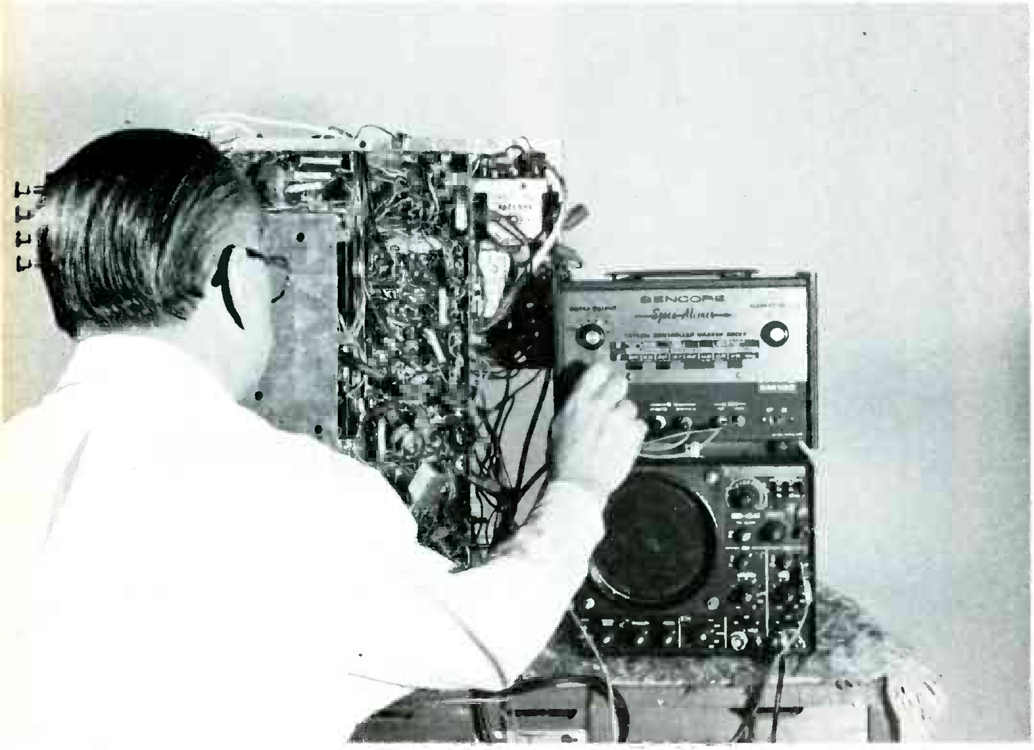
Interpreting alignment curves

By Gill Grieshaber, CET

*Seldom can you obtain the **exact** IF alignment curve that's specified by the manufacturer of the receiver. If the curve deviates from the specs, which parts are important and cannot be compromised? And which variations are harmless? The new sweep generators provide accuracy and fast operation. However, **YOU must evaluate the curves.** These tips and shortcuts should give you helpful guidelines.*



For this alignment, a B&K Model 1470 scope, Sencore Model SM158 sweep generator, and a separate Sencore multiple bias supply were used. The old tube-type TV chassis requires a separate adjustment of the "link" (output IF coil in the tuner and the input coil on the chassis, which are an overcoupled pair). A flat-top curve without tilt is required, otherwise the following adjustments can't compensate enough to give a good overall curve.

Several months ago, I offered to tell some of the symptoms of wrong IF alignment, and how to evaluate such curves. Many of you wrote that you were interested. Since I need extra time for research on the General Electric VIR "Broadcast-Controlled" color circuits, we'll discuss alignment this month before resuming the modular coverage.

Why Should Alignment Need Checking?

Most alignment adjustments are stable, and do not drift enough to cause trouble. So why should television receivers ever need realignment? Here are some of the reasons:

- Tubes can age or become gassy, or they might have been replaced with others which distort the alignment curve;
- Loading resistors across the coils can change in value, thus shifting the resonant point and changing the "Q", or coil forms can deteriorate and allow the turns of wire to move;
- The adjustments might have suffered from "diddle-stick drift". Or, to say it less politely, a previous technician might have turned the adjustments, by mistake or out of ignorance;
- The core of a coil might fit so loosely that it moves from vibrations. Of course, adjusting a loose core is useless, but you can tighten it by removing the core, inserting a short length of nylon sewing thread in the coil form across the grooves, and reinstalling the core before you adjust it by sweep alignment. Or, if the set runs cool, add a dab of wax to the threads of the core, then replace and adjust it.
- Worn hex alignment tools often break a core; and a cracked core just will **not** tune correctly, no matter how you turn it. Sometimes, a broken core can be removed by a right-sized Allen wrench. If that fails, break the core into little pieces and remove them one by one. Once the core is removed, scavenge a similar core from a discarded coil; and
- Coil shields, tube shields, or stage shields can become improperly grounded. Tube socket

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pins can become corroded (clean them with tuner spray), or a ground of a circuit board can open.

Symptoms Of Misalignment

Although little time is needed for you merely to **look** at an alignment curve (without doing any adjustments), it would be foolish to check the alignment of **all** TV receivers on the test bench. For example, a B&W TV that has a sharp, stable picture, and normal sound without buzz or noise, when the fine tuning is turned for the best picture, obviously does not need realignment.

A similar simple evaluation should be done for color receivers. Check for these undesirable conditions:

- The color is weak, or the color is too strong and blurred;
- The fine tuning must be adjusted to one critical position to bring in color; or two positions of the fine tuning bring in color (switch off the AFT for the fine-tuning tests). Don't blame the **tuner** for **either** of these wrong results!;
- When the color is correctly fine tuned, the vertical locking is loose, or there is AGC overload;
- Beat patterns (cloth-like lines) are always in the picture;
- The color part of the picture is smeared and moved to the right; and
- It's difficult or impossible to obtain the correct tint by the normal adjustments.

Of course, other defects also can produce these same symptoms. But suspect poor alignment if **two or more** of the symptoms are found in the same receiver.

Advantages Of "Looking" At Alignment

By merely looking at the overall IF or chroma curve, you can be **certain** of the bandwidth shape, and **save** considerable time as a bonus.

If you use the sweep equipment regularly (so the cables are in good condition, and you can connect everything without referring to the operating manual), and **if** you know where on that particular receiver to make those three or four initial connections, then **you can be looking at a dependable IF-sweep curve in less than five minutes!** Add another five, and the overall VSM chroma curve can be verified.

Believe me, if the problem is caused by wrong adjustments, rather than defective parts, those few minutes often can save you hours of worry and testing. (Also, a curve that cannot be forced into tolerance, points suspicion to certain components. But that's another story.)

In addition, many erratic IF or tuner conditions show up more quickly and more positively on a sweep curve, than by any other test method. I could give you true examples by the dozen, but the first time you see the curve shift radically when you rock a tube in its socket or bend the corner of a circuit board, you'll gladly add this test method to your arsenal of effective tricks, even without my urging.

There's one more advantage to be gained by a quick look at the alignment curve: everything is ready for those times when alignment **is** needed. Many, many times a quick alignment touch-up has greatly pleased my customers, who often say the picture is better than when the TV was new. (Of course, that's probably not true, but it sure helps the reputation!)

How Easy?

Now, I'm not foolish enough to say alignment is a snap, or that I enjoy doing it. But, as the comedian says, "Compared to what?" Compared to older sweep methods (that required four separate instruments plus a scope, dozens of cables needing many reconnections at various steps, and a single variable marker requiring constant checks against a crystal standard), the new equipment and methods are a breeze to use.

This article is not about sweep equipment as such. But I have a genuine affection for the generators that combine all functions (except scope, of course) into one cabinet. Besides the IF and chroma sweep, there are post-injection crystal-controlled markers, good attenuators, and some models even have adjustable AGC bias supplies built in.

Probes and pads

Other good features of the new sweep generators are the various universal "probes" and "pads" (Figure 1). A probe is a network for impedance matching, filtering, or signal detection that's placed between the TV receiver and the generator or scope. A pad is any kind of network between the output of the generator and the input of a TV set.

Now, these universal probes and pads usually perform just fine, and they're certainly more convenient than the ones we had to wire-up ourselves in the old days. In a few rare cases (usually with some solid-state sets), the universal network might tilt the curve. Test for this possibility, when you suspect it, by comparing the curve with the performance seen on the picture tube. A "perfect" curve and a poor picture (or a good picture from a distorted curve) proves that a problem exists somewhere.

Fixed AGC bias

An important necessity to avoid false curves is the correct AGC voltage during alignment. If you don't know what DC voltage to apply to the IF AGC and RF AGC points, then measure these two voltages on a strong TV signal. When there's no strong local sta-

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Fig. 1 In order to produce curves that are truthful, it is absolutely necessary to use proper pads and probes with the sweep equipment. At the top is the 39G26 Sencore quadrupler link detector, and a similar home-made quadrupler is shown at the bottom.

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tion, use a color-bar generator signal. Those voltages are the ones to use during alignment. After the bias supply is connected, measure the DC voltages, and, with the receiver power on, adjust for the voltages needed.

What's The Curve Tolerance?

Let me warn you that the curves you obtain in practice seldom (or never) will be exactly like the books say. Most service data (except Photofact) show an artist's drawing of the standard alignment curve. How authentic can they be? An artist could draw an alignment curve in spirals, if he chose!

Even if an actual scope waveform is shown, some tolerance must be allowed. And it's not sufficient to specify ±10%, or whatever. Many details of an alignment curve must have nearly zero tolerance (as seen by eye on the scope screen). Other specs can vary 25% without any picture degradation.

So, instead of the usual meaningless specifications for tolerance, I am going to tell you what the various parts of the alignment curve do for the picture quality, etc. Then you can know whether a certain curve is "good enough" or not.

Color And Picture At 50%

First, we should puncture the myth of the rule placing the picture carrier and color carrier on opposite sides of the IF curve at exactly 50%. At first thought, this seems reasonable and correct. The picture carrier should be at 50% to compensate for the partial (vestigal) sideband removed at the transmitting station. And the color carrier at 50% was necessary because of the narrower IF bandwidth adopted for receivers in 1956.

However, the 50% spec was initiated for the **flat-top** IF curves of the early color receivers. With a flat-top curve, those two carriers **should** be exactly half-way between the zero base line and the flat top at the horizontal center of the curve (see Figure 2A).

Many color models manufactured during the past 10 years or so have IF curves of the "haystack" type. Should you continue to set the two carriers at 50% of the tip of the haystack? (See Figure 2B) The answer is "no", but if not 50%, then where?

We must obtain the proper slope and spacing of the markers on the color-carrier side of the curve, then set the picture carrier equal in height (from the base line) with the color carrier. Figure 2C shows you where the flat-top would be.

Now, this haystack **does** give different high-frequency response to the composite video signal. Supposedly, any differences are trimmed in the peaking values of the video amplifiers.

Align flat-top or haystack curves?

If you were to align a set designed for a flat-top curve to the haystack curve, the video response would be wrong. Also, if you aligned a flat-top curve in a TV designed for a haystack, the video response would be degraded. **How do you know which one is correct?**

Suppose the marker positions and spacings are correct on both sides of the curve, when you look at the curve. Then, it's almost a certainty that the curve is okay, regardless of which type it is.

If you are aligning, it's very unlikely that you could adjust for the wrong shape of curve. I have never seen one I could force into the wrong type. That's reassuring.

An example is found in the curves of Figure 3. The original curve before alignment (Figure 3A) **appeared** to be a haystack. However, the curve was not right, for the picture carrier (45.75-MHz on the right side) was too high at about 90% (if we call the color carrier 50%), and the 47.25-MHz trap was too far to the left.

When I moved the 47.25-MHz adjacent-channel sound trap to the correct marker, the picture carrier moved even higher up the curve (about 125% in Figure 3B). Something was wrong. A complete alignment was required, and at the end, **the curve was a typical flat-top.**

This example illustrates a basic truth about alignment: when you change **one** adjustment, the entire curve changes, and then several adjustments (or all of them) are required to make it right. **Each adjustment appears to interlock with all others.**

Let's say the curve is almost right, but you need to extend the bandwidth on one side. There's a core for that frequency, and you

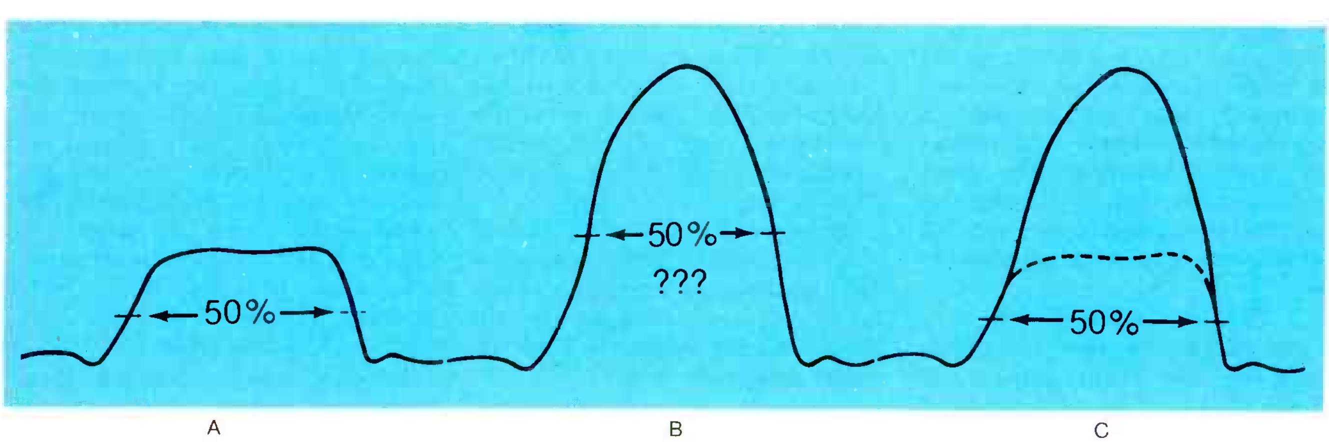

Fig. 2 With "haystack" IF curves, the 50% point for color and picture carriers must be determined by the slope of the curve and the positions of the markers. (A) Only flat-top IF curves should have color and picture markers at 50% of the total height. (B) Placing the two carriers at 50% of the total height on the "haystack" curve is wrong, and the picture will be very poor. (C) Mentally add lines simulating the flat-top location on a haystack curve, then locate the 50% point.

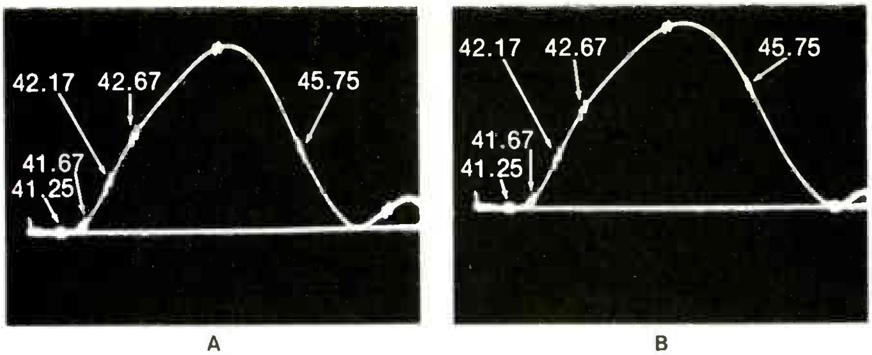

Fig. 3 Waveform (A) is the original curve of a tube-type color TV which had only fair quality color, and barely enough color intensity. It is a haystack curve, but the picture marker (on the right side) is much too high, and the adjacent-sound trap is too far toward the center. When the trap was adjusted correctly, the picture carrier moved higher up the curve (B). Realignment proved the curve should have been a flat-top type, and the color was excellent afterwards.

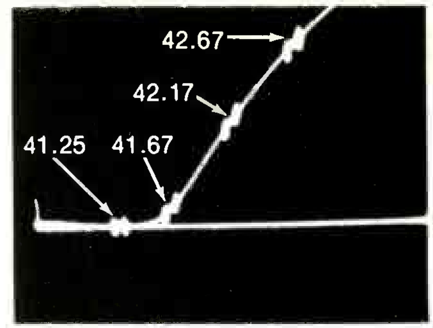

Fig. 4 Spread out the curve by decreasing the sweep width on the generator, and move the left (color) edge to the center of the scope screen. Then make sure the 41.25-MHz marker is at minimum amplitude, and the other three markers are nearly in a straight line while appearing to be equally spaced. The slope and shape of this side of the curve determines the intensity and quality of the color picture.

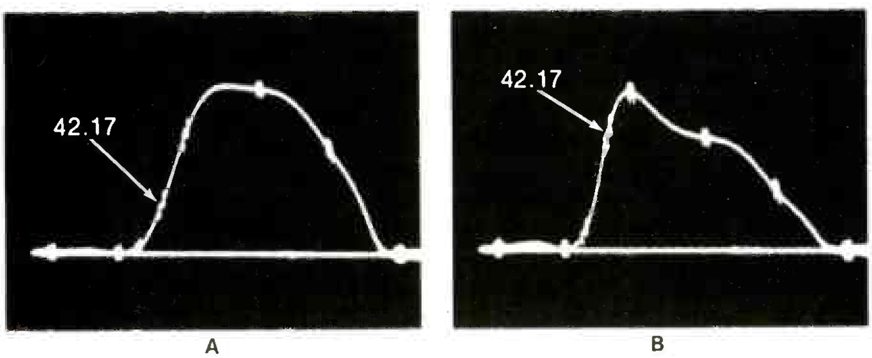

Fig. 5 Here are two examples of wrong color sides of the IF curves. (A) The 41.67-MHz marker is too near the base line, and the spacing between the 41.67-MHz and 42.17-MHz markers is too narrow. Probably the picture would have weak color that is slightly blurred. (B) This curve is even worse. The 42.17-MHz marker is too high from the base line, the 42.67-MHz marker is around the corner, and also too near the other marker. The color would be very strong, but blurred.

