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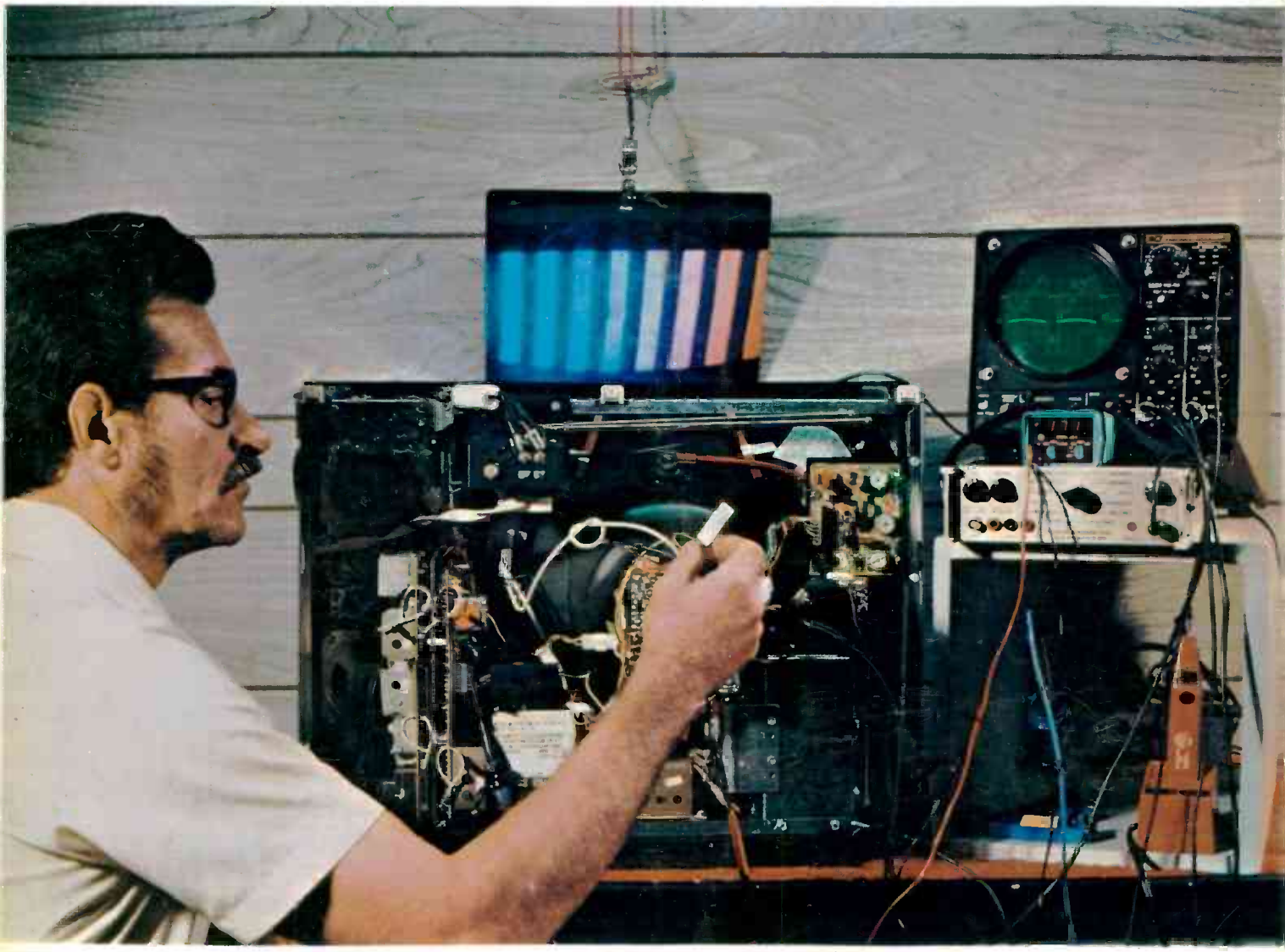

Servicing GE Modular Color

Satellite Update

Accurate CB Tests

1977 Color Features

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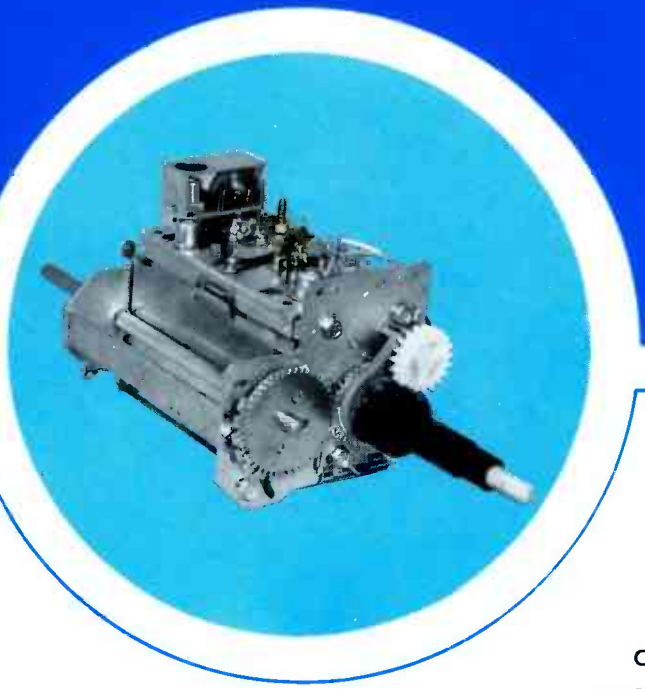

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General Headquarters: P.O. Box 272, Bloomington, IN 47401

For More Details Circle (1) on Reply Card

August, 1976 □ Volume 26, No. 8

Electronic Servicing®

in this issue...

ABOUT THE COVER

Richard Shipley, a technician around Kansas City for many years, is shown measuring voltages and looking at waveforms of the GE 19YC2 chassis in the ELECTRONIC SERVICING laboratory.

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EDITORIAL
RONALD N. MERRELL, Director
CARL H. BABCOKE, Managing Editor
SHARON ELWOOD, Editorial Assistant
DUDLEY ROSE, Graphic Designer

ELECTRONIC SERVICING
1014 Wyandotte Street
Kansas City, Missouri 64105
Tele: 913/888-4664

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For More Details Circle (12) on Reply Card

electronicscanner

news of the industry

Recently, the Federal Communications Commission (FCC) called in samples of CB radios along with the applications for Type Acceptance. After FCC tests, all 25 radios were rejected as failing to meet the requirements. Previously, Type Acceptance was granted or refused from specification sheets alone. According to Ray Spence, FCC chief engineer, some manufacturers will be given 60 days to correct the problems found; but other applications were dismissed, and these must be resubmitted.

The RCA Service Company has installed the sound system called "Sensurround" in 289 theaters for the film "Midway". It is the same sound system which thrilled audiences with ultra-realistic sensations in "Earthquake". In "Midway", movie spectators will experience special effects that duplicate the vibrations of huge naval artillery, airplane bombings, and explosions.

Sansui Electronics presented an AM-radio quadriphonic stereo sound system at the Audio Engineering Society's Show in Los Angeles. Two of Sansui's AM stereo systems are capable of delivering frequency response to 15 kHz with full dynamic range comparable to the best FM-stereo transmission and reception. Both Sansui systems are compatible with QS 4-channel encoding. Currently being studied by the National AM-Stereo Radio Committee, the two systems will go on the air for field tests this fall.

Sony Corporation of America has broken ground for a multi-million-dollar distribution center and product-testing facility at the Air World Center in Kansas City. Completion is scheduled for 1977. This is the fourth such Sony facility.

It has been predicted that the use of microprocessors in conjunction with video technology will expand video games into home computers, which could provide educational programs, as well as games of higher sophistication. Two products illustrating this point are Fairchild's video system and Rockwell's Videospond. Greg Reyes of Fairchild is quoted in **Home Furnishings Daily** as saying that, although the original Fairchild video entry is a game, it is expected to evolve into a home computer. Not only should the computer control the home temperature, lights, home security, fire and smoke detection, and other useful functions, but would include a video monitor displaying catalog pages from which merchandise could be ordered and billed to a credit card. He also predicted that by 1980, a majority of homes will have a computer, and by 1985 all homes will have one or more. Videospond has a keyboard (similar to a typewriter) and a video screen for the answer to be displayed.

"The greatest source of the 'new energy' which the world needs for continued growth will have to come from improved productivity", Harold S. Geneen, chairman and chief executive of International Telephone and Telegraph Corporation said recently.

The Communications Equipment Distributors Association (CEDA) has charged the New York Times News Service with misrepresenting CB to the public in an article that ran in the July 11th editions of the Chicago Tribune. The article stated that many CB's now in stock may be made unsaleable and partly obsolete by channel expansion and that the addition of channels is also an FCC attempt to slow the sale of CB radios as prospective customers wait for the new equipment, thus

(Continued on page 6)

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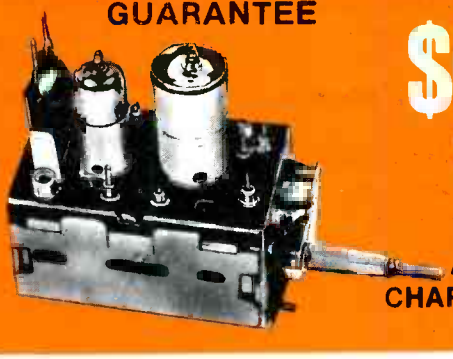

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	JERSEY CITY, NEW JERSEY 07307	547-49 Tonnele Ave., Hwy. 1 & 9	Tel. 201-792-3730
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N. CAROLINA	GREENSBORO, N.C. 27405	2914 E. Market Street	Tel. 919-273-6276
OHIO	CINCINNATI, OHIO 45216	7450 Vine Street	Tel. 513-821-5080
	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
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	CALGARY, ALBERTA T2H-1Y3	P.O. Box 5823, Stn. "A"	Tel. 403-243-0971

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

For More Details Circle (12) on Reply Card

(Continued from page 4)

reducing the interference caused by the 4-watt CB's. In a rebuttal statement issued by CEDA President E. Craig Martin, he pointed out that "When and if channel expansion does come, the present 23 channels will become the bottom 23 channels on the expanded band, and that's where 99 percent of the CB conversations will take place." He also stated that "Most interference is not the result of CB radios, but rather the lack of proper shielding in televisions, stereos and other electronic devices."

General Electric's 25-inch color console TV sales to dealers reached an all-time high for the combined months of May and June. Fred R. Wellner, of GE's TV Business Department, reported a 26% increase over the same period last year. He attributed much of the increase to GE's new VIR "broadcast-controlled" color feature.

The new warranty labor-claim form developed by NARDA now will be honored by MGA, RCA, Sylvania, and Zenith, according to an article in **Home Furnishings Daily.** In addition to sufficient space for all information needed by the manufacturers, the six-part form has room for the store name and logotype at the bottom. All copies are numbered. To order forms, or request samples, write to: NARDA, 318 West Randolph Street, Chicago, Illinois 60606.

Magnavox has expanded its all-electronic Touch-Tune system in the 1977 color-TV line, and has introduced a field-installed remote control system to the new 25-inch Videomatic Touch-Tune models. The field remote feature means that the TV set can be purchased as a non-remote unit, and then converted to a remote unit either at the time of purchase, or at a later date. According to **Home Furnishings Daily,** the unit will retail for $40 to $75.

RCA has announced production of the 70 millionth RCA television picture tube at its Scranton, Pennsylvania plant.

Suddenly, you're the most versatile shop in town.

With this little 25-pound test jig, you can adapt to over 10,000 color sets, 59 different brands. Delta 70° and 90° tube, hybrid, transistor, SCR sweep. Anode voltages to 30kV and more. Regular 4.5kV and 7.1kV focus voltages.

And our new optional In-Line Test Kit lets you handle more than 100 precision in-line chassis, including RCA, Magnavox, Admiral and Sears. (We're the first test-jig manufacturer to offer a kit like this.)

CK3000 comes to you fully assembled, pretested and ready to use. Just plug it in, and you're in business. See it now, at your Sylvania distributor.

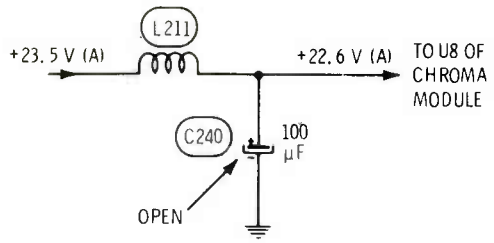
GTE Sylvania, Electronic Components Group, 100 First Avenue, Waltham, Massachusetts 02154.

The Sylvania CK3000

Simply the most versatile test jig you can buy.

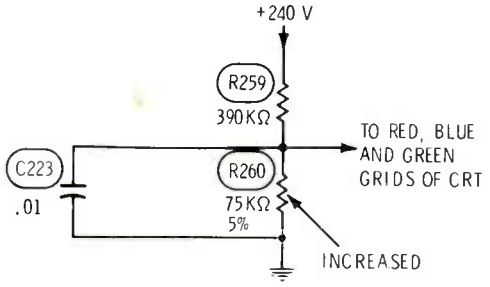
GTE SYLVANIA

Chassis—Zenith 25EC58
PHOTOFACT—1370-2



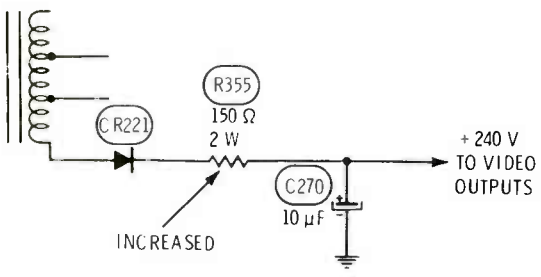
Symptom—No color at left, and vertical "jail bars"
Cure—Check C240, and replace it if open

Chassis—Zenith 25EC58
PHOTOFACT—1370-2



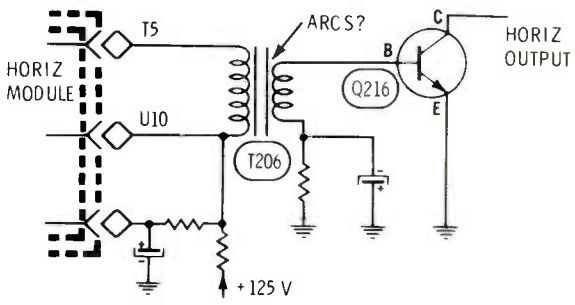
Symptom—Vertical-retrace lines after a few minutes
Cure—Check R260, and replace it if increased or varying

Chassis—Zenith 25EC58
PHOTOFACT—1370-2



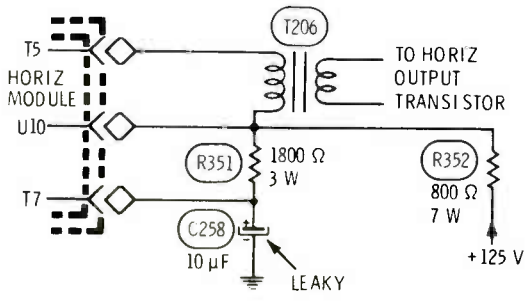
Symptom—No video, excessive brightness with retrace lines
Cure—Check R355, and replace it if open or increased

Chassis—Zenith 25EC58
PHOTOFACT—1370-2



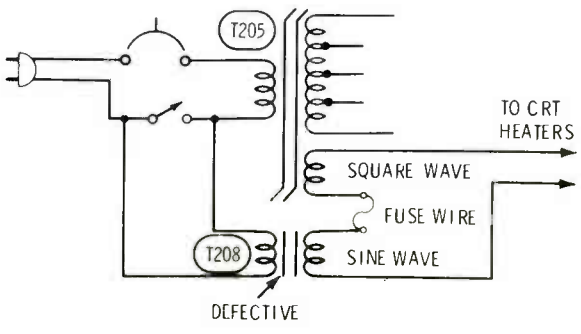
Symptom—Intermittent horizontal displacement (tearing)
Cure—Replace horiz driver transformer, T206

Chassis—Zenith 25DC56 (also 25DC57)
PHOTOFACT—1312-3



Symptom—HV and raster slow in appearing
Cure—Check C258, and replace it if leaky

Chassis—Zenith 25DC56
PHOTOFACT—1312-3



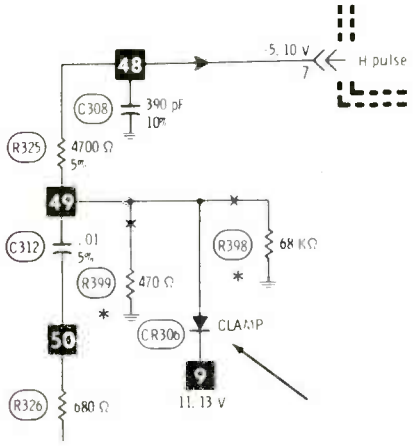
Symptom—Picture tube appears to be weak
Cure—Check CRT heater transformer, T208, and replace it if defective

troubleshooting tips

Send in your helpful tips—we pay!

No color on right
RCA CTC72 (Photofact 1439-2)

Color was okay on the left half of the screen, but there was none on the right. Problems that show different symptoms on the right and left sides of the screen usually originate with horizontal pulses somewhere. But where? After some testing with a scope that did not pinpoint the source, I tried substituting all the diodes involved with horizontal pulses.



CR306 was the cause, but it checked okay on an ohmmeter, so I don't know the exact defect.

C. W. Hume, CET
Greenville, South Carolina

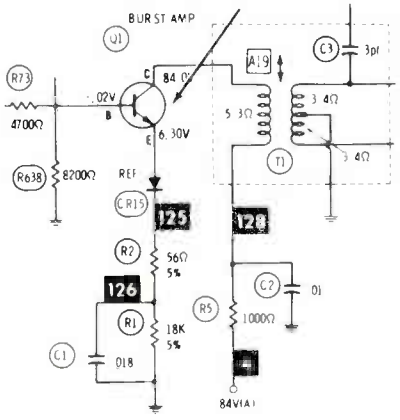
No color, and noisy sound
RCA CTC44A chassis
(Photofact 1191-1)

There seemed to be no connection between the frying noise in the sound and the lack of color, so I decided to check the color problem first.

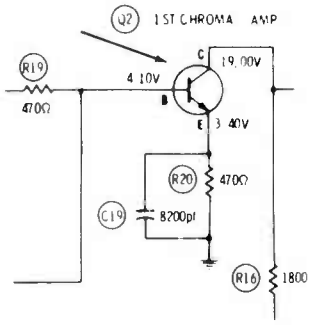
Collector voltage of Q5 ACC-killer amplifier was near zero, leading me to believe the burst was weak at the phase detector. My dual-trace scope did measure weak burst at CR3 and CR4, and I installed a GE-21 (as listed under replacements) for the burst amplifier (Q1). Now there was no burst at all!

After more checking, I discovered a GE-21 is a PNP; however, a NPN was needed. Back to the cross-over charts, and found a GE-18 to be a good substitute. This time the burst was higher than at the beginning, but there was still no color.

No color-killer adjustment is provided on these sets. Q21 is made to stop conduction during b-w programs, and this opens the emitter circuit of Q10, the second chroma bandpass amplifier. I shorted Q21 from collector to emitter as a shortcut test of the killer action. There still was no color, but that proved the killer circuit was not responsible.



Back to the scope, I found chroma (using color bars as a signal) at the base of Q2, but none at the collector. Also, the DC collector voltage was high, about +30 volts. The transistor was open, and a new one brought in strong color.



What about the noisy sound? It was just a bad audio-output transistor.

Erv Schrader
Albuquerque, New Mexico ☐

reader's exchange

For Sale: *Heathkit color-bar generator, Model IG-28, $60; RCA market-adder, $40; and Knight RF sweep generator, $30.*

Charles B. Cerates
10420 Wise Road
Auburn, California 95603

Needed: *Schematic and/or service manual for Packard Bell Electronics Model 5 Mc 2P oscilloscope. Please send card.*

S. C. Dean
Box 55293
Indianapolis, Indiana 46205

For Sale: *Sylvania Polymeter Model 301 with manual and leads. Excellent condition, $27, postpaid.*

David Bloom
21 Dodge Road
Hyde Park, Massachusetts 02136

Needed: *H.O.T. for Motorola, part #24D68804A02 or #24D67601A10. Also need schematic/service manual for Ward TG900 video set generator.*

T. E. Gregg
Montgomery Center, Vermont 05471

For Sale: *Heath 5MHz triggered-sweep scope, $175; Heath 2½-digit digital multimeter, $80; and Heath color-bar/dot generator, $100. All calibrated and in excellent condition.*

Tom Henry
5825 Bird Cage St.
Citrus Heights, California 95610

For Sale: *Used test equipment, and some old service manuals and magazines. Write for list and make offer.*

Lloyd's Radio & TV
807 13th Street
Box 504
Auburn, Nebraska 68305

Needed: *Horizontal-scan output choke for Sylvania Model 1-125-1, chassis 1-186. Sylvania part #241-0002, or Merit part #2980. Will pay reasonable price for new or good used part.*

Charles L. Pierce
Highway 180
Suches, Georgia 30572

Needed: *Schematics for RCA amplifiers, Models MI-9257-C, MI-9333-A and MI-9358-A. Will buy or copy and return.*

Robert E. Byars
P. O. Box 1297
Corinth, Mississippi 38834

Needed: *Supreme radio manuals #2, #7, and #17.*
Schmidt's TV & Radio
Highway 281 NW
Jamestown, North Dakota 58401

For Sale: *Heathkit IO-103 oscilloscope with low-cap and demodulator probes, and manual; 2 years old; $150, or best offer.*
David A. Day
P. O. Box 476
Apalachicola, Florida 32320

For Sale: *RCA Model WR-69A sweep generator; good condition; reasonable.*
George H. Bleeker
200 Ira Avenue
San Antonio, Texas 78209

For Sale: *Hickok CA-5 universal adapter and roll charts for Model 6000 tube tester; 30KV Pomona HV probe #2900A, first offer.*
K. R. Berquist
7328 Independence
Merrillville, Indiana 46410

Needed: *Schematic or operators manual for a Realistic CB Transmi-Test. Will pay cost of copying, or send manual for copy and return.*
Herbert Naugle
1792 Finch Ct.
Hayward, California 94545

Needed: *Schematic for a Telecon walkie-talkie CB radio, 13 transistors, 2 channels [it's not Sams CB10 early model]. Customer purchased in Japan several years ago. Will buy, or copy and return.*
G. M. Eckert, Apt. 18
2460 S. Federal Hwy.
Boynton Beach, Florida 33435

For Sale: *RCA 19" 10J103 test jig with adaptors for most RCA and Zenith sets. Also IG57 Heath alignment generator and IG37 FM stereo generator. Assorted GE tubes for color servicing.*
Joel Malmberg
1715 Crosby Road
Wayzata, Minnesota 55391

Needed: *Schematic for a Contact 23 CB radio made by United Scientific Labs. Will buy, or copy and return.*
Jack Burgess
Box 124
West Blocton, Alabama 35184

Exchange: *Will exchange a 27-volume set of Rider's TV manuals, for some or all of Rider's radio manuals, plus a cash payment to adjust. Would consider buying outright.*
Lawrence Beitman
1760 Balsam Rd.
Highland Park, Illinois 60035

(Continued on page 12)

(Continued from page 11)

Needed: Address of Delmonico-Nivico, or a horizontal driver (A42131) for a Model 9T-4UHF. Also, need a new tube index for a Model 107B Seco tube tester.
Marin CB
968 Second Street
Novato, California 94947

Needed: Deflection yoke (part #UTRAD 9A-2654-001D) for a Bradford color TV, Model 1205C40. Will pay any reasonable amount.
Joseph J. Mehalko
324 4th Street
Blakely
Olyphant, Penn. 18447

Wanted: 1923 and 1924 Radio News Magazines.
J. E. Smith Radio Shop
130 Cherry St.
Montezuma, Georgia 31063

For Sale: Heathkit Model IG-57A post-marker/generator. Factory aligned. Unit has never been used. $160.00.
Dale A. Rotz
Hurley Drive, RD-5
Shippensburg, Penn. 17257

Needed: Schematic and service manual for Lambda power supply Model LT 2095M.
Frank Quackenbush
53 Otsego St.
Canajoharie, New York 13317

For Sale: Telequipment D-67 oscilloscope, with probes. $900.
William D. Shevtchuk
One Lois Avenue
Clifton, New Jersey 07014

Needed: Service literature for a Lantz Model TV4R2 4-inch b-w TV.
Tri/Tronics
1313 Geo. Wash. Way
Richland, Washington 99352

Needed: Schematic and service data for a Candle MT510 5-inch b-w TV. Will buy, or copy and return.
Al's Radio and TV
9 Leonard Road
Hyannis, Massachusetts 02601

Needed: 1 output cable for a Triplett Model 3433 FM-AM signal generator.
John D. Villano
2207 Palermo
San Diego, California 92106

For Sale: Sencore SM-152 sweep/marker generator, $260. Also Sencore CRT tester CR-161, $90.
Mario Rosignuo
368 South Hill Blvd.
Daly City, California 94014

Needed: Service information on a Model OP-51G general service scope manufactured by the Kikusui Denpa Co.
Neil R. Matheson
107-28 134 St.
Richmond Hill, New York 11419

Needed: Stringing diagram for dial of a radio; Radiola (made by RCA) Model 61-3; chassis #RC1011. Will pay, or copy and return.
B. Kutilek
17215 70th Ave.
Tinley Park, Ill. 60477

Needed: Schematic for Precision Series E-400 sweep generator; schematic for Triplett 3423 tube tester; schematic for Heathkit audio generator, Model G-2; and schematic for Eico Model 950 resistance capacitance-comparator bridge. Will buy, or copy and return.
Enrique Diaz
966 Halsey Street
Brooklyn, New York 11233

Needed: Time base (sweep) amplifier for Type 561A Tektronix scope. Have Type 3A75 amplifier for trade if desired.
Chaparral Electronics
Hwy. 28
Messilla, New Mexico 88046

For Sale or Trade: Rider's radio manuals; also antique radio tubes 01A, 00A, 99, 40, 6F7, 7B8, 7F7, 6S7, FM 1000, 14AF7, 25B8, 70A7, 70L7, 117L7, and others. I need Rider's radio manuals 1-2 and 23.
Goodwin Radio Shop
Rankin, Illinois 60960

Needed: Dial cording stringing instructions for Realistic Model #12-1469. Dial cord is not shown in Sam's #MHF, #43. Will pay copying cost.
Hughes Electronics Service
Route 2, Box 271
Kings Mountain, North Carolina 28086

Needed: Schematic and/or service information for GE radio, Model M-125. Will copy and return.
Michael Helgerson
Box 103
Electric City, Washington 99123

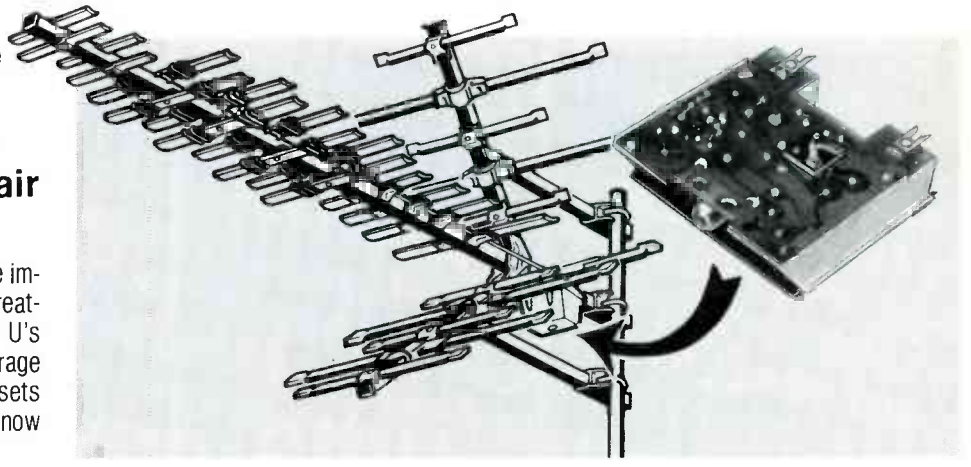
(Continued on page 14)

PHENOMENAL BREAKTHROUGH IN UHF RECEPTION!

