May, 1972 □ 75 cents

A HOWARD W. SAMS PUBLICATION

Electronic Servicing

Selling Results Instead Of Time:

flat-rate service labor pricing, page 35

HOW TO TROUBLESHOOT:

$9.75

TUNER SERVICE CORPORATION

PROVIDES YOU WITH A COMPLETE SERVICE FOR ALL YOUR TELEVISION TUNER REQUIREMENTS AT ONE PRICE.

TUNER REPAIR

VHF Or UHF Any Type $9.75.
UHF/VHF Combo $15.00.

In this price all parts are included. Tubes, transistors, diodes, and nuvistors are charged at cost.

Fast efficient service at our 4 conveniently located service centers.

1 year guarantee backed up by the largest tuner manufacturer in the U.S.—SARKES TARZIAN INC.

All tuners are cleaned inside and out, repaired, realigned and air tested.

TUNER REPLACEMENT

Replacement Tuner $9.75.

This price buys you a complete new tuner built specifically by SARKES TARZIAN INC. for this purpose.

The price is the same for *every* type of universal replacement tuner.

Specify heater type

Parallel 6.3V
Series 450 mA
Series 600 mA

All shafts have the same length of 12″.

Characteristics are:
Memory Fine Tuning
UHF Plug In
Universal Mounting
Hi-Gain Lo-Noise

If you prefer we'll customize this tuner for you. The price will be $18.25. Send in original tuner for comparison purposes to our office in INDIANAPOLIS, INDIANA.

TSC

TUNER SERVICE CORPORATION

FACTORY-SUPERVISED TUNER SERVICE

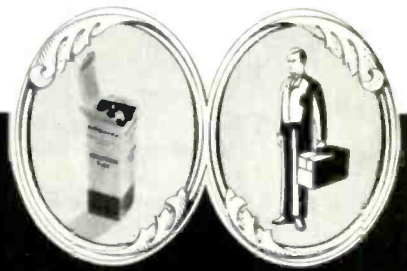
MIDWEST	817 N. PENNSYLVANIA ST., Indianapolis, Indiana (Home Office)	TEL: 317-632-3493
EAST	547-49 TONNELE AVE., Jersey City, New Jersey Highway 1 & 9	TEL: 201-792-3730
SOUTH	938 GORDON ST., S. W., Atlanta, Georgia	TEL: 404-758-2232
SOUTH-EAST	1505 CYPRESS ST., TAMPA, FLA. 33606	TEL: 813-253-0324
WEST	SARKES TARZIAN, Inc. TUNER SERVICE DIVISION 10654 MAGNOLIA BLVD., North Hollywood, California	TEL: 213-769-2720

Circle 1 on literature card

There's an Amperex replacement tube for any socket in any set you're likely to service...

TV, HiFi, FM or AM, House Radio, Car Radio, P.A. System or Tape Recorder. Imported or Domestic!

AMPEREX ELECTRONIC CORPORATION, DISTRIBUTOR SALES, HICKSVILLE, NEW YORK 11802



AMPEREX SUPPORTS THE INDEPENDENT SERVICE DEALER

Amperex®

TOMORROW'S THINKING IN TODAY'S PRODUCTS

A NORTH AMERICAN PHILIPS COMPANY

Circle 4 on literature card

May 1972 • Volume 22, No. 5

Electronic Servicing

DEPARTMENTS

Second class postage paid at Kansas City, Mo. and additional mailing offices. Published monthly by INTERTEC PUBLISHING CORP., 1014 Wyandotte St., Kansas City, Mo. 64105. Vol. 22, No. 5 Subscription rate $6 per year in U.S., its possessions and Canada; other countries $7 per year.

ELECTRONIC SERVICING (with which is combined PF Reporter) is published monthly by Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105.

Subscription Prices: 1 year—$6.00, 2 years—$10.00, 3 years—$13.00, in the U.S.A., its possessions and Canada.

All other foreign countries: 1 year—$7.00, 2 years—$12.00, 3 years—$16.00. Single copy 75c; back copies $1.