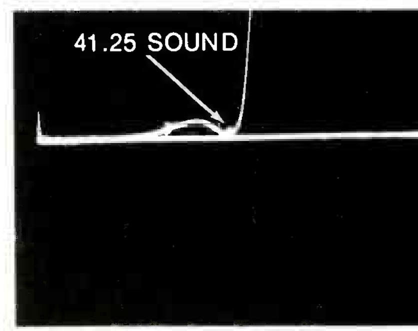

Fig. 6 Traps that have some method of increasing the attenuation need careful adjustment. Increase the scope gain, increase the generator output slightly, and move the trap marker to the center of the scope screen. Then adjust the trap and balancer for best attenuation (curve nearest the base line) at the marker.

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move the curve over. But, the amplitude of that side goes down, giving a bad tilt. Then the other cores must be turned to correct the tilt while retaining the slope and bandwidth. That's why no one can say which adjustment will correct any certain condition. You **can't** turn one for a sharper picture, and another for stronger color, etc. **All adjustments must work together.**

Picture-Carrier Slope

The height of the 45.75-MHz marker on the picture-carrier side of the IF curve, and the angle of the sloping side, together determine the low-frequency response of the composite-video signal after detection. Thus, a 45.75-MHz marker that's too low gives over-peaked video, weaker vertical sync, and a tendency toward AGC overload (picture carrier is too weak).

In other words, the picture-carrier side of the IF curve mainly affects the video (B&W picture), and has little to do with the color.

Location and attenuation of the 47.25-MHz trap is important for interference from adjacent-channel sound, when the TV is used on cable signals.

Shape of the center of the IF curve (around 44 MHz) determines the high-frequency response of the B&W picture. **Ringing in the picture usually originates from excessive amplitude here.**

Color-Carrier Characteristics

On the other side of the alignment curve, the amplitude and slope determine much of the color quality.

First of all, the 41.25-MHz sound marker should have maximum attenuation. Then, the markers for 42.67-MHz, 42.17-MHz color carrier, and 41.67-MHz should be nearly in a straight line, and the spacing between them should be exactly the same, as shown in Figure 4. (In the chroma channel, after video detection, 42.67 MHz becomes 3.08 MHz, 42.17 is 3.58, and 41.67 becomes 4.08.)

Unequal spacing between these three markers tilts the response of the signal applied to the chroma IF's. The 42.67-MHz marker can be near the corner of flat-top curves, but should **never** be on the corner or beyond it. Figure 5 shows two horrible examples, and yet one doesn't look too bad, until you examine it according to these standards.

Height of the 41.67-MHz marker above the base line determines the color gain in the IF's. It should never be below about 10%, or the color intensity probably will be insufficient. Some of the best color I have ever seen came from curves with the 41.67 marker at about 15% or 20%, and showing a notch from the sound trap just below it.

Response at the sound frequency of 41.25-MHz has much to do with the amount of 920-KHz beat in the picture; therefore, this trap should have full attenuation (some traps have a balancing resistor to increase the attenuation) and be precisely on frequency.

The picture carrier of the next channel is at 39.75 MHz. Some receivers have a trap for it. In any event, make sure there is no appreciable response there, if the machine is to be used on cable where all channels are occupied. Widen the sweep of the generator (this narrows the alignment curve) and look for spurious responses outside of the usual curve.

A trap should never be set to the wrong frequency in order to shape the overall curve. This will just trade problems.

Setting traps

As mentioned before, some traps have a balancing resistor or double cores to increase the attenuation at the trap frequency. Therefore, merely setting such traps to the right frequency is not nearly enough.

There are two general methods of checking for trap attenuation, depending on the facilities of the generator. Some generators allow audio modulation of the trap frequency. With that one marker only turned on, you adjust everything for the minimum amplitude of the **audio** waveform. **Precautions must be taken to prevent any overload, which obscures the best point.**

The other method (the one used with the Sencore, which does not modulate the markers) is to increase the output amplitude of the generator and increase the scope gain, then spread the curve and center the trap frequency (see Figure 6). This separates the base line from the low points of the curve until the amplitude at the trap frequency can be seen easily.

Good And Bad Examples

Figure 7 shows one normal overall IF curve and two bad ones. A large peak near the center of the curve (Figure 7B) usually causes ringing which is changed (but not eliminated) by adjustment of the fine-tuning control. The IF's are almost oscillating.

Inverted waveforms, or ones with a double peak (Figure 7C) often result from a failure to clamp the AGC voltages, or insufficient voltages. On the other hand, an excessive level from the sweep generator often produces a curve with a top that is too flat.

Overcoupled

Two tuned circuits that are coupled together in the proper degree, can produce a flat-topped curve with sharper skirts. In TV sets, these are sometimes disguised. This overcoupling can be either by capacitive or inductive means. Generally speaking, the primary tuning moves the center frequency (moves the markers up one side and down the other), while the secondary tuning changes the tilt of one top corner versus the other.

In older color sets, the IF coil in the tuner and the first IF on the chassis were an overcoupled pair. These must be adjusted by themselves, and not with all the others, in order to obtain the required flat top. Alignment of this pair often is called "link alignment". Figure 8 shows examples both with and without a sound trap.

Low signal levels typically found during link alignment often require a "quadrupler detector" or a detector with an amplifier to raise the amplitude enough to be seen easily on the scope.

VSM Alignment

Video-Sweep Modulation (VSM) techniques are used to sweep the chroma stages. A crystal-controlled carrier of the picture-carrier frequency is modulated by a swept-video signal, and the VSM signal is applied to the tuner test point the same as the IF-sweep signal was. A demodulator probe is necessary to recover the swept-video modulation.

Typical VSM curves are shown in Figure 9.

Aligning The 4.5-MHz Trap

Most receivers have a 41.25-MHz sound trap in the IF's, plus a 4.5-MHz sound trap in the video. (The effectiveness of this latter trap is not changed by fine-tuning adjustments.) So, the 4.5-MHz trap must be set accurately, or else the 4.5 and 3.58 signals heterodyne, producing 920-KHz beats, which

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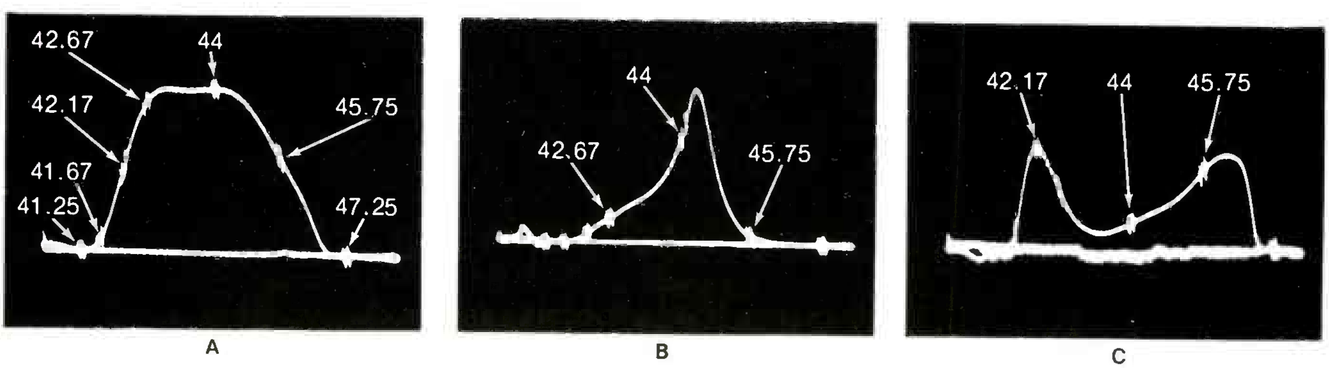

Fig. 7 (A) This curve is the normal one following a complete realignment; it is a flat-top type. (B) A sharp peak near 44.5 MHz indicates either a very poor job of alignment, or IF stages that are near self-oscillation. (C) This is the (A) curve with the AGC bias removed, and the input RF level reduced. Correct AGC fixed bias is a MUST.

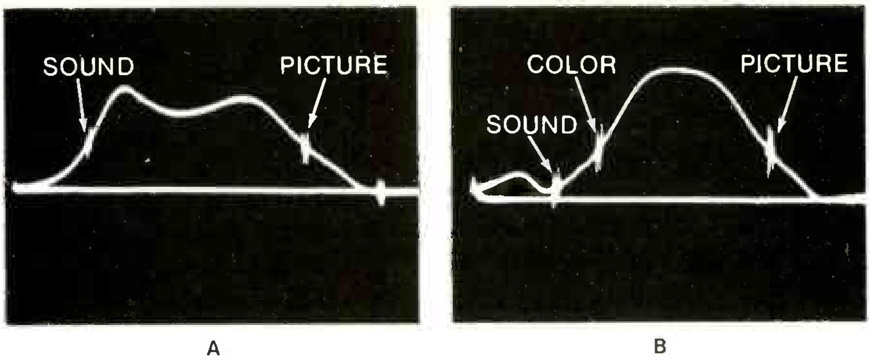

Fig. 8 Links (tuner and first chassis coil) without traps usually should have both the sound carrier and picture carrier markers at 50% (or 75%, according to the model of TV). (A) When there is a sound trap (B), the color carrier often is at 50%. Follow the manufacturer's specs, when you know them.

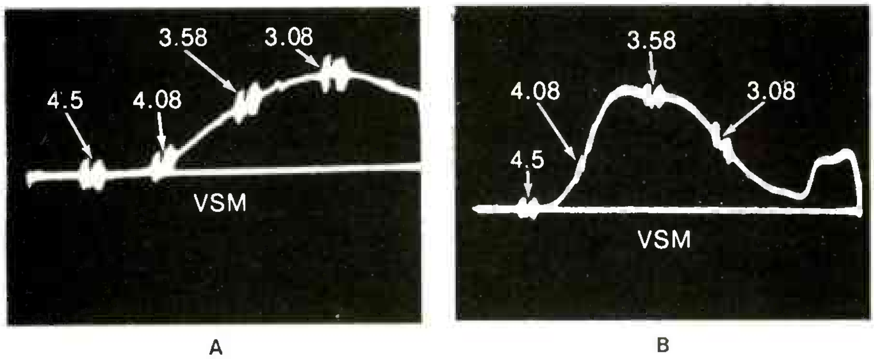

Fig. 9 With the Sencore generator, it's easy to obtain VSM (called color) sweep: just turn one knob, and add a demodulator probe. The curve at (A) is the overall response from tuner test point to the output of the video detector. (B) Theoretically, the curve at the chroma-IF input of a color demodulator should be a flat-top type with the three markers along the top. Most sets will not do that well. Next best is to have the 3.08 and 4.08 markers the same height above the base line. Blurred color of the wrong hues results from one marker being much higher on the curve than the other. Response at 4.5 MHz should be zero.

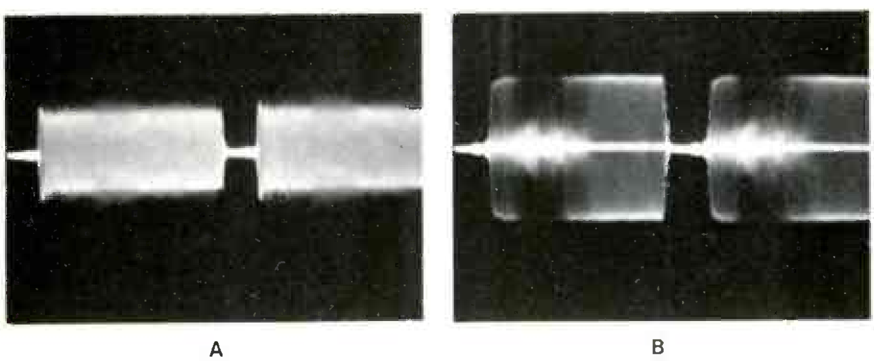

Fig. 10 Here is a new, more accurate way to set the 4.5-MHz trap. Connect the scope probe to the color-IF input of a demodulator and adjust the trap so the color sidebands vary in amplitude more with changes of the color picture, and the horizontal white line through the center is distinct. (A) shows very little amplitude change and no line, while (B) amplitude changes with the color picture and the center line is clear.

Alignment

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are very annoying in the pictures when seen as a rough cloth-like pattern.

Many technicians fine tune barely into the beat pattern and adjust the 4.5-MHz trap to minimize the beat in the visible picture.

Almost by accident I found a way to adjust this trap more accurately using a scope. Connect the low-cap scope probe to the chroma signal at one of the demodulators (lock the scope externally to the horizontal sweep, using a test lead near the output). Fine tune slightly into the beat.

Now, the amplitude of the signal here should change according to the color saturation of the program. When the trap is set wrong, the chroma signal **doesn't** change much. But as you approach the right spot, the amplitude changes more with the color program and a white line appears in the center horizontally. These two conditions are shown in Figure 10. With a little practice, you should be able to make this adjustment easily.

Comments

Remember that extension cables for the picture-tube base blur the B&W pictures noticeably, and they smear the color until it's impossible to evaluate it at all. In other words, when you want to check the performance following an alignment check or a full alignment, remove the extension cable from the CRT base and use only the usual cable and socket.

Well, I drifted more into the mechanics of actual alignment than I intended. However, you can evaluate the curves better when you know how to align. And evaluation sometimes leads to alignment.

The basic principles of sweep alignment are simple enough. But when the results are all wrong, the practice of alignment can become frustrating at times. Then you are faced with these questions:

- Is the defect in the color receiver?
- Is the fault in the sweep equipment? Or,
- Could it be your fault (horrors!) from doing something wrong?

At those times, you will appreciate some of the tips given here.

Few valuable things are learned easily. However, you can learn more from mistakes than from successes. And the new sweep generators take most of the uncertainty and inaccuracy from a task that formerly was rough enough to scare many technicians. Add these statements together, and they translate to: start doing sweep alignment; take your lumps as the dues you pay for learning and you will become an expert at TV alignment. **You'll be very glad you did!** □

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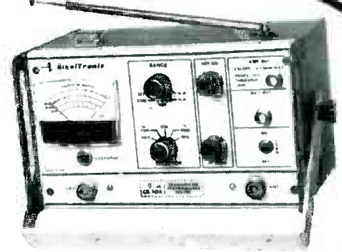

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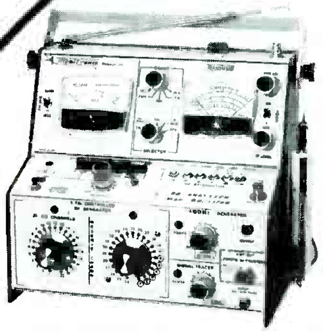

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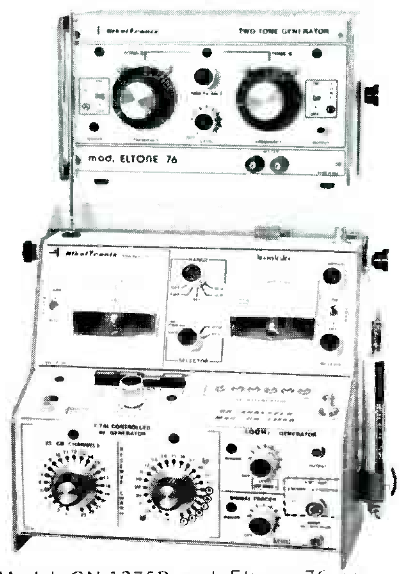

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For More Details Circle (17) on Reply Card

An ohmmeter, hand tools, and schematics are the only materials needed for repairing CB microphones.

Profitable Repairs of CB Mikes

Part 2/By Marti McPherson and Forest H. Belt

Study the talk/listen wiring of the CB transceiver to find which replacement mike is needed, and how to wire it correctly.

In Part 1, we showed you how to deal with the two most common mike defects: a bad cord, and a faulty connector. You learned that simple analysis, thoughtful preparation, and careful workmanship were the three steps for a quick and profitable mike repair.

Identifying Wiring

Before we get into the more technical qualities and characteristics of communications microphones, let's clear up one loose end. We promised you a quick way to identify wiring.

Suppose your customer brings in a fancy amplified microphone he wants to use with some other transceiver. Neither you nor he has the mike wiring diagram to follow as you install the different plug on the cord. With the exception of white and shield, which commonly (but not always) carry voice signals from the mike amplifier, you can't rely on color coding in the mike's cable. There are too many nonstandard codings. Even among models by the same manufacturer, colors don't necessarily identify which conductor does what.

Try at least to find an **original** diagram of the transceiver. Without it, accurate wiring might take quite a bit of time and circuit tracing. You can't always depend on mike-wiring booklets. Some transceiver makers modify the same model again and again. Too often, the microphone companies and schematic services aren't notified, or get the information very late.

You might find clues in the old connector and transceiver. Identify wires in the old connector. Write down their functions and color. Then wire up the new plug the way we showed and explained in Part 1.

Lacking all that, here's how to proceed. Cut off the old connector. Peel back about an inch of the outer covering on the cable. (If it's stiff and cracking, install a whole new mike cord.) Strip ¼ inch from the end of each conductor. Twist the strands and tin them. Tin the shield.