Don't say you can't get good UHF reception until you've tried this new combination by Winegard

New Super Lo-Noise Preamp With New Antenna Makes Poor Pictures Good and Fair Pictures Excellent

Good reception of UHF stations is more important than ever. Programming has greatly improved in recent years on the U's and many offer exclusive sports coverage viewers so eagerly want. If you sell sets or install antennas in UHF areas, you know what we're talking about.



Winegard AC-4990 Preamplifier Combined With CH-9095 Antenna Delivers Amazing UHF Reception.

The Problem

You also know what we're talking about when we say that reception of UHF stations in most areas is rarely as good as you get on the VHF stations. This is a major, universal problem.

Why the problem? For one thing, many UHF stations are not on full authorized power. And, transmission line losses at UHF frequencies present difficulties. But the biggest culprit of all is the high noise figure of the TV set tuners at UHF frequencies.

Generally speaking, you have to deliver *3 times* as much clean UHF signal to the set as you do VHF signal—in order to get comparable reception.

The quantity and quality of UHF signal you feed the set is greatly determined by the antenna and preamplifier you use.

SPECIFICATIONS	AC-4990
GAIN	
UHF	17.5db
BANDPASS (MHZ)	
VHF-FM	54 to 216
UHF	470 to 890
MAX. TOTAL OUTPUT (Volts)	
UHF	.882
MAX. TOTAL INPUT (Volts)	
UHF	.126
NOISE FIGURE	
UHF	2.2db

The Solution

A few months ago Winegard Company introduced a new line of Chromstar UHF antennas featuring a new Tri-linear director system. This configuration offers the highest gain we've ever seen on a UHF antenna and the field reports we've been getting from professional installers have been most enthusiastic.

Now Winegard Company is introducing another...and even bigger breakthrough. This is a super lo-noise UHF preamplifier, Model AC-4990.* It has a 6db signal-to-noise improvement over the best UHF preamps previously available.

Combine the AC-4990 with a Winegard CH-9095 Chromstar UHF antenna and you get a 9db improvement or *3 times cleaner signal.*

This means you can give good UHF pictures to customers who can barely get UHF now. It means you can deliver "excellent" reception to those who now receive just "fair" pictures.

*Pat. Pending.

In actual practice, good reception of all UHF stations is now extended up to 30 additional miles...in many cases nearly doubling the effective reception range.

New Sales Potential

Potential sales of CH-9095's and AC-4990's are greatly increased. This combo can be sold in areas where UHF reception hasn't been good enough to bother with *and,* as a replacement for customers who are only getting "fair" reception now.

Incidentally, the AC-4990 preamp has a VHF bypass so it can also be used with any Winegard V-U Chromstar antenna with excellent results.

Antenna dealers in UHF areas are advised to try this new Winegard antenna-preamp combination as soon as possible. Seeing is believing...and the new profit opportunities are tremendous.

NOTE: Due to demand, the AC-4990 preamp will be in short supply for a few months. An order should be placed now with your Winegard distributor.

WINEGARD COMPANY
3000 Kirkwood • Burlington, Iowa 52601

(Continued from page 12)

Needed: *Audio output transformer (#1080-15) for a Lafayette amplifier, Model LR800.*

Bernard William
929 East 77th Street
Brooklyn, New York 11236

Needed: *Schematic with parts valves and component numbers for a Precise oscilloscope, Model 300. Will buy, or copy and return.*

Daniel Evans
P.O. Box 4227
Huachuca City, Ariz. 85616

Needed: *UHF, VHF plug-in circuit boards for Peterson Model HL-44 police scanner radio.*

Phil Hanson
C/O Hanson Appliance Co.
207 Long Avenue
North Aurora, Illinois 60542

Needed: *Schematic and/or operating manual for Cadre 510-B CB radio. Will buy, or copy and return.*

Aero-Marine Electronics
950 La Mesa Drive
Menlo Park, Calif. 94025

Needed: *Will pay top price for set of speaker lid hinges for Sony TC-530 tape recorder. Send price.*
Scott's TV, Inc.
P. O. Box 33013
Fort Lewis, Washington 98433

Wanted: *Field strength meter for VHF TV.*
Joseph E. Strenk
R. D. 2, Box X
Rhinebeck, New York 12572

For Sale: *1 Eico scope demodulator probe, with manual; 1 Eico VTVM, Model 232, with manual; 1 visual-aural Heath signal tracer, Model 1T-12. Good condition; reasonable offer plus shipping.*
R. C. Migliorino
231 Birch Lane
Forked River, New Jersey 08731

Needed: *Operating/service manual for Triplett Model 3434-A TV/FM sweep generator and marker. Will buy, or copy and return.*
The Village Electronics
P. O. Box 73
Gambier, Ohio 43022

Needed: *Schematic and alignment data for an RCA MX-7 stereo FM-AM receiver. All-tube unit from about 1962-1965; resembles a Fisher. Will buy, or copy and return.*
Gordon Trump
2113 Main Street
Rothsville, Pennsylvania 17573

For Sale: *Sony EV-310 1" black-and-white video tape recorder, good condition, might need new heads, $400 plus shipping.*
Mark M. Byrum
P. O. Box 2044
Wintersville, Ohio 43952

Needed: *Schematic and/or service manual for Magnavox Model S973 color TV test fixture. Will pay $5 for schematic, or $10 for both.*
H-G TV & Electronics
233 S. Victory Blvd.
Burbank, California 91502

For Sale: *Ampex 1" video-tape recorder with Motorola 19" monitor, service manual, cords and extra tape included. Both in working order. Also have Berlantz audio tape deck, uses 10½" reels, has five tape heads. With schematic, two single-channel recording amps, patch cords and extra tape; all in good working order.*
Dailis Melbarde
644 Washington St.
Hackettstown, New Jersey 07840

Needed: *Heath Model IG-57A sweep/marker generator; any condition. Also need Eico flyback tester Model 944K; any condition. State price, age, and completeness.*
Robert Boudreau
290 Prospect St.
Bridgeport, Connecticut 06604 □

Servicing GE Modular Color TV

Part 1/By Gill Grieshaber, CET

Most of the Part 1 coverage of the GE 19YC2 color chassis is a picture story to familiarize you with the locations of the major components, and to illustrate the features and overall performance of this model.

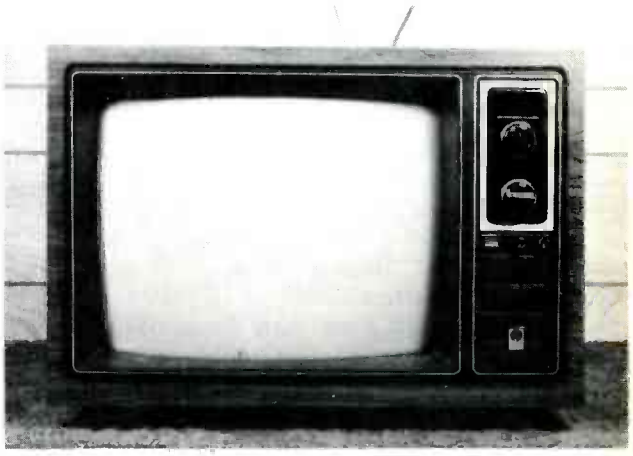
General Electric Model WYC7518WD 19" table model color receiver has been selected for our next detailed analysis. This modular TV is new in the 1977 GE line. It uses the 19YC2 chassis, which is similar to the YC chassis of last year, except for better convergence and pincushion circuitry, and "Cable Ready" provisions for direct cable connection. Some YC2-chassis receivers have digital readout of both VHF and UHF channels, and also an extra module for VIR Broadcast-Controlled Color. A preliminary report on the VIR feature was in the July issue of ELECTRONIC SERVICING.

Of course, the circuitry is all-solid-state, except for the picture tube, which has the three guns in-line horizontally and vertical stripes of phosphor on the screen.

Six modules plus the convergence board hold most of the circuitry of this hot-chassis color receiver.

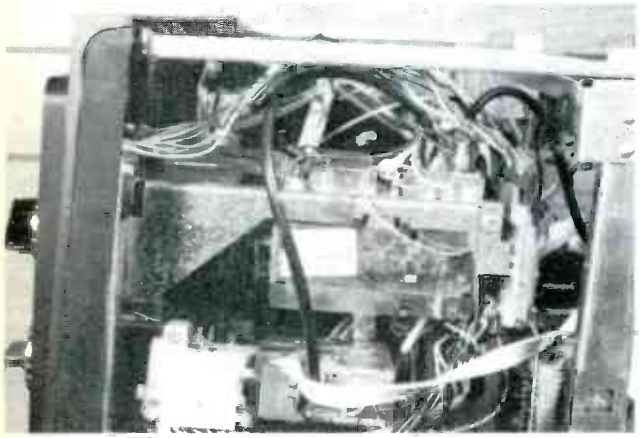
Features Shown By Pictures

The following pictures should make you feel "at home" with the YC2 GE receiver, and help locate the modules and major components.

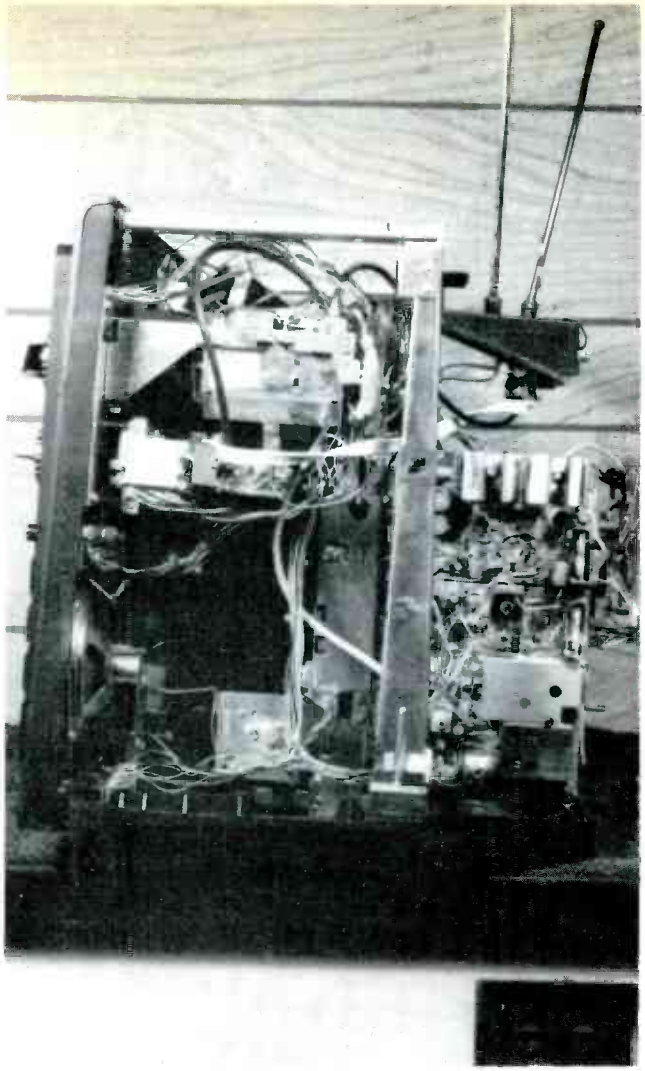


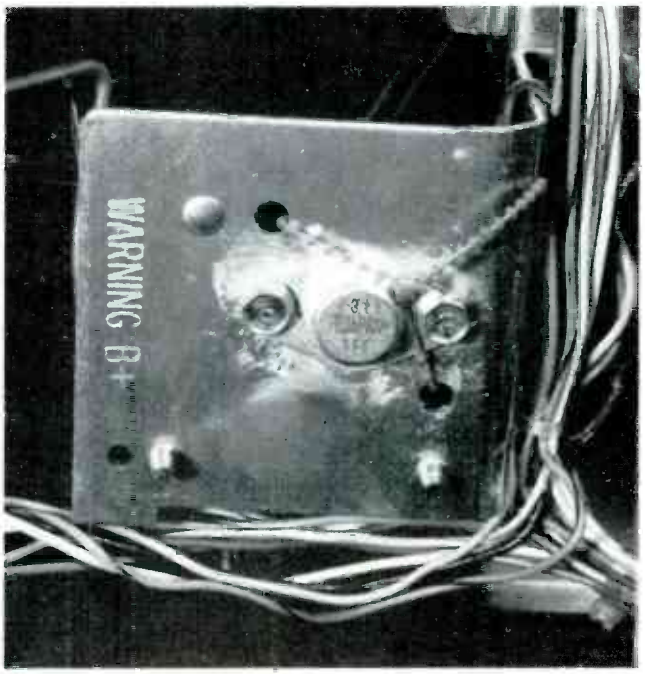
Picture 1 When the power is off, the GE WYC7518WD color-TV receiver seems conventional (this model does not have the VIR circuit). Below the UHF detented dial is the "Automatic" pushbutton, which selects preset color, tint, and brightness. To the right is the "Custom Picture" control (adjusts color, contrast, and brightness), with the "On/Vol" control at the extreme right. Along the bottom, under the speaker grill, are the color, brightness, and tint manual controls.

Picture 2 Turn on the power, and the ½-inch channel numbers light up in orange. All 12 VHF and 69 UHF channels are displayed on the two-character 7-segment glow-discharge type of readout. The position between 2 and 13 of the VHF knob at the top causes the same display to show the UHF channel which is selected. The lower knob is detented for *every* UHF channel, and it can't turn beyond 14 and 83. When I first tried it, the mechanism worked excellently, and I liked it after I became familiar with the action. But the operation felt strange and different because the numbers do not move sideways (as older models did where the numbers were on a drum), and there was no vibration, except for the detenting.

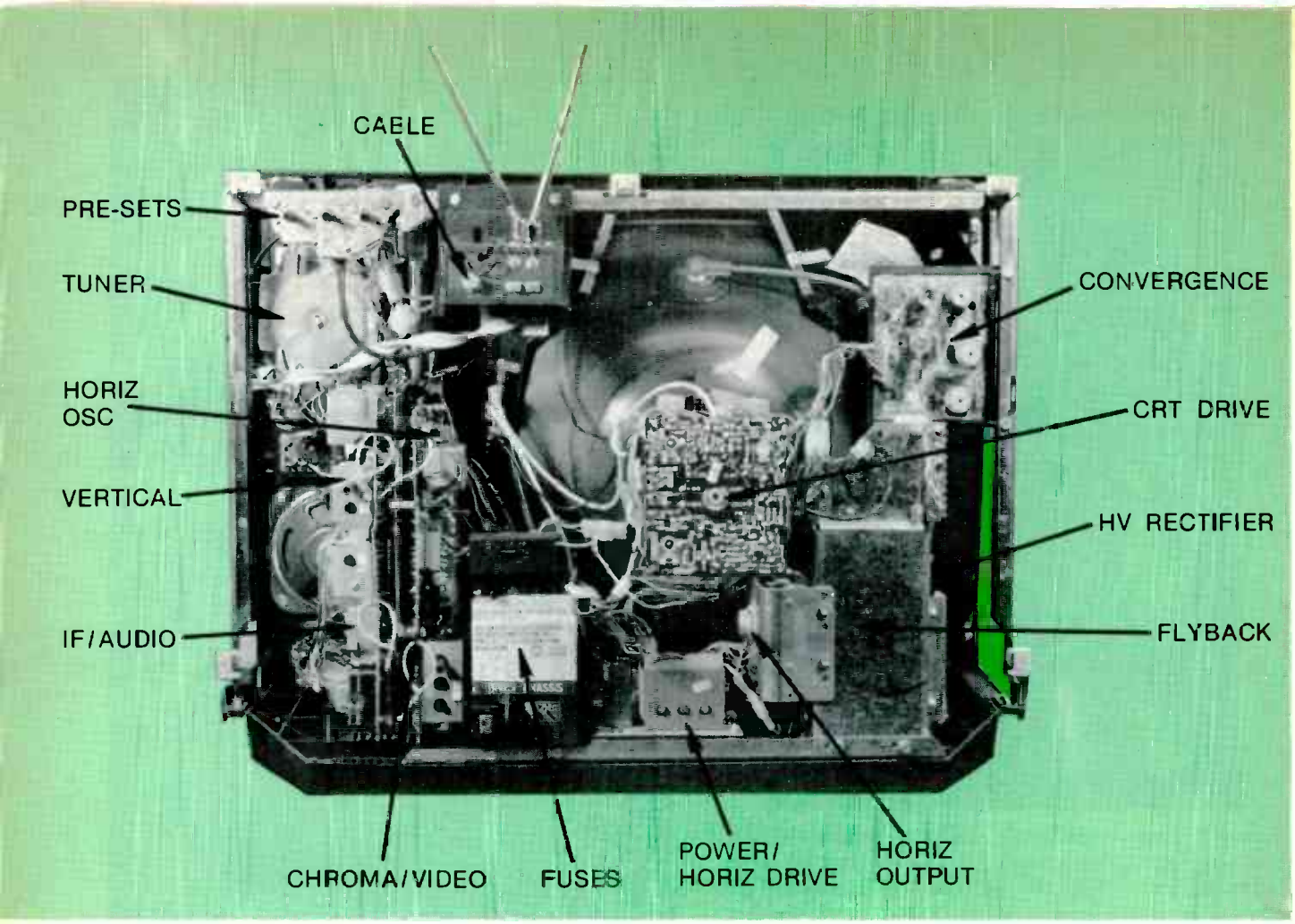


Picture 3 The back comes off easily, leaving most of the works exposed, such as the two tuners. For the VHF digital display, the switch is at the rear of the tuner; while the UHF switch is in front of the UHF tuner, with the detenting mechanism. The tuner assembly comes out as a unit.

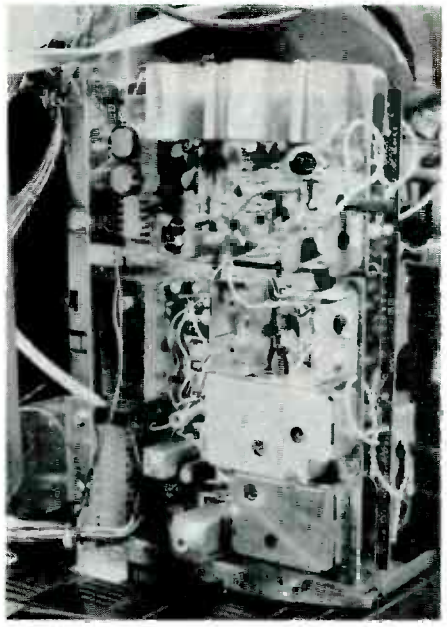




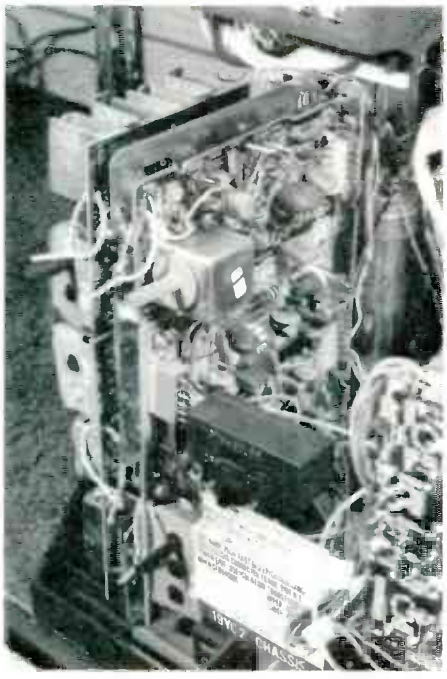
Picture 4 Just behind the speaker is the audio-output transistor, with the output transformer on the other side of the heat sink. Two modules are visible at the rear: the vertical module is at the top, with the IF/audio module below.



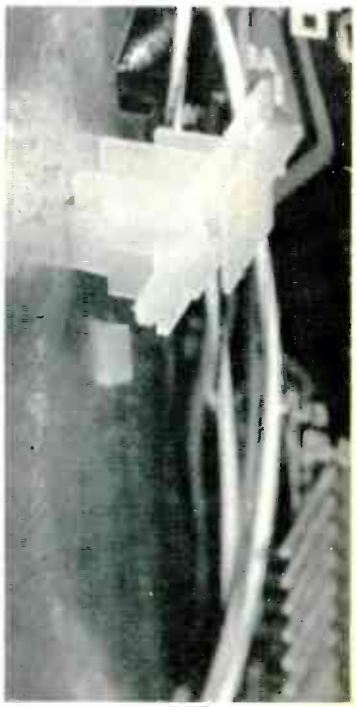
Picture 5 Arrows point to the modules and several major components.



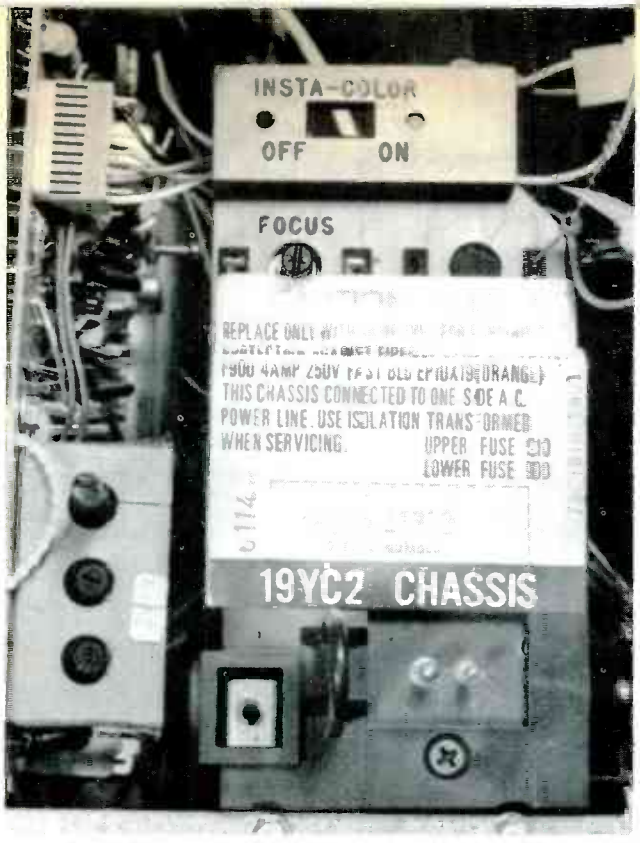
Picture 6 Here's a closer look at the vertical module above (the output transistors are inside the large heat sinks), and the IF/audio module below. The vertical module has 9 transistors and five diodes; while the IF/audio module has 3 IC's, 4 transistors, and three diodes. Each module is secured by one screw, plus the connectors and a plastic track.