Adjustment necessitated by subscription termination at single copy rate.

Robert E. Hertel, Publisher

Intertec Publishing Corp.
Subsidiary of Howard W. Sams & Co., Inc.

¼ x 1¼" Fuses

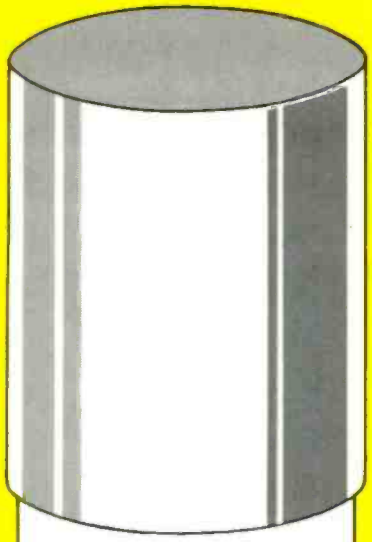
Normal Blowing Fuses
AGC GLH MTH
From 1/500 to 30 amps
for 32V, 125V, or 250V

Time Delay Fuses
MDL MDX
From 1/100 to 30 amps
for 32V, 125V, or 250V

Visual Indicating Fuse
GBA
(red indicating pin)
From ¾ to 5 amps, 125V

TRON Subminiature Fuses

MANY OTHER TYPES, SIZES, AND RATINGS AVAILABLE



Whether your requirements are ordinary or unusual,

BUSS

can supply what you need in FUSES, FUSEHOLDERS, AND FUSEBLOCKS

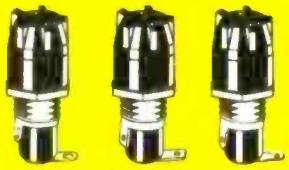
BUSS QUALITY FUSES

BUSSMANN MFG. DIVISION
McGRAW-EDISON CO.
ST. LOUIS, MO. 63107

BUSS BULLETIN SFB

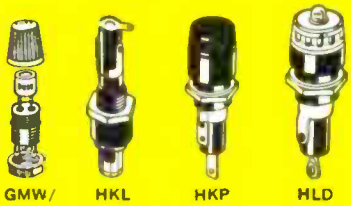
Space-Saver Fuseholders

for ¼ x 1¼" Fuses



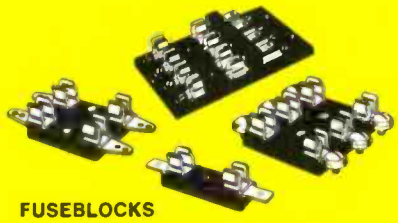
HTA HTA-HH HTA-DD

HTA (Solder Terminals)
HTA-HH (¼" Quick-Connect Terminals)
HTA-DD (3/16" Quick-Connect Terminals)



GMW/HWA HKL HKP HLD

GMW/HWA Subminiature Fuse and Holder
HKL Lamp Indicating Fuseholder
HKP Fuseholder for All-Purpose Applications
HLD Visual Indicating Fuseholder



FUSEBLOCKS
Bakelite, phenolic, and porcelain types — signal-indicating types — solder or screw type terminals, or 3/16" and ¼" quick-connect terminals available.

FUSE CLIPS — Clips for printed circuit boards and other applications — available without terminals or with solder or screw terminals.

BUSSMANN MFG. DIVISION ES—572
McGraw-Edison Co., St. Louis, Mo. 63107

Name

Title

Company

Address

City, State, Zip

electronicscanner

news of the industry

A replacement-parts telephone "hot line" has been established by Philco-Ford Corp. Intended to speed up delivery of parts to Philco's 5500 service agents, the new ordering system permits the servicer to place his order by phone from anywhere in the country, for $1 per call. The order is recorded and routed to the nearest Philco-Ford regional parts and service depot in Philadelphia, Chicago, Atlanta, Dallas, or Los Angeles, where it reportedly is filled within 24 hours.