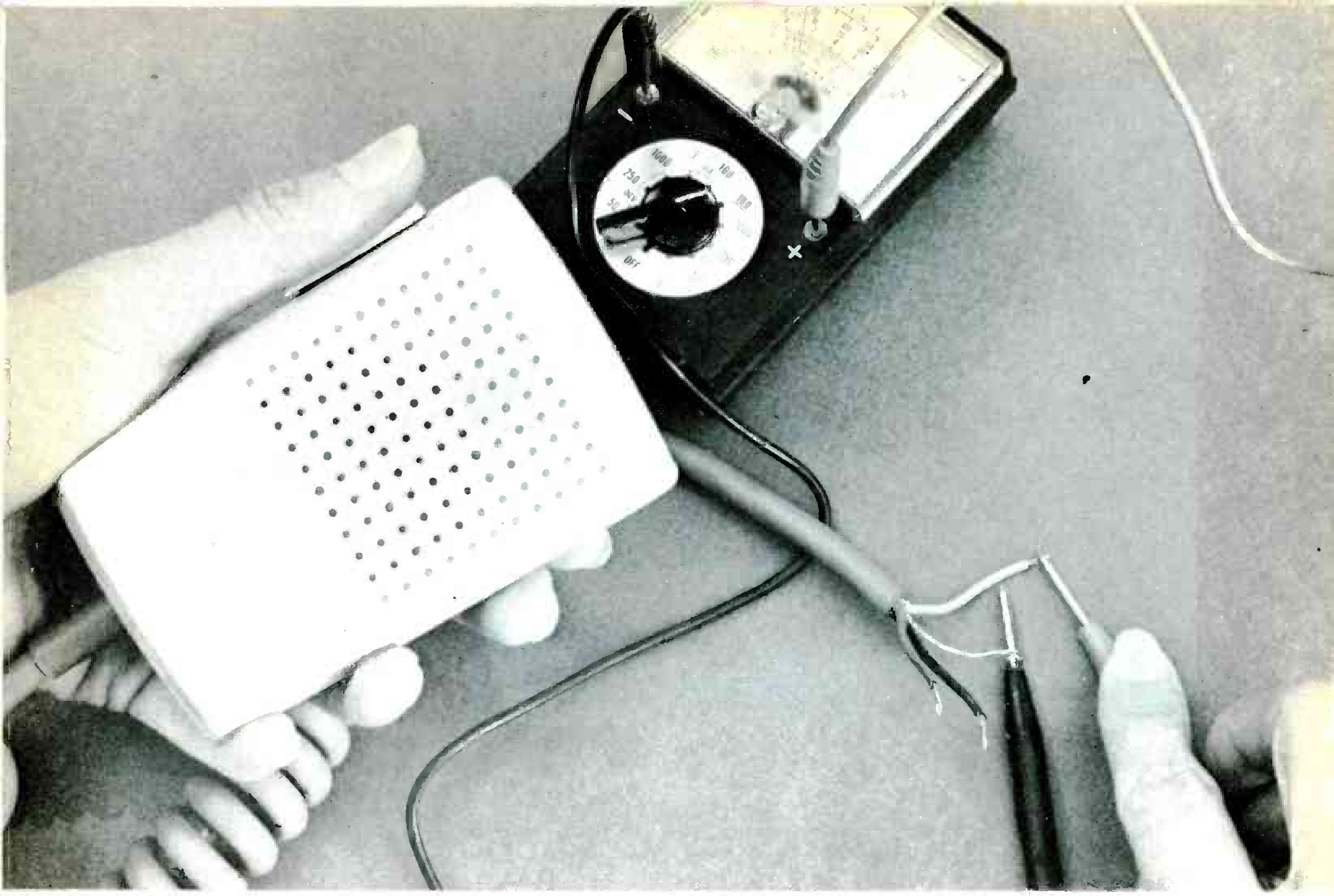
Get out your electronic voltmeter and set it to read ohms. Clip the negative (black) probe to the bare shield wire. Touch the positive (red) probe to the bare ends of the conductors, one by one. You'll probably see the ohmmeter needle bounce and return as you touch the white wire. That's the charging of the output coupling capacitor of an amplified mike.

A steady resistance reading proves that the white wire connects direct to the microphone, without an amplifier. You might even hear a faint scratching noise from the mike element as the voltage from the ohmmeter causes it to act as a speaker.

This simple test has shown the white wire as the one with the audio signal, and also whether there is an amplifier or not.

Three-pin wiring

Next, you should find the keying wires. Suppose the system has three wires and a three-pin plug. The shield has three functions. It



"shields" the audio signal from hum and noise pickup, and it is the ground return for both the keying and the microphone signal.

Therefore, the wire that **doesn't** carry the audio is used for keying. Verify it by clipping the ohmmeter probes to shield and the third wire (often red or black). The reading should be open until you press the push-to-talk button. Then the meter should show zero ohms, indicating continuity through the switch.

You see, in three-wire mike systems, a relay in the transceiver switches the circuits for receive or transmit. One end of the relay coil connects to a DC voltage, usually the main supply. The other end goes through the mike cable to the push-to-talk contacts in the mike, as shown in Figure 1A. When the P-T-T is pressed, the switch connects the "cold" end of the relay coil to the grounded shield conductor, thus applying a DC voltage to the relay coil. (Keying is the same for a microphone containing an amplifier.) Then the relay contacts change the transceiver mode from receive to transmit.

Four-pin wiring

A couple of alternative circuits are found in four-pin mike setups, as shown in Figure 1B and Figure 1C. A relay still switches the CB rig from receive to transmit, and the relay is activated by a switch in the mike. The difference from the previous example is in the relay-coil wiring. When the relay connects to supply voltage, the keying wire is grounded at the radio. Or the keying wire can have the supply voltage and the relay coil is grounded. The keying operation is the same. However, the example of Figure 1B offers current-limiting in case of shorts in the mike or mike cable.

Both kinds of four-wire mike cables prevent any possibility of a ground loop, which could develop when the shield is used for both audio and keying. This ground-loop problem becomes more of a concern with amplified mikes.

Blue and red or black and red are typically the colors used for the two keying wires. You identify them with the ohmmeter the same as you did for the three-wire. You should find continuity only when you hold the mike button down. But in the cable and mike you're faced with, which wire is A and which B? As usual, there's no consistency among mike brands. However, the tendency is to assign red to A and the "other" color to B. Wire them that way to the new connector. If they're wrong, you may send out a squeal from the transmitter every time you key it. (Listen on your shop monitor, or watch the modulation meter for a reading when there should be none.) Rather than rewire the plug, just swap the wires at the mike switch; connections are probably more accessible there.

Electronic and "Special" Switchover

Before we go on, let's return to

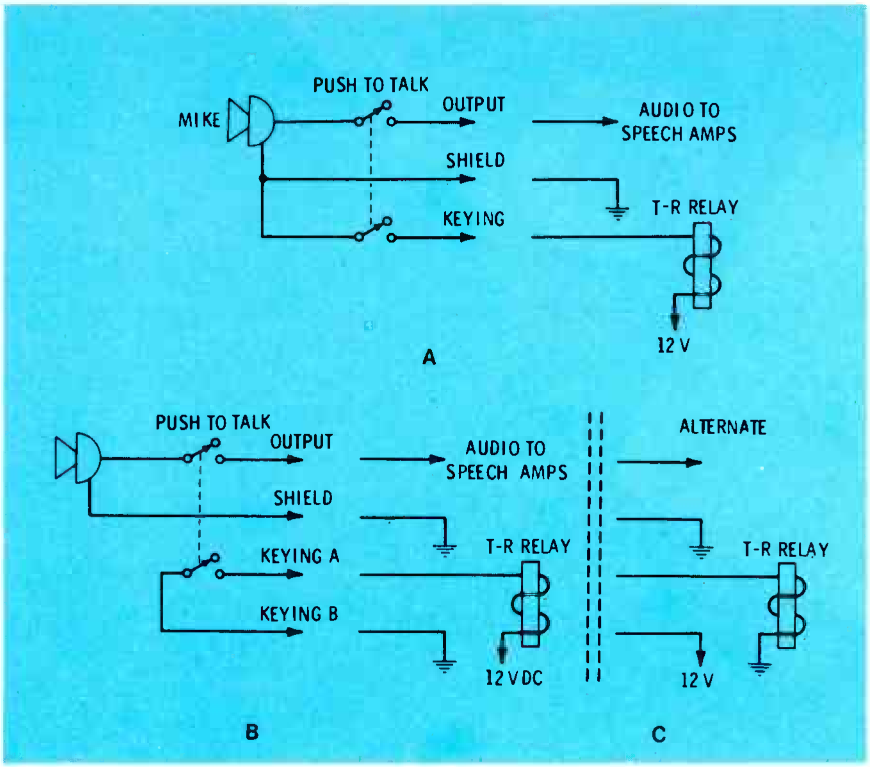


Fig. 1 Three-pin mike wiring uses the mike cable shield as the ground for a relay-type keying circuit (A). Ground loops from the common ground might produce noises, squeals, or distortion. A separate relay ground wire (B) is added in some mike cables to prevent such problems. (C) An alternate circuit switches the supply voltage to the relay, instead of grounding the cold end of the winding. The drawback is the possible damages from the supply voltage in case of a cable or switch short.

the example which opened Part 1 last month. A customer wanted a replacement mike, and you had only one in stock that filled his need. But, it wouldn't fit his transceiver, because your mike was wired for relay-type keying, and his CB radio used electronic switchover. It's time you learned about electronic switching.

Figure 1 shows three kinds of switchover using relays. Contacts of the relay remove the supply voltage from receiver stages and apply it to the transmitter stages; also, another set of contacts transfers the antenna circuit from receiver input to transmitter output.

Electronic switchover changes the radio from receive to transmit directly from the microphone contacts. Figure 2 shows some examples. The concept is not complicated, and to simplify the explanation, we've grouped the transceiver circuits and stages into three categories. One group of stages has power and operates in both modes. Another operates only during receive, and the third group works only for transmit.

In Figure 2A, the DC power is applied to all radio stages constantly. But all of the necessary ground returns of the transmitter stages are connected to a common wire which is grounded by the P-T-T mike switch when it is pressed for transmit.

In like fashion, the required receiver ground returns go through a common wire to the P-T-T switch, and is grounded for receive. Since **both** power and a ground are required, this efficiently switches from receive to transmit, and vice versa.

A popular alternative is given in Figure 2B. All of the ground returns are grounded permanently, and the P-T-T switch contacts apply supply DC voltage to the receiver circuits when you listen, and to the transmitter circuits when you press the button to talk.

Microphone people call this **special** switching, although you can see the similarity to electronic switching. One drawback of such an arrangement is the possibility for serious current drain that could damage the power supply or blow fuses in case of certain short circuits. Later, you'll see how it can happen.

Commercial Microphones

Figure 3 shows the switch wiring for three brands of amplified replacement mikes: Turner, Telex, and Realistic.

The item of most importance in these schematics is the color code. But be cautious: even these mike companies vary the coding sometimes. So, verify the coding of any new mike shipment you get.

By using the shield as a common ground, Turner and Telex manage with only four wires (Figure 3A). While Realistic appears to have five wires (Figure 3B), the blue wire dead ends in the mike plug.

Not shown in these simplified schematics is another set of switch contacts. This set applies the battery power to the mike preamplifier, thus preventing the extra gain except when you talk. They are not involved with the cable or connector.

Special Switching

Generally, special switching requires one wire more than that for simple electronic keying, because voltage (rather than ground) is switched. In addition, special mikes might include an extra set of contacts to switch the speaker on and off. Some examples are in Figure 4.

As you can see, the circuits are identical; only the colors are different. The ground side of the speaker is opened to prevent acoustic feedback (loud howl) that would occur during transmit in those radios where the audio-output transformer doubles as the modulator transformer, also.

Rewiring Replacement Microphones

Now, we are back with the customer who needs a new mike that we don't have. By now, you should realize how easily the connections inside the mike can be altered to accommodate either kind of transceiver switchover.

Carbon, ceramic, or magnetic?

Few manufacturers use carbon

mikes anymore. A few use crystal (or ceramic) types. But most prefer a dynamic element, for the clarity of tone and the sturdiness. **None of these three types can be interchanged!** Ceramic and crystal are high impedance (in the megohms); and dynamic mikes are low impedance. What's more, dynamic mike elements come in any number of impedance values.

If you compare mike wiring in the diagrams you've already studied, you should reach the following conclusions: You can wire **almost any** electronic-switching mike to handle relay switchover. You can rewire **some** relay-type mikes for electronic switchover. You can wire a special-switching mike for **either** electronic or relay switching. It's a matter of knowing which kind does what, and our diagrams and explanations should be enough to clue you in.

Rewiring Example

We rewired this microphone as an example, so you could see it done in steps. The object was to change a relay-switching mike to operate an electrical-switched transceiver. Figure 5A is the schematic of the relay type and Figure 5B shows the electronic wiring.

When we examined the two schematics, we found it necessary to change only two wires. The whole job required about five minutes time. Follow these step-by-step instructions in the photographs of Figure 6.

Remove the back or baseplate from the microphone (Figure 6A). Notice the extra terminal at one end of the block (Figure 6B). It would have been used if the mike had been intended for electronic switching.

You'll leave the mike output white lead exactly as it is. Likewise, you'll not change the black wire that goes to the radio; it stays at the "normally-closed" position of the switch. Our job is to change the way the switch affects the red conductor.

You unsolder the red wire (Figure 6C) from its terminal (third from the left, in this case). Eventually, you'll move it to the vacant fourth terminal.

These contacts can be verified with your ohmmeter, or from a schematic, if you are not familiar with the mike.

Add a jumper wire from ground to the terminal just vacated (number 3 in Figure 6D), which goes to the "normally-open" contact of the switch. Use a striped wire to distinguish it from the others.

Solder the red wire to the fourth terminal. Recheck your wiring (Figure 6E), then reassemble the mike. Install the proper connector for the transceiver.

That's all. The customer has the mike he needs, and you can ring up a sale.

To modify an electronic-switching mike for relay operation, just

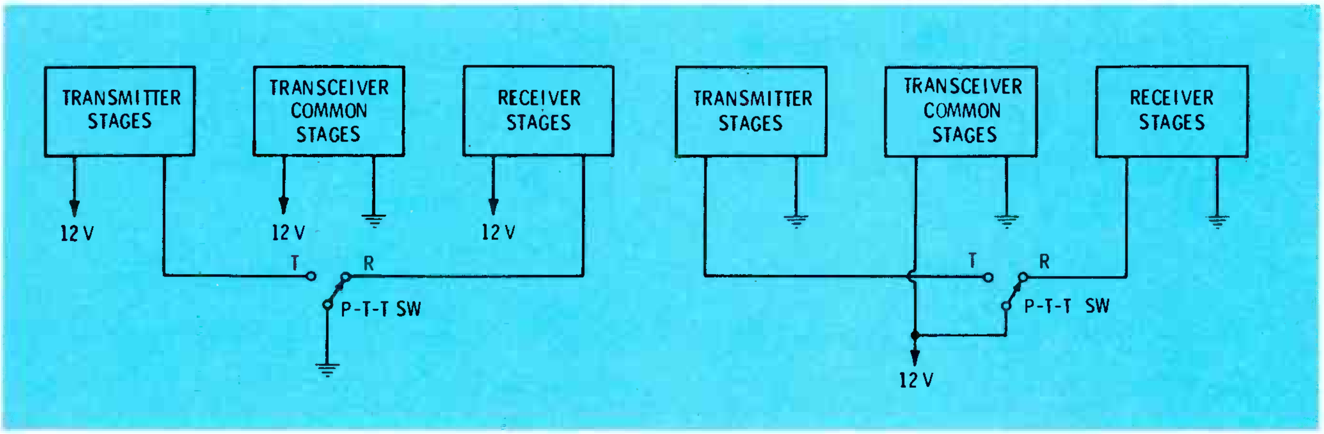


Fig. 2 Keying can be done by the mike switch without a relay by switching the common ground of the respective transmitter and receiver **stages** (left). This is called "electronic keying". An alternate (special keying) is similar, but the common supply voltage to the transmitter and receiver stages is switched (right) by the Push-To-Talk button. In both versions, the stages common to both transmit and receive have power all of the time.

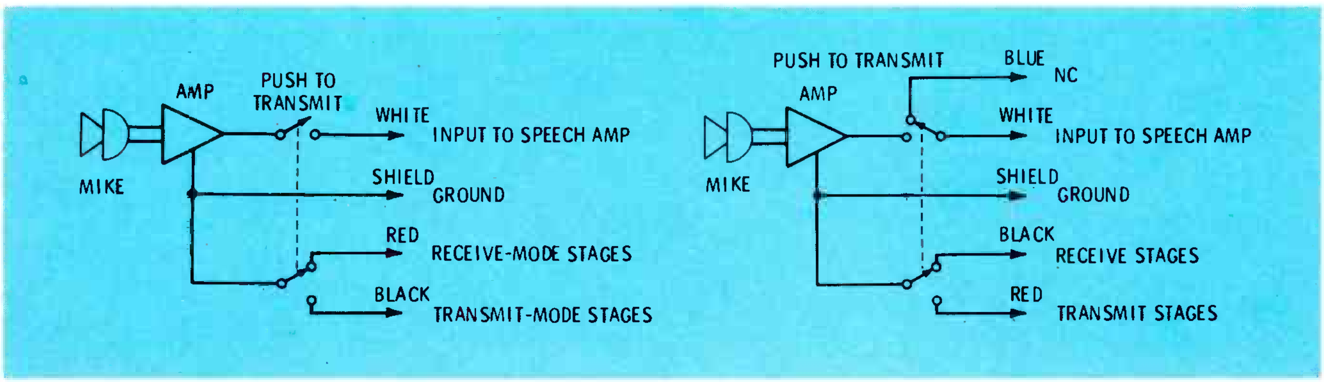


Fig. 3 These are the simplified schematics and color codes of three popular brands of amplified (power) mikes. Turner and Telex are shown at left, and Realistic at right.

reverse the changes just described.