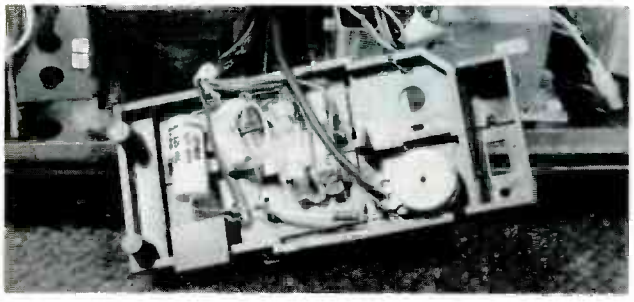
Picture 7 On the center side of the partition shield are two more modules: the horizontal-oscillator module (above); and (below) the large chroma/video module.



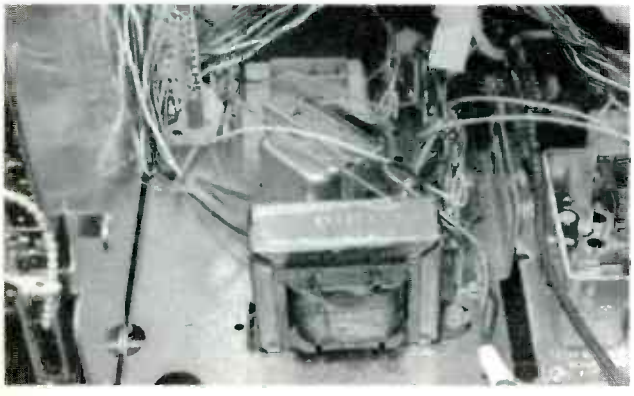
Picture 8 With the horiz-oscillator and chroma/video modules removed, the plastic guide track is visible.



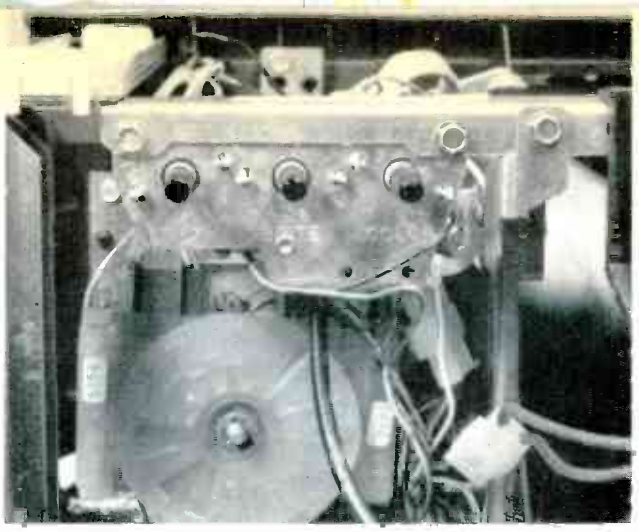
Picture 9 Power comes in through a polarized plug having one large and one small prong. It's mounted on a plastic bracket that has the focus control, labels, and some holes not used in this model. On the back side are two fuses, as shown in the next picture.



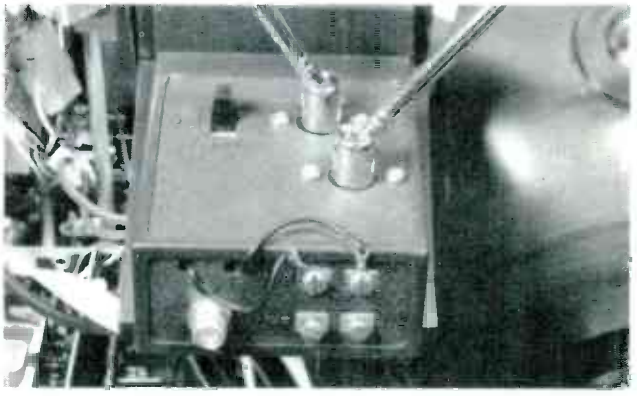
Picture 10 On the back of the plastic power bracket are two fuses. The 1.8-ampere B+ fuse is above, and the 4-ampere AC fuse is below.



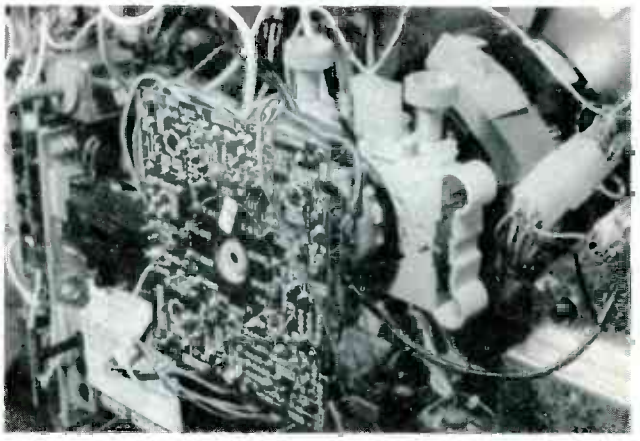
Picture 11 With the power bracket removed, the filter choke and the picture-tube heater transformer (front) can be seen.



Picture 12 Looking a bit higher, along the top at the left are the factory "preset" tint, brightness, and color controls for the "Automatic" feature.

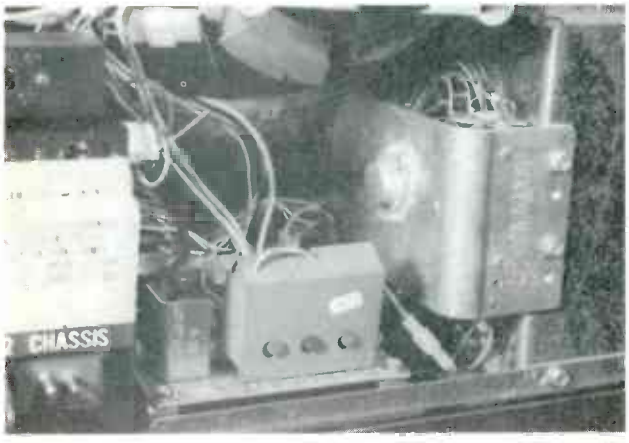


Picture 13 Just to the right is the antenna bracket, which stays attached to the chassis framework. Two antenna dipoles are on top, along with the AFT switch. Along the back are the connector for cable TV, and the usual connectors for UHF and VHF antenna leads.

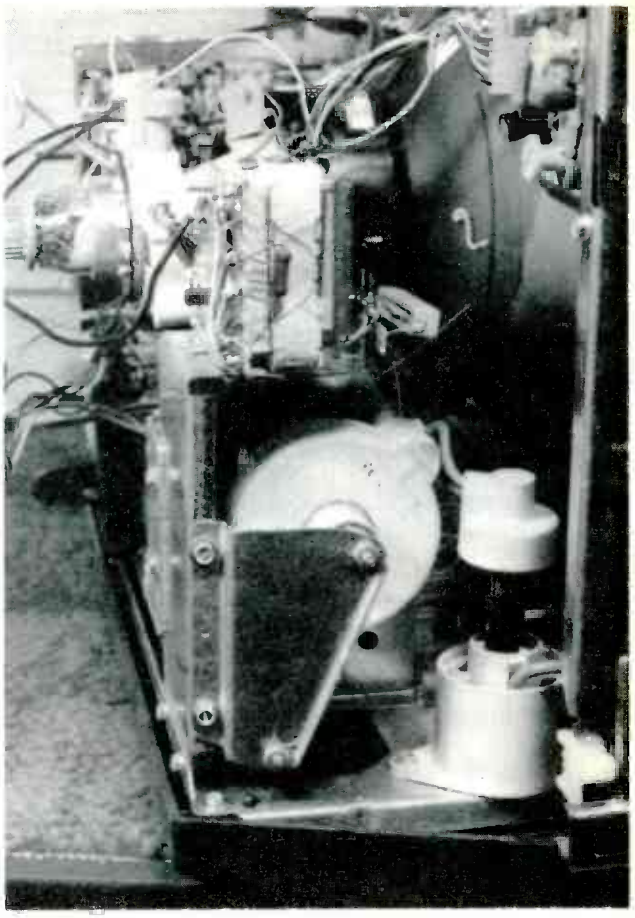


Picture 14 The CRT socket is combined with the color-drive circuitry. Just in front of it are the purity magnet and the assembly with the center-and dynamic-convergence components. The last item on the neck of the picture tube is the yoke, which has a toroid configuration of both the vertical and horizontal windings. This CRT-drive module has the video-driver, red-output, green-output, and blue-output transistors on it.

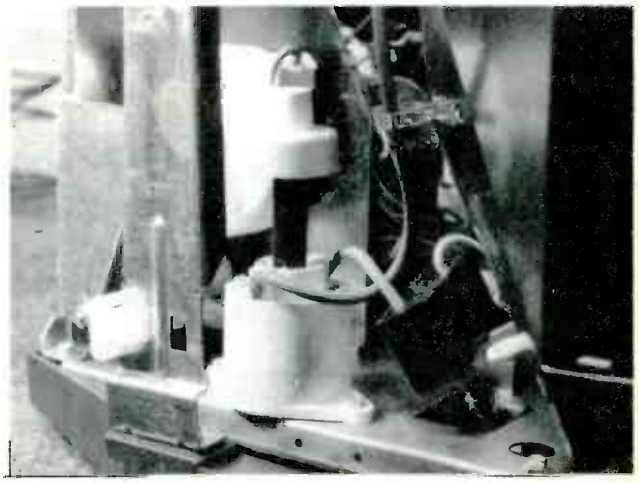
Picture 15 The dynamic-convergence board is located in the upper-right corner of the chassis frame. Only one coil and three controls are adjustable.



Picture 16 Horizontal-sweep and high-voltage components are found in the lower-right corner. The three screen controls and the regulator heat sink identify the power-supply/horizontal-driver module. A bracket fastened to the flyback shield holds the horizontal-output transistor, the damper, and the boost-rectifier diode.



Picture 17 Around the right end are the flyback and something that appears to be a rectifier tube. Actually, it is the HV diode rectifier with socket and cap, so replacement and testing should be easy.



Picture 18 In front of the HV rectifier is a black box, resembling some HV triplers. This box has the HV bleeder resistors which furnish the focus voltage by voltage-divider action.

Comments

If you are to diagnose with greatest accuracy, you need to know how good (or bad) the picture quality *should be*, for the model in question. Therefore, I will give my impressions of this 19YC2 General Electric chassis, after a preliminary examination of the receiver operating from both the usual local stations and two color-bar generators.

Picture sharpness and brightness were very good; there was more color available than anyone would want, and the tint control had a wide range, with correct hues obtained near the center of the control.

When I examined the screen of the picture tube up close, I could see the pattern made by the trios of vertical lines of the phosphors (see Figure 1). However, the pattern disappeared as I stepped back to the normal viewing distance.

No regulation of the DC supply voltage for the horizontal-output stage is provided, so I tested for the effects of different line voltages. As shown in Figure 2, the picture size did decrease slightly when the line voltage was reduced 10 volts (from 120 down to 110 volts). However, the other picture characteristics (such as focus, and locking of both vertical and horizontal) were not affected at all. DC voltage for the vertical-output transistors is obtained by rectification of horizontal pulses, so any change of width also produces a like amount of width change.

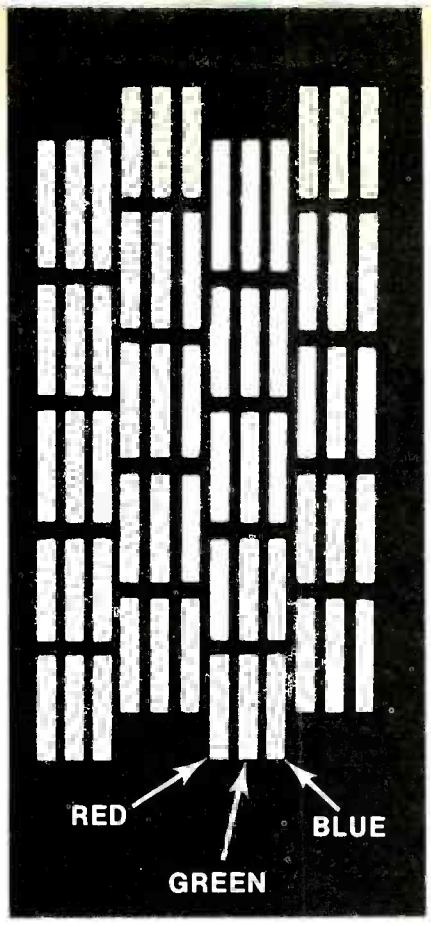


Fig. 1 This drawing shows the approximate shape and positioning of the color stripes of phosphor on the screen of the GE picture tube using in-line guns.

There is no vertical linearity control, because the waveform of the vertical yoke current is used for negative feedback, giving automatic good linearity (Figure 3 shows the linearity when the height was reduced to minimum).

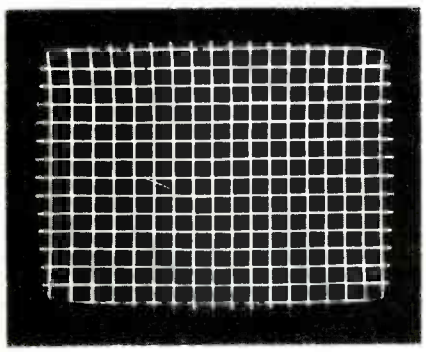
The modules were moderately easy to remove. Only one screw (and the connectors and guides) hold them in position. I advise you to use moderate care when you reinstall a module. Line up the connectors, and hold one hand behind the main chassis and connectors to reduce the strain against them.

Only about 0.5 KV reduction of the high voltage could be measured between a black raster and normal brightness. The gray-scale procedure limits the maximum brightness to a reasonable amount, and the automatic brightness-limiter circuit prevents most moderate overloads of the picture tube. Whatever the reasons, the HV regulation was very good.

Looking back on the various tests, I think the one characteristic that impressed me the most was the excellent **stability.** There was no noticeable drifting of any kind. For example, neither variations of line voltage nor the changing to a color-bar pattern ever required relocking the vertical or the horizontal.

Next Month

Several readers have asked for explanations of transistor-regulated power supplies, so we will include some extra information about them next month as part of the power-supply coverage of the GE 19YC2 chassis. □



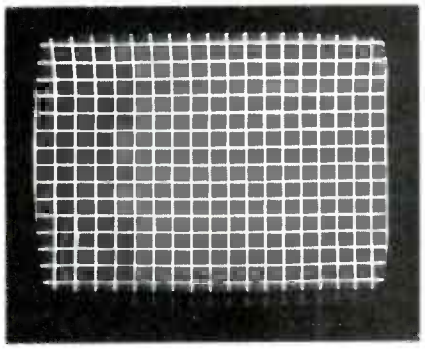


Fig. 2 Good linearity, both vertically and horizontally, and equally good pincushion correction are shown by these crosshatch patterns. The picture size shrank slightly when the line voltage was changed from 120 volts (left picture) to 110 volts (picture at the right).

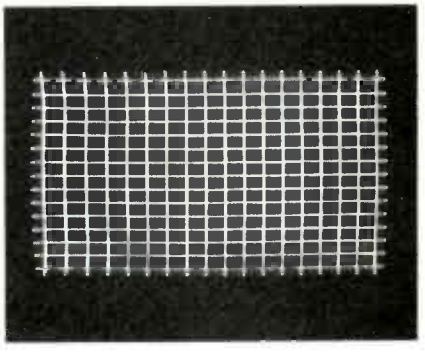


Fig. 3 When the vertical height was reduced to the limit of the control, the vertical linearity remained perfect.

Satellite TV Update

***Western Union's** Westar I, shown blasting off into orbit, can re-broadcast 12 TV programs simultaneously. Other satellites that are being designed will broadcast as many as 65 TV channels. (Courtesy of Western Union)*

***The Wall Street Journal** newspaper operates this direct-reception terminal, so type set in Massachusetts can be printed in Florida. (Courtesy of American Satellite Corporation)*

By David A. Ferre'
Engineer, RF Communications, Inc.

In the July, 1974 issue of **Electronic Servicing,** we predicted that reception of TV programs direct to homes from satellites would be a reality by 1980. So far, the developments leading to this goal are right on schedule.

Our prediction of CATV (cable) via satellite became a reality in November of 1975, when a broadcast relayed by satellite was received by a CATV system in Fort Pierce, Florida. At this time, three "channels" are available from the satellite to CATV operators, and certainly more will follow.

New Developments

On the engineering drawing boards are new high-power, high-frequency satellites for the Ku band (12,000 MHz), that could provide the direct link between TV studios and individual homes. Of course, earth terminals are available now, but the price of $65,000 is a bit high for an individual viewer.

TV receivers operating from digital video signals (rather than the present analog type) have been developed. They are said to provide sharper pictures, have bandwidth-reduction circuits, allow receiving noisier signals without snow, and are compatible with the proposed picture-on-the-wall flat TV screens. In fact, it's likely that in just a few years, **all** communications will be by digital synthesis.

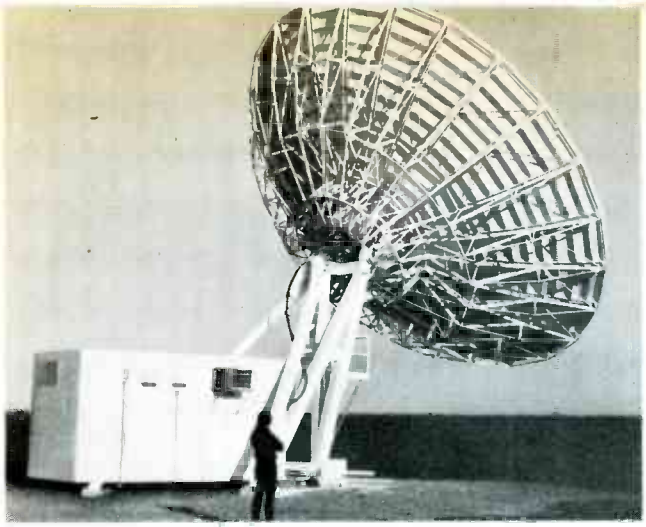
Newsworthy Events

Here are some of the satellite developments during the past two years:

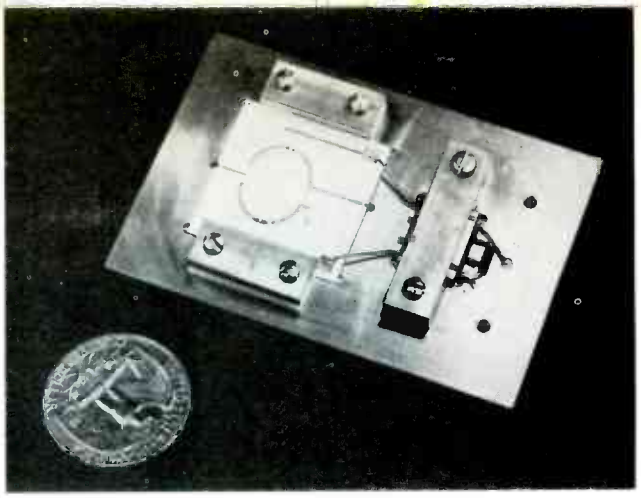
- Satellites launched since July of 1974 **could** broadcast more than 150 TV channels simultaneously, if required. Presently, they are used for voice and data communications, plus three TV video channels for CATV systems;

- Toshiba of Japan has announced the development of a $500 earth terminal to receive signals from Japan's direct-broadcast satellite, which is scheduled for launch in 1977;

- Direct reception of MUZAK pro-



A typical CATV receiving antenna is this $65,000 30-foot dish. Reorientation to another synchronous satellite requires only about 15 minutes. (Courtesy of the Harris Corporation)



***This is the** small "heart" of a mixer to down-convert Ku-band signals (12,000 MHz) to TV Channel 4 (70 MHz). (Courtesy of Westinghouse)*

***A 10' conical-horn** antenna, mounted on a boat trailer, was used to receive MUSAK programs. Five other demonstrations also were successful, some operating from a 4' dish antenna. (Courtesy of Antennas For Communications, Inc.)*

***One commercial** satellite-demodulator covers frequencies between 3,800 MHz and 12,000 MHz. Only an antenna and a TV monitor are required for operation. (Courtesy of Terracom)*

grams has been demonstrated using both a 4-foot parabolic antenna dish, and a 10-foot conical horn antenna;

• In India, $1,000 earth terminals receive TV programs everyday from the ATS-F satellite;

• Scientific-Atlanta (an earth-terminal manufacturer) predicted that 250 CATV companies will own satellite terminals by the end of 1976;

• Andrews, Harris Corporation, Scientific-Atlanta, and others offer direct-reception terminals for approximately $65,000 each;

• European Space Agency announced the scheduled launch of a direct-broadcast satellite for the European community. Size of the receiving dish antenna is expected to be about 3-feet; and

• COMSAT, ATENA, and IBM formed a company called Satellite Business Systems (SBS) to launch an **all-digital** satellite in 1979. The satellite probably will broadcast 65 TV channels at one time, using the Ku band.

Roadblocks?

Not all individuals and groups are in favor of direct reception of TV programs from satellite relay. Immense amounts of money are involved (consider the effects of closing **all** present TV stations in the country). And there are emotional roadblocks, as well.

As reported in Communications News last September, the National Association Of Broadcasters (NAB) warned the FCC that satellite-to-home broadcasting could contain the "seeds of destruction" of the world's best system of localized service. Further, NAB is quoted, "There is something foreboding about the thought of the government or any other party being in a position to reach virtually every home in the country without any intermediate cut-off points."

So, the technology of satellite broadcasting is proceeding smoothly, with the future expansion to be determined partially by the opposition.

Electronic Servicing will keep you informed of all new developments. □

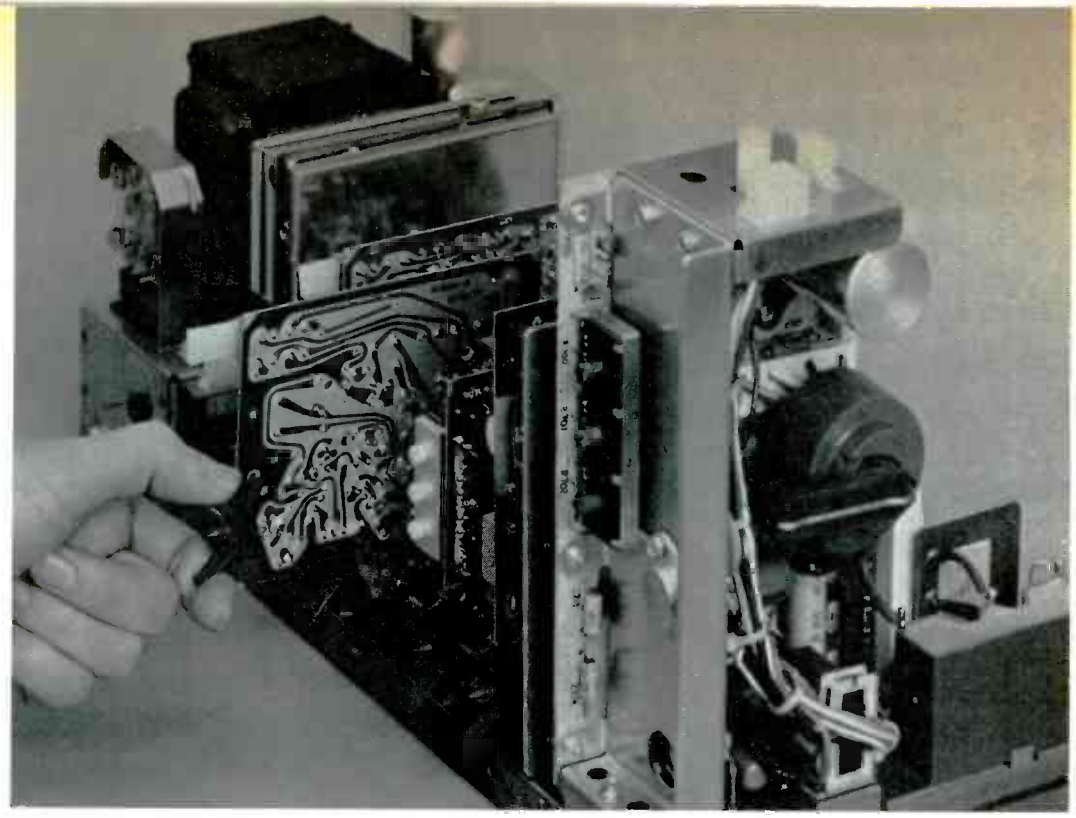


Fig. 1 Seven modules are used in the "Era II" and "Era II Limited" lines from Admiral. More components are mounted on these modules and fewer are on the mainframe.

1977 Color TV Trends

By Carl Babcoke

One definite trend in the new 1977 color receivers is towards larger and fewer modules per chassis. Tubes and conventional boards have lost out completely; I know of no new models that have them. Most vertical circuits seem to have complementary-symmetry outputs, and pre-CRT matrixing of video and chroma signals is common. Single-button selection of factory pre-set color controls is being replaced by more sophisticated circuits (RCA ColorTrak and GE VIR systems, for example). Although many models seem to have similar features, the individual circuits are completely different. More IC's are used each year.

Outlook For TV Makers

These next few months will be critical ones for television receiver manufacturers. The "survival of the fittest" has left few TV manufacturers remaining in business. And many of those have changed hands. Offhand, I can think of only three major companies (RCA, Zenith, and GE) which remain under the same management.