TV, radio and household appliance dealers' sales in 1971 increased 2 per cent over 1970 sales, according to a recent report by the Bureau of the Census of the U.S. Department of Commerce. Total sales by these retailers in 1971 totaled $6,073,000,000.

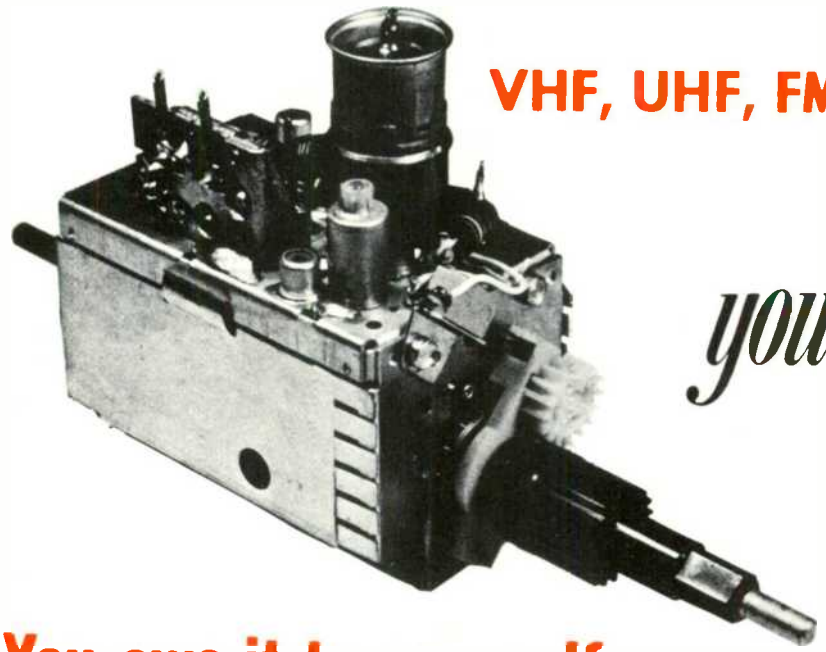
A "discrete" four-channel stereo record has been developed by RCA. The new record, according to a recent report in **Home Furnishings Daily,** employs an "additional band of indentation in the groove that carries the regular stereo signals. These indentations, which are an FM carrier, are converted to audio sounds by a special demodulator that is used in conjunction with the audio system in the home." The system reportedly provides 25 dB of separation between the front and rear channels. CBS last year introduced a 4-channel record based on a matrixing technique. The two record types and related systems reportedly are not compatible.

A new monolithic integrated circuit (IC) which decodes stereo FM signals in radios and tuners without the use of tuning inductors has been announced by Motorola Semiconductor Products. Previous designs of IC decoders usually require up to three tuned circuits which are adjusted at the factory after the IC is installed in the tuner or radio. The new IC employs the phase-lock loop principle, which eliminates the need for tuned circuits.

Zenith has realigned its service department. Edward J. Kob, formerly assistant national service manager since 1968, has been named manager, service operations, and is responsible for the departments activities in the areas of: service engineering; preparation of technical manuals and product guides; product servicing; and administration of in-warranty programs. **Richard C. Wilson,** formerly field service engineer, has been named manager of field service engineers.

(Continued on page 6)

TV TUNER SERVICE



VHF, UHF, FM or IF-Subchassis. . .
. . . All Makes

you get...

Fast 8 hr. Service!

You owe it to yourself

to try P.T.S. We are the fastest growing, oldest and now the largest tuner service company in the world. Here is what you get:

1. **Fastest Service — 8 hr. — in and out the same day. Overnight transit to one of our six plants, for parts, tuners or IF-modules.**
2. **All tuners cleaned inside and out, repaired, realigned and air tested.**
3. **On IF-modules all stages checked, all traps set with high calibre test equipment.**
4. **Fine Quality! Your customers are satisfied and you are not bothered with returning your units for rework!**
5. **Lower Cost! Up to $5.50 less than other tuner companies!**
6. **Friendly, helpful personalized service!**

1 YEAR GUARANTEE

FIRST TO OFFER 365-DAY GUARANTEE!
COLOR—BLACK & WHITE—TRANSISTOR TUNERS—ALL MAKES
GUARANTEED COLOR ALIGNMENT—NO ADDITIONAL CHARGE

We offer you finer, faster...