Undoubtedly, you'll find variations of this example. It pays to do your homework with mikes you stock, **before** the need arises. If you have the changes figured out in advance, the work takes little additional time or thought.

Universal mikes

You might consider stocking just those mikes that come wired for "special" keying. If you stop to think about it, you'll see they can be connected easily for either electronic or relay keying, **without any wiring changes inside the mike.** Instead, just solder the appropriate wires from the six-wire cable into whatever connector fits the radio.

This way, a small inventory of "special" mikes in various impedances, element types, and designs can handle virtually all of your replacement requests.

Curing Mike Problems

Sometimes complete mike replacement isn't necessary. Don't let the attraction of a mike sale override your obligation to give your customer the best service possible. Certain microphone faults can be corrected quickly enough to save your customer money and turn a nice profit for you, also.

Let's discuss some symptoms. In Part 1 we went over complaints you hear that generally involve cables and connectors. Those we focus on here relate more to internal mike faults. They show up as weak or dead modulation, as distortion in your transmitted voice, or as squeals that accompany modulation when you transmit. Non-amplified mikes exhibit a few of the symptoms analyzed here, but mostly we're referring to mikes with preamplifiers (your customers erroneously call them "power mikes").

Weak modulation

A strong carrier with weak or no modulation is a common complaint. Open up the mike, or the battery compartment (see Figure 7). Perhaps your customer installed the battery backwards. Check the battery voltage, but do it under load, with the mike keyed for transmit. If the battery terminals are corroded, or the battery has leaked, clean up the terminals and the battery compartment. Snap in a fresh battery, close the mike, and operate it.

When a microphone needs new batteries every few weeks, suspect a defective switch, which won't shut off. If it's a cheap mike, recommend a new one. But with a quality mike, merely adjusting the switch contacts might remedy the trouble.

Open the mike for access to the contacts. Clean and polish them with crocus cloth so they can't stick

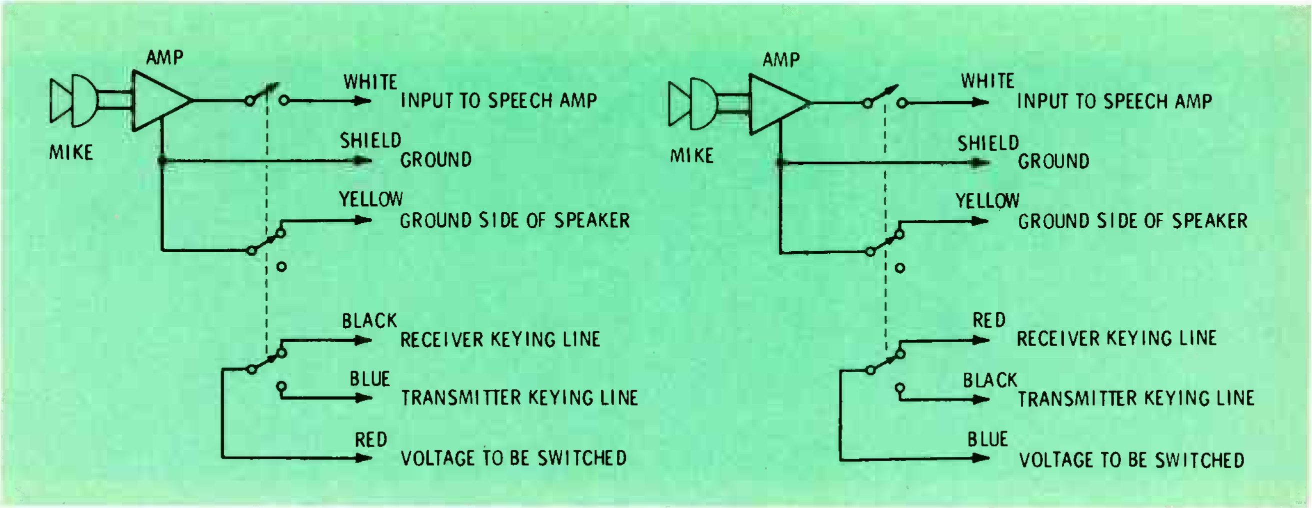


Fig. 4 Three separate keying wires are the hallmark of "special" versions which must silence the speaker during transmit.

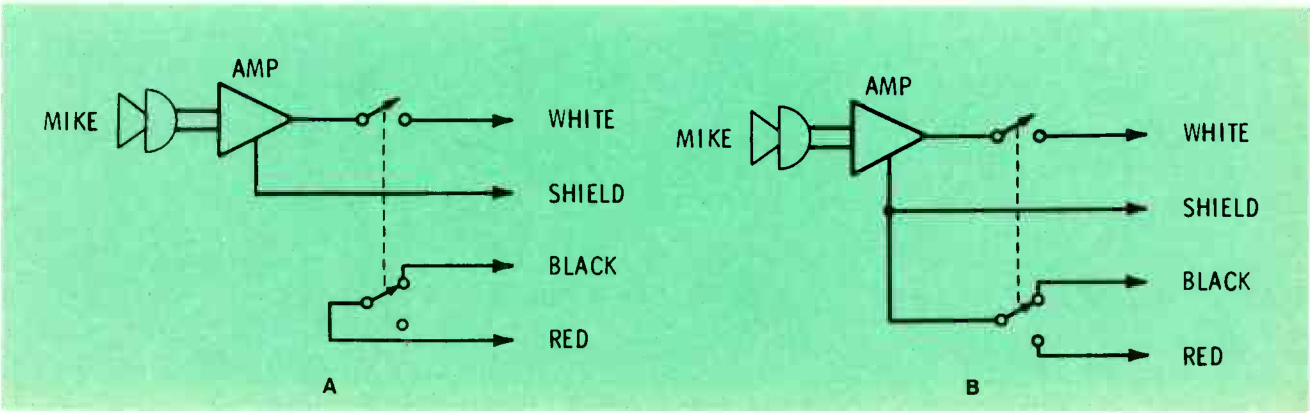
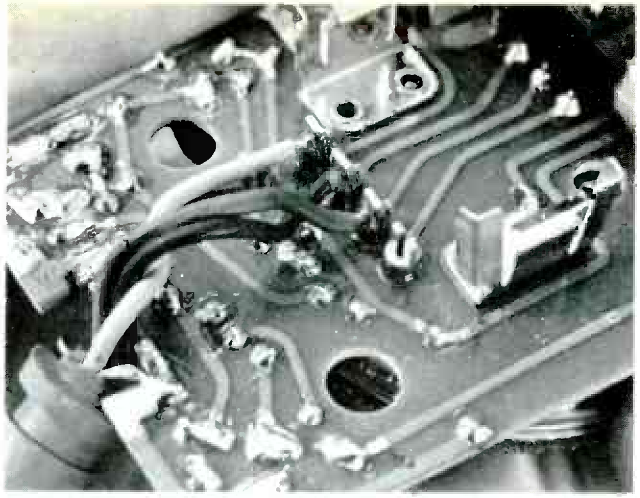


Fig. 5 Changing an amplified relay-switching mike to electronic switching usually requires two minor changes, as shown.

A



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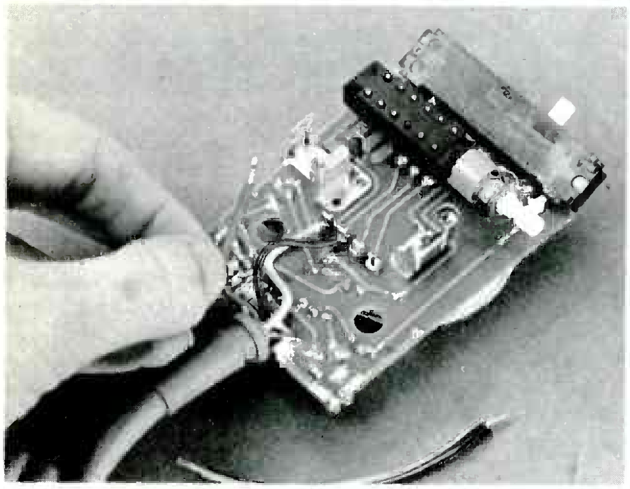

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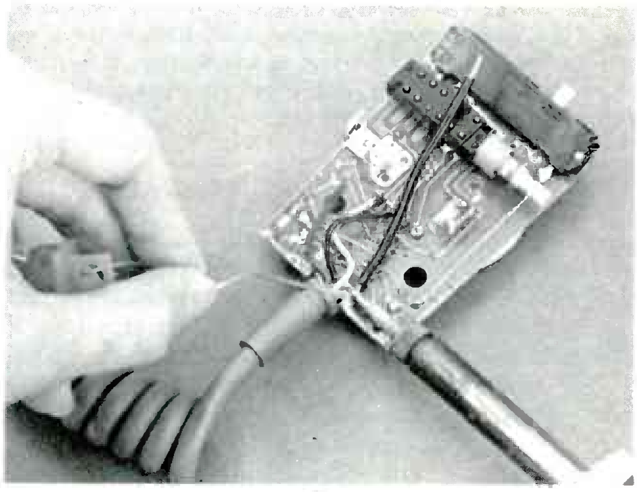

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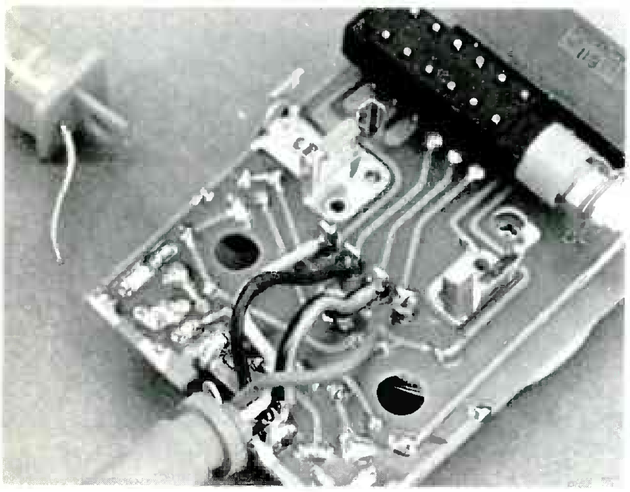


E

Fig. 6 These pictures show the modification of Figure 5 from relay to electronic switching. (A) Open the mike to expose the wiring of the switch. (B) Originally, only three of the four switch connections were wired. (C) Remove the wire from the third terminal from the left. (D) Add a jumper (with striped color code to show a change) from the cable shield to terminal 3. (E) Solder the red wire (which has been removed from terminal 3) to terminal 4. That's all, except testing the performance.

together. Bend the turn-on contact slightly farther away from its mate, usually a grounded armature contact. If this doesn't clear up the problem, you or your customer will have to decide whether the mike is worth the cost of installing a new switch.

Weak modulation also can be caused by an impedance mismatch. Perhaps your client mistakenly bought a mike with the wrong element (ceramic instead of dynamic, for example) for his particular transceiver. That's why you should keep on hand a variety of replacement mike elements. They're quick and easy to install, when the old one is defective, or a wrong type has been used. Often you can make as much profit by repairing these mikes as you would selling a new one.

Squeals or squawks

Complaints of squeals or squawks that accompany or drown-out the

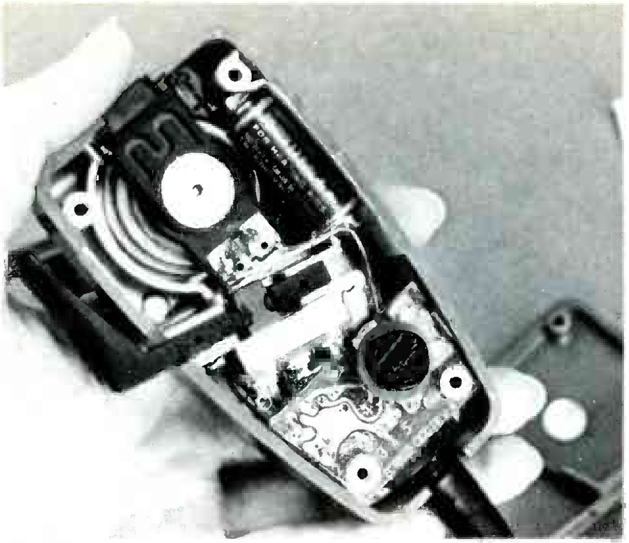


Fig. 7 The most common cause of weak modulation or no modulation in amplified mikes is the battery. Check for corrosion, notice polarity, and check the voltage with the switch activated.

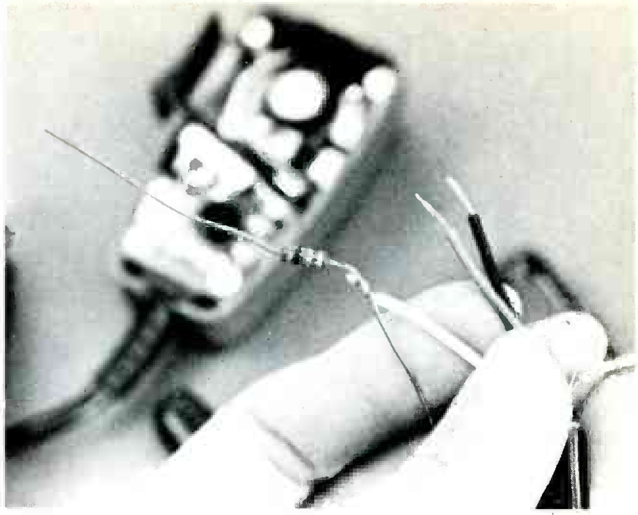


Fig. 8 A suppressor resistor or RF choke might be needed in series with the output of an amplified mike to eliminate squeals. It is most effective in reducing the squeals, and is easier to install, at the connector end of the mike cable.

voice during transmit usually are caused by RF feeding back into an amplified microphone. You'll hear this symptom described three ways, and each points to a different cure.

One kind of squeal occurs in base mikes. It lasts only for the first fraction of a second after the start of transmit. The source is the switch contacts which turn on the transmitter before the receiver circuits are silenced. The cure is in adjusting the mike switch. Bend the switch leaves so the action sequence goes like this, as you push the switch button:

- the speaker ground contact (yellow wire) opens;
- the receiver keying contact breaks;
- transmitter keying contact closes;
- preamp turn-on contact (not shown in the simplified schematics) closes; and finally
- the preamp output contact (to white wire) closes.

Any other sequence invites trouble.

Another kind of squeal accompanies all transmissions, usually being heard constantly. It can occur with either amplified or non-amplified microphones.

When a non-amplified mike causes the squeal, it's usually a sign the mike element doesn't match the input of the transceiver. First, determine that the mike has the correct type of element in it, including the right impedance. You might, particularly with some replacement mikes, have to add a resistor in series with the mike element (see Figure 8). The value must be found by an experiment. Start with 470 ohms and keep raising the value toward 47K until the squeal stops, but **be certain the modulation doesn't drop more than a few percent.**

If there is insufficient room inside the microphone, place the added resistor in series with the white wire at the connector. This might call for a longer connector shell. Wherever you place the resistor, clip short the leads. Insulate it with a sleeve of clear plastic, which is long enough to cover the soldered connections at both ends.

When the value required to suppress the feedback is so large it cuts modulation percentage too much, use an RF choke instead. About 50 microHenry seems to be about right.

The third squeal might be more of a squawk. It has an unstable sound, rather capricious and erratic. Moreover, it might be intermittent. To eliminate it, try reversing the two relay-keying leads. If the wrong one gets into the ground system, unwanted coupling introduces feedback that occasionally makes the squawking sounds. Even when the effect is not bad enough to produce a distinct noise, the feedback can increase the distortion.

Summary

To be successful and make a profit servicing CB microphones, you need these three keys:

(1) **Familiarity with microphone equipment.** When you take on a new line, or new models come out, give those mikes a hands-on inspection. Obtain any booklets or spec sheets the manufacturers offer. Learn what to do about each mike problem.