Each manufacturer knows he **must** make a profit soon or be forced out of business. Consequently, every company has made strong efforts to reduce expenses. Automation is one method of minimizing the price rises that have hit them just as hard as it has us as individuals. I know of no industry that has had such mild retail price increases (inflation has been cancelled by cost reductions).

Competition has been fierce, and it will continue to increase. RCA is making giant efforts to regain the number one position lost a few years ago to Zenith. General Electric is determined to be a strong number three in total sales. Others are trying equally hard.

Quality of these new modular products is excellent, probably because of the strong competition. Solid-state has decreased the average number of repairs, and these

Fig. 2 Admiral "Era II Limited" Model 19C7089RA is a 19" deluxe model with matching stand, photo-electric eye, electronic tuning, and digital channel readout.

When you install a B-T Booster outside, you get a lot of new boosters inside.

The service technician's job is a tough one. Customers are always grumbling about the high cost of TV service calls. And they complain about poor reception—even when it's almost impossible to get a good signal.

But now and then a TV service technician wins one. And one of the products that can make him a winner, and create customer goodwill, is a Blonder-Tongue outdoor booster.

B-T Boosters can produce a dramatic improvement in picture quality, particularly on color and especially in difficult reception areas. After 25 years of making outdoor boosters, B-T is number one in sales, and enjoys the finest reputation for making products of highest performance and reliability. B-T Boosters do cost a bit more than competition, but they perform and last longer. And that's what makes satisfied customers.

The VAULTER, for example, is the number one outdoor booster today in the B-T line... *and* in the entire industry. This ultra-high performance, all-channel amplifier offers the ideal combination of lowest possible noise figure (4.6dB, VHF; 7.0dB, UHF) and high gain (15dB). While it can't make unusable, snowy pictures perfect, it *can* reduce fading, loss of color, overcome cable loss and reduce lead-in cable noise. It can even feed more than one TV set from the same antenna in fringe reception areas. It has separate U/V inputs and a coax output. Finally, it's specially designed for lightning prone areas.

The B-T line consists of 5 all-channel models (including the popular VOYAGER); 5 VHF models and 4 UHF boosters (the ABLE-U2b is a favorite).

See your B-T distributor for details. And see why you can count on boosters inside, when you install B-T Boosters outside. Blonder-Tongue Laboratories, Inc., One Jake Brown Road, Old Bridge, N.J. 08857.

25 BLONDER-TONGUE

For More Details Circle (4) on Reply Card

Fig. 3 Several Admiral "Era II Limited" models have provisions for adding a remote amplifier at any time. The plug-in unit, plus the portable remote hand unit, provide full remote operation.

Fig. 4 The Admiral remote-control transmitter requires only a 9-volt battery to become operational.

new modular designs might well reduce service even more.

Some service shops already are reporting a general reduction of gross income that's not attributable to general business conditions. Has the impact of fewer repairs per chassis begun in earnest?

Certainly, we cannot ask for a return to the old days of "six calls per year". What is the answer for our repair industry?

Admiral

New color-TV models of the 1977 Admiral television line are offered in two categories: the "Era II"; and the "Era II Limited", which is the top-of-the-line.

Era II

Eight 25-inch and two 23-inch consoles comprise the "Era II" line. Nine of these have a negative black-matrix picture tube, and four are equipped with a digital channel read-out display.

The chassis has seven modules for rapid repairs of most service troubles. Each module snaps in or out of an interconnect frame (see Figure 1), which takes the place of the conventional chassis pan. More components are included on the modules, and fewer components are handwired on the mainframe.

Some electronic features include: an automatic limiter to stabilize the color saturation; a color processor that eliminates green halo; and a DC restorer for better black level, especially during low-contrast or night scenes.

Portables

Two 13-inch and one 17-inch portables join the four 19-inch portables already in the Admiral line. A new-type chassis is used in the portables just introduced.

Black-and-white

Eleven black-and-white models, from 9-inch to 22-inch, first were shown in May. The 19-inch and 22-inch versions have a new chassis that is said to have improved sensitivity, better locking, increased brightness, and pre-set VHF fine tuning.

Era II Limited

Admiral's top-of-the-line series, called "Era II Limited", has three 25-inch consoles and three 19-inch models with optional stands. Model 19C7089RA is shown in Figure 2. All "Era II" features are included.

Automatic brightness level is provided by a built-in photo-electric cell that measures the amount of room light falling on it, and the cell resistance determines the brightness.

Channel selection is by electronic tuning with digital readout. The viewer can select any UHF or VHF channel by pressing buttons on the receiver's control panel. For example to select Channel 41, you push four, push one, and then press the "Select" button. Before you can withdraw your finger from the button, the channel is tuned and the number 41 showing on the digital display.

Several of the "Era II Limited" models have provision for an electronic control that can be installed (even by the customer) at any time (Figure 3). The cover plate is removed and the remote amplifier plugs in. A 9-volt battery installs in the remote-control transmitter, which has controls similar to those on the receiver (Figure 4). The receiver can be controlled then from either the receiver's control panel or by the remote control. Volume control has a variable adjustment, providing any volume desired. The remote has a test for the condition of the battery.

General Electric

Way back in 1965, General Electric introduced the HB-chassis "Portacolor". One of the unique features was the horizontal in-line arrangement of the picture-tube guns. Convergence was simplified

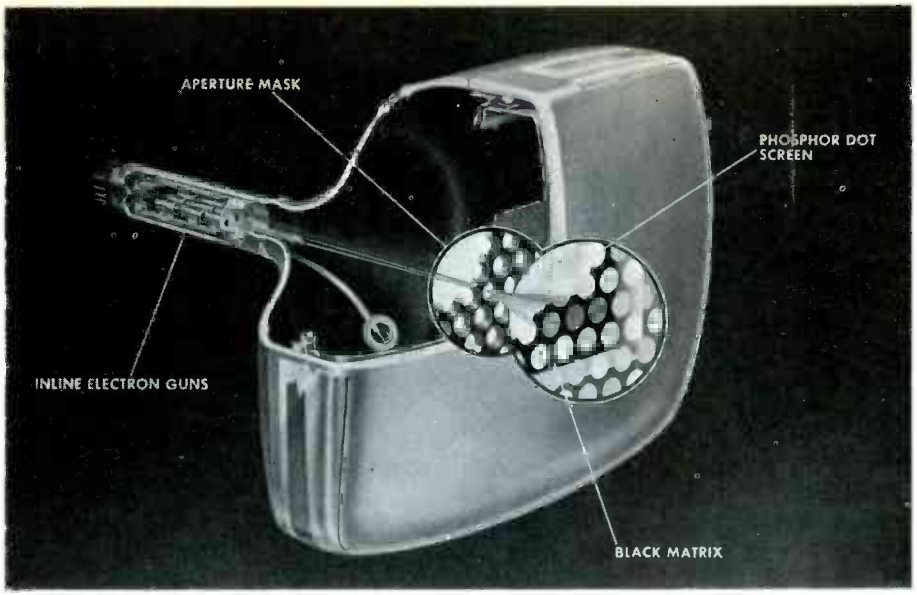


Fig. 5 The horizontal-in-line-guns color picture tubes from General Electric come either with phosphor dots or with small trios of stripes. All of the 1977 GE's have in-line picture tubes, including the new 25-inch size.

Fig. 6 General Electric offers several deluxe table models with stands, such as this WYC-7660WD, having gas-discharge digital readouts for both VHF and UHF channels, plus six modules. Many 1977 GE's have the new VIR module, which adjusts both color and tint according to the VIR signal sent out with the network color programs.

by this configuration. For one reason, the gun in the center needed no dynamic correction. And the other two demanded less, because they at least were in the center of the yoke in the vertical direction.

Let me digress to say that many of the "facts" given in books, about the need for dynamic convergence, are completely wrong. For example, the non-spherical contour of the faceplate with the phosphors has been blamed for the errors of dynamic misconvergence at the edges of the picture. Actually, the near-flat faceplate degrades the focus near the edges (the distance from gun to phosphor is greater there), but other possible discrepancies are solved in the original placement of the phosphor dots or stripes.

No, the principal error is caused by the guns not firing down the **exact center** of the deflection yoke. That's why an in-line tube requires fewer dynamic adjustments. (A true single-gun tube would require even less.) GE says total convergence can take as little as 4 minutes.

In the 1977 line, General Electric has in-line-gun picture tubes in **all** color receivers. Figure 5 shows the beam paths inside a tube having conventional color dots. Many of the new GE's have the colors applied in trios of small stripes, as explained in the article about GE modular color elsewhere in this magazine.

Some models of 19-inch and 25-inch receivers have 0.4-inch-high gas-discharge digital readouts, which are activated by switches on the tuners (see Figure 6).

VIR color

Probably the most important feature of any brand or model color TV this year is the circuit in certain General Electric models which automatically adjusts both color saturation and tint according to the Vertical-Interval Reference (VIR) signal that's broadcast during most network color programs.

The circuitry required to make automatic color and tint corrections from the condition of the VIR signal is sophisticated and complex, requiring identification of two horizontal lines out of each 525, testing for the presence of the VIR signal, and then the precise selection and comparison of certain parts of the signal to provide a DC signal for control of color and tint.

A preliminary report on the circuit appeared last month starting on page 30 of the July issue of ELECTRONIC SERVICING. Later, we intend to provide an in-depth analysis for you.

Quasar

Quasar Electronics, a subsidiary of Matsushita Electric Corporation of America, recently completed a multi-million-dollar modernization of the color-TV production lines in Franklin Park, Illinois. Much of the assembly work is done by automated and computer-controlled equipment.

A slow-moving line takes each Quasar color receiver for a 45-minute ride during operation at full power (see Figure 7). This time test gives an opportunity for the components to stabilize before the final checkpoint is reached.

The new color line of 35 models is the first complete Quasar line engineered and produced since the acquisition from Motorola, so any trends are significant.

Models from 12-inch through 17-inch, plus some 19-inch versions incorporate the "Service Miser" modular chassis, which was first used last year, and in-line matrix-stripe picture tubes.

Perhaps the most unique new feature is the "Super Module" (shown in Figure 8). This one huge module has 5 IC's, all the customer-used secondary controls, plus most of the components and wiring. Eliminated are many plugs and wiring that formerly connected to the secondary controls. This "Super

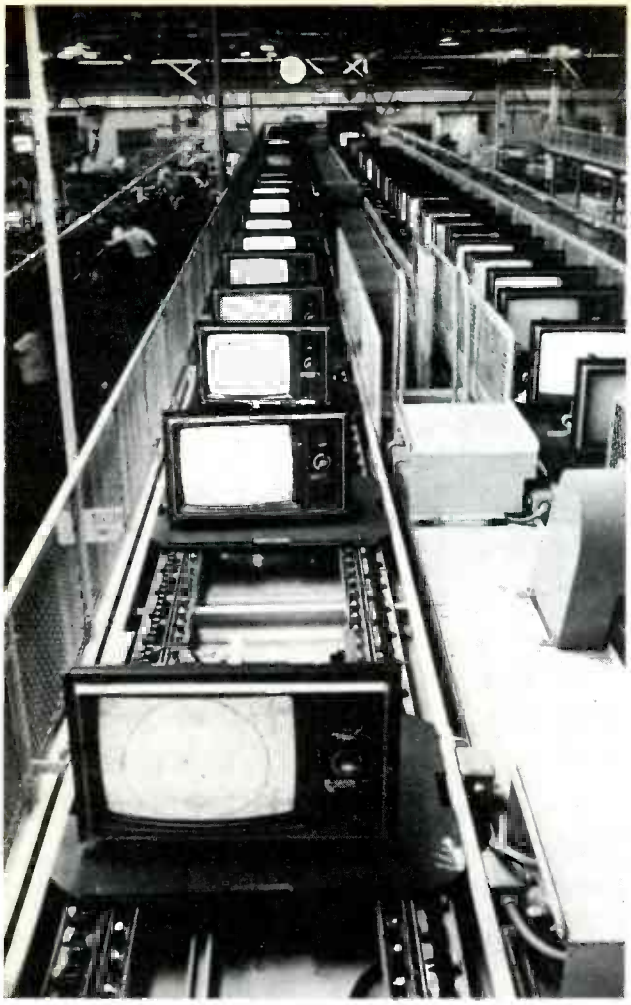


Fig. 7 New Quasar color receivers take a slow ride during their time test before final testing.

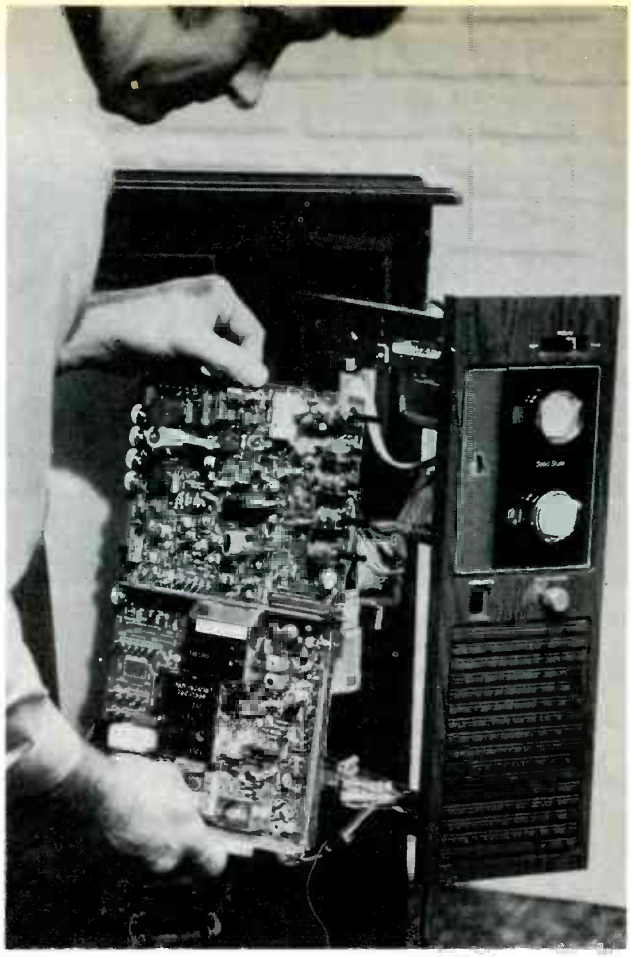


Fig. 8 Quasar "Super Module" color receivers have just one huge module. All of the secondary controls are mounted on the "Super Module", thus reducing wiring and eliminating many connectors.

Module" can be replaced from the front of those 20 models that continue the "Works in a Drawer" tradition.

Perhaps you remember that the first Motorola modularized receivers had 11 modules.

Five top-of-the-line models feature the "Satellite III" remote-control tuning system, "Super Module", "Super Insta-Matic" tuning, "Glare Guard" picture-tube filter, and delta matrix picture tube.

RCA

RCA Consumer Electronics division continues to phase-out the previous XL-100 models in favor of the "ColorTrak" versions (Figure 9). "ColorTrak" receivers have 6 modules versus 12 for the older models.

Two basic chassis are used in the "ColorTrak" line: CTC74; and CTC81.

CTC74 chassis receivers

Features of the CTC74 RCA color receivers include:

- modular construction with six modules;
- 30 KV of HV anode voltage;
- "AccuFilter" (individual filters for color dots or stripes), Precision-In-Line (PIL), negative-matrix picture tubes with slotted shadow mask and phosphors;
- automatic color control and AFT;
- automatic room-light compensator circuit; and
- a constant-voltage power transformer (the kind with a 3.5-microfarad capacitor across the secondary).

The four versions of the CTC74 chassis are:

- CTC74F, detented-switch tuners;
- CTC74J, varactor VHF and UHF tuners;
- CTC74H remote, varactor VHF and UHF tuners; and
- CTC74K Direct-Address Remote (DAR), varactor VHF and UHF tuners.

Fig. 9 RCA "ColorTrak" color TV's, which have six modules, are replacing the top models of the older 12-module XL-100 receivers in the RCA line. Some features include a constant-voltage power transformer, room-light compensator, automatic skin tint, and "AccuFilter" (individual filters for some color phosphors). Shown is the RCA Model GA830.

CTC81 chassis receivers

Features of the RCA CTC81 chassis color receivers include:

- modular construction, using the same modules as the CTC74, except for the vertical/horizontal-oscillator module;
- 31 KV of high voltage;
- "AccuFilter", 25-inch delta-gun picture tube with dot trios;
- AFT and automatic color control, including semi-automatic tint;
- constant-voltage power transformer; and
- automatic room-light compensator circuit.

Automatic tint correction

One feature attracted my attention immediately; the one called "automatic tint correction". Quickly, I read the RCA description about how the circuit worked. A sample of the chroma-IF signal goes through a limiter to level the amplitude changes. Output of the limiter and some 3.58-MHz carrier from the tint circuit are combined in a phase detector. Output of the phase detector plus more limited chroma go to an adder, whose other input signal is the main 3.58-MHz carrier.

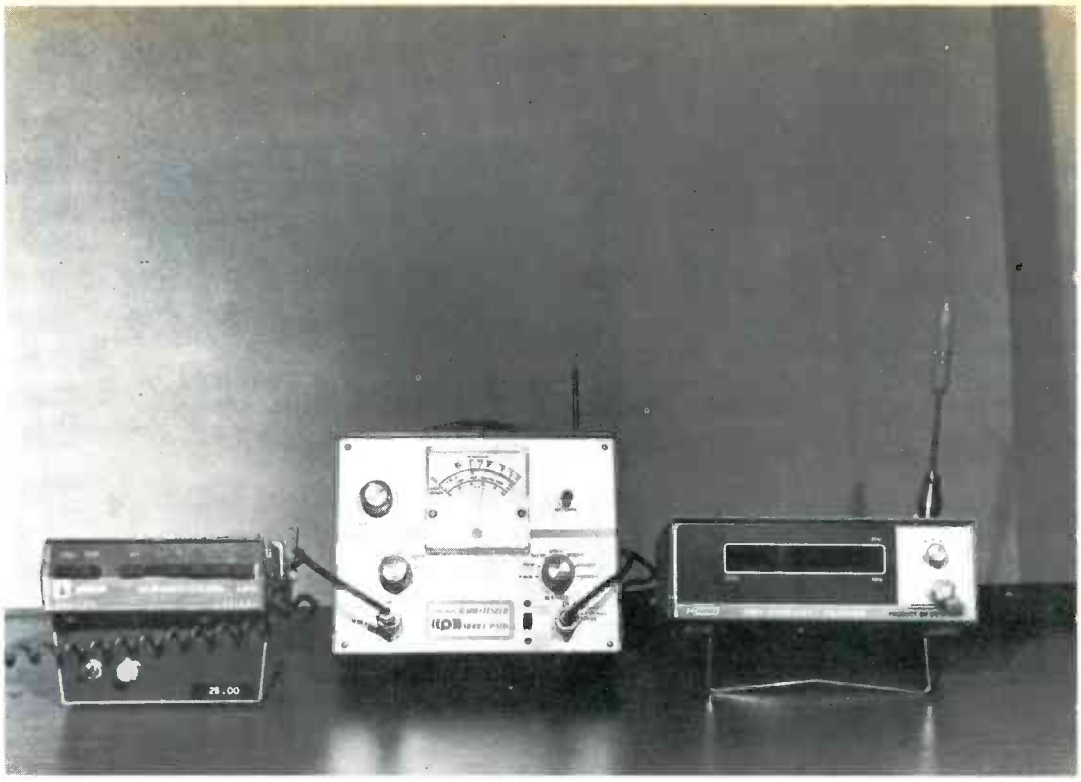
Phase of the output signal from the adder is a vector sum of the phase of the 3.58-MHz carrier and the phase of the sample of chroma sidebands (chroma IF). This output signal is the 3.58-MHz carrier going to the "I" demodulator (and through the usual phase-shifting network to the "Q" demodulator).

In other words, the phase of the 3.58-MHz carrier that is applied to the demodulators is changed to pull-in all tints (which are near skin color) so they become skin color.

At that point, I opened the Photofact for the CTC81 (Folder 1572-2) to check the complete schematic of this interesting circuit. Unfortunately, I could not trace it. The entire function that I listed is done **inside** one of the chroma IC's! As one RCA service manager said, "You have to take it on faith."

Direct-address remote

In addition to tuning the selected channel instantly by the varactor tuners, the channel number is fed through the video circuit so it appears on the screen with the picture. Or the time can be displayed in the same way. □



Here is one correct way of measuring power output and frequency of a CB radio transmitter. Shown at the left is a Johnson 120 feeding a Pace Model P-5430 (tests power, SWR and modulation) which has a built-in 25-watt dummy 50-ohm load, and at the right is a B&K Model 1801 frequency counter.

CB Test Readings... Right Or Wrong?

Part 1—By Marvin J. Beasley, CET
Land Mobile Regional Manager, E. F. Johnson Company

It's bad enough to feel uneasy about the accuracy of readings when you're testing CB transceivers, but it's much worse to depend on them, not knowing they are wildly inaccurate. It requires more than good test equipment to produce correct readings; you must know how to connect and use every one.

Incorrect results from tests can be more detrimental to CB repairs than if you made no tests at all. This sobering fact has not been given proper emphasis in most service literature.

What tests and test equipment should be used? How can you be certain the results are accurate? We'll try to answer those questions. Not all of the test equipment will be expensive, nor will all of the tests be complicated. Everything has limitations; it's essential that you know what has been proved or disproved within those limitations.

First, we'll describe some problems that appear to be internal

defects of a CB radio, but which actually are caused by things external.

Supply-Voltage Problems

Well-designed CB radios have internal voltage regulators that prevent any noticeable change of performance within the **normal** range of voltages in an auto. Defects in the auto can force the battery/alternator voltage outside of the usual range, causing various problems.

Also, the unprecedented demand for CB radios has allowed some poorly-designed "cheapie" models to be installed.

Not all customer complaints about poor performance will be caused by defects inside the radio. Therefore, the first part of your diagnosis should be to determine which of these three possibilities is true:

- The radio is normal, but the supply voltage is wrong;
- The radio is not defective, but the design is not adequate to prevent certain symptoms that are triggered by **normal** supply-voltage changes; or
- The radio has an internal defect and needs repairs.

Excessive voltage

At the other extreme, excessive supply voltage can cause failures of transistors, IC's, and fuses, without any other defect.

Low supply voltage

In an auto, the supply voltage from the battery should not measure less than 11 volts at the radio. A lower voltage might cause:

- a drifting frequency;
- erratic shifting of the frequency, causing a variable volume change during reception;
- a loss of oscillation (the radio would become dead); or
- weak transmitting power, which reduces the maximum range.

Testing the voltage

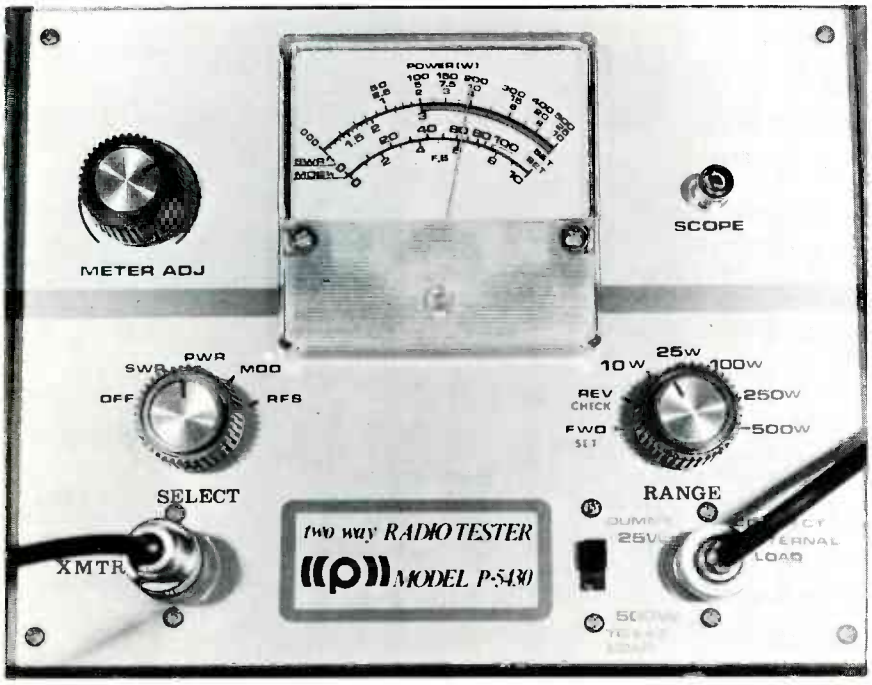
A complete voltage-supply test should include the readings on receive and transmit with the engine not running, and also on receive and transmit with the engine running fast enough to give maximum charge.

Failure of the alternator voltage regulator can raise the voltage when

the engine is running up to 15 or even 18 volts. Standard idling voltage, according to the Electronic Industries Association (EIA), is 13.8 volts. This is the correct voltage for measurement of transmitter output power.

With the engine shut off, a voltage reading of less than 10 volts probably means a defective cell in the car battery.

Another kind of voltage problem is indicated when switching to transmit dims the dial lamp and the transmit power is very weak. One possible cause is the small "crimp-on" connector that's supplied with many radios. Recrimp or solder the connector to increase its current-carrying ability.



A maximum legal RF output of 4 watts is being measured from a normal CB radio when the connections to the test equipment are correct.

Power output during this test is only 0.6 watt. Is the transmitter defective? No, a mistake has been made in connecting the test equipment. The error will be explained next month in Part 2.