. . Precision Tuner Service

VHF-UHF-FM	$ 9.95
UV-COMBO	$16.95
IF-MODULE	$12.50

Major Parts charged at Net Price

CUSTOMIZED REPLACEMENTS AVAILABLE FOR $12.95 UP (NEW OR REBUILT)

LIKE TO DO IT YOURSELF?
PTS makes all tuner parts available to you.
Send one dollar (redeemable) for our
TUNER REPLACEMENT GUIDE AND PARTS CATALOG

•60 pages of top information •Blow-up of all tuners •Largest exact tuner replacement guide •Antenna Coil Replacement Guide •Multi-fit Replacement Tuner Shaft Guide

For fastest service, send faulty unit with tubes, shields and all broken parts to:

PTS ELECTRONICS, INC.

HOME OFFICE—	P. O. Box 272—Bloomington, Ind. 47401	Tel. 812/824-9331
EAST—	P. O. Box 3189—Springfield, Mass. 01103	Tel. 413/734-2737
WEST COAST—	P. O. Box 41354—Sacramento, Calif. 95841	Tel. 916/482-6220
MOUNTAIN—	P. O. Box 4145—Denver, Colo. 80204	Tel. 303/244-2813
SOUTHWEST—	P. O. Box 7332—Longview, Tex. 75601	Tel. 214/753-4334
SOUTHEAST—	P. O. Box 6771—Jacksonville, Fla. 32205	Tel. 904/389-9952

Circle 6 on literature card

(Continued from page 4)