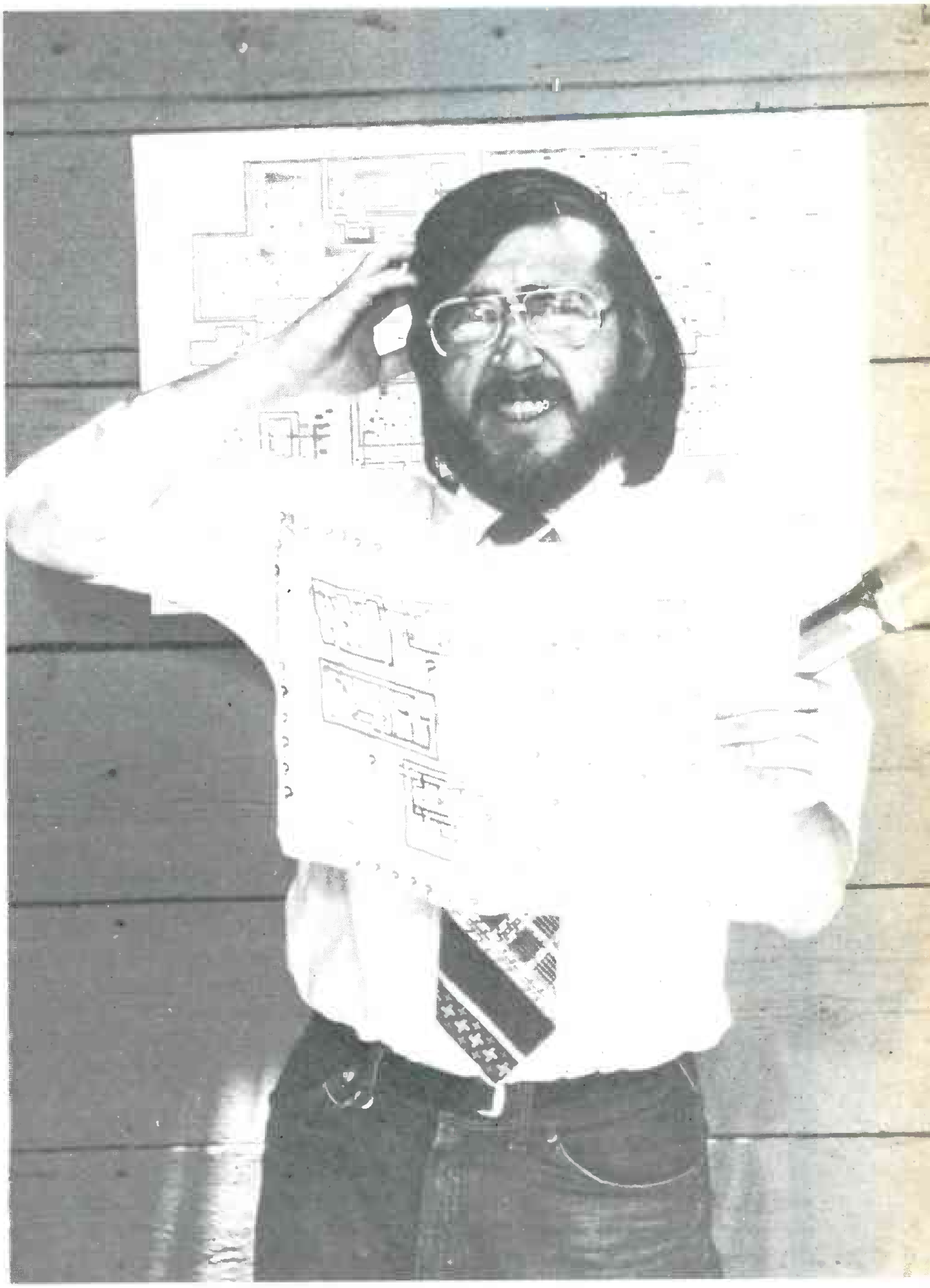
(2) **Rapid repairs.** After you know how to make the repairs, do it quickly. If you can't repair a **cheap** mike in 15 minutes or less, sell your customer a new mike. Even with a quality mike, complete servicing should not exceed 30 minutes. If it does, either you'll be overcharging, or you'll lose money. Of course, servicing **must** be profitable.

(3) **Inventory.** The last key to success is an adequate inventory. You should stock replacement mikes, mike elements, cables, connectors, and batteries. Keep on hand replacement switches for your popular mikes, and a few 50 microHenry RF chokes. You won't tie up much money in this stock, but you'll reap good profits. You can soon build a reputation as a technician who really knows his CB and communications mike repairs. □

The trouble with TROUBLESHOOTING!!

Is this an allegorical story, written merely to amuse you? Or, is the problem real, and the solution badly needed? Give us your answers.

By Thomas J. Schum



Mr. Trainee is scratching his head in bewilderment, the wrinkled schematic symbolizes uncertainty, the question marks illustrate the questions he has about tolerances, and he's trying with the flashlight to shed light on the problems. The picture of author Thomas Schum is by photographer Mitch Laing.

Joe Trainee was enthusiastic about his new job with **Mr. Boss.** He had studied in electronics school for eight months, and was eager to tackle the great challenges of the **Bench Tech Trainee.**

Questions, questions

Right away, **Joe Trainee** got into trouble. The complaint on the first bench job was "foggy picture". Joe diagnosed it as insufficient horizontal blanking, and started testing by measuring the base voltage of the blanker transistor. His digital multimeter read +3.1. However, the schematic called for +2.8 volts DC.

Joe began to worry, "Well, it looks a little high, but maybe not high enough to matter. After all, that's just outside the ±10% tolerance. But, on the other hand, maybe it's important. I'll just do some more checking."

So, he tested this and tested that, asked **Mr. Boss** for advice, replaced the flyback on suspicion, and became more nervous by the minute. Nothing helped, so four hours later, he shotgunned the entire blanker-bias section. Now the TV worked okay, but he didn't know which part had been defective.

continued on page 34

Troubleshooting

continued from page 27

Mr. Boss is displeased

Other repairs, during the next two weeks, were just as frustrating. Finally, **Mr. Boss** said, "Joe, I know you've been doing your best, but you're working pretty slow, and not finishing many repairs. What's the problem?"

"It's like this, **Mr. Boss,** when I measure a voltage or check a waveform, **it's never exactly what the schematic says it should be.** It's always a little high or a little low. And I don't know whether these variations are enough to be important or not. So, I spend lots of time, and make wild guesses. What can I do?"

"Well, in a couple of years, if you work hard at it, you'll be able to make a **Good Guess** about each problem. I've been in the business for ten years, and I've reached the point where I usually have a **Very Good Hunch.** Eventually, you will, too."

Joe felt better after that, and went back to work encouraged. However, doubts came again and again. Now, **Joe** liked electronics, had done well in his studies, and didn't want to guess all the time. "Maybe this isn't my best line of work," thought **Joe.** "Perhaps I should continue studying and become a design engineer. But, on the other hand, it's satisfying when a customer thanks me for the fine job I did on his TV. Engineers don't get much approval of that kind. No, I think I'll keep trying to become a better technician."

Mr. Boss was sympathetic with **Joe,** for he too had learned the hard way, and could remember asking the same question. But, he also was **evading** the question. Although he couldn't express it in words, **Mr. Boss** knew emotionally that top-notch troubleshooting could NOT be learned entirely by facts and figures. Perhaps some day he can explain it.

"Nominal" conditions

The **VIP's** at Nationwide TV Corporation decided it was time for a new state-of-the-art solid-state TV chassis. They requested **Engineering** to design the new model. Then **Engineering** sent the design to **Production Engineering.**

The job of **Production Engineering** was to adapt the design so it would give adequate performance with the least-expensive components possible. Of course, wider tolerances reduce the costs. Worst-case analysis provided exact figures for the maximum variation of waveforms, voltages, resistances, and currents which would still allow good performance. Finally, the production design was completed, specifying 5% here, 10% there, and 40% for most places.

The **Production Analysis** was filed with **Quality Control** to guide the tests following production. When the schematic for technicians was drawn up, it was marked with "nominal" (or average) figures.

No doubt, **Production Engineering** had done an excellent job, but the detailed information about design limits never traveled beyond the walls of the factory. This suppressed data didn't help **Joe Trainee** at all; he still had to spend most of his time guessing about the variations, and wondering if they were important.

Good (?) advice

One of the most respected technicians in **Joe's** region was **Mr. Head Man,** the Service Manager of the distributor for Nationwide TV's. One day **Joe** had a chance to talk

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Editor's Note: What do **you** think? If voltages were listed as a range instead of a single nominal voltage (for example, +11.2/+15.4 rather than +14), would all questions be eliminated about whether or not a voltage was "close enough"? Or, is **Joe** asking the wrong question and expecting an impossible answer? Think about this basic problem, then send your comments to:

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---

to him, and described his difficulties. "Since they already have the information from the **Production Analysis,** why don't they list the highest voltage and the lowest voltage that will allow normal circuit operation, instead of showing average or "nominal" voltages?"

Mr. Head Man replied, "Listen, technicians are supposed to know what they are doing." "But, **Mr. Head Man,"** said **Joe.** "It's a fact of life that beginning technicians still are learning their trade, and they make all kinds of mistakes because of that "nominal" information, the same as I do."

"Look," said **Mr. Head Man,** "if they don't know how to do the work, they shouldn't be in the business. I think you need more training."

Joe didn't understand this attitude. It seemed unreasonable, so he left, mystified. Didn't the factory people know that if the new men made fewer mistakes, they could work faster and charge the customers less? The lower price for service and the improved performance would make the customers glad they bought such a good product. They might tell their friends, who also would buy the same brand, thus making more profit for the TV manufacturer.

Then **Joe** indulged in a little daydreaming. "Maybe something would get done about giving us the information we need, if many people knew about this. I'll write a story about it." And that's what he did. He sent it to ELECTRONIC SERVICING. It was accepted, and it was printed, earning **Joe** a big fat check.

At the Nationwide TV factory, **VIP #14** happened to read the article in a copy of the magazine he "liberated" from one of the troubleshooters on the line. He said to himself, "Perhaps this **Joe** has a good idea. Maybe I can do something about giving the service people the accurate information about those limits."

Will **VIP #14** be able to navigate the devious caverns of the **Corporate Mentality?** Will the TV manufacturers publish more than "nominal" voltages, resistances, and waveforms? **Indeed, would this information eliminate all uncertainty during servicing tests?** ☐

WEIRD TV REPAIRS

By Robert L. Goodman, CET

The "Old Pro" will never forget these repairs, because of the strange and unusual symptoms or defects.

Interference Or Sweep?

Where do you look for the defect that causes the TV picture of Figure 1? Is it caused by RF interference from outside the receiver? Could radiation from a sweep generator make such a pattern? Perhaps it's the effect of an unstable horizontal oscillator. Or, could it result from some kind of hum?

A few simple tests and observations should weed out most of the wrong guesses. RF interference from outside the TV probably would bother only one channel. But, this effect was the same on all channels. In fact, it was there also without any input signal.

The pattern is not typical of those from sweep generators, and a test signal would bother only one channel. Also, sweep generators work in synchronism with the 60-Hz line (not the 59.95 Hz of TV vertical); so the heterodyne pattern between station and generator would move slowly up the picture, the same as a filter hum. None of these conditions applied to this problem.

Fig. 1 Where should you look for the cause of this peculiar picture: vertical, horizontal, pincushioning, AGC, or power-supply hum?

Double-triggering of the horizontal oscillator might cause the symptom. However, I never have seen one malfunction at both the **top** and **bottom,** and not at the center.

Just to be certain the horizontal oscillator was not at fault, I substituted a new oscillator module. There was no improvement.

None of my first guesses were right. After some thought, **I decided the top and bottom part of the symptom must be significant.**

Pincushion problem?

Two separate items of information made me suspect the pincushion-correction circuit. I had heard rumors of weird symptoms caused by defects there. And, a pincushion circuit operates **only** at top and bottom of the raster.

(Here's a brief description of how top/bottom pincushion correction operates: filtered samples of horizontal sweep are added to the vertical, thus increasing the height at the top and bottom of the picture near the horizontal center. No correction is necessary near the center point of the vertical deflection. That last sentence is important!)

Eliminate the PC

There is a quick test to determine whether or not the pincushion circuit is defective: just connect a test lead between C1303 and C1304 (as shown in the pincushion schematic of Figure 2). If the PC circuit has caused loss of height, a trapezoidal raster, or an intermittent sweep problem, then **the symptom should be gone,** and the raster should show pincushioning.

In this case, the picture became normal (except for the pincushioning) when the jumper was added. The test proved that the defect was in the pincushioning circuit; but which component was bad?

Visual tests

Where the defective part or condition can be seen, visual inspection is the quickest method to use. And a reading glass (or other kind of magnifier) helps to be certain of the condition.

A cold-soldered joint at one terminal of R1307 (the PC Amplitude control), **obviously was intermittent.** Of course, an open R1307 or a defect in T1301 might give similar visual symptoms on the screen. The bad joint is shown in Figure 3. A narrow white horizontal line could result from an open or defective L1301.

Breaker Trips At Turnoff

A peculiar condition has been reported with some of the solid-state Zenith color chassis which have (1) a voltage-regulating power transformer, and (2) a remote control. It is the combination of the VRT and the remote circuitry that causes the breaker to trip from overload, when the TV is shut off by the remote. Next time the TV is turned on, the receiver is dead until the breaker is pressed. There's no defect in the TV circuits. The problem is in the turn-on circuitry.

Voltage-regulating transformer

Figure 4 shows the essential parts of the voltage-regulating power transformer. The bent ends of the lines that represent the core laminations indicate some kind of nonlinearity. In this case, there is a certain kind of loose coupling between primary and secondary, producing a near-squarewave voltage from the secondary windings. The 3.5 microfarad capacitor across the secondary adds needed capacitive current, smooths the fast rise time, and increases the amplitude (by resonant action). **Don't use an electrolytic as replacement; it probably would explode!**

A distorted input waveform can

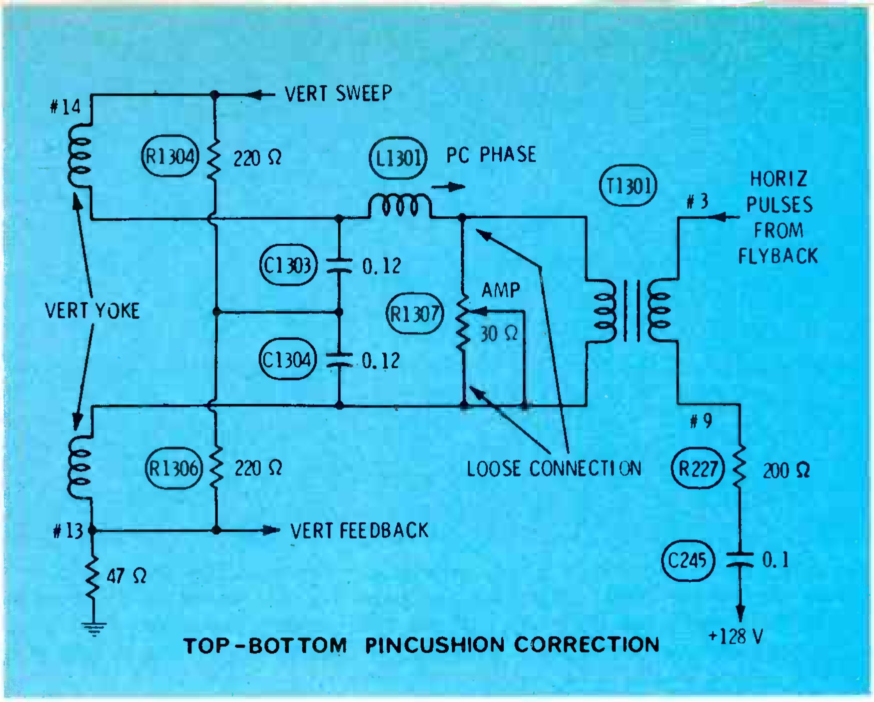

Fig. 2 The previous symptom was caused by a bad soldered connection at one end of R1307, in a late-model Zenith color portable. Other possible symptoms from a defective pincushion-correction circuit include a white horizontal line, no vertical, or a trapezoidal picture.

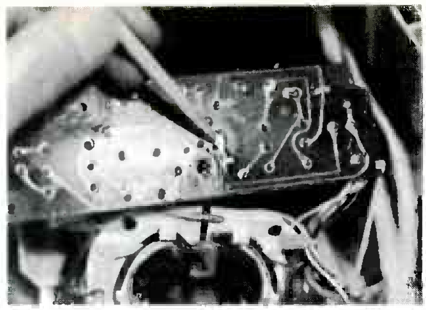

Fig. 3 Location of the poor connection is shown on the convergence-pincushion circuit board.

cause excessive primary current for two reasons: it upsets the resonant effect; and some distortions have a DC-voltage component (unlike sine waves, which have no DC value).

Triac on/off circuit

Triacs make fine AC switches, because they pass both positive and negative peaks when their gates are biased properly. Therefore, they would make ideal replacements for relays to turn the TV power on and off. The drawback is that the remote circuitry then would be connected to the triac, which in turn would be wired to 120 volts of line power. Such a condition would be a safety hazard, so several manufacturers have used "photo-optical isolators" to trigger the triac, without any connection between the triac and the remote control.

Wiring of the Zenith photo-optical isolator (after one modification) is shown in Figure 5. When the remote control is commanded to turn-on the TV power, it lights the bulb inside the isolator assembly. The light strikes a cadmium-sulfide cell, which reduces its resistance (both the bulb and cell are inside a light-tight enclosure). Since the CdS cell is connected from anode to gate of the triac, this reduced resistance applies enough AC voltage to the gate to force the triac into conduction between the anode and cathode. The triac (instead of the usual switch) is connected in series between one side of the power line and the TV power transformer, so the TV has normal line voltage.

Excessive VRT current

Defects in either the photo-optical isolator or the triac can cause excessive current in the primary winding of the VR transformer, particularly during turn-off time.

Although it could be argued that the shift of waveform applied to the primary of the VRT (see Figure 6) is responsible, it's likely a peculiarity of triacs is the main reason for the high current.

It's not very well known, but with a triac, the minimum gate-to-cathode voltage that's necessary for anode-cathode conduction is slightly different for positive than for negative peaks of AC voltage.

Therefore, if a certain triac requires more gate voltage than usual, or if a photo-optical isolator assembly does not give a low enough gate-supply resistance, then **it's possible for a triac to conduct during only one peak.** In that case, the AC voltage fed to the primary of the VR transformer will have a DC component; and the DC voltage will cause excessive current through the primary, thus tripping the overload breaker.

Why is this more likely to happen during turn-off rather than turn-on? That's because of the CdS cell. It decreases resistance faster when illuminated than it increases after the light is eliminated. So, during borderline conditions, the triac functions as a half-wave rectifier; the VRT draws excessive primary current for a short time, but time enough to trip the breaker. After the breaker is reset, the TV operates normally (there is no overload in the TV).

Zenith recommends replacement of both the triac (part number 800-618 kit) and the isolator (part number 800-617 kit) at the same time. These kits also contain the Metal-Oxide Varistor (MOV), that is shown in Figure 5. The MOV is designed to conduct during any transient voltages, such as lightning spikes, to protect the triac and the power transformer.