Other causes of poor supply regulation have been traced to stranded wire that has been carelessly stuffed into the fuse block with only a strand or so touching the hot lead.

Transceivers with polarity switches sometimes blow fuses when the switch is set for the wrong polarity.

If a customer says the radio lights up and operates only when the antenna is connected, the radio is not grounded properly. Chances are the transceiver bracket is mounted to a **plastic** dash. Unless the receiver has a good ground, the supply voltage will vary excessively, and probably too much ignition noise will be picked up.

SWR Measurements

Over the years, many myths about coax, antennas, and RF measurements have crept into the service world. Often the terms "SWR" and "VSWR" are used incorrectly or without any explanation.

An antenna acts as a terminating load for the signal coming through a transmission line (coax cable). If the load is purely resistive (properly tuned so it's neither inductive or capacitive), and the resistive value is the same as the characteristic impedance of the line, the line and antenna are matched. In that case, no energy is reflected from the antenna back to the transmitter. But if the matching is poor, part of the signal is reflected back to the source. This signal is out of phase with the original signal, so "standing waves" (points of maximum voltage or current where the two signals add, and points of minimum voltage or current where the two signals subtract) are formed. Of course, any standing waves that return to the transmitter are subtracted from the power radiated by the antenna. Excessive standing waves can cause damage to the output stage of the transmitter.

"VSWR" (often pronounced vizwahr to save time) means Voltage Standing-Wave Ratio, and it is the most common method of measuring SWR. VSWR is the ratio of the maximum voltage found in the coax relative to the minimum voltage there. With perfect matching, the minimum and maximum voltages are the same, so the VSWR is 1:1,

or a one-to-one ratio. If the maximum voltage is 8 times the minimum, the VSWR is 8:1.

Most inline CB power/VSWR meters have a bridge circuit to read separately the voltage to the antenna and the voltage reflected back to the transmitter.

Remember, SWR is a **relative** measurement. For example, service techs for commercial two-way radios use an RF wattmeter and measure the power in both directions. They don't calculate or worry about the actual SWR just so long as the reflected power is less than 5% of the forward power.

VSWR versus the percentage of reflected power is:

VSWR	% Power Reflected
1.5:1	5%
2:1	10%
3:1	25%
4:1	30%
6:1	45%
8:1	50%

If you measure a VSWR of 3:1, then one-fourth (25%) of the power from the transmitter is wasted. This loss added to other losses in the system could mean that half of the power is wasted.

Only a matched 50-ohm impedance coax and antenna system will allow the readings of SWR meters and RF wattmeters to be accurate. These fine items of test equipment can be notorious liars, when the conditions are not right.

For example, an antenna manufacturer specifies that a certain antenna has a 50-ohm impedance. This is not necessarily true, for most such antennas have the rod slightly too long so it can be trimmed (shortened) to match the radio.

Of course, we should attempt to obtain a VSWR as near 1:1 as possible, for low VSWR readings indicate high efficiency along with minimum chances of damaging the RF output transistor in the transmitter. **But remember this: it's possible to obtain a low VSWR at the transmitter although the antenna or coax cable might either be open or shorted!** How can you know when to rely on these readings? First, check the power into a 50-ohm dummy load, then become suspicious if the power or VSWR readings change too much when the antenna is connected. An example of "normal" amount of mismatch is a quarter-wave whip, which at 27 MHz probably will have an impedance of 36 ohms with a VSWR of 1.5:1 or 2:1. Worse readings should be investigated.

Next, check the coax and antenna for opens and shorts. A full-length non-loaded (without loading coil) whip should check open when measured by an ohmmeter. Antennas with a loading coil check as though shorted. To check the coax or connector, remove the base load from the antenna mount and check the line separately.

Don't confuse impedance and DC resistance. Some technicians believe a 50-ohm antenna should read 50 ohms on an ohmmeter! Impedance is AC resistance, which cannot be read by an ohmmeter.

Coax cable should measure low resistances from the shield of one end to the shield at the other end, and from the center pin of one end to the center pin at the other end of the cable. Between the center wire and the shield, when the cable is checked alone, there should be an infinite reading.

Antenna And Coax Damage

Automatic carwashes indirectly provide you with lots of extra business. Before getting a wash job, a CB user often will unscrew the load, instead of removing only the whip. A few such removals will break the center conductor in the mount, bringing intermittent operation. Also, removal of the base load leaves a cavity which collects soapy water, and a buildup of soap and corrosion can weaken the signal.

Many trunk-lid antenna installations damage the coax, crushing it flat between the gasket and the trunk lid. Such crushing displaces the center conductor, and this changes the characteristic impedance, causing a higher VSWR reading.

Sharp edges of the trunk lid can sever the cable or break the inner conductor. To prevent these problems, flatten or bend the sharp edges. And position the cable, perhaps with cable clamps, so it enters the trunk at the same place each time the lid is opened and closed.

Also, look for cable trouble under the seats where weight of the driver or passengers exert pressure, under the metal trim along the door openings, and around any loops of coax that might be snagged when the trunk is loaded or unloaded.

More Wrong Readings

Another way of getting erroneous VSWR and power readings is to leave the car doors open and the trunk lid up. An open trunk lid affects the performance of antennas regardless of the location, although a roof-top mount is affected the least. You can appreciate the importance of the lid position after you watch an experienced two-way

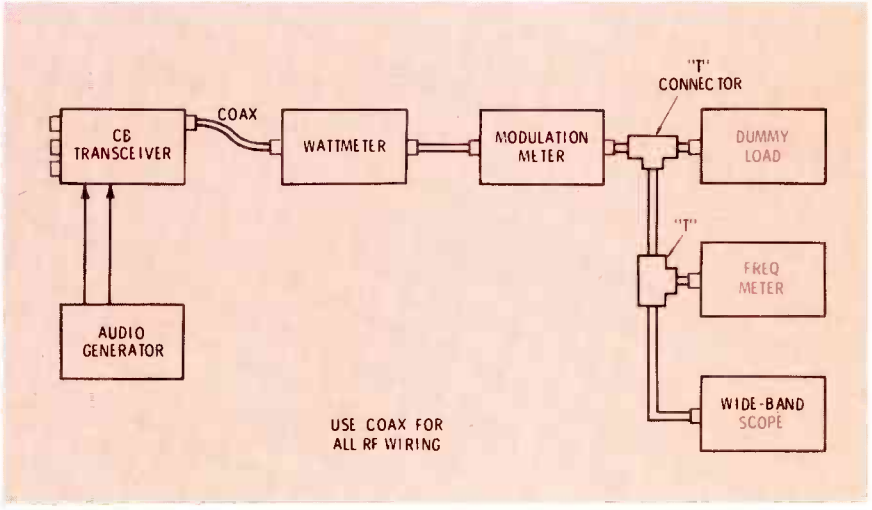


Fig. 1 These instruments are required for a complete test of a CB transmitter. Often the wattmeter, modulation meter, and dummy load are combined in one instrument. Care must be used in the length of the coax lines, and in coupling to a frequency counter.

radio technician crawl inside the trunk and pull down the lid during a final tuneup.

Measuring Frequencies

It should be a snap to measure the frequencies in a CB transceiver. Just use a frequency counter that has five times the accuracy required by the FCC for CB transmitters. Unfortunately, you can obtain erratic or erroneous readings, if you use the wrong wiring to bring in the signal to the counter.

Counters have one blind spot: they can't discriminate between cycles from the desired signal and those from noise or a spurious signal. For example, noise pulses riding on the signal add to the count, producing serious errors.

Good wiring minimizes errors

Figure 1 shows an efficient setup of test equipment, with the wiring arranged to minimize lost time and to reduce the chances of wrong readings.

The wattmeter and modulation meter can be in a single instrument along with the dummy load. It's vitally important that the dummy load be exactly 50 ohms and noninductive. Also, the resistance should not change from the heat of normal operation. One way is to make up your own load (Figure 2), using carbon or composition resistors whose total wattage is several times the expected maximum amount. (Carbon and composition resistors tend to change with heat, and when overloaded and recycled many times, this change can become permanent. The solution is to make certain the heat always is kept far below normal ratings.)

The relative-power load assembly of Figure 2 can be constructed easily. Use a VOM or multimeter as an indicator, and calibrate it against a standard of known accuracy.

Warning: a #47 dial-lamp bulb is **not** a satisfactory load, although many books and articles recommend it. These bulbs are rated at 6.3 volts and 150 milliamperes, which calculates to 42 ohms. Right there is a mismatch. But there's more. The rated wattage is about .95 watts, and many transceivers have 4 watts of output power. Now, 4 watts into 50 ohms figures about 14 volts RMS, so it's obvious that a full-powered CB rig might burn out the bulb. The only thing preventing the failure is the same characteristic of the bulb that makes it unsuitable as a load: **the resistance varies with temperature of the filament.** I made a chart of those resistance changes at one time. The chart is filed away somewhere, but as I recall, the resistance changed from perhaps 15 ohms when the bulb was barely lit to over 80 ohms with more than 6 volts across it. Our advice is to use one of the bulb test gadgets (coax connector with #47 bulb) for a quickie test that tells you only, "Yes, there is some

Fig. 3 Bird Electronics offers several types of power wattmeters. Although this kind does not measure SWR directly, it measures both forward and reverse power flow. If the reverse power is less than 5% of the forward, the SWR is satisfactory.

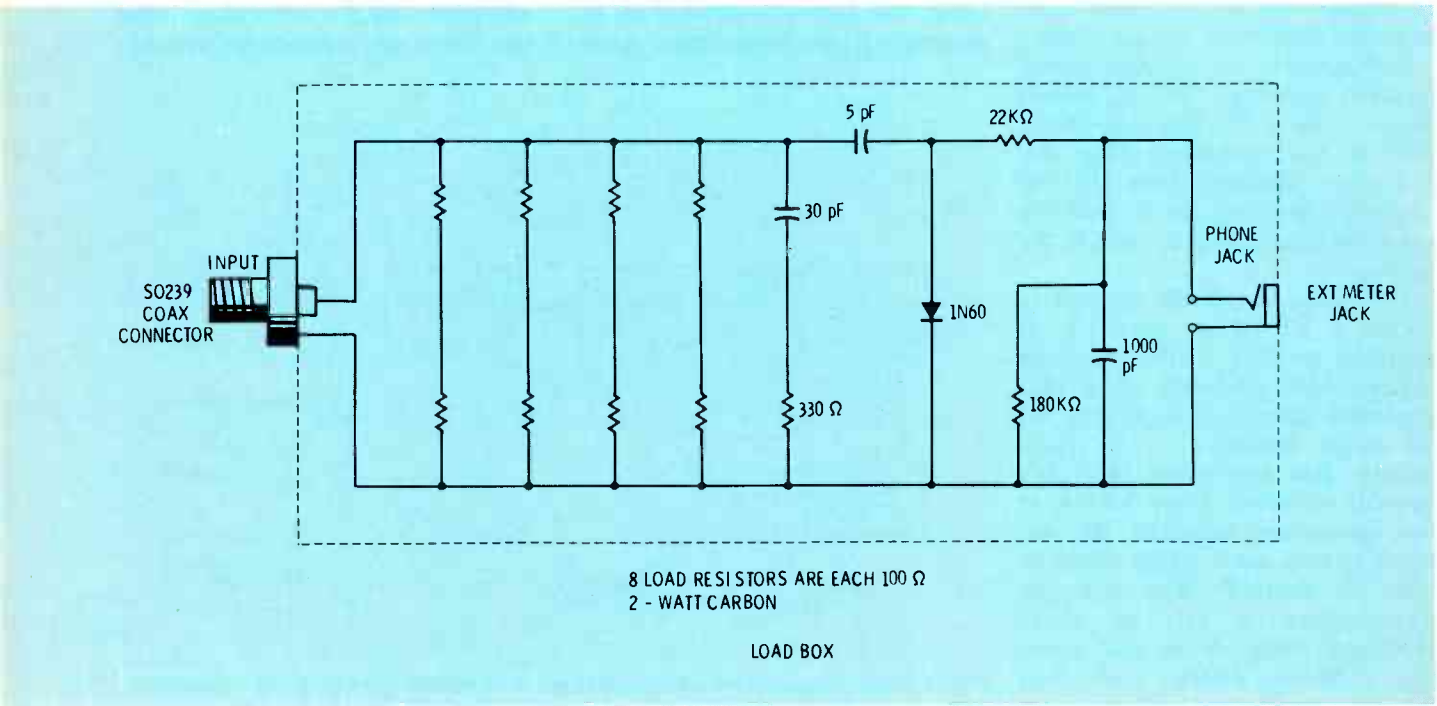


Fig. 2 You can build this dummy load in a metal box. A reading of relative power output can be obtained if you use a VOM connected to the "external-meter jack".

output."

One of the most popular dummy loads over the years is the Heath Cantenna. It has a gallon bucket with a 50-ohm non-inductive load resistor immersed in mineral or transformer oil. Power handling can reach 1,000 watts for short periods. It should not even run warm with CB's. Bird offers a wide range of wattmeters and loads for every need (Figure 3). Motorola has a low-power load, and supplies a chart to show the power when used with a 50-microampere meter.

Connecting Counters

Modern frequency counters are extremely sensitive, requiring very little input voltage to produce reliable readings. In fact, excessive input is responsible for far more wrong readings than is too little.

Measuring output frequency

It is good practice to check the frequency and approximate power output on all channels, as the final checkout of a transceiver. Figure 4 shows one way to connect the output RF to a counter that has a 50-ohm input, A direct connection is not recommended because it would allow too much amplitude to reach the counter; and the 50-ohm input impedance would parallel the dummy load, making the total load only 25 ohms (a mismatch).

The 5 pF capacitor has about 1,000 ohms of reactance at 27 MHz, so the loss is about 20-to-1. If the counter has a high-impedance input, then add a 50-ohm carbon resistor on the counter side of the coupling capacitor.

This kind of coupling works fine with a scope, also. But most scopes can accept the full output signal without any problem from overload.

Measuring individual frequencies

Troubleshooting synthesizers often requires you to know the frequencies of the high and low oscillators. The problem here is making the reading without loading down (detuning) the synthesizer circuit.

One way is to prepare a shielded cable (Figure 5) with a short length of the "hot" wire extended to act as a probe. Ground the shield, and position the "hot" center wire **near** the circuit. Capacitive action of the nearness usually gives sufficient signal without loading.

If actual contact is needed, add the capacitor and resistor at the end of the cable, as shown. Remember to keep all the leads short.

Next Month

The first subject will be an explanation about why and how a length of coax cable can function as a trap, giving an open or a short, according to the conditions.

Also, correct methods will be described about making accurate and meaningful measurements of the receiving functions. □

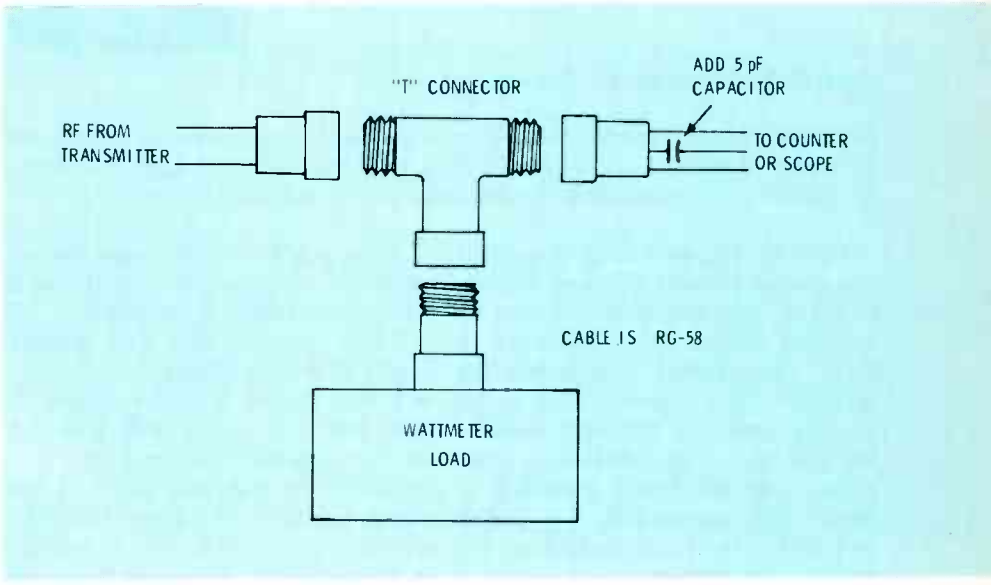


Fig. 4 Use "T" connectors to wire in different items of test equipment. To prevent overload of a frequency counter that has a 50-ohm input, add a 5-picofarad capacitor inside the shield of the coax, as near the connector as possible. A high-impedance counter should have a 50-ohm carbon resistor added between the counter side of the capacitor and the shield (as shown in Figure 5). Do **NOT** wire these components at the counter end of the coax.

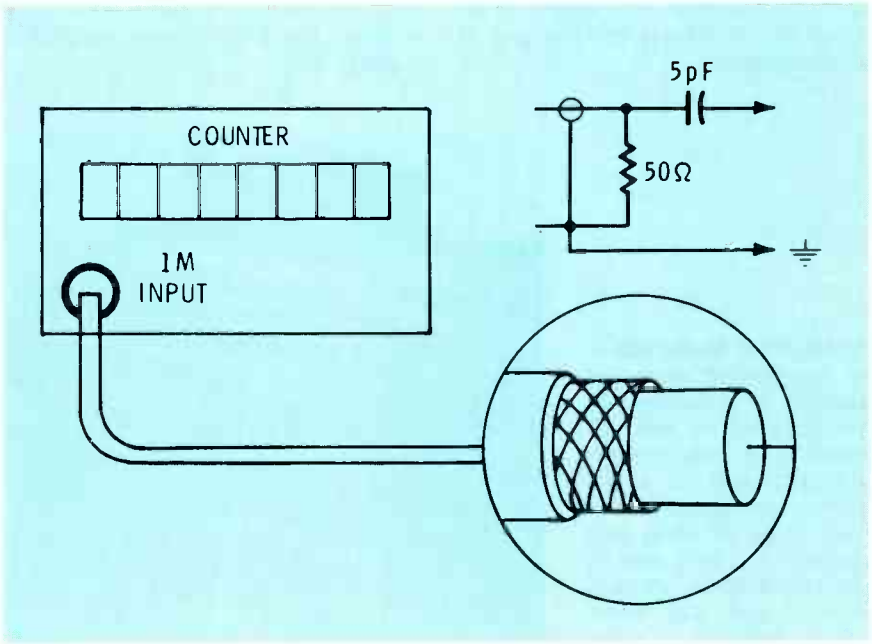


Fig. 5 Most counters that have a high-impedance input will pick up enough signal in the transmitter stages when the coax is prepared as shown, exposing a short length of the center conductor. The center wire is positioned near to the circuit under test. In the event a direct connection is required, add the capacitor and resistor, using short leads.

SERVICING ELECTRONIC ORGANS

Part 3/By Norman H. Crowhurst

Both general and specific methods of troubleshooting electronic organs are presented. Included are ways of telling by symptoms and logic whether a key switch or an oscillator/divider stage is causing a dead note.

Last month, we briefly described the unique circuits of those brands of organs you are most likely to be asked to service. Next, you need to know the general troubleshooting methods for organs, and some specific ones for different models. Of course, some servicing techniques will be nearly identical to those used successfully for radios and TV's. One basic is checking for AC and DC power.

Dead Organ!

Suppose the organist reports that the instrument produces no sound; it is completely dead. Try the organ for yourself, making sure at least **one** stop is turned on, and that the headphone (used for silent practicing) has not been left plugged in accidentally.

After you're certain there are no errors of operation causing the lack of volume, follow these steps:

- Make certain the wall duplex outlet has full voltage;
- Check the AC plug for a tight fit with the wall outlet, and look for an open circuit near the plug;
- Check the indicator lamp (if the organ has one). A lighted indicator proves there's AC power, at least;
- Examine the tubes (if any) for heater glow, especially the power-output tubes; lack of glow in **all** tubes suggests an AC power failure;
- If these preliminary tests indicate normal power, listen near a speaker for hum (a normal organ will have a small amount), and move the expression control, noticing any noise or change of hum level that suggests the main power amplifier is alive; and
- Check the main power amplifier as a whole unit by a simple "buzz" test. Find the input, perhaps at a plug or connector, and touch it with a small screwdriver blade. To obtain more buzz, keep a finger against the blade and don't ground yourself to anything. Power hum picked up capacitively through the air will give enough distorted sine waveform to produce a strong buzz when the amplifier has full gain. After a little practice you can learn how much volume to expect. Of course, if there is no buzz, the amplifier is dead and must be repaired.

If the main amplifier (usually on a separate chassis) is okay, you must check upstream through the pre-amplifier stages. But for now, we'll assume that the problem is in the amplifier or power supply.

In the following explanations, we are assuming that you have had little experience at troubleshooting audio circuits of this kind. If they seem simple to you, just use the procedures as a review.

Testing Tube-Type Amplifiers

Although it's true that visual tests give complete and correct answers **only** with certain defects, they are very worthwhile because they save much time in those specific cases.

Several visual conditions of the tubes should be examined first. With tube rectifiers (such as the 5U4G), a common defect is an open filament, often from poor soldering of a pin. If the tube filament does not light (and you don't have the correct type with you), check the pins with a reading glass, and resolder the bad pin. A new tube can be brought out later.

Output tubes, also, should have a definite heater glow. The glow in smaller tubes is more difficult to see, but it should be there. Of course, all operating tubes should be warm or hot to the touch.

Look for cracks in the glass, especially around the base. Even a tiny crack lets in air; which, in addition to ruining the tube, also turns the "getter" white. The getter is a black area on the inside of the glass where some material was flashed during manufacture to use up the last of the oxygen. White getter indicates an air leak.

Another warning sign is a blue or

The Wurlitzer Model 805 is not intended for beginning organists or inexperienced technicians. It has 25 pedals, two full 61-note manuals plus a small synthesizer keyboard, and a full range of stops and percussions. This one is used as a store demonstrator, and has extra speaker switches (at lower left of the great keyboard). One switch connects the Leslie (rotating speaker) tone cabinet, which is shown on the right.

purple glow from either gas or fluorescence. Such a blue glow **inside the metal elements** indicates gas, and the tube should be replaced. But, when the glow is on the inside of the glass, that is merely fluorescence; the tube is not defective.

When the plate current of an output tube is excessive, red areas might appear on the metal of the plate. This can be caused either by a circuit defect (insufficient bias from a leaky coupling capacitor to the grid), or by a gassy condition in the tube itself.

Other visual tests should include a search for burned resistors and defective filter capacitors. Many filters are housed in aluminum cans, and they should be checked for bulges or running too hot. A white powder around the terminals is proof of some leakage of the electrolyte, and often means the capacitor is open.

Check all fuses. When a high-amperage type blows from a severe overload, a prominent black area usually shows on the glass. Small-current fuses might not show a definite visual defect; it's best to check those with an ohmmeter. Of course, a blown fuse points to a more serious problem, such as a short circuit of some kind.

Power-supply defects

Figure 1 shows two variations of popular power-supply circuits. Both are full-wave types, having a ripple frequency of 120 Hz. However, an open of one diode changes either circuit into a half-wave type, thus reducing the DC voltage and increasing the hum level.

A shorted filter capacitor, diode, or rectifier tube loads down the power transformer, usually tripping the breaker or blowing the fuse.

Open filters seldom eliminate all sound; instead they produce other symptoms. The filter nearest the rectifiers affects the amount of DC voltage, as well as the hum level. For example, when it's open, the DC voltage might be 20% to 30% low. Other open filters increase the hum level or reduce the bass response. Sometimes, an open filter will remove the decoupling, permitting an audio oscillation.