electronic scanner

news of the industry

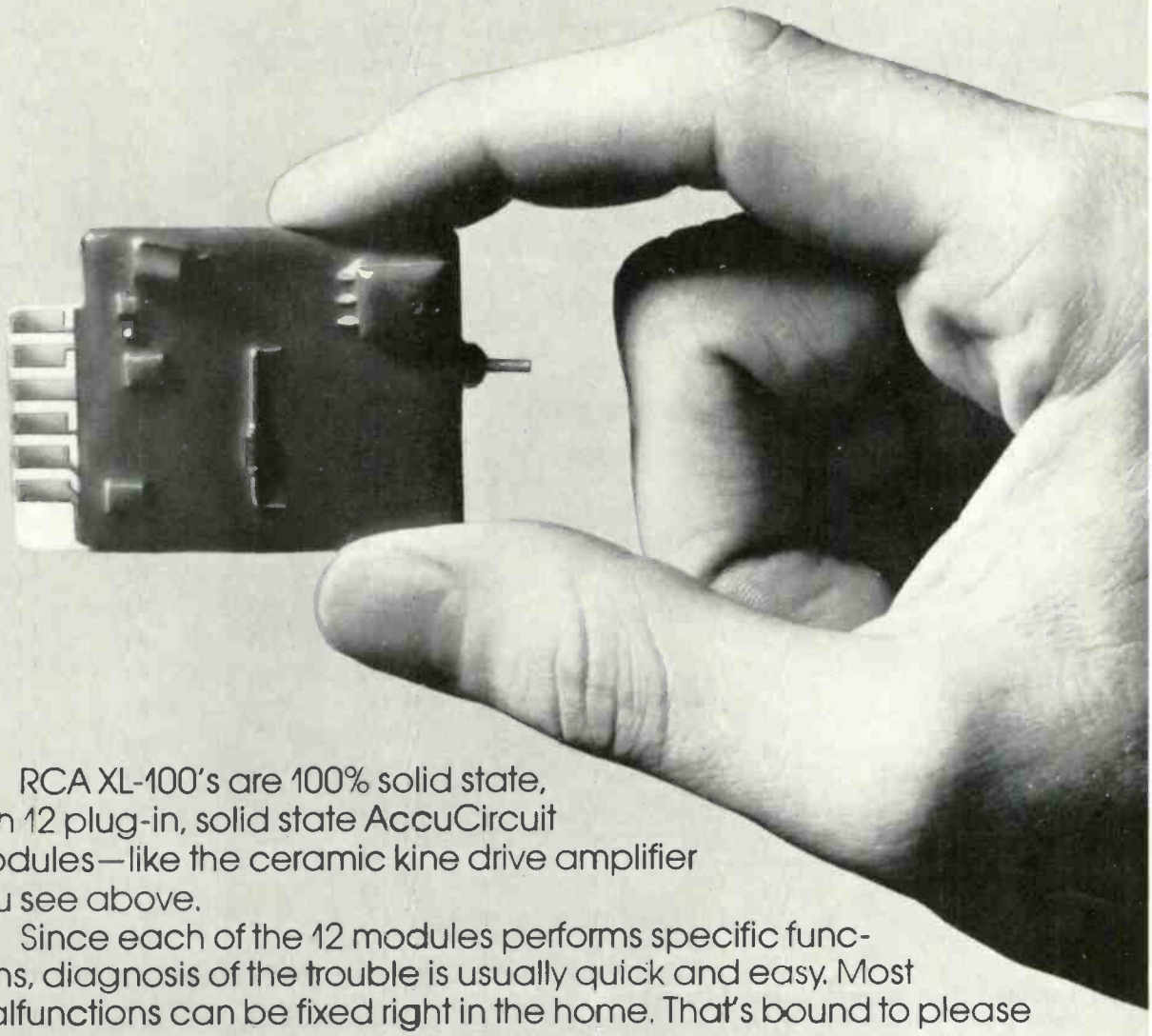
BTVision, Inc., a Blonder-Tongue Company, has filed an application with the Federal Communications Commission (FCC) for permission to operate a subscription television (STV) channel in West Orange, New Jersey. The STV station, Chanel 68, which will serve the New York metropolitan area, will use the BTVision system for over-the-air transmission, reception and decoding of scrambled TV signals. A small decoder which can be used with any conventional TV receiver will permit a subscriber to select and unscramble the STV signal.

"You'll find in the years ahead that the expense of making color TV in the U.S. will drop materially because of the increasing use of IC's."—C.W. Kepler, assistant to the general manager, consumer division of Motorola, in an interview recently in New York, reported in **Home Furnishings Daily.** In the same interview, Mr. Kepler said: "We are in fact working toward a color system which will approach the design, manufacturer and service simplification of monochrome TV sets—especially as it applies to portable receivers."

Sylvania now is producing and marketing hi-fi component products. A line of receivers and speakers has been announced by Sylvania, and will be sold through the company's regular distribution and retailing system.

Cartridge home video-tape recorders (VTR's) seemingly finally are getting off the ground. Sears, reportedly the first to offer a cartridge VTR for home use, will begin marketing their unit in Chicago in June. The Sears record/playback video-tape units, manufactured by Cartridge Television, Inc., reportedly will be offered with a 25-inch color set and a black-and-white camera for $1600. A color camera will be made available later. Admiral and Teledyne Packard Bell reportedly also have begun receiving compatible home VTR units from Cartridge Television, Inc., and soon will begin nationwide marketing. A recent report in **Home Furnishings Daily** stated that Admiral will make available to **Montgomery Ward, Emerson** and **DuMont** a color TV set with a built-in Cartrivision (VTR) unit. **RCA** reportedly will produce and market by late 1973 MagTape SelectaVision player/recorder video-tape units for about $700. **Bell & Howell and Magnavox** also plan to market VTR units designed around the SelectaVision MagTape system, according to a report in **Merchandising Week.** Philco-Ford reportedly also now is doing more than just considering a home VTR unit. Cartridge Television, Inc. is manufacturing pre-recorded video tape cartridges containing a variety of entertainment programs which reportedly will be rented to consumers by Sears for about $3 to $5. □

Why RCA XL-100's can be a quick fix:



RCA XL-100's are 100% solid state, with 12 plug-in, solid state AccuCircuit modules—like the ceramic kine drive amplifier you see above.