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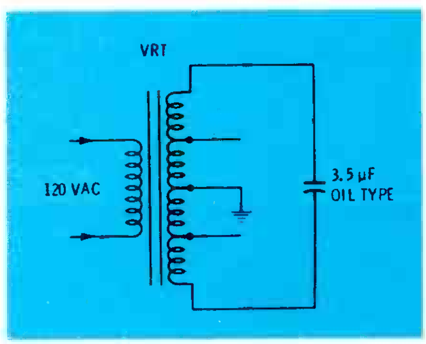

Fig. 4 The new Voltage-Regulating Transformers (VRT) regulate the secondary voltages by a combination of loose coupling between windings, voltage saturation (giving square waves from the secondary), and capacitive current from the special oil-filled tuning capacitor. Because of the square waveshape, the secondary voltages must be rated in peak-to-peak.

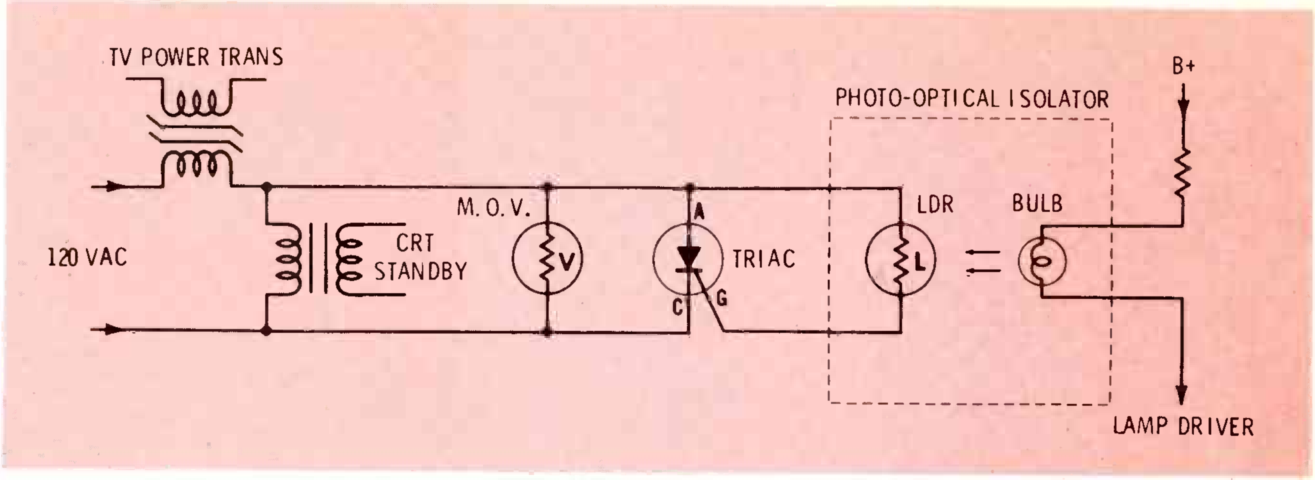

Fig. 5 A photo-optical isolator allows the remote to switch on the TV power without any electrical connection between the remote and the triac power wiring. However, certain borderline conditions can allow the triac to act as a half-wave rectifier, and the DC voltage forces excessive DC current through the primary of the VRT, causing the breaker to trip at turnoff. Zenith repair kits include the Metallic-Oxide Varistor (MOV) which protects the triac by conducting to clip any voltage peaks on the power line.

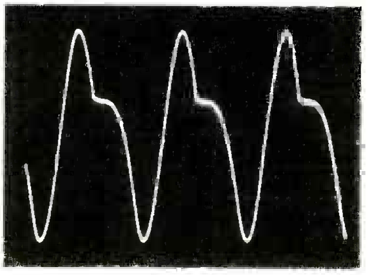

Fig. 6 A defective photo-optical isolator allows the triac to pass all of the negative peak and only part of the positive peak, as shown by this waveform across the TV VRT primary.

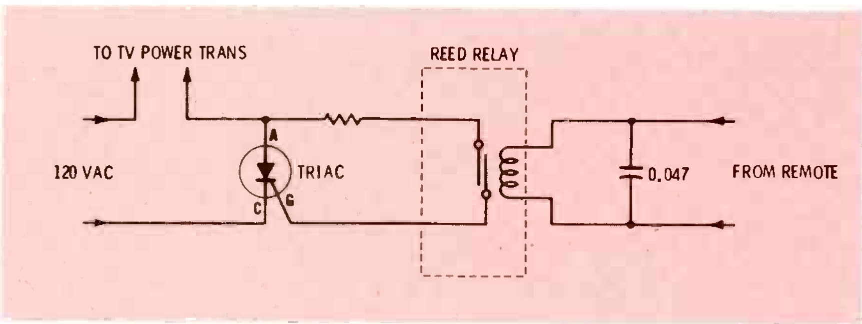

Fig. 7 Some late-production Zeniths have changed to a magnetic-reed relay for biasing the triac, because the relay is less susceptible to damage by transients.

Fig. 8 Not a single scanning line could be seen on this out-of-focus picture. The trouble was **not** caused by the voltage-divider resistors.

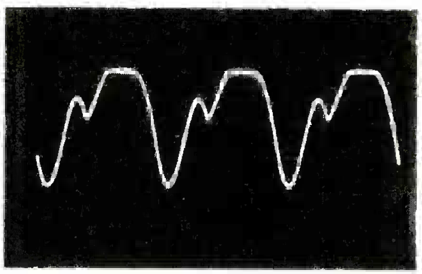

Fig. 9 A light-dimming control using an SCR distorted the power-line waveform and kept the remote control of the TV from operating. That's weird!

Weird Repairs

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Reed relay

New "H" chassis (19HC45, etc.) Zeniths are equipped with a reed relay (Figure 7) that's said to give more dependable operation.

Poor Focus

When you adjust the focus control, but nothing happens, and the picture is far out of focus (Figure 8), you always should check the resistance values of the focus voltage divider. Right? Well, not necessarily.

Some "E" and "F" line chassis have been found with excessive focus voltages measuring from 8 KV to 12 KV. There are two ways of tracing the origin of such wrong voltages. Remove the CRT base socket and, with the power applied to the set, check for any DC voltage at the focus pin (#9) of the picture tube base (not socket). This voltage should be less than 1 KV. **If it's higher, perhaps the picture tube has internal leakage between the aquadag and the focus element.** Such leakages can be intermittent.

While the socket is removed, measure the voltage at pin 9 of the socket. Vary the focus control, making sure the voltage changes in step, and adjusts slightly above and below the nominal 5 KV that's needed. If it won't do these two things, a focus voltage-divider resistor probably is out of tolerance.

Tempermental Remotes

The owner of this new Zenith remote-controlled color receiver complained that the remote would not function after 8 p.m. During three separate service calls, made in the daytime, the remote operated perfectly. Even so, I replaced the remote module, power unit, and the hand remote control box as call-back insurance.

Again, the owner complained of complete loss of remote functions at night. After the set was brought to the shop for a long time test and no problems were found, the dealer finally concluded the customer was just trying to get out of the sales contract, and the TV was returned to the dealer.

About two weeks later, another customer with a Zenith having the same Model SC1000 remote control complained that the remote would not operate after 7 p.m. "Aha," we thought, "another customer trying to get out of paying."

However, this customer added another comment that the remote would quit after dark **when the room light was turned on.** Any connection with turning on a room light seemed very "remote" (to make a feeble joke). Then I noticed the light had an SCR dimmer. **I turned on the light** with the dimmer **and the remote control refused to operate!**

Although I still couldn't believe the dimmer could be the cause, I brought in a scope and looked at the waveform at the AC outlet where the TV was plugged in. The waveform became very distorted (see Figure 9) when the light was turned on by the SCR dimmer. Probably that was the problem at the other similar complaint.

Model SC1000 remote

Space does not permit a full explanation of the unique circuitry of the Zenith Model SC1000 remote control system, but I will give a few details. An IC called a Digital Decoder has a binary counter, a confidence counter, and a function decoder. These eliminate all of the tuned circuits formerly necessary to separate the various functions, and stop false triggering from room noises (such as phone bells, etc.).

Instead of an oscillator, the binary counter uses 120-Hz unfiltered B+ as a clock signal (Figure 10). During the 8⅓ milliseconds of each 120-Hz sawtooth waveform, the signal frequency from the hand remote unit is counted, and the count is stored. This stored number is compared with the count taken during the next 8⅓ millisecond 120-Hz clock signal. The count is examined to be sure the frequency from the remote unit is of the correct approximate frequency. Then if the frequency is in the right band and the counts match, the confidence counter updates by one its tally of correct comparisons.

When the confidence count reaches seven, it is assumed that the signal is a valid continuous remote signal (not noise) and the function decoder is allowed to activate the appropriate function.

Of course, we assume that the 60-Hz line always has a sine waveform, and the Zenith system evidently was designed for sine waves. However, in addition to waveform distortion from SCR dimmers, other loads on the power line can add harmonics of 120 Hz and 240 Hz. If these become too strong, they will upset the clock-timing signal sent to the IC decoder, and the remote system will not accept **any** signal from the remote unit!

Figure 10B shows three parts changes that have been made by Zenith on replacement modules and later-model receivers. These changes should enable the remotes to operate correctly, even when the line-voltage waveforms are distorted. (But don't modify any sets unless a problem has been reported.)

Color Flicker

A new color symptom has developed in those solid-state color sets that have a low-voltage regulated power source using a zener diode and a series-drop transistor. This symptom shows as a color change (usually intensity) in horizontal bands across the picture, and the problem usually is very intermittent and unpredictable.

In a General Electric MA chassis, I used a wide-band scope to isolate a narrow, intermittent spike that was riding on the +23-volt supply. The spike (see Figure 11) was caused by a transient break-

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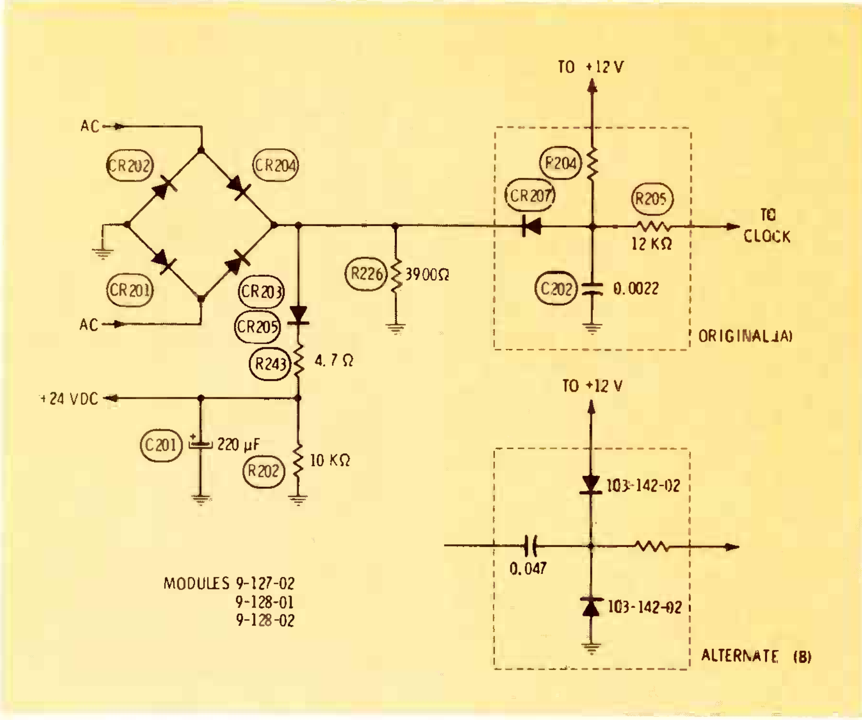

Fig. 10 Instead of using an oscillator for a "clock", the new Zenith remote receiver samples the 120-Hz power-supply ripple. However, distorted power-line waveforms can kill the remote operation, so the alternate circuit at (B) is recommended. An open in any of the four power-supply diodes also can kill the remote operation.

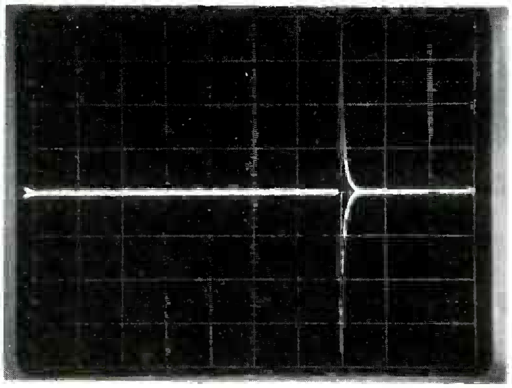

Fig. 11 This intermittent voltage pulse on the regulated B+ supply line can cause segments of the picture to have brighter color.

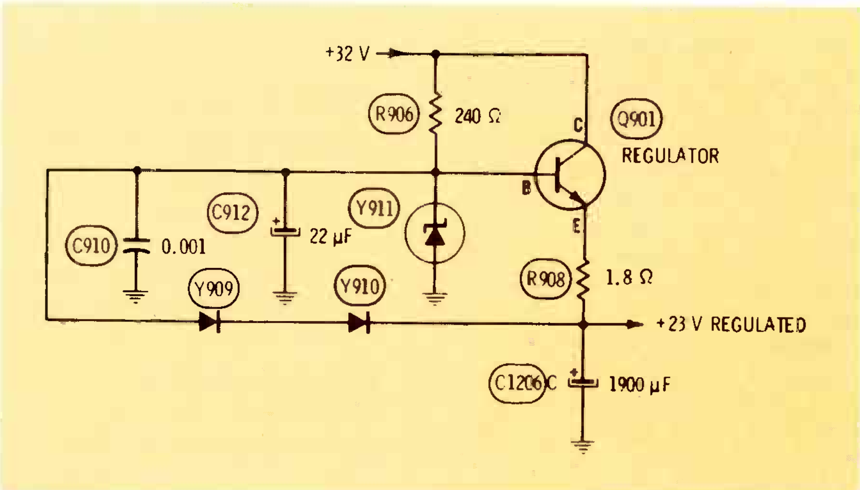

Fig. 12 Q901 of the regulator circuit of the General Electric MA chassis was the source of the pulse on the +23-volt line.

Weird Repairs

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down of the regulator transistor, Q901 (Figure 12).

Scopes of wide bandwidth and fast rise time are necessary to find such narrow pulses.

Also, the zener diode (Y911, or the equivalent in other circuits) can cause a narrow horizontal white line that floats slowly up through the picture.

Washtub Antenna

The following true story is not exactly about a TV trouble, but tells of an unusual TV reception phenomena.

Several years ago, I made a home call for an older model B&W TV where the customer complaint was loss of reception from our only fringe-area TV station.

While I walked toward the house, I noticed no sign of an outside antenna. **When I entered the room, I was startled to see an old number-10 galvanized washtub sitting on top of the TV, and inside the tub was a rabbit-ear antenna!**

Of course, I explained to the lady customer that she would need an outside antenna, if she wanted to get a clear picture from Channel 8. She let me know in positive terms that she had been receiving Channel 8 for the past year, and to please get her set repaired.

I gave up trying to educate her and started to check the TV, finding that it needed new tuner tubes and cleaning of the tuner switch contacts to remove the snow from the local station signal.

After the local channel was coming in okay, I turned to Channel 8, prepared to tell her "I told you so." However, **Channel 8 was almost snow-free.**

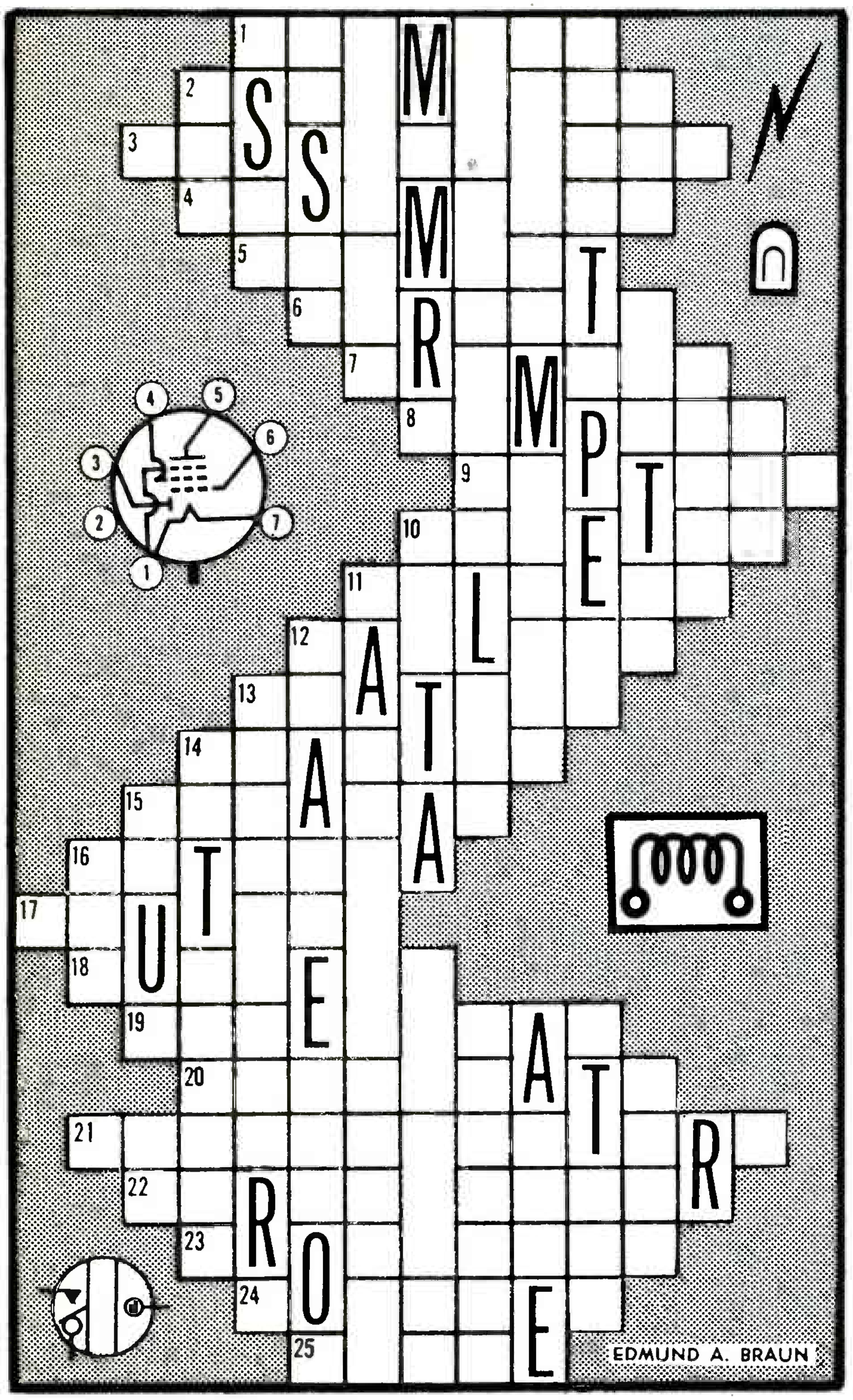
The antenna required careful orientation inside the washtub to obtain the best picture and the least snow. And the customer said this one spot was the only place in the room where the station could be received. I removed the rabbit ears from the tub (I couldn't believe it), and the station disappeared.