A peculiar type of defect can

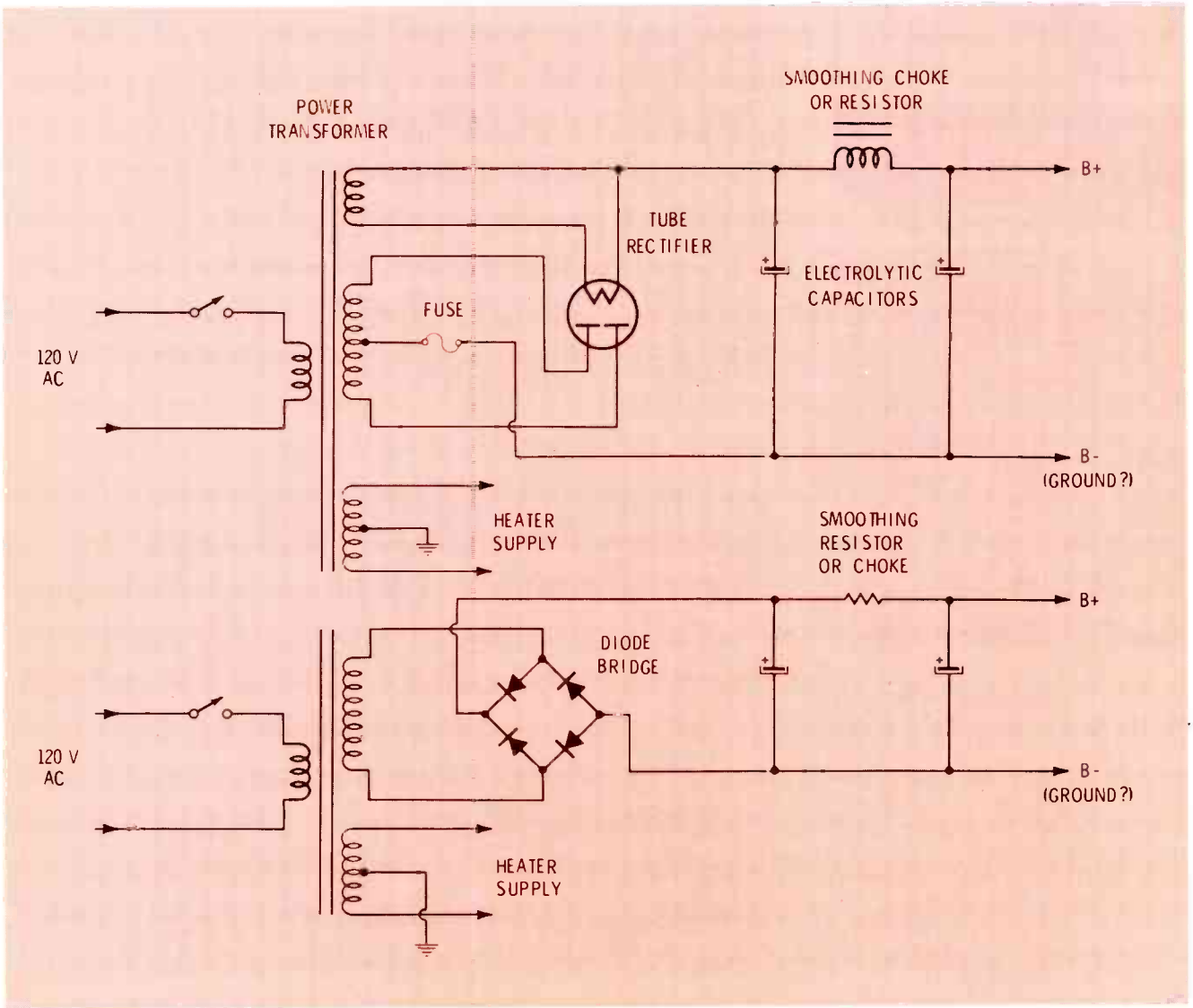


Fig. 1 Many variations of these two basic power supplies are to be found in organs. For example, a resistor added between B-minus and ground develops a negative voltage across it, for use as tube bias. The way the heater supply is grounded affects the hum pickup inside the tubes; retain the original wiring if you replace the power transformer.

occur in power supplies using a filter **resistor**, rather than a filter choke (Figure 1B). If the first (or input) filter opens, the second one tries to function as the peak-reading capacitance. However, the capacitor-charging current flows through the filter resistor, overloading it and often causing it to burn up. Since the charging current is AC, the usual DC measurements and Ohm's Law do not indicate any overload, thus it seems to be a defect without a cause. After the resistor burns open, the amplifier is completely dead.

False hum

By the way, organs are susceptible to "false" hums. Sometimes the springs or adjustments of the pedal mechanism can change enough that a pedal note sounds all the time. Those Baldwins that have a straight volume control to key each pedal note make the condition even more mysterious because the note can sound softly.

Pedal notes sound very similar to hum, and it's easy to confuse the two sounds. Also, B-natural pedal is just a few cycles away from 60 Hz, making that note seem to be pure hum when it is a "cipher" (sounding when no key is pressed).

There are two ways of checking for pedal ciphers. One method is to try each pedal note in turn. When you reach the bad note, no change of pitch will take place. Of course, if the noise is a loud hum, each pedal produces a beat note.

Replacing filter capacitors

Filter capacitors for tube-type amplifiers often are required to operate near the maximum DC voltages that are possible with the electrolytic type. Be sure you do not use any replacements having lesser voltage ratings.

If you can't find replacement filter capacitors of the exact ratings, select the next higher values. Most circuits operate just as well (or better) with filters increased to as much as twice the original capacitance.

Forming new filters

Electrolytic capacitors gradually deteriorate when stored too long, causing excessive current and heating when full voltage is applied. In rare cases, filter cans have been known to explode.

Therefore, it's an excellent idea to be on the safe side and prevent callbacks by re-forming any replacement filter capacitors.

Figure 2 shows how to form a set of filters. Add a resistor (perhaps a 100K, 2-watt value) temporarily between the rectifiers and the first filter capacitor; also, disconnect all of the load wires at the output of the filter circuit. Operate the power supply for a time (perhaps 15

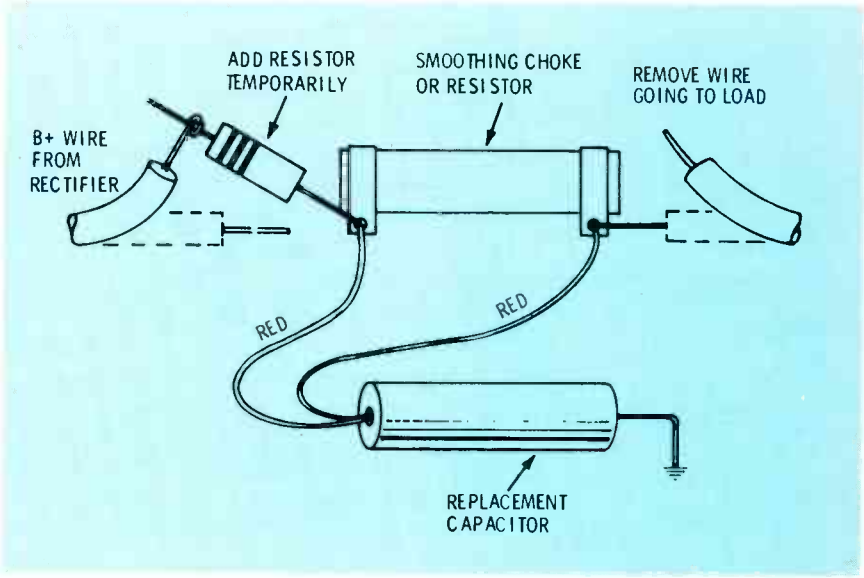
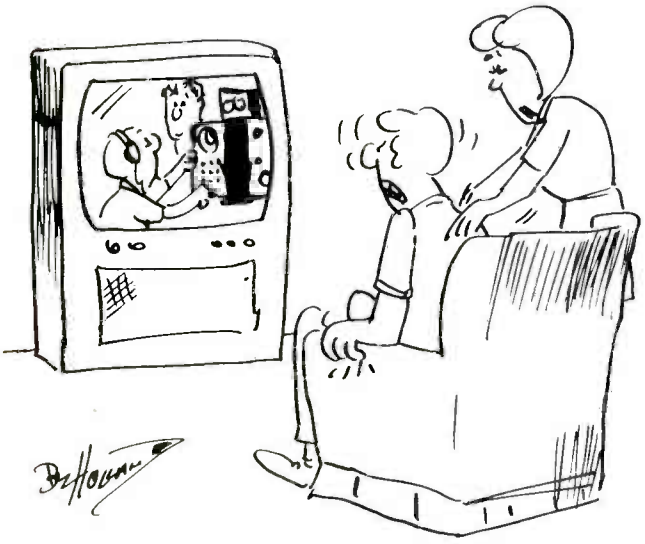


Fig. 2 Some electrolytic filter capacitors de-form (lose capacitance and develop leakage) from a long shelf storage. Temporarily change the wiring as shown to form the new capacitor after it is installed. A 100K 2-watt resistor should be about right to limit the current during forming.

CARTOON CORNER



"There, there, dear. Of course he's not using the oscilloscope properly; after all, it's only an old war movie."

"Hey! This new zoom feature is pretty nice!"

"Personally, I think he's carrying this honesty gimmick a bit too far!"

"I think this old scope has finally had it."

minutes) this way, noticing if the capacitor operates too hot. After the capacitor temperature returns to normal, restore the original wiring.

Signal-Tracing Tube Amplifiers

After you have determined that the AC and DC power-supply voltages are normal—but the main amplifier remains silent—then several simple signal-tracing techniques should be tried, to locate the dead stage.

As mentioned before, your fingers touching the blade of a small screwdriver or soldering-aid make a convenient source of buzz. Insulating yourself from earth ground and from any part of the organ makes the buzz louder, and enables you to touch pre-amp or driver plate circuits (which have a moderate amount—say up to 200 volts—of DC voltage) without receiving a shock. Be careful to stay away from the plates of the output tubes.

A much better idea is to use a regular audio oscillator, or a small home-built tone source, which has a special output circuit that's safe to use with transistors (Figure 3).

Warning: Don't connect an audio source directly—or through a capacitor **only**—to any transistorized stage. If the audio source has a low impedance, such as a transformer secondary, there's danger of increasing or decreasing the bias enough to destroy or cut-off the transistor. And, if the audio is coupled through a capacitor, **the charging current** (when it's connected to a circuit having voltage) **can zap a transistor. Use the protective circuit shown in Figure 3.**

Starting with the grids of the output tubes, use the buzz test or the audio source at each plate and grid in turn, working back towards the input, until you find a stage that does not pass the signal. Figure 4 shows some of the points to be tested. Normally, the volume of the test signal increases as the point of injection becomes farther from the output tubes. The precise amount of volume depends also on the impedance of the circuit where the test signal is injected; therefore, it is impossible to state an iron-clad rule.

After you've found the dead stage, try a new tube. If the tube replacement doesn't help, measure the DC voltages at the tube socket, and analyze the defect from the voltages. Figure 5 lists some examples. A high-impedance DC meter—such as a VTVM, FET meter, or digital multimeter—is recommended for these voltage tests, to minimize the errors from meter loading.

If the problem is in the pre-amp stages, rather than the power amplifier, use the same techniques to locate the defect there.

Testing Organ Circuits

These audio tests are exactly the same as those used in the audio section of a tube-equipped TV, or in a public-address amplifier.

After the pre-amp and main-amp circuits are known to be okay, but the organ remains dead, it's time to start checking the non-audio circuits.

What can kill all notes?

In order to silence all notes, the

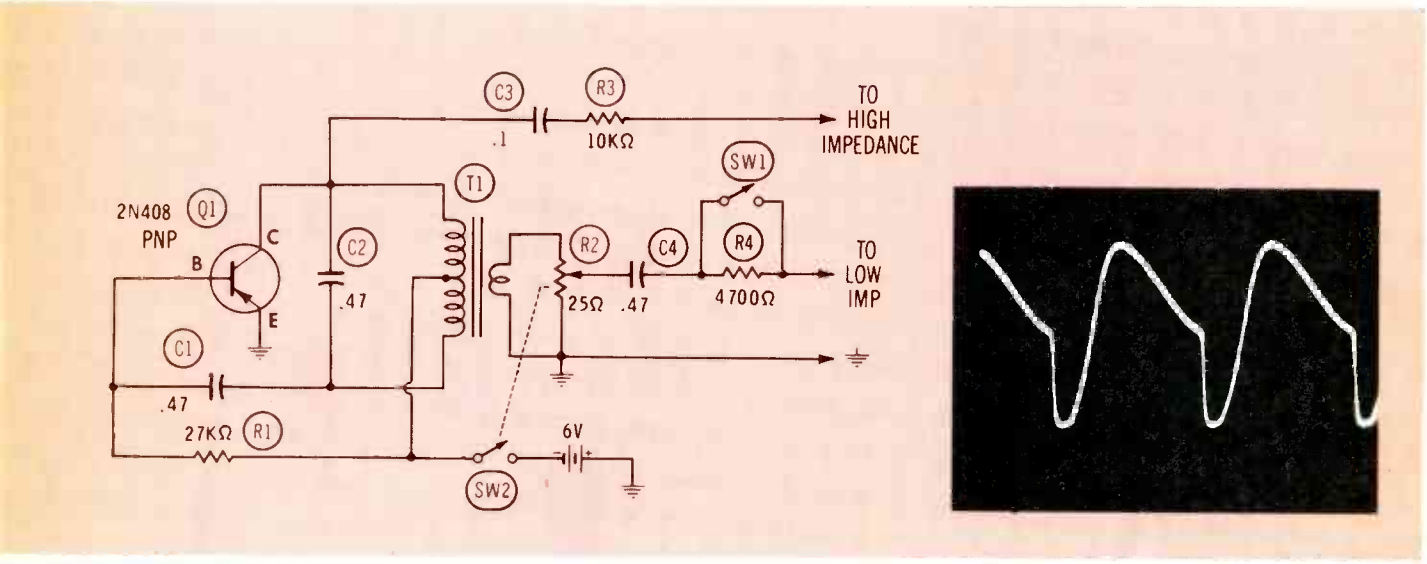


Fig. 3 Here is an audio tone-source you can build easily. It's very handy for testing any kind of audio amplifier, including both tube and transistor versions in organs. Nothing in the schematic is critical; most values can be changed without problems. The circuit is a Hartley-type oscillator built around a push-pull miniature transistor-radio output transformer, which has a speaker secondary useful for feeding low-impedance transistor circuits. The resistors in the output circuits are to limit the charging currents of the coupling capacitors, and R4 can be switched out when necessary to increase the output amplitude.

To prevent ruining any transistors by poor connections of the test unit, we recommend this procedure: before attaching the tone source, turn off the power to the unit being tested; connect the tone source, preferably using the insulated-hook type of "hot" lead, then turn on the power for the listening test; turn off the amplifier power before disconnecting the audio test source; if necessary to use the switch SW1 for shorting out the resistor—to obtain more transistor drive—have the tone source connected and the power on *before* switching out the resistor.

The waveform of the sample built by Editor Babcoke is a distorted sine wave, which is a good substitute for music, since it has harmonics that make the volume sound louder and more clear than a pure sine wave. Your version probably will have a slightly-different waveform.

defect must be universal. If the keying operates on DC rather than audio, perhaps a defect has eliminated all keying voltage. Or, a failure of the regulator circuit supplying all the oscillators could prevent all tones.

Another possibility, especially with older organs, is corroded plug connectors. Modern organs frequently incorporate gold-plated contacts to minimize connector problems.

Stop Tabs

Organs with the stops wired as shown in Figure 6 are not likely to lose all notes because of either bad keyboard contacts or stop switches. A short circuit to ground from the common input to the stop filters would kill all those tones; however, similar circuits are provided for other pitches, and these would not be affected. If only **one** stop does not work, the defect is certain to be inside the stop circuit itself.

Stop switches that furnish DC voltages for indirect control of the notes (Figure 7) could prevent all sound, if the DC supply voltage became zero. An open stop-tab switch would eliminate only that one function, and a defective keying switch could silence only one note of one pitch.

Many features from pipe organs

Because many of the general functions of electronic organs came from pipe organ design, it might be interesting and helpful to digress for a brief look at some pipe organ features.

Figure 8 shows the operation of the old "tracker" pipe organs, in which all functions were accomplished mechanically and directly, without any power assists. The "stop valve" actually stopped (or prevented) the air from entering the

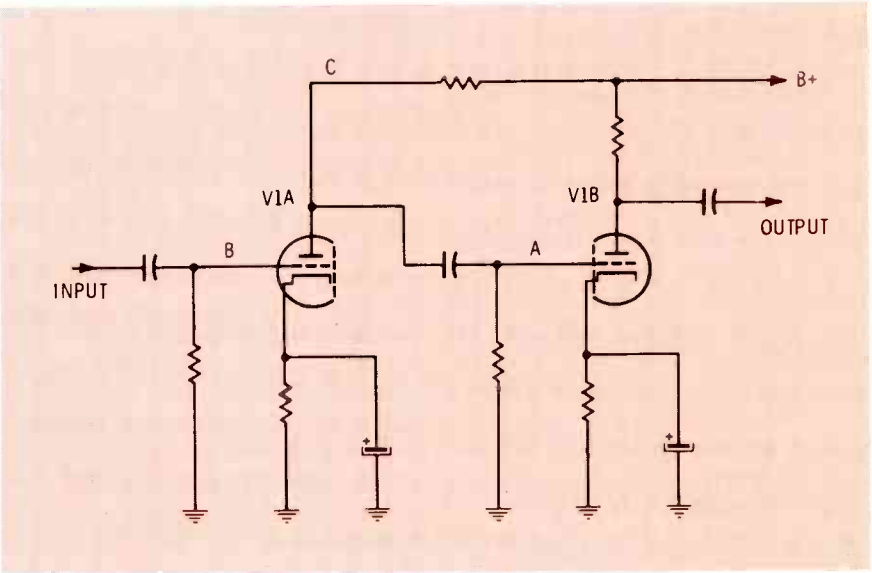


Fig. 4 These points of a tube-type amplifier are best for the "buzz" or audio-source tests. With signal-injection checks, you usually start at the input of the output tubes or transistors and work back toward the low-level stages.

Typical of solid-state amplifiers in small organs is this one in a Lowrey. For tests, the audio input can be found at one of the input plugs at the top, or at the terminals of the expression control.

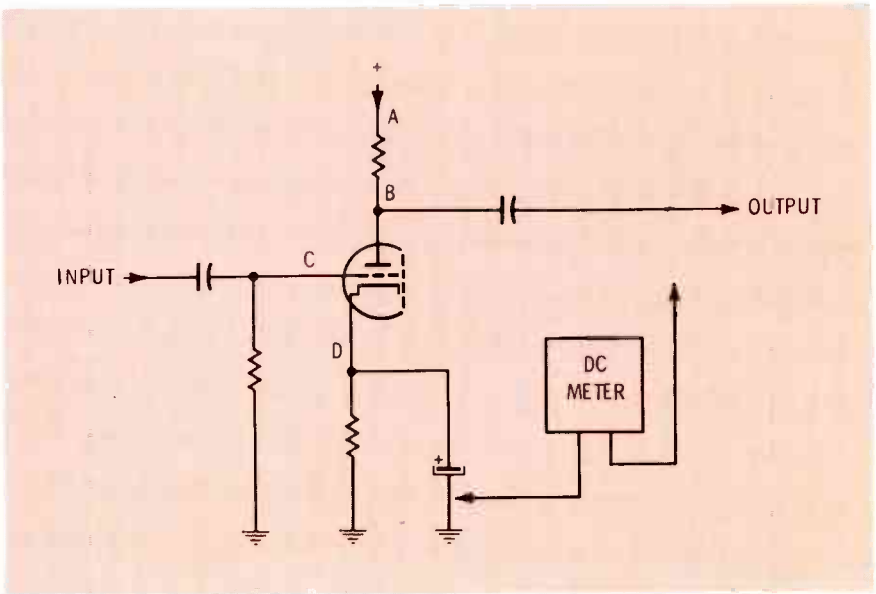


Fig. 5 In this type of audio circuit, the grid should measure zero. A negative voltage indicates either an increase of the grid resistor value, excessive signal input, or insufficient cathode voltage. If the grid is positive, the input-coupling capacitor is leaking, or the tube is gassy. Excessive tube current increases the cathode-to-ground voltage and decreases the plate-to-ground voltage. Insufficient plate voltage might be caused by insufficient bias (wrong grid or cathode voltage) or an increase in the resistive value of the plate-load resistor. An open cathode-bypass capacitor reduces the gain, but does not distort the tone.

chest which supplied one rank of pipes.

Some early electrically-operated pipe organs adapted the wind stop so it could be closed or opened by a kind of solenoid relay (Figure 9). It was only natural, then, for some of the first stops of electronic organs to be operated by relays that locked in the last position selected (Figure 10).

Tone-Wheel Hammonds

All of the older Hammond organs had electromechanical (tone wheel) generators of sine waves, and the generator shafts were driven by a synchronous motor.

Actually, there were two motors. One was a starting motor. It was a conventional type with gearing selected so it would turn the generator shafts just slightly too fast. During turn-on of the organ, the first switch position (Figure 11) energized only this starting motor (the amplifier and synchronous motor were not powered yet). After a wait of several seconds for the starting motor to reach maximum speed, the organist was supposed to flip the switch, turning off power to the starting motor, and on to the synchronous running motor and the amplifiers.

In a quiet room, you could hear the various motor speeds. First, for six or eight seconds, the speed increased and steadied, and then the speed decreased as the synchronous motor locked to the line frequency.

If the switches (some organs had two) were not operated in the right sequence, or the starting motor not allowed to run long enough, the synchronous motor would not start. In such cases, the amplifiers were okay, but the organ would not play a single note.

The motor and generator bearings were supposed to be oiled constantly by a filling of the oil reservoirs every six months. A few organists who did not listen to the explanation and wouldn't read the instruction book ended with frozen bearings, after failing to have the organ oiled. In fairness to Hammond, we must say the organs often ran for three or four years without oiling before any problem occurred.

Few of these synchronous motors ever burned up from improper starting. The reason is that the resistance of the windings was very high, thus preventing excessive current in a stalled motor. In fact, the Model M3 had an input for a phonograph, and the instructions

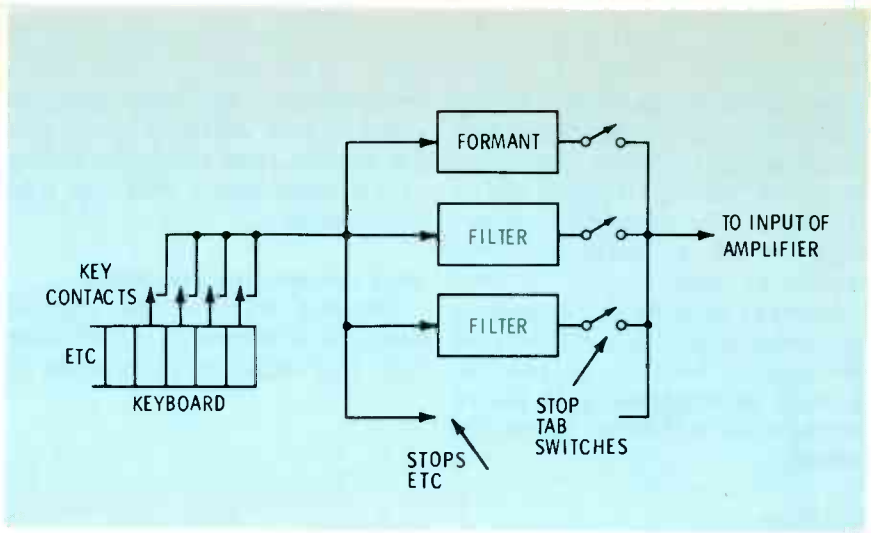


Fig. 6 Organs that key the audio directly, as shown, are not likely to lose all notes at once, except because of a loss of supply voltage to all the oscillators. Notice which notes of what stops are wrong; usually it's not difficult to figure out where the defect begins.

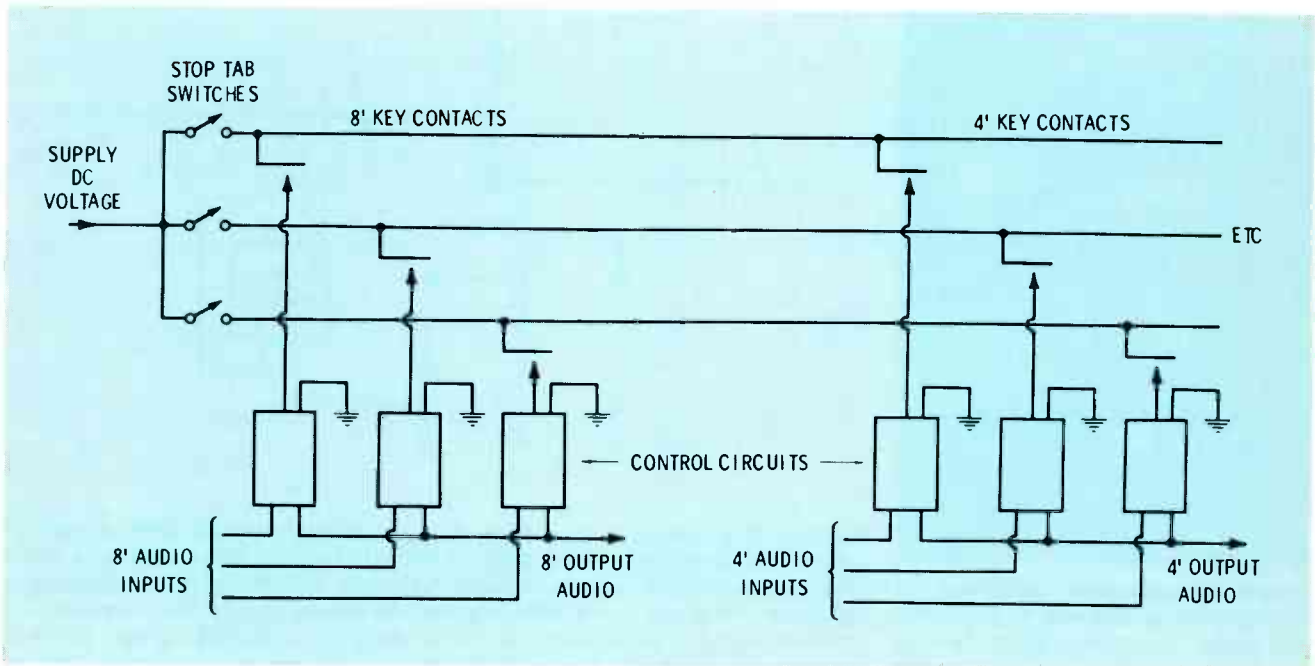


Fig. 7 A loss of the supply voltage probably would eliminate all notes of any organ using this kind of circuit. Defects in the key contacts or the control circuits can silence any one note.

stated the organ was to be turned on without using the starting switch. The amplifier was on to amplify the phono, but the motor and generator shafts were not turning.