Since each of the 12 modules performs specific functions, diagnosis of the trouble is usually quick and easy. Most malfunctions can be fixed right in the home. That's bound to please your customer.

So when it comes to servicing RCA solid state color, XL-100's let you make more house calls—in a lot less time!

And you won't waste so much time hauling sets back and forth to the shop.

Something else: Whether you're servicing an XL-100 console, table model or portable, most modules are interchangeable, function for function. That will make your life easier, and you won't have to worry about stocking a large parts inventory.

RCA XL-100. It's already got a great reputation.

It could even add to yours.

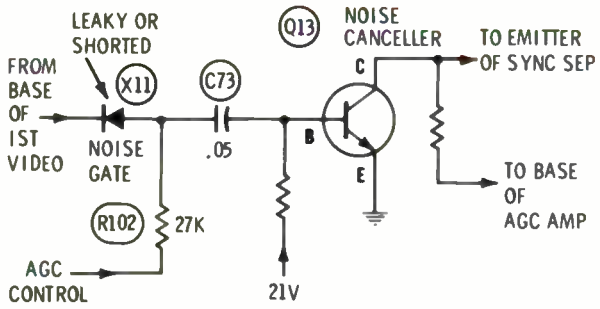
RCA XL-100 100% Solid State AccuColor

Circle 7 on literature card

Symcure

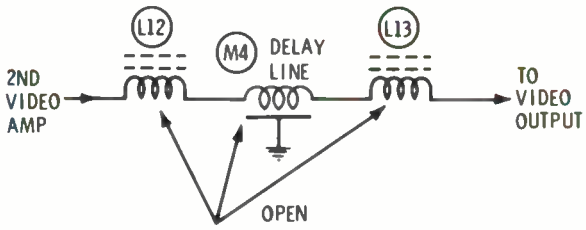
Symptoms and cures compiled from field reports of recurring troubles

Chassis—Sylvania D12
PHOTOFACT—1045-2



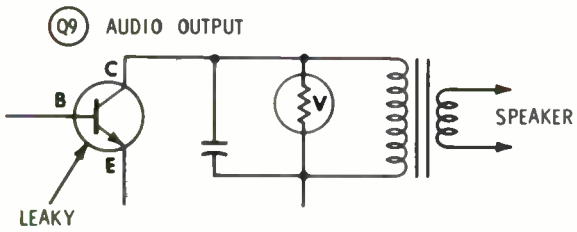
Symptom—Poor horizontal hold, or no picture until AGC amplifier is removed.
Cure—Check X11 for short or leakage; replace, if defective

Chassis—Sylvania D12
PHOTOFACT—1045-2



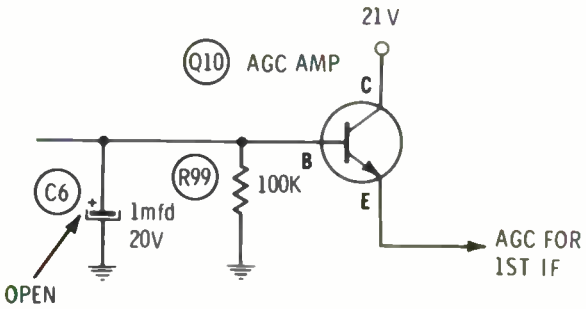
Symptom—No video; color is present
Cure—Check for an open L12, L13 or the delay line, M4