Do you suppose this customer accidentally discovered a new principle in antenna design? Perhaps we should call it the "cavity-tuned tub". □

FOR LIVE WIRES ONLY!

By Edmund A. Braun

Hi there! Now that you have a few minutes to spare, have fun solving this Just-across-word Puzzle based on Electronics! Each word is connected to the word above and below by one or more letters although only one is shown as a clue. Each correct answer is worth 4 points; a perfect score is 100. It should prove fairly easy to get a high rating except perhaps for someone who is sure "flutter" is an oleo substitute, or that "broadband" is a female music group! Pencil sharp? Then relax and GO!



1 Transformer winding that receives the current; the input.

2 A determined computation of the probable cost.

3 Loss of electrical energy as heat.

4 Instrument for measuring radiation.

5 Any component of a vacuum tube.

6 Chemical compound of iron oxide.

7. Insulating washer inserted through a hole in a panel or chassis.

8 Fabricated closely and firmly in a small space.

9 A seven-electrode vacuum tube.

10 Speaker intended to reproduce the very high frequencies.

11 A cgs unit of magnetomotive force.

12 A breakdown; not able to perform.

13 Not professional.

14 Device to change terminal arrangement of a jack, plug, socket, etc.

15 Conductive graphite coating used in and on a CRT.

16 An aerial.

17 An uncharged particle of a slightly greater mass than a proton.

18 The movement or passage of electricity.

19 Voltage difference between two points of a circuit.

20 In microelectronics, the material on which circuit is fabricated.

21 Materials through which almost no electricity can flow.

22 Tool for turning a threaded fastener in wood or other material.

23 Electronic transmission of speech, music, or visual programs.

24 An early form of detector used in wireless telegraphy.

25. A coil of low resistance and high inductance.

Now wet your thumb and turn to page 54 for the solution.

Reports from the test lab

By Joe A. Baldaczar

Each report about an item of electronic test equipment is based on examination and operation of the device in the ELECTRONIC SERVICING laboratory. Personal observations about the performance, and details of new and useful features are spotlighted, along with tips about using the equipment for best results.

LogiMetrics CB Generator

LogiMetrics calls it "Model 980 CB Receiver Test Set". The panel (Figure 1) is a model of simplicity, having only a dual-purpose meter with a selector switch, large LED readouts of the channel numbers, an unmarked knob to select the channel, an "AM Level Set" (modulation control), a single-range attenuator, a connector for the output signal, and an on/off switch.

Apparently this reflects the manufacturer's intention of supplying a high-accuracy, well-constructed, military-rugged instrument which should give superior accuracy and best-possible speed for CB receiver adjustments.

Forty Channels Plus

Model 980's that are now being sold cover all of the new 40 channels, although the generator can be factory modified for a maximum of 64 channels, if the need should arise. (Previous 23-channel 980's can be modified at the factory for no extra charge.)

Channel Selection

Controls for channel selection and signal attenuation are located on the right half of the front panel. Above the readout window and the knob is the legend "CHANNEL SELECT" (see Figure 2). A two-digit 0.43-inch-high red LED seven-segment display shows the channel that's selected by the knob.

Actually, the knob does not directly determine the channel. The knob programs the decoder. In turn, the decoder controls the "programmable divider", and the divider operates the Phase-Locked Loop (PLL) oscillator to provide the channel frequency, after proper dividing (Figure 3). The LED readout is fed by the same source that supplies the decoder. Extensive use of digital circuits makes the PLL operate automatically with the display.

Operation of the channel selector is unique. The selector switch makes one complete revolution for every 8 channels, or a total of nearly five mechanical revolutions for all 40. That gives easy channel selection because of the large spaces between the detent positions. Also, the knob can be turned in either direction, and there is no stop.

Because of the channel selection by digital signals, rather than by a certain knob position, any time the generator is without power it reverts to Channel 40 when next turned on. This is rather startling, before you understand that it is normal. It's just another reason why the knob has no numbers; only the LED readout tells the channel.

Attenuation

No range switches or calibration adjustments are provided for the RF-output attenuation circuit. One dial is calibrated directly both in volts (0.03 microvolts to 20 millivolts) and in dBm (-135 dBm to -25 dBm), as shown in Figure 4.

At all settings, the attenuator has an impedance of 50 ohms, with a VSWR of 1:2 or better.

By the way, as much as 5 watts of power can be applied to the "RF OUTPUT" connector without damage to the attenuator, or to any other part of the generator. Also, a power of 12 watts for no more than 12 seconds should not harm anything. So, if you forget and key-on the transmitter while the generator is connected, there should be no damage.

Radiation

Rating of the RF leakage is less than 0.1 microvolt at one inch from

Fig. 1 Model 980 CB-receiver generator by LogiMetrics features accuracy and simple controls, made possible by sophisticated digital circuits.

the case of the generator. I was happy to find **NO** detectable RF by bringing the unshielded end of a receiver coax cable near the generator.

This lack of radiation of signal is important for two reasons. It permits several generators of the same model to be used in close proximity. The generator of one test position won't interfere with measurements at another test position. (With other units which have excessive leakage, it's possible to align a receiver wrongly by picking up a signal from another generator.)

Also, such low leakage of the Model 980 permits you to use low levels from the generator without worrying that leakage has been added to the signal, thus increasing it over the calibrated amount.

Amplitude Modulation

Low-distortion amplitude modulation, adjustable from 0% to 95%, is provided by the Model 980. A two-position meter switch selects either the modulation percentage (with the percentage read directly on the mirrored-scale meter), or the level of the RF output signal. Thus, the "AM LEVEL SET" knob does not require calibration; the modulation is read on the meter.

In the "CW-RF CAL" position of the selector switch, the meter reads the level of the RF output from the generator. An area of the meter scale (Figure 5) is marked "RF CAL", and the meter should remain within these marks, regardless of the channel. There is no front-panel adjustment for this calibration; it is merely a crosscheck to be certain the internal Automatic-Level Circuit (ALC, although the manual does not call it that) is operating correctly. Turning the switch to the "RF CAL" position stops the modulation.

Comments

Apparently, the LogiMetrics Model 980 is not intended for IF alignment, or as a source of single-sideband signals. Instead, the accent is on low radiation and accuracy of readings. The few controls and the precise way they operate prevent you from making most mistakes.

When first unpacked, this individual Model 980 was nearly 1600 Hz too high in frequency on

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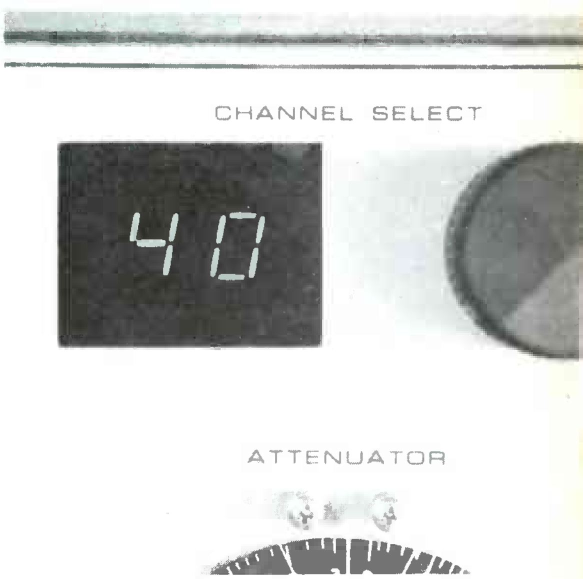
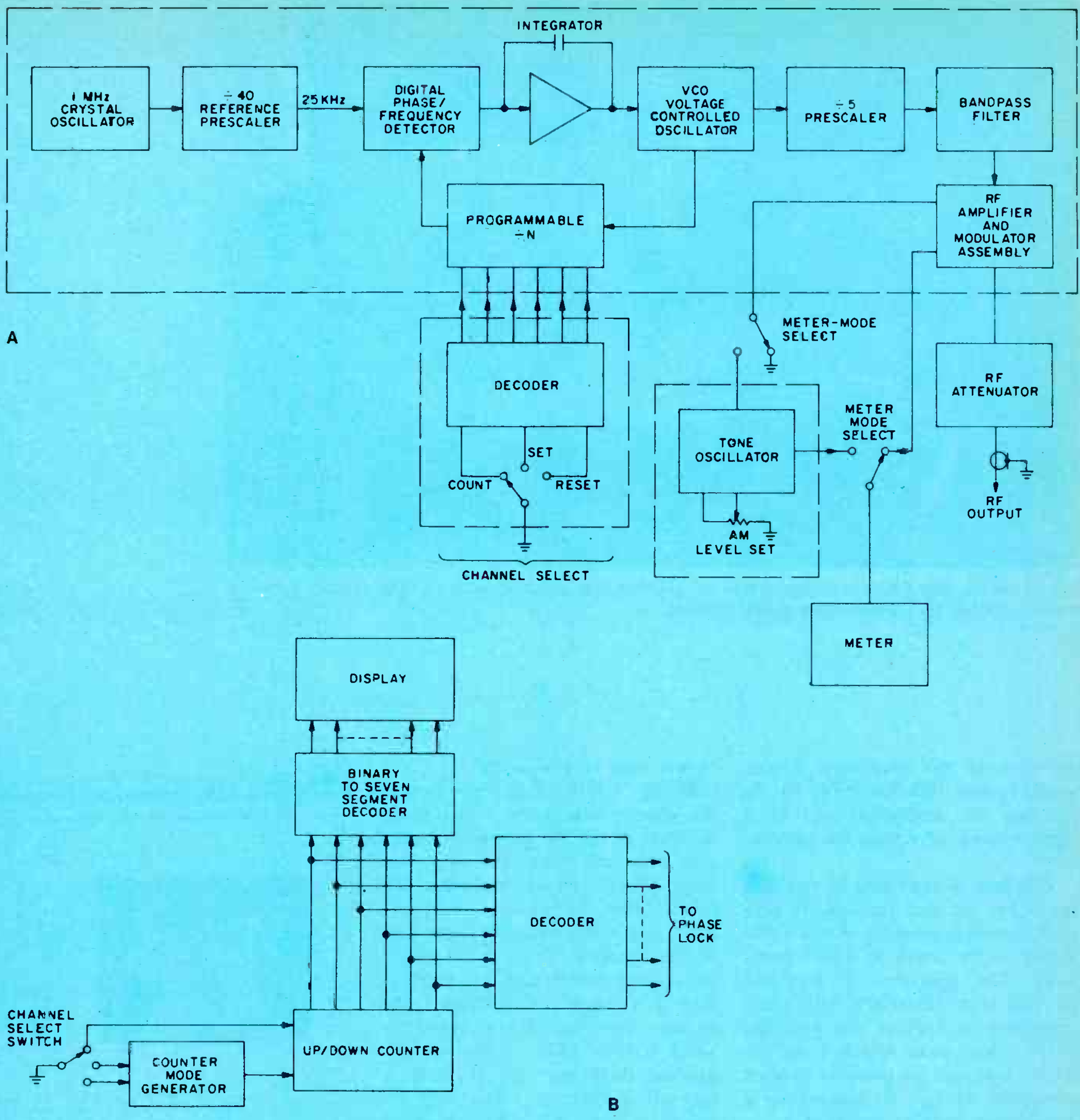


Fig. 2 The "CHANNEL SELECT" knob makes several turns to tune all 40 channels, which are identified by the large LED readout.



Test Lab

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each channel. But, it seems the error merely was from a lack of sufficient time for heat stabilization during factory calibration. A short period of operation each day brought the frequency nearer the standard, until on the fifth day it was only about 300 Hz too high. No further drift was noted, and I'm sure I could have used the internal control to bring it in right on the nose. (Up to 1,000 Hz of correction is possible internally.) Of course, you should check the accuracy of any item of test equipment, particularly by using station WWV as the standard. After warmup, the normal drift of the Model 980 is rated at 2 PPM, and I believe it will exceed that.

Features that appeal to me include the RF leveling, which eliminates any need to set the level to a calibration mark, and the high-power rating of the attenuator, taking away any concern about accidental keying to transmit.

All in all, the LogiMetrics Model 980 CB receiver generator performed its duties very well. □

Fig. 3 These block diagrams clarify some of the Model 980's digital circuits. (A) As the channel selector is rotated, different switches close for counterclockwise and clockwise rotation, and for indexing. These contacts feed the decoder, which programs the variable divider in the PLL circuit. All channel frequencies are locked to one crystal oscillator. (B) Output of the up/down counter also feeds the decoder for the LED display, as well as the decoder for the Phase-Lock Loop. (Courtesy of LogiMetrics)

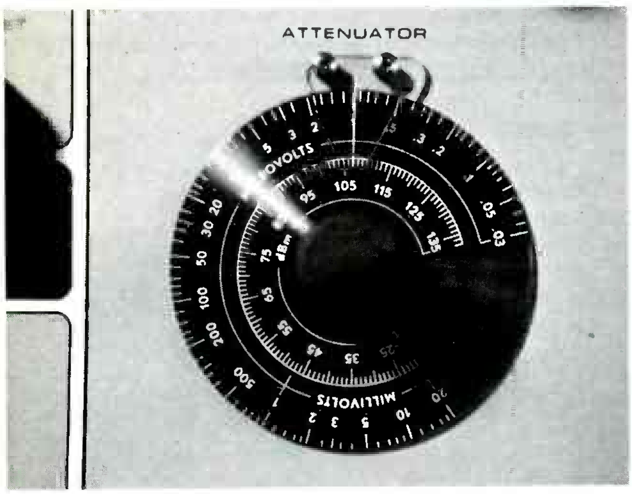

Fig. 4 The RF-output "ATTENUATOR" dial has calibrations both for volts and for dBM. There are no range switches; and the attenuator can stand a 5-watt carrier without damage, in case the CB transmitter is keyed-on by mistake.

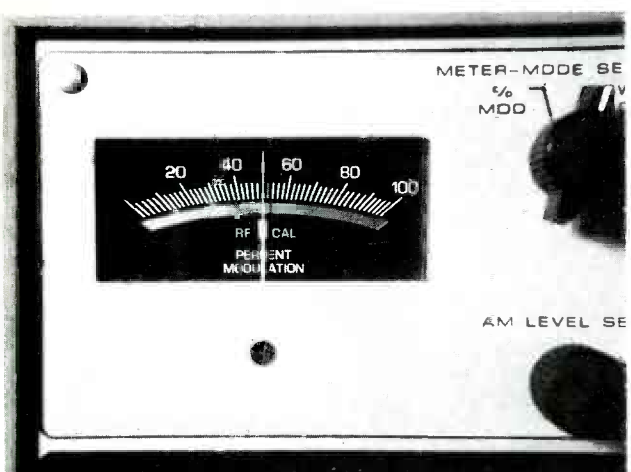

Fig. 5 The modulation/RF-calibration meter has a mirror scale to eliminate parallax errors. It is calibrated for modulation percentage, and for a 0.1-dB variation of the output signal level. The "RF CAL" function checks the operation of the circuit that keeps the output amplitude constant for all channels.

test equipment report

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CB-Receiver Test Set

The **LogiMetrics** 980 CB-receiver test set has a flat RF output level for all 40 channels. All the output channels are derived from a single crystal-controlled synthesizer designed for high accuracy and stability, with one adjustment for calibration.

The output attenuator is continuously adjustable from 0.03 microvolt to 20 microvolts, calibrated in both voltage and dBm with an accuracy of ±1 dB.

Leakage level from the box is said to be less than 0.1 microvolt. Price of the Model 980 is $1,195.

For More Details Circle (50) on Reply Card

Tuner Sub/Convergence Generator

Model SG-785 from **Telematic** is a dual purpose test instrument combining a tuner substitute and a generator of lines or dots for convergence adjustments.

TV Channels 2 through 83 can be tested by the substitution method using the VHF and UHF tuners, which have 40-MHz outputs. A numbered RF gain control and a rear-panel internal/external UHF switch are added features.