Swell-Pedal Problems

One potential source of a dead organ, surprisingly enough, is the swell-pedal circuitry. Some older organs (and perhaps new economy models) simply used an audio-taper potentiometer (Figure 12) that was rotated by gears from the expression pedal, or by metal linkages.

Many organists operate the swell pedal continuously, and even a heavy-duty pot eventually will become noisy. In some cases, the element has broken or worn through, and this stops all sound.

Other basic types of swell controls were designed by manufacturers trying to improve the reliability. One solution that appeared in several versions was to use an air-dielectric variable capacitor (Figure 13), which was similar to those found for years in AM radios. These circuits worked quite well, with occasional problems from moisture or dust inside the plates.

Figure 14 shows another low-noise swell circuit. Early models used a variable-mu tube, and had a variable negative voltage from the potentiometer as grid bias. Noise from the control and hum could be filtered out by the capacitor connected across the control voltage. Other models used a similar idea to change the bias of a transistor, or FET.

Lower distortion can be obtained from the expression circuit of Figure 15. The DC control voltage (filtered to remove hum and noise) varies the brightness of a small bulb in a light-tight assembly. More light causes the CdS "light-depen-

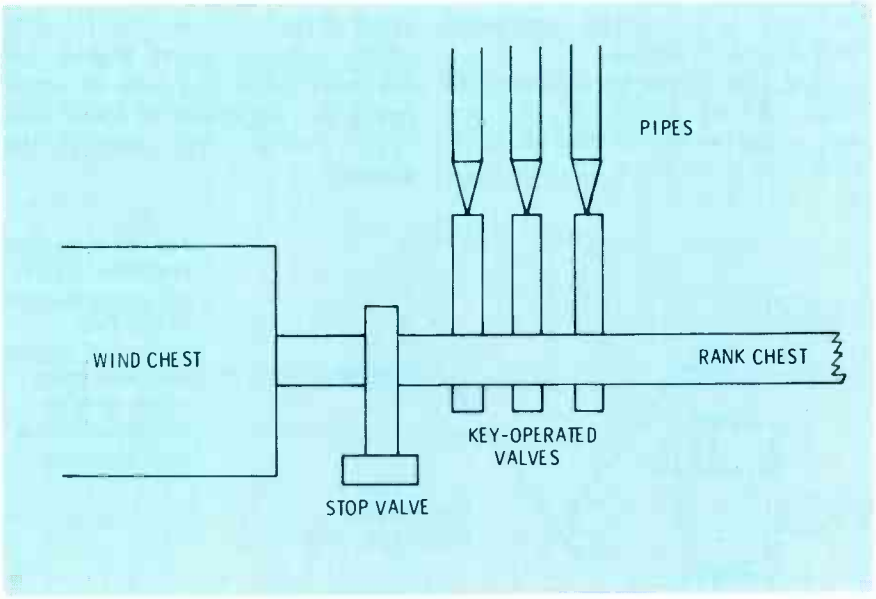
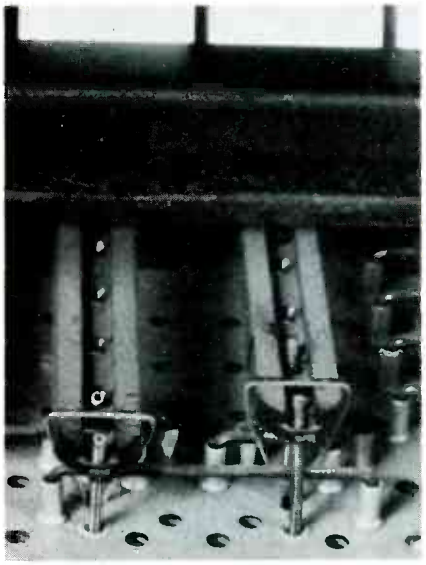


Fig. 8 Ancient "tracker" pipe organs had an air "stop" valve for each rank of pipes, and the notes of the keyboard mechanically controlled the air going to the individual pipes from the wind chest. It took a strong man to play such an organ, when several stops were "pulled"!



Most stop switches have a "snap" action, to prevent intermittent contacts. When this stop is moved about half way or more, the spring action pulls the switch spring tightly against the bus wire.

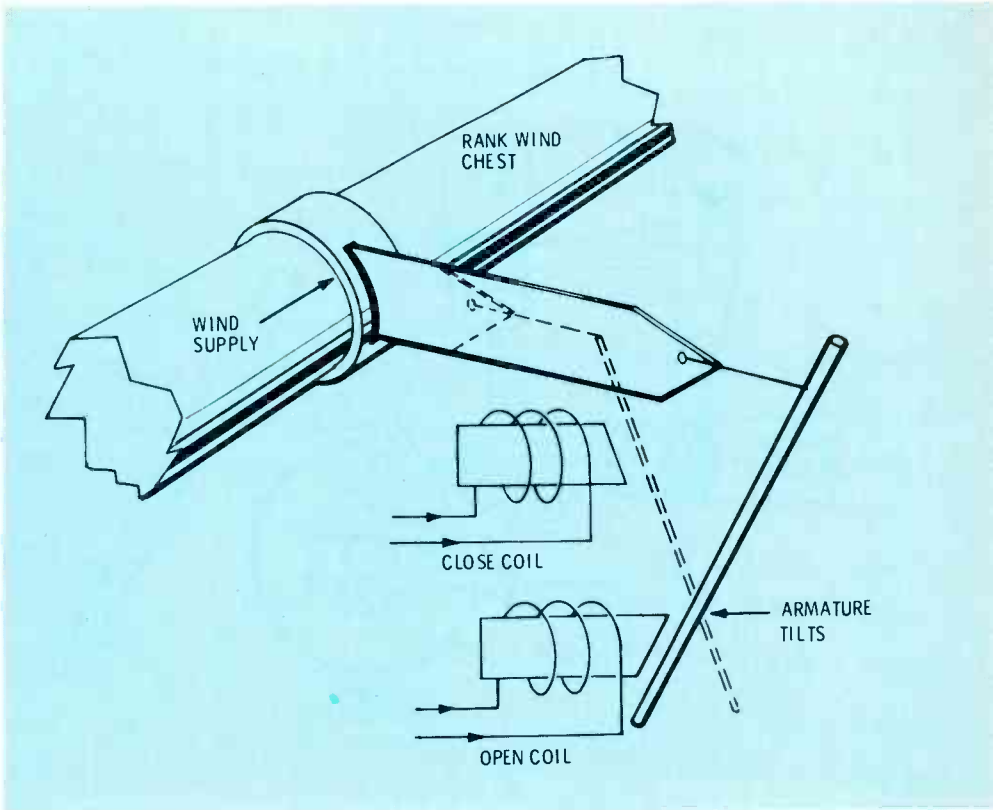


Fig. 9 The first electrically-operated pipe organs changed to solenoid operation of the wind "stops".

dent" cell to reduce its resistance, thus varying the amount of signal applied to the main amplifier. A burned-out bulb eliminates the volume.

Dead Notes

A failure of just a few notes (perhaps only one, or one pitch of one note) is a common complaint with electronic organs.

First, you should try all notes, all stops, and all pitches (8', 4', etc.) and make a list of any failures. Next, you must know whether each note has a separate oscillator circuit, or whether the notes are generated by 12 oscillators followed by dividers to provide the lower octaves.

For example, let's say the organ is a Conn, with a separate oscillator for each basic note. However, the same oscillator is used for an 8' pitch of one note, for the 16' pitch of the note an octave higher, and for the 4' pitch of a note an octave lower. It's important to know these facts, because they simplify the analysis.

Suppose middle "A" of the 8' stop is dead. There are two main possibilities. The oscillator circuit might be dead; or the key switch might not be making connection. Which is it?

Try the "A" one octave above middle "A" with the 16' stop down. If it plays, the oscillator (also used for 8' middle "A") is okay, and the trouble probably is the key switch under middle "A". But if it doesn't sound, the 8' middle "A" oscillator is dead. Of course, the test can include the 4' stop of "A" an octave below middle "A", in the same way.

With oscillator/divider organs, the first part of the analysis is the

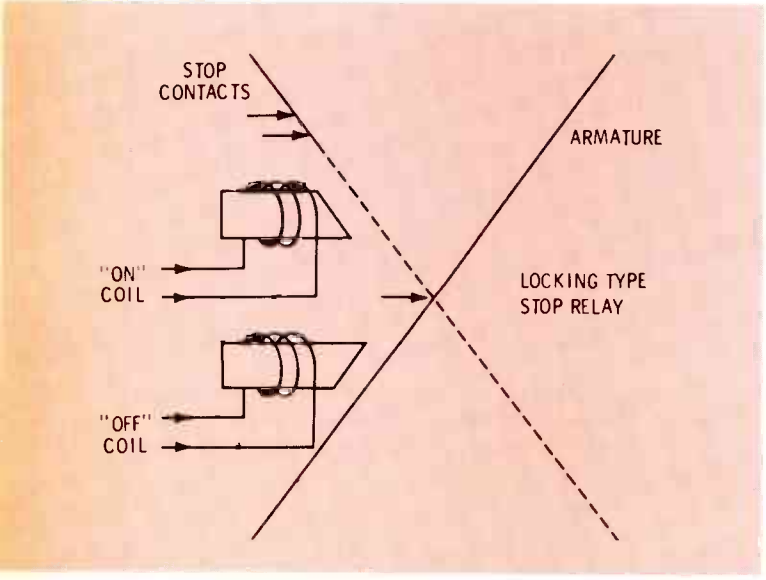


Fig. 10 Pipe-organ practices guided the manufacturers of the first electronic organs, and they used solenoid-relay activation of the stop switches.

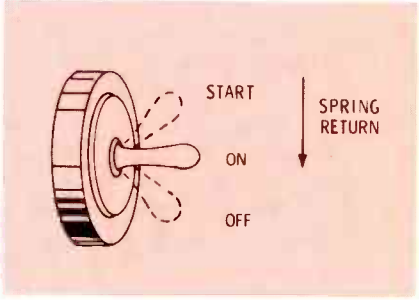


Fig. 11 Hammond organs, which had the tone wheels, had either two switches for starting the synchronous motor, or a single switch (as shown) with three positions. The "start" position was of the spring-return type, so it could not be left in the wrong position after the starting time was over.

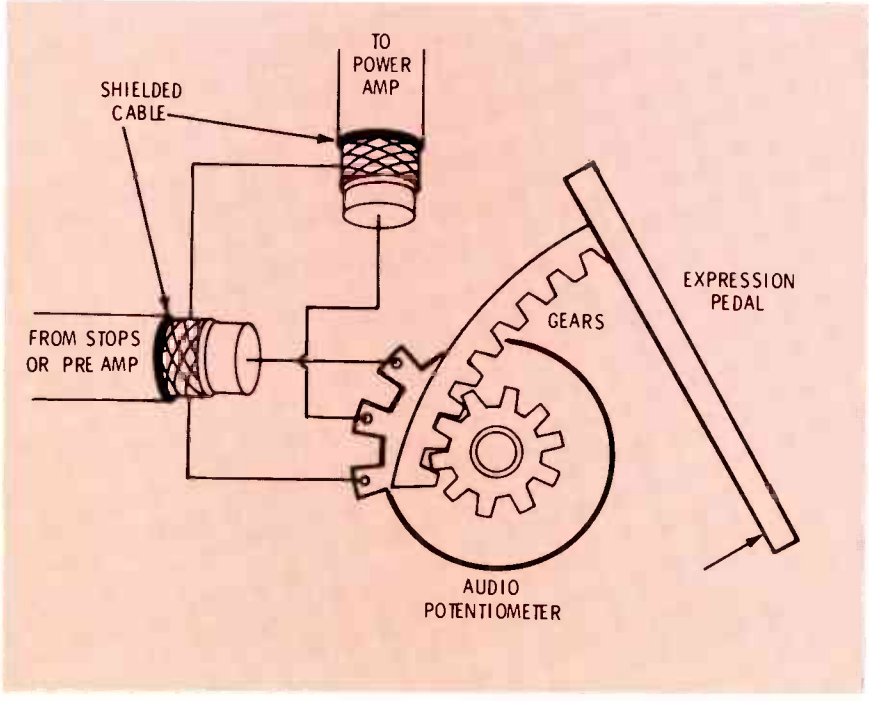


Fig. 12 Some expression pedals rotate a heavy-duty audio potentiometer by a system of gears. The carbon elements can wear out, causing noise or intermittent operation.

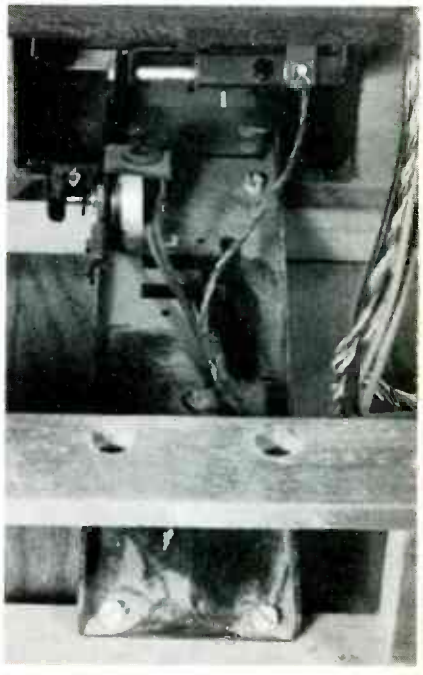


Fig. 13 A few organ models merely used a couple of metal linkages to turn the potentiometer expression control over part of a revolution.

same. However, there is one important difference. A dead divider also eliminates all of the same notes below it. Let's say the 8' "B"-flat in the middle octave is dead. If the problem is in the divider, rather than the key switch for that note, then all the "B"-flats of all octaves below it will be dead, also.

Swapping tubes

Cross-switching tubes to see if the defect moves with the tubes is a time-saving technique. For example, with an old Baldwin which has three 6SN7 tubes in each of the 12 generators (oscillator/divider type), move all the tubes from the bad generator to another that is normal. If the problem stays with the original bad note, the defect is in the generator circuit; but when the problem changes to the other note, the cause was a bad tube.

Tube sockets occasionally become intermittent or open, particularly the 9-pin types. A temporary cure often can be obtained by spraying tuner cleaner in the socket holes, and wiping the prongs of the tube with a cloth moistened by tuner cleaner. Check for intermittents by playing the bad note as you rock the suspected tube in its socket.

Key contacts

Key contacts (switches under the keyboard) often cause trouble. Many are made of small-diameter spring wire, and can become bent or misshaped.

Many manufacturers specify that the switch should close when the keyboard note is depressed to about half of the maximum movement. Some caution and experience are needed to adjust these key contacts, and it can be a tedious job when many need adjustment.

If you must bend a contact wire, it's best to bend it near the mounting point, and not near the tip.

Some organs have bus-bar adjusters, which can be used to move the larger, common part of the contacts to either side, thus exposing an unused area where the spring can make better continuity. This is much preferred to any attempt to clean the springs or bus-bars individually.

Next Month

More typical organ repairs and troubleshooting methods will be presented next month. □

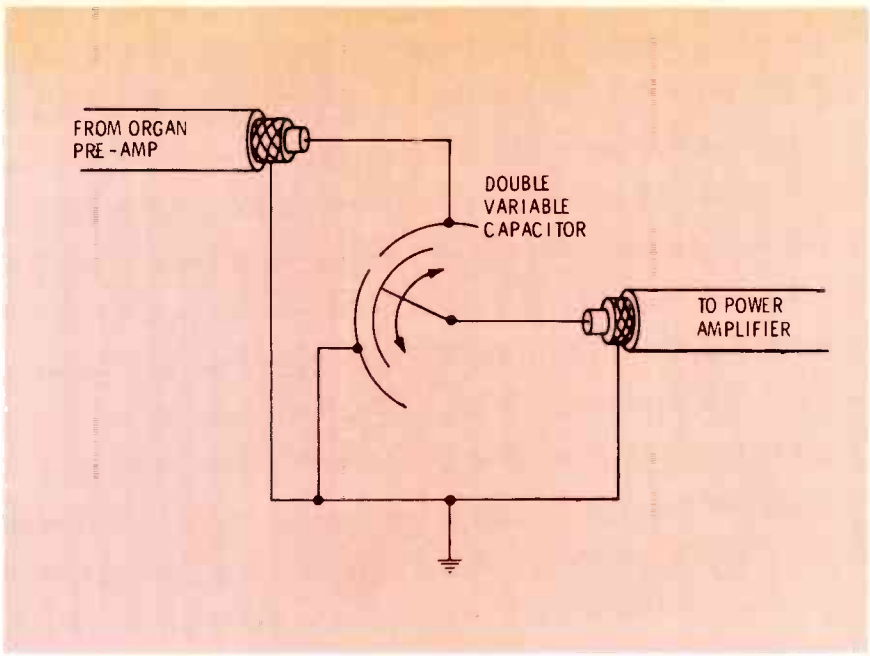


Fig. 14 Variable capacitors of the aluminum-plate, air-dielectric type used in radios were included in some organ designs. These generally were dependable and not subject to failures, but dust or moisture in the plates caused noise or intermittents.

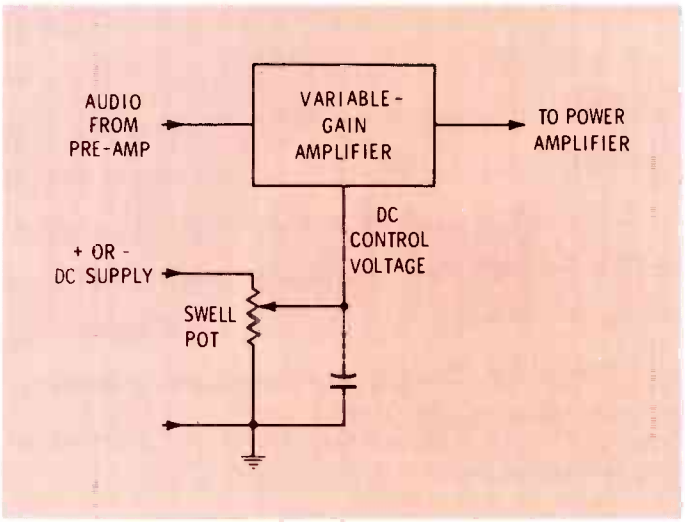


Fig. 15 One low-noise variation of the potentiometer expression control used the pot to develop a variable DC voltage, which was filtered to remove hum and noise before it was used to control the gain of a tube, transistor, or FET amplifier.

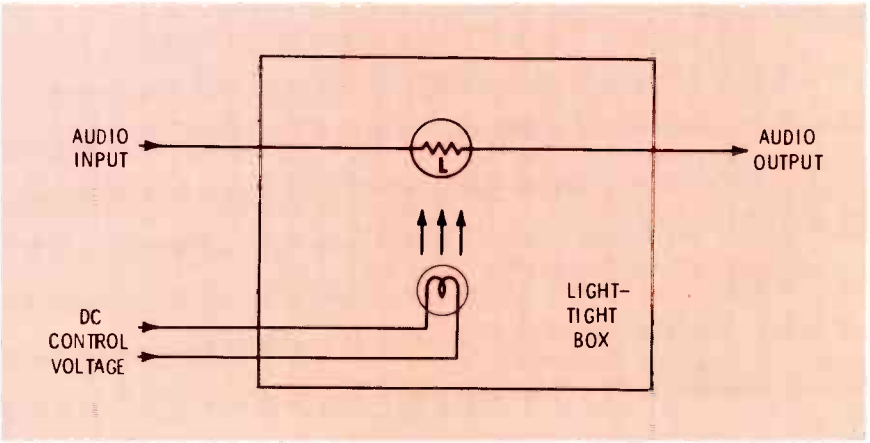


Fig. 16 Light-Dependent-Resistors (LDR's) function very well in expression circuits; the distortion is very low, and the bulb-control voltage can be filtered to remove hum and noise. The LDR's seldom fail, but a burned-out bulb can eliminate almost all volume of the organ.

Fig. 1 In a space smaller than 3-1/4 X 5-3/4 X 1-7/8 inches (when closed, and including two batteries), the Hickok Model 239 color-bar generator produces nine useful test patterns of perfect stability.

Reports from the test lab

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.

By Carl Babcoke

Three products (tiny color-bar generator, function generator, and a frequency counter) from **Hickok** are reviewed this month.

Hickok Pattern Generator

Nine different patterns of excellent quality and stability—this phrase sums up the features of the Hickok Model 239 Color-Bar Pattern Generator (Figure 1).

Two 9-volt batteries take up almost half of the room in the case, and that illustrates the extreme miniaturization made possible by Large-Scale Integration (LSI) of the modern count-down digital circuits. Another space-saving technique is found in the selector switches. Two slide-type switches, each having three positions, determine which pattern modulates the RF carrier. A single rotary switch would have required much more space.

Drawings of the various patterns, as they appear on the screen of a color TV, mark the 8 positions giving dots and bars. The color-bars position says "GATED RAINBOW". A sliding control adjusts the intensity of the color bars to 150%.

A toggle switch turns the generator power on and off. A metal bracket in the lid flips the switch to "off" whenever the lid is closed, thus preventing discharge of the batteries because of someone's memory lapse.

On the left, a small jack connects an external battery charger that's used when the 100-182 kit (including NiCad batteries) is added.

Late-production versions bring out the RF through a phono jack on the right side of the case. A screwdriver adjustment (accessible through a hole in the panel)

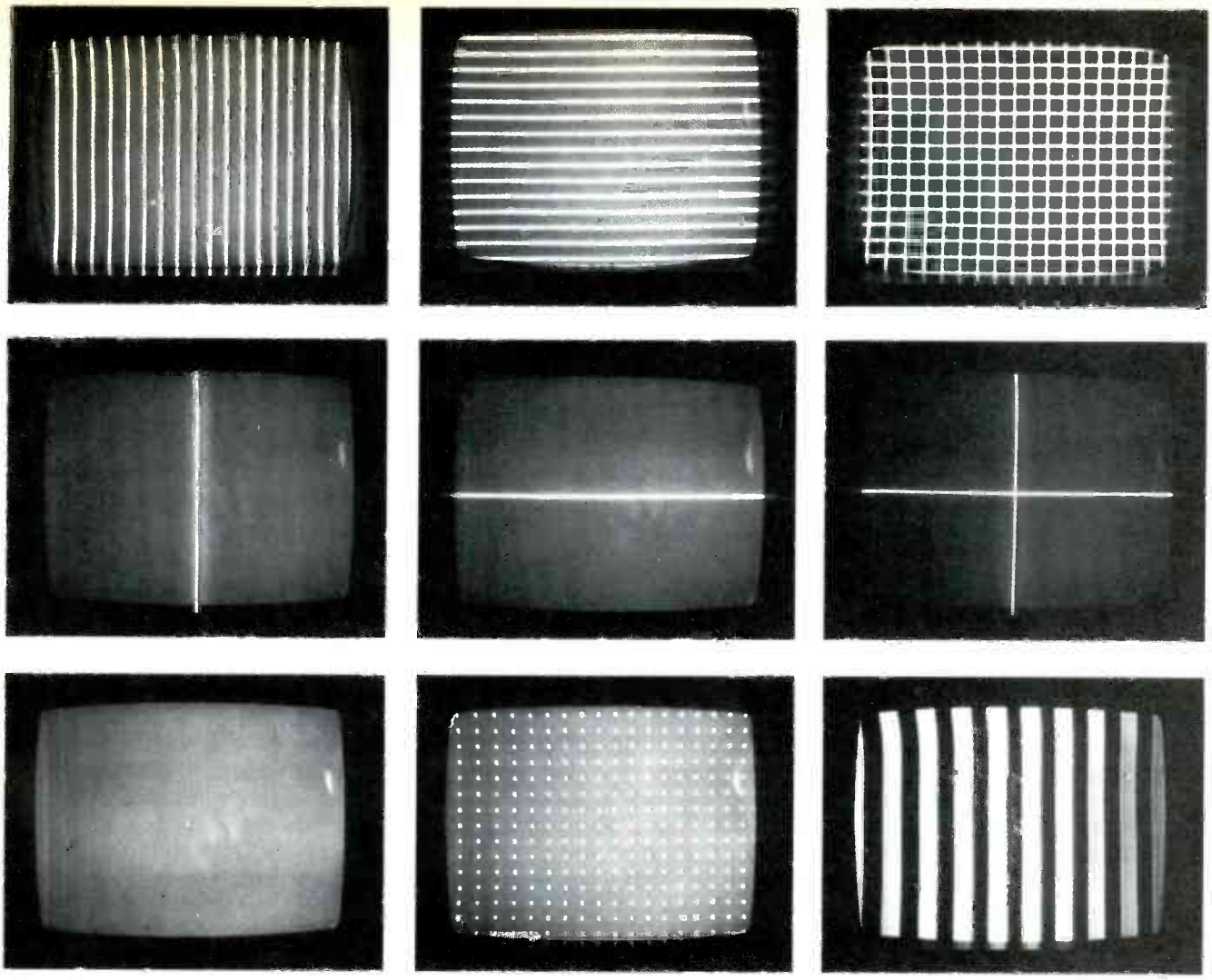


Fig. 2 The Model 239 Hickok generator showed these patterns on the screen of a GE color receiver. Top photo, the bottom switch was at the left position, and the switch at the right was at the top. Moving the right switch to the center position gave one vertical line at the middle (center photo), and moving the right switch to the bottom produced one single dot at the middle of the screen (bottom photo).