In the generator section, crystal-controlled digital count-down circuits produce stable patterns for centering and convergence adjustments. A switch gives a choice of a crosshatch pattern with 8 vertical bars and 7 horizontal bars, or 56 dots. These patterns are said to permit accurate centering of the picture.

The instrument (called "Ferret") operates from regular 120 VAC power, and each function has its own on/off switch.

For More Details Circle (51) on Reply Card

Frequency Counter

Frequency measurements between 10 Hz and 60 MHz can be made accurately by the **VIZ** Model WD-752A frequency counter. One different feature of the counter is the 1-KHz audio signal with a separate on/off switch and amplitude control. It can be used in many ways, but is especially helpful with single side-band. SSB transmitters have no carrier unless there is modulation. So, to measure the carrier frequency, the 1-KHz "side tone" is used to modulate the SSB radio.

With any counter, false readings can result if excessive noise is mixed with the signal, and the counter has high sensitivity. This possibility is minimized with the VIZ counter by two features. An input-level switch provides input sensitivities of either 10 microvolts or 100 microvolts minimum for stable counting. Also, a signal lamp indicates when the input is strong enough to be counted correctly.

Frequency, decimal point, and the range (MHz or KHz) all are displayed automatically by the six 0.3" 7-segment LED's.

The price to dealers and technicians is $255.

For More Details Circle (52) on Reply Card

productreport

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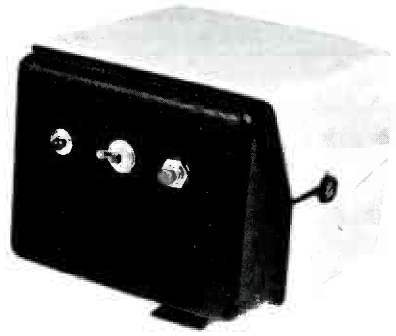
Radar Detector

The **Whistler** "Radar Eye" is designed to alert drivers to radar speed traps, thus encouraging safe, legal



highway driving speeds. The unit is said to detect speed radar at several times the distance that the speed can be measured, and not give false alarms from other signals. There is no sensitivity control, and the visual and audible indicators show the approximate distance from the radar machine.

For More Details Circle (68) on Reply Card

Flashing Alarm Light

Mountain West has a flashing red-strobe light that's designed to work with nearly all types of alarm systems, including bell alarms, sirens, and silent systems. The light flashes brightly once per second, and it continues to flash even after the bell or siren cuts off automatically. Model A14 operates on 6 VDC and 400 milliamperes, although a 12-volt model is available.

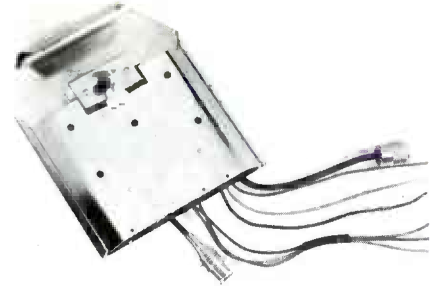
The light is intended for either indoor or outdoor installation, and is priced at $50.

For More Details Circle (69) on Reply Card

TV Cart

Professional TV Service has introduced their "One Man Easy-Does-It" TV cart. It is designed for one-man transportation of large, heavy television sets or stereos. Casters built onto the front and top of the unit allow transportation with little weight on the operator. The cart is lightweight but sturdy. Price is $169 shipped C.O.D.

For More Details Circle (70) on Reply Card



Anti-Theft Mount

RMS Electronics has announced the availability of a key-lock slide mounting bracket to safeguard CB radios against theft. Model CBLM-520 mounts under the dashboard or on the floor. The mount and the CB radio can be unlocked easily and removed from the automobile when not in use. It comes with male and female coaxial cable connectors, 3 wires, mounting hardware, and key. List price is $14.50.

For More Details Circle (71) on Reply Card

Tuner Cleaner/Degreaser

"Big Bath" from **GC Electronics** is a cleaner and degreaser for TV tuners, and it is said to be safe for plastics. "Big Bath" comes in a 24-ounce aerosol can.

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Chassis TAC-600, TAC-620 1631-2

ZENITH
Chassis 13HC10/10Z1 1634-2

catalogs literature

Circle appropriate number on Reader Service Card.

91. Seton Name Plate Corp.—has published a 72-page full-color catalog presenting over 186 identification products such as decals, truck signs, parking-control labels, and award plaques at factory prices. The catalog offers technical data and price information for purchasing agents and shop owners.

92. Standard Handling Devices—has issued a 144-page catalog picturing equipment for in-plant and warehouse transporting, lifting, dumping, hoisting, pulling, conveying, and storing. New products including ladders, cabinets, and scaffolding are also featured. Technical and engineering information are included.

93. Fordham—has released a discount mail-order catalog catering to radio and TV servicemen, electronic technicians, CB users, and hobbyists. 148 pages list test equipment, CB equipment, tools, tubes, antennas, speakers and microphones, phonograph cartridges and needles, and other items. Particular emphasis is devoted to test equipment.

94. Hewlett-Packard—has a 32-page publication which provides background on such subjects as thermal printing, testing, servicing, C-MOS, P-MOS, and N-MOS circuits and RPN language. A catalog section provides background on each of the hand-held and printing calculators, including an explanation of functions, physical specifications and accessories. The publication also includes a question and answer section and a collection of unusual case histories.

95. Tech Spray—has issued a free booklet entitled "Business Letters—They're Easier Than You Think." The booklet relates to topics such as business letter attitudes, collection of thoughts, how to say no, and good letter-writing practices.

For news of our industry, read Electronic Scanner, page 4

bookreview

Basic Transistors, Revised Second Edition
Author: Alexander Schure
Publisher: Hayden Book Company, Inc., 50 Essex Street, Rochelle Park, New Jersey 07662
Size: 152 pages
Price: $5.70 paperback

Several years of research and experimentation with instructional methods at the New York Institute of Technology have resulted in this compilation of transistor uses in electronic applications. The simple, pinpointed approach makes the contents useful for the individual as well as classroom study. The book covers a number of concepts ranging from the structure of atoms to the characteristics and circuitry of modern transistor types. The text is generously illustrated and presents one important concept per page. Major points are stressed on question and problem pages throughout the volume.

Understanding Television
Author: Philip D. Kennedy
Publisher: Howard W. Sams & Company, Inc., 4300 West 62nd Street, Indianapolis, Indiana 46268
Size: 128 pages
Price: $3.95 paperback

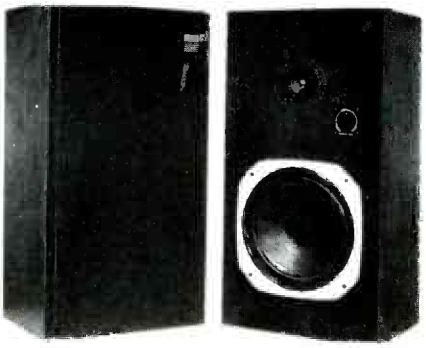
The coverage begins with a short description of camera tubes, scanning principles, and how the RF signals from picture transmitter and sound transmitter are combined and sent to a common antenna. Changing to the TV receivers, the way B&W and color picture tubes operate are explained. All of the basic receiver stages are shown in block-diagram form. Because of the basic nature of the book, no specific circuits are diagrammed or explained. The purposes of many adjustment controls are discussed, along with how to operate them. Common receiver troubles and misadjustments are illustrated by pictures. Beginners in electronics should find the book to be very helpful in understanding the broad principles of television.

audio 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.

Bookshelf Speakers

Encased in walnut veneer, **Sony's** SSU-2000 book-shelf speakers employ 10-inch woofers and 2¼-inch tweeters. Frequency response is quoted as 35-20,000 Hz, with the crossover frequency at 2.5 KHz. Recommended



amplifier power is 20-watts minimum and 100-watts maximum with 8-ohms nominal impedance. The speakers sell for $150 each.

For More Details Circle (40) on Reply Card

Paging Speaker

Paso Sound Products has on the market the TR7/8 paging and talk-back horn speaker. It handles with high efficiency all low-to-medium levels in paging, intercom, and wireless receiver applications both indoors

and outdoors. The TR7/8 is rated for 20 watts of power, and has an impedance of 8 ohms. (The TR7/16 is available with 16-ohm impedance.) The high-impact molded construction minimizes damage from weather or abuse.

For More Details Circle (41) on Reply Card

Boom Mike Headset

Clear talking and listening on CB radios in noisy locations are possible with the Model CB-1200 boom-mike headset by **Telex.** The single headset

can be worn on either ear, with the other ear listening to the normal sounds. The boom microphone is adjustable so it can be placed in front of the lips, or pivoted out of the way when not in use. A long-life 1.4-volt mercury battery powers the built-in FET amplifier for the mike. By a change of the cable, the Model CB-1200 can be adapted to the switching circuitry of any CB transceiver.

The suggested list price is $59.95.

For More Details Circle (42) on Reply Card

Miniature Speakers

Mouser Electronics has miniature speakers available for installation in a wide range of electronic equipment. These 8-ohm speakers have a power range of 0.1 to 3 watts. Round and square frames are sized from one to four inches and the oval frames are 2x3, 3x5, and 4x6 inches. They are available in large OEM quantities.

For More Details Circle (43) on Reply Card

Music-On-Hold

The Series 300 Music-On-Hold System by **C-Five** is available for use on key telephones without the previously-required telephone coupler. It is said to be budget-priced.

For More Details Circle (44) on Reply Card

audio systems report

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Intercom

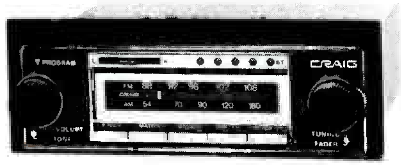
Model K-ML-5WA intercom **Talk-A-Phone** is a master for as many as five non-private sub-stations. The unit can call, listen, and talk with the subs individually or simultaneously. Calls from the subs can be received by voice or buzz, at the master's option.

The K-ML-5WA is equipped with a built-in facility to connect, through the companion Model K-RW-5A Relay, an existing radio receiver or tape deck for playing music, announcements, or commercials through horn type sub-stations. The music automatically stops when conversation is in progress, and resumes when conversation is over.

For More Details Circle (76) on Reply Card

8-Track Tape Player

Craig has available the Model S601 stereo matrix, 8-track player with AM/FM/MPX radio for in-dash installations. The S601 features a red LED program display; repeat button for continuous play; separate balance and fader contols; and a matrix pushbutton for expanded four-channel effect. An adapter socket is provided for



Craig's powerplay booster which provides up to 50 watts of power for lower distortion and improved transient response. Suggested minimum retail price is $129.95.

For More Details Circle (77) on Reply Card

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antenna systems report

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UHF Amplifier

An ultra-low-noise UHF preamplifier from **Winegard** is said to provide a lower noise figure than TV-receiver tuners, because of new circuitry.

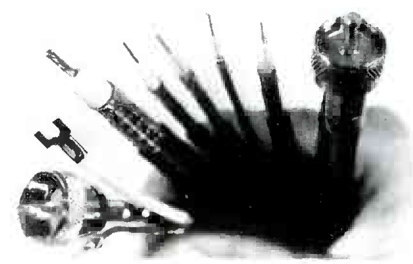
Two versions are available. Model UA-4030 has a 300-ohm input with a noise figure of 3.1 dB and a gain of 8 dB; Model UA-4050 has a 75-ohm input with a gain of 8.6 dB and a noise figure of 2.2 dB. Both models

bypass the VHF signals, and have separate 300-ohm VHF and UHF outputs. The preamplifier mounts on the back of the TV receiver or on the wall, and requires an input power of 120 VAC at 2.5 watts.

For More Details Circle (53) on Reply Card

CB Cable

A new line of 50-ohm CB cable from **Cerro Communication Products** is available in 8, 58, 59, and 174/U types to fit all CB, land mobile, and marine radio applications. Items are available in various bulk lengths. The 8 and 58/U types come in factory-cut and



terminated lengths with PL-259 connectors. 59/U co-phasing harnesses also are available with factory-installed PL-259 connector and spade lugs for twin CB antennas.

For More Details Circle (54) on Reply Card

continued on page 55

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Start with 100 points and deduct 4 points for any part you may not have answered correctly.

Your rating:

60 - 64 Good
68 - 72 Gooder
76 - 84 Gooderer
88 - 96 Gooderest

100 PERFECT! You're sensational!

continued from page 54

Band-Separators

Electrocolor band-separators have been introduced by **Blonder-Tongue Laboratories.** These TV accessories accept signals from a single TV antenna and separate them into UHF and VHF signals. Four versions are available: The BS-75UV 75-ohm band-separator is for UHF/VHF; a 75-ohm BS-75UVF for UHF/VHF/FM; BS-300UV, a 300-ohm UHF/VHF band-separator; and a 300-ohm BS-300UVF for UHF/VHF/FM.

Input and output return losses for the 75-ohm units range from 11 dB to 14 dB, while through losses are 1.0 dB to 1.5 dB. With the 300-ohm units, input and output return loss ranges from 8 dB to 12 dB, while through losses are only 1.0 dB to 2.5 dB.

For More Details Circle (60) on Reply Card

Mobile CB Antenna

Model M-276 mobile CB antenna from **The Antenna Specialists** comes with an attached in-line connector.

Scratches of the rear deck caused by opening and closing the trunk lids have been prevented by the low-profile "Quick Grip" design, which allows permanent installation without holes.

Suggested list price is $27.95.

For More Details Circle (61) on Reply Card

Mirror-Mount CB Antenna

A 48-inch CB antenna designed for mounting on West-Coast-style mirrors on trucks and RV's has been introduced by **Breaker Corporation.** "Savannah" Model 10-401 provides maximum omnidirectional talk power over the entire 27-MHz CB band with its heavy-duty ABS encapsulated top load coil. The white fiberglass whip has a low 1.5:1 VSWR. **Breaker's** Auto-Flex spring offers protection from severe bending stress to the whip. Complete with heavy mounting hardware and an 18-foot coaxial cable with pre-assembled PL-259 plug, the 10-401 sells for $23.95.

For More Details Circle (62) on Reply Card

Push-On Connector

Bell Industries has available a push-on connector to adapt RG-58/U antenna cables to PL-259 terminals on CB equipment. The nickel-plated brass connector allows easy disconnection of antennas from CB equipment on slide-out brackets in

vehicles, and quick hook-up of test equipment. An adaptor is included with the connector.

For More Details Circle (63) on Reply Card

CB Antenna

The 36-inch Little Giant CB antenna from **Shakespeare** features half-wave design with full-length loading. It requires no ground strips or ground planes. The antenna has a power rating of 25 watts (well above FCC requirements), and the SWR is 2.0-to-1 or better.

Constructed of fiberglass, the Little Giant 4050 comes with automatic fold-down mount and 7 feet of coaxial cable. For bass-boat fishermen, the Little Giant 4050-B is available with lift and lay mount.

For More Details Circle (64) on Reply Card

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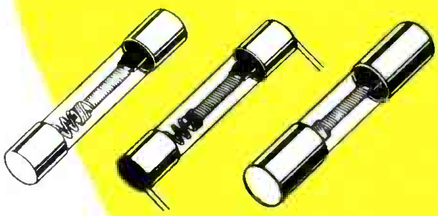

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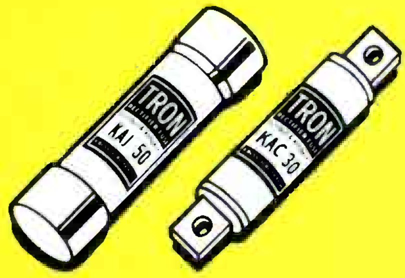

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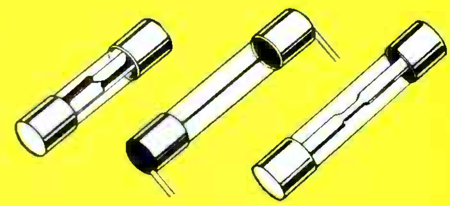

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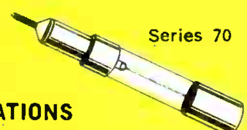
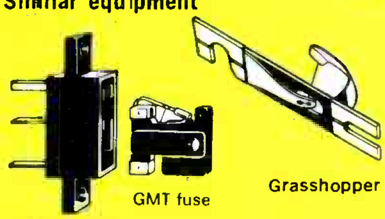


Series 70



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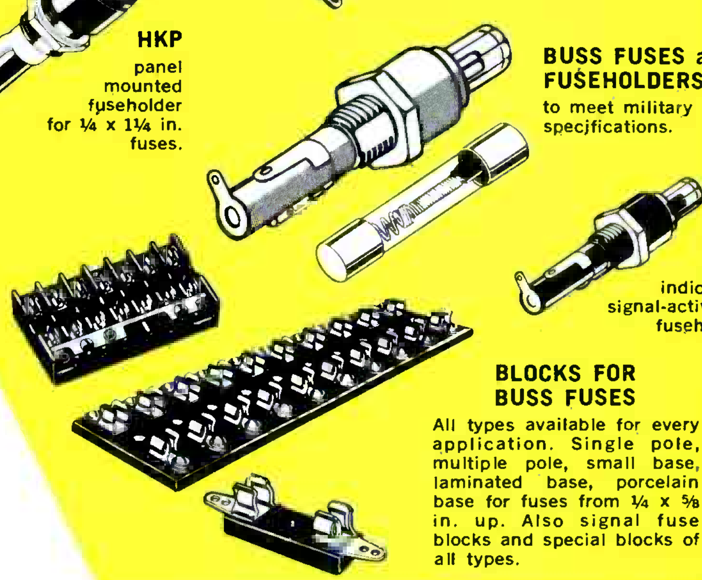

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