Fig. 3 Moving the bottom switch to the middle position, and moving the right switch from top, to middle, and to bottom positions gave these pictures.

Fig. 4 With the bottom switch in the extreme right-hand position, these pictures were obtained on the screen of the color receiver.

permits you to change the carrier anywhere between Channel 2 and Channel 4, according to which one is not used in your area.

Figure 2 shows actual photos of the three patterns obtained with the left position of the selector that moves horizontally. Patterns from the center position of the selector are shown in Figure 3; and the last three patterns are in Figure 4. The gated-rainbow color bars are on top of pedestals so the spaces between bars are black.

Because crystals are used for control of the color-bar 3.56-MHz carrier, and for the top frequency that is divided by digital logic down to the other displays, the patterns all had perfect stability.

Lines and dots were very narrow and sharp. There are more lines than the number available with many larger generators, and I like the squares that are produced when perfect linearity is obtained with the crosshatch pattern.

Model 270 Function Generator

Perhaps we should explain first the definition of "function generator". Basically, a function generator is an audio generator with several waveforms, plus several extra features.

Usually, sine, triangular, and square waveforms are supplied, and that is the case with the Hickok Model 270 (Figure 5). The basic waveform is triangular, and it is shaped by several stages of diode clippers into a low-distortion sine wave. Square waves are created by filtering. Special IC's make these waveforms possible in fairly-simple, low-cost circuits. Any attenuation

Fig. 5 The Hickok Model 270 Function Generator not only produces sine, triangular, and square waves between 1 Hz and 1 MHz, but by use of some connections in the rear, also can generate sawteeth and pulses.

follows the waveform shaping stages.

The oscillators are equally unusual. Tuning of the desired frequency is accomplished by rotation of a potentiometer that provides a variable DC voltage to the Voltage-Controlled Oscillator (VCO). The pot is calibrated in frequency.

One feature, rarely used for repair work, is that the output waveform can ride on an adjustable DC voltage, perhaps from +10 to -10 volts.

Most function generators (as a bonus from the VCO oscillators) have provision for a change of frequency either in steps or a gradual change, from application of a suitable DC voltage or waveform from an external source. More about that later. Also, several calibrated and one variable uncalibrated attenuators are supplied.

The Hickok Model 270 Function Generator has all of these features, and more.

Six push-button-selected decade ranges provide coverage from 1 Hz to 1 MHz. For example, the first range is from 1 Hz to 10 Hz; then 10 Hz to 100 Hz, etc. Sinewave amplitude exceeded 9 volts RMS.

Frequency response was very good between the low and high ends of each range, and between the various ranges, except for the highest range. The dial calibration is not necessarily accurate above 200 KHz; also the amplitude falls above that frequency. Only expensive lab-type generators exceed those specs.

Pushbuttons select sine, triangular, or square waves (Figure 6). Waveshapes of the square waves at the frequency extremes were very good, as shown in Figure 7. Between the usual Hi-Fi limits of 20 Hz to 20 KHz, the square waves were perfect.

Incidentally, this is the first time I have photographed a 1-Hz square wave. All I could see at any time was just a dot of light that moved slowly across the screen, alternately high and low. The low sweep range of the B&K Model 1470 scope made possible such a photo.

Other waveforms

On the back of the Model 270 is an edge connector. When you connect together two of the terminals of the female connector which is furnished, and provide a resistance between two more terminals, then sawteeth or pulses are produced. Figure 8 shows the progression from the nearly-symmetrical triangular waveform with 100K resistance to the sawteeth (at bottom) when the resistance was zero ohms. Also, you will notice that the number of cycles increases as the retrace time of the sawteeth becomes shorter. That means the dial calibration no longer is accurate, and you must use another means of determining the repetitive frequency.

The method of obtaining negative-going pulses is similar. The connector in the rear is prepared, but the "function" pushbutton for square waves is pressed. Figure 9 shows how the width (and repetition rate) of the pulses varies as the external resistance is varied. Narrowest pulses are obtained with zero resistance. Again, the repetition rate changes as the pulse width is varied.

These extra waveforms are a real bonus, and the small disadvantage of the loss of dial calibration is more than offset by the nearly zero added cost.

Swept audio

Two more interesting things can be done with this function generator, by using the connectors on the

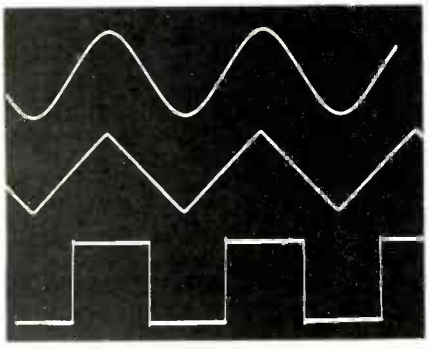


Fig. 6 These are the three basic waveforms generated by the Model 270: sine waves (top); triangular (center); and square waves (bottom).

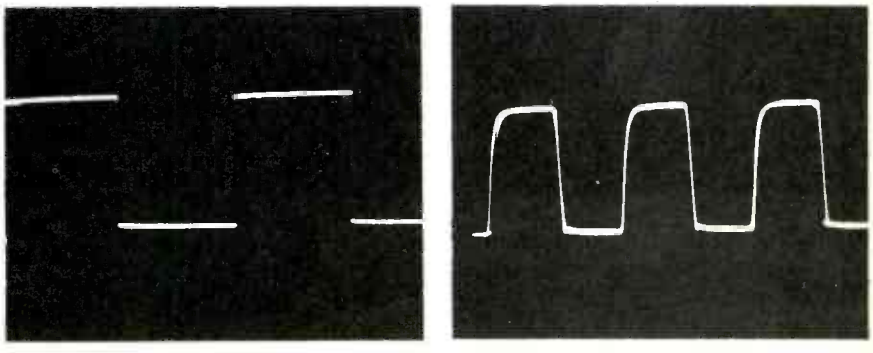


Fig. 7 These waveforms were taken at the extreme frequencies of the Model 270. At the left is a perfect 1 Hz square wave (the first one I ever have seen). 200 KHz square waves show rounding of corners and slowing of the rise and fall lines (right photo), but probably some is due to the scope.

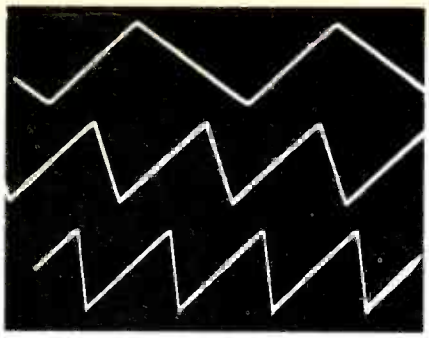


Fig. 8 By wiring the rear connectors of the Model 270, triangular waves can be tilted into sawteeth. The effect of a 100K resistor is at top; about 10K produced the sawteeth of the center trace; and zero ohms gave the sawteeth shown at the bottom. Lower resistances also increased the repetition frequencies.

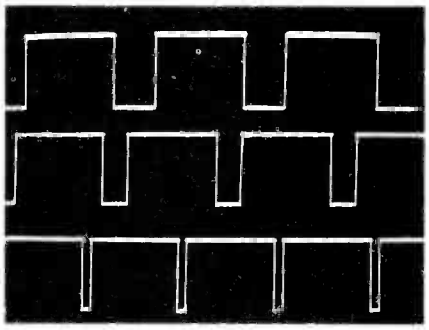


Fig. 9 Starting with square waves and the recommended wiring of the rear connector gave these pulses. At the top a 50K resistor gave these broad pulses. Decreasing the resistor to about 10K ohms narrowed the pulses and increased the repetition rate (center trace). A zero-ohms resistance produced these narrow pulses (bottom). The vertical lines have been drawn in; otherwise the lines would appear to be unconnected.

rear. The frequency can be changed by application of DC voltage to the right pin. If the voltage is changed in specific steps, the frequency will change in the same way. It's possible to obtain an effect sounding like an electronic organ.

An input of a sawtooth, when the controls are set correctly, will produce a swept audio (that is, the frequency gradually changes from low frequency to high, and then repeats). I tried sawteeth from another brand of function generator, and had fair results. Hickok says (and I believe them) that another Model 270 wired to produce sawteeth would sweep a wider frequency band. Such a swept-audio test can furnish very-rapid response curves of moderate accuracy when viewed on a scope.

Hickok Model 380 Frequency Counter

Hickok certainly must have had CB technicians in mind when they developed the 380 series. Four models are offered. One counts up to 80 MHz and has an overall accuracy of 10 parts-per-million (Model 380). Model 380X is similar, except for the temperature-compensated crystal oscillator which gives an overall accuracy of 1 part-per-million (PPM).

Model 385 is a dual-range counter. The low range counts from 1 Hz to 80 MHz. It has two input connectors, and the one for the low range has an impedance of 1 megohm. The second connector (with an impedance of 50 ohms) permits counting from 10 MHz to 512 MHz. Model 385X is similar, except it has a temperature-compensated oscillator, providing an overall accuracy of 1 PPM.

Both the 380X and the 385X have connectors on the back giving a buffered 1 MHz output signal from the low-drift timing oscillator. Models 380 and 385 each have a connector on the back to accept an external 1-MHz timing signal.

Therefore, a single 380X can drive up to four 380's, providing high-accuracy readings for all five counters. Similarly, a single 385X can drive four Model 385's, giving an accuracy of 1 PPM.

All models have automatic selection of either 0.1 second or 1.0 second, according to which gives the best accuracy of readout. Or, if you want the fastest update, a pushbutton switch (AUTO/SPEED-READ MODE) locks in the 0.1-second mode. The decimal point moves automatically as well.

No input-level control is used, and the inputs are protected against excessive voltage (the exact voltage depends on frequency).

In appearance, all four models are similar (see Figure 10 for 380 and 385 pictures), except for the extra input connector and input switch on the 385 models.

We examined a Model 380 Hickok Auto-Ranging Frequency Counter in the lab, and were very favorably impressed by the convenience and accuracy of the readings. All models have seven 0.3-inch LED digit readouts. □

Fig. 10 Here are two of the four Model 380 series of Autoranging Frequency Counters from Hickok. At the left is Model 380, which counts to 80 MHz, and Model 385 (a dual-range version) is shown at the right.

productreport

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

Multi-Purpose Tool

A multi-purpose hand tool that performs a wide variety of assembly and maintenance chores is now available from **Hollingsworth Solderless Terminal Company.**

The Multiplier cuts and strips wire, cuts six common sizes of bolts and screws, and crimps insulated and non-insulated terminals to wire sizes 22-10 AWG. Equipped with plastic-coated handles, the Multiplier also features a tapered nose with serrated surfaces which serves as needle-nose pliers. Each wire, bolt, and terminal size that the tool handles is engraved on it. Complete instructions are furnished with each tool.

For More Details Circle (30) on Reply Card

Tuner Guide and Parts Catalog

A new 134-page tuner-replacement guide and parts catalog is now available from **PTS Electronics.**

The new catalog, Number 6, features extensive listings of all major makes and models of tuners and replacement parts and includes photo enlargements of tuners, enabling quick detection of a tuner problem and easy location of the correct replacement part.

The catalog also includes considerable detail about PTS products; it sells for $2.

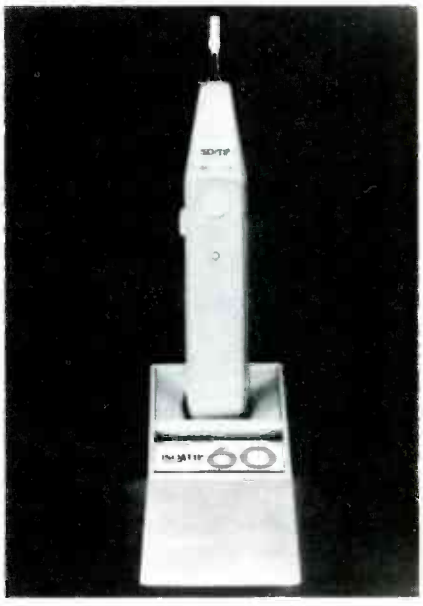
For More Details Circle (31) on Reply Card

Cordless Soldering Iron

Wahl Clipper Corporation introduced its new "Iso-Tip 60" cordless soldering iron at the recent NEW-COM show in New Orleans.

The low-voltage, battery-operated, ground-free unit is the first that can be recharged from "dead" to "full" in one hour. With the "60", the user can enjoy virtually uninterrupted service from a single unit.

The "Iso-Tip 60" has the capacity for up to 125 or more electronic joints on a single charge. It can be kept at a constant "full" charge by resting it in the recharge stand between joints. The iron will accept a very fast charge when the battery is down, then switch to a trickle rate for maintenance purposes. An LED indicator shows when the charge is full.



The "Iso-Tip 60" kit, #7800, includes a recharging stand, a fine tip, a chisel tip, and an instruction booklet.

For More Details Circle (32) on Reply Card

CB Home-Study Course

ATIA (Associated Technical Institute of America) has announced a new audio-visual, self-teaching, CB radio-operator course for CBers, retailers and store sales personnel.

The home-study course is designed to help everyone, whether beginner or 18-year veteran, understand CB radio electronics and applications, instead of learning just facts and figures. It includes easy-to-understand Autoinstruction-method lessons of programmed, step-by-step training in all phases of CB radio operation, installation, and troubleshooting. Also included is a pre-recorded cassette with samples of conversations covering a variety of communication situations, plus tips on microphone technique, etc.

Price of the ATIA CB radio operator course is $19, plus $1.95 for shipping and handling.

For More Details Circle (33) on Reply Card

test equipment report

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Test Jig Adapter

The **RCA** 10J107 test jig adapter increases the capability of present test jigs, permitting the servicing of color TV receivers produced by some 45 manufacturers, including tube, hybrid, and solid state models.

Horizontal and vertical yoke impedances can be matched to a wide range of TV receivers by means of front-panel switches, thereby eliminating the need for transformer adapters and plug-in switch units common to most other jigs. The 10J107 also can be used to update earlier RCA test jigs 10J102; 103; 104; and 105.

User price of the 10J107 is $89, and includes a low-impedance yoke, yoke-extension cable, ground lead, test jig yoke cable, and complete instructions.

For More Details Circle (36) on Reply Card

Color Test Rig

The Universal PJS-298 test rig for tube and solid state color-TV chassis will accept thousands of chassis listed on the **Telematic** cross-reference chart.

The PJS-298 incorporates a special 33KV 19" leaded-glass CRT to protect technicians from any radiation produced by the increased high voltages of the newer color receivers.

Included as standard equipment: 40KV meter with 50 microampere sensitivity for accurate, low drain monitoring of the anode voltage; and a built-in speaker which hooks-up with alligator clip extensions.

Accessories include: convergence yoke assembly; blue lateral assembly; convergence load; transverter (TA-3000); 90° CRT extension; yoke extension; safety anode extension; universal yoke; and an up-to-date cross reference.

Suggested price of the PJS-298 is $229.95.

For More Details Circle (37) on Reply Card

Frequency Counters

A full 8-digit LED display, a high-stability TCXO internal reference, and overdrive protection now are available as standard equipment on the Series 7500C frequency counters from **Dana Laboratories**. All three features were previously options costing $250.

The standard 8-digit display provides 10 times greater resolution than was previously available on the standard 7500 series counters. The overdrive protection is a fuse between the 50-ohm input and the attenuator circuitry, protecting from input signals exceeding 5 volts. Sinewave sensitivity is 15 mV rms through the entire frequency range to 1 GHz. The Model 7580C measures signals up to 1 GHz with automatic gain control from 15 mV to IV rms; the 7570C to 600 MHz.

For More Details Circle (38) on Reply Card

Frequency Counter

A frequency counter has been added to the **Non-Linear Systems'** line of miniature, battery-powered test instruments. The portable FM-7 frequency meter will monitor frequencies from 10 Hz to 60 MHz and display the frequency to seven digits, using 0.25" high LED's. Input sensitivity is 30 millivolts RMS from 50 Hz to 30 MHz, and 100 millivolts RMS from 10 Hz to 60 MHz, with a 1-megohm input impedance. It has an input-signal overload capability of up to 250 volts RMS at 500 KHz. The gate time is 1

second, giving a resolution of 1 Hz below 10 MHz and 10 Hz from 10 MHz to 60 MHz. Accuracy is ±1 digit; there is only a ±10 PPM change over a temperature range of 0°C to 40°C.

Priced at $195, the FM-7 comes with rechargeable NiCad batteries and a charger unit. Options include a panel-mount flange, a tilt stand, and a leather case.

For More Details Circle (39) on Reply Card

antenna systems report

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

Rotor Bearing

Unarco-Rohn has a new thrust bearing (TB-3) for mounting antennas.

Made of heat-treated cast aluminum for extra strength, the bearing incorporates 30 stainless-steel bearings in a race that is protected from the elements. Three lock nuts fasten the antenna mast in position, thus relieving the weight of the antenna on the rotor and allowing a free turning movement.

For More Details Circle (40) on Reply Card

Amplified FM Antenna

JFD Electronics Corporation has produced a miniature electronic FM antenna.

The FM500 provides the following features: a built-in solid-state transistor amplifier that has a noise figure of less than 4 dB; an omni-directional capacitive end-loop folded-dipole element; a shielded coaxial cable; and a 75-300 ohm matching transformer for matching the antenna to an FM tuner.

The FM500 mounting kit includes antenna, power supply, 10-ft. coaxial cable and mounting hardware. List price is $51.95.

For More Details Circle (41) on Reply Card

Coaxial Cable Kits

Three new pre-cut coaxial cable kits are available from **Hy-Gain Electronics**.

Kit #523 includes a 3-foot RG58/U coax with PL-259 type connectors for use between transceiver and station accessories, such as preamps, power meters, or antenna matchers.

Kit #524 includes an 18-foot RG58/U coax with a PL-259 connector at one end and lugs on the other. This kit has been designed for mobile installations, and can be used as a replacement coax for CB antennas, such as Hy-Gain's Gypsy.

Kit #526 is a base station accessory for antenna installation complete with 50-foot RG58/U coax and solderless PL-259 connectors that slide easily through mounting holes.

For More Details Circle (42) on Reply Card

MATV Amplifier

Model A510UV from **Ava Electronics** is a UHF-VHF-FM amplifier for MATV systems.

Both 300-ohm and 75-ohm inputs are furnished, bandwidth is 50-900 MHz, and the output can reach +30 dB without overload. The circuit provides surge lightning protection, and the power supply has a transformer for isolation.

Model A510UV lists for $37.95.

For More Details Circle (43) on Reply Card

Coax Switch

The two-position coax antenna switch from **Breaker Corporation** permits quick change-over from single to duals, or other CB antenna arrangements.

Model 13-200 has a single SO-239 transceiver input connector that can be switched to either of the two SO-239 antenna cable connectors. It is for mobile or base station usage, and lists for $7.95.

For More Details Circle (44) on Reply Card

Dual CB Antenna

The bumper-mounted co-phased whip combo from **Shakespeare** features 2 half-wave center-loaded antennas with Shakespeare's Diplexer harness.

Vertically polarized and matched at 50-ohms impedance, the SWR reads 1.9 to 1 or less over the entire bandwidth. Gain is 3 dB over a single loaded quarter-wave antenna.

The 76" fiberglass antenna has spring loading to protect against damage from low hanging obstacles.

For More Details Circle (45) on Reply Card

catalogs literature

Circle appropriate number on Reader Service Card.

100. Heath Company—has a free catalog that includes complete descriptions of over 400 electronic kits—from build-it-yourself color TV and hi-fi equipment to amateur radio gear. Two new products introduced are an electronic digital miles-per-gallon monitor/speedometer, and a low-cost fire and smoke detector kit.

101. Dana Laboratories—a 16-page, four-color brochure describes Dana's full line of 3-1/2 and 4-1/2 digit multimeters. A complete product line recap provides a summary of Dana's other DVM's as well as frequency counters. Included is a detailed accessory listing, as well as a color-coded specification chart covering the 3-1/2 and 4-1/2 digit multimeters. Highlighted is Dana's new 4600 digital multimeter.

102. Breaker Corporation—offers a 12-page, full-color catalog with a Bicentennial theme. The "Freedom" line of 27-MHz mobile, trucker, and base-station CB antennas and accessories is described with many application pictures. A technical reference section provides useful tips on antennas and CB rig operation.

103. Tab Books—free 44-page 1976 catalog describes over 400 current and forthcoming books, plus 14 of the firm's electronic book/kits. Some of the subject matter listed includes: Amateur Radio License Study Guides; Appliance Repair; Basic Electronics Technology; Communications—2-Way, Shortwave and CB Radio; Do-It-Yourself; FCC License Study Guides; Radio Receiver Servicing; Television Servicing; and many other subjects.

104. Mouser Electronics—offers a free 56-page electronics purchasing manual. Electronic components, test equipment, tools and production aids are some of the items featured.

105. Pomona Electronics—announces its 25th anniversary catalog of electronic test accessories. The 76-page publication includes a special new-products section, hundreds of photographs, and separate sections on molded banana plugs, banana plug accessories, molded patch cords, cable assemblies, test socket adaptors, spaced molded accessories, molded test leads, connecting leads, and IC test clips. Special charts cover a cross index of UG numbers, and an alphabetical and numerical index is included.

106. Enterprise Development Corporation—features the full line of Endeco soldering and desoldering equipment in their "Catalog 76". Included are soldering irons, desoldering irons, kits and the desoldering head that converts a soldering iron into a desoldering iron. Also shown are tips, desoldering bulbs, solder paks and soldering tool stands.

107. Cornell-Dubilier—has released their 1976 General Line Catalog and Electrolytic Guide for professional electronic technicians and engineers. The 86-page catalog provides cross references, specifications and configurations. Included are twist prong, electrolytic (aluminum) film dielectric, AC, mica dielectric, ceramic dielectric and DC Kraft. Information on CDE's relays, TV/FM antenna rotor systems and CB noise filters are also provided.

108. Fordham Radio—offers a complete line of electronic equipment and accessories in their 1976 catalog. They specialize in selling test equipment, featuring such names as B&K, Hickok, RCA, Leader, Sencore, Simpson and many others. Considerable savings are offered on receiving tubes, parts, and CB equipment. Also included are parts kits, tools, and soldering equipment.

109. Saxton Products—the 52-page catalog features coaxial and twin-lead cables for CB, amateur radio, and television use, plus antenna-mounting hardware, tools, hook-up wire, intercoms, audio connectors, and decorator telephones.

bookreview

CB Radio Accessories
Author: Leo G. Sands
Publisher: Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis, Indiana 46268
Size: 128 pages, book number 21124
Price: $4.25 paperback

Many accessories for CB transceiver radios are available factory-made, others can be constructed by the owner or a technician. Generally, accessories are used for making the operation more convenient, increasing the range, reducing interference, and preventing interference to other electronic equipment. One limitation in the addition of accessories is because of the few "interfaces" on the CB radio. Most such radios have an SO-239 coaxial connector for the antenna, a phone jack for an external speaker or public-address speaker, and a jack for the microphone. Many of the accessories described make use of these radio outlets, but some require modification internally of the radio. The book describes antenna system accessories, audio input and output devices, control systems, performance indicators, noise suppression, preamplifiers, and frequency converters.

Contents: Antenna System Accessories; Performance Indicators; Audio System Accessories; Power Supplies And Sources; Interference Prevention; Vehicular Noise Suppression; and Receiving Accessories.

Troubleshooting With The Dual-Trace Scope
Author: Robert L. Goodman
Publisher: Tab Books, Blue Ridge Summit Pennsylvania 17214
Size: 224 pages, book number 772
Price: $8.95 hardbound, $5.95 paperback

Veteran servicer Goodman's new book tells all about the dual-trace scope and its features; how to use triggered-sweep and automatic-sweep modes, dual-alternate and dual-chopped sweep modes, and all the other features. The first chapter describes several of the various models of dual-trace scopes available; it lists features, and defines the specialized operation of these scopes and their application to color TV and Hi-Fi stereo-system troubleshooting. The reader will learn the most important specs to look for before buying a dual-trace scope. Uses for the dual-trace scope are described in detail, such as stereo channel-comparison testing, stage-gain measurements, comparison of pulse widths, checking countdown and frequency-divider circuits, time measurements in delay lines, timing checks, and many more applications. The author provides tips for locating the specific problem, tells how to use a dual-trace scope to trouble-track and fault-isolate in a quarter of the time required for single-sweepers. The book is complete with some 252 illustrations.

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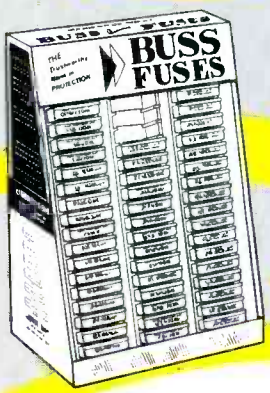

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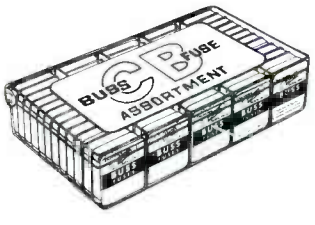

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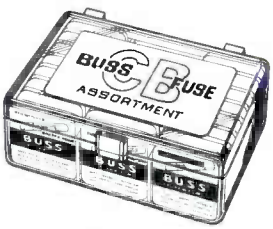

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