Chassis—Sylvania D12
PHOTOFACT—1045-2



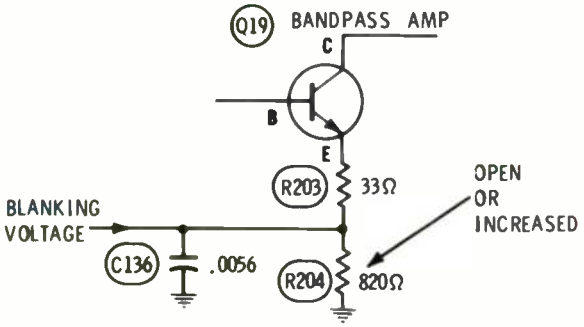
Symptom—Popping or crackling noise in speaker
Cure—Check for intermittently leaky audio-output transistor, Q9

Chassis—Sylvania D12
PHOTOFACT—1045-2



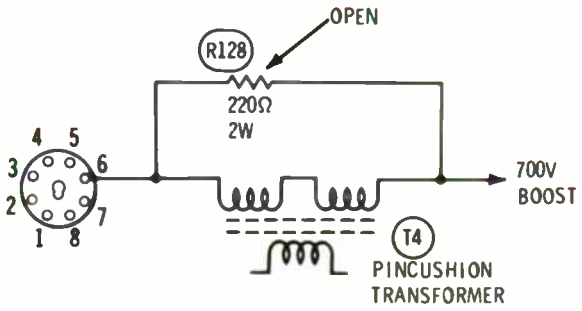
Symptom—Poor vertical and horizontal locking; raster dark on right
Cure—Check for open C6; replace with Im-fd unit, if defective

Chassis—Sylvania D12
PHOTOFACT—1045-2



Symptom—Color missing on 1st inch of left side of screen
Cure—Check R204; replace, if increased or open

Chassis—Sylvania D12
PHOTOFACT—1045-2



Symptom—Dark, vertical lines on left side of raster
Cure—Check R128; replace, if open

Introducing the expensive curve tracer that doesn't cost a lot.

The B&K Model 501A.

It's a lab-quality instrument that provides fast analysis of all semiconductors including J-FET's, MOS-FET's, signal and power bipolar transistors, SCR's, UJT's and diodes.

You can test transistors in circuit for GO/NO GO condition. Badly distorted curves will indicate the stage where a defective transistor or other faulty component exists.

The 501A is complete—with scope graticule and FP-3 probe for fast, one-handed in-circuit testing. It generates true current and voltage steps, with 3% accuracy, for measuring beta at all current levels. And it has a sweep up to 100 volts and 100 milliamperes.

$129.95

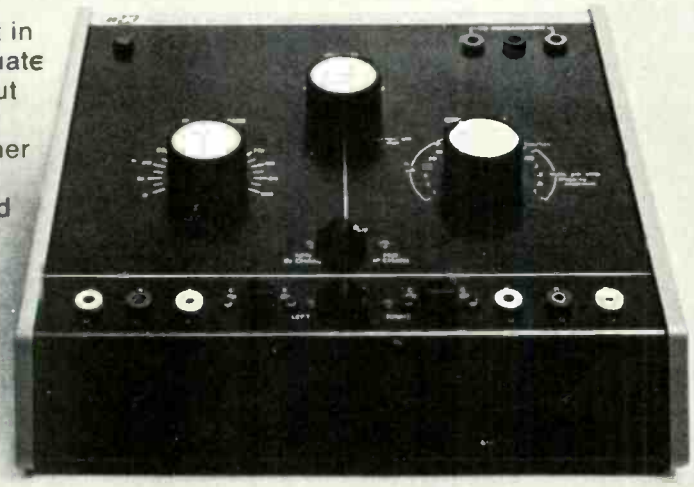
With the 501A, curves are displayed on an auxiliary scope screen. And you can hook it up to any scope—old or new.

All three controls can be set in quick-test positions to test and evaluate 90% of all solid-state devices without manufacturer's data sheets.

The 501A won't burn out either the semiconductors or itself.

With all these features, you'd think the 501A was an expensive curve tracer. But look at the price.

For complete technical data, call your B&K distributor. Or write Dynascan Corporation.



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

Product of Dynascan Corporation
1801 West Belle Plaine Avenue, Chicago, Illinois 60613

Circle 8 on literature card

CET Test Sites

CET Test Day—June 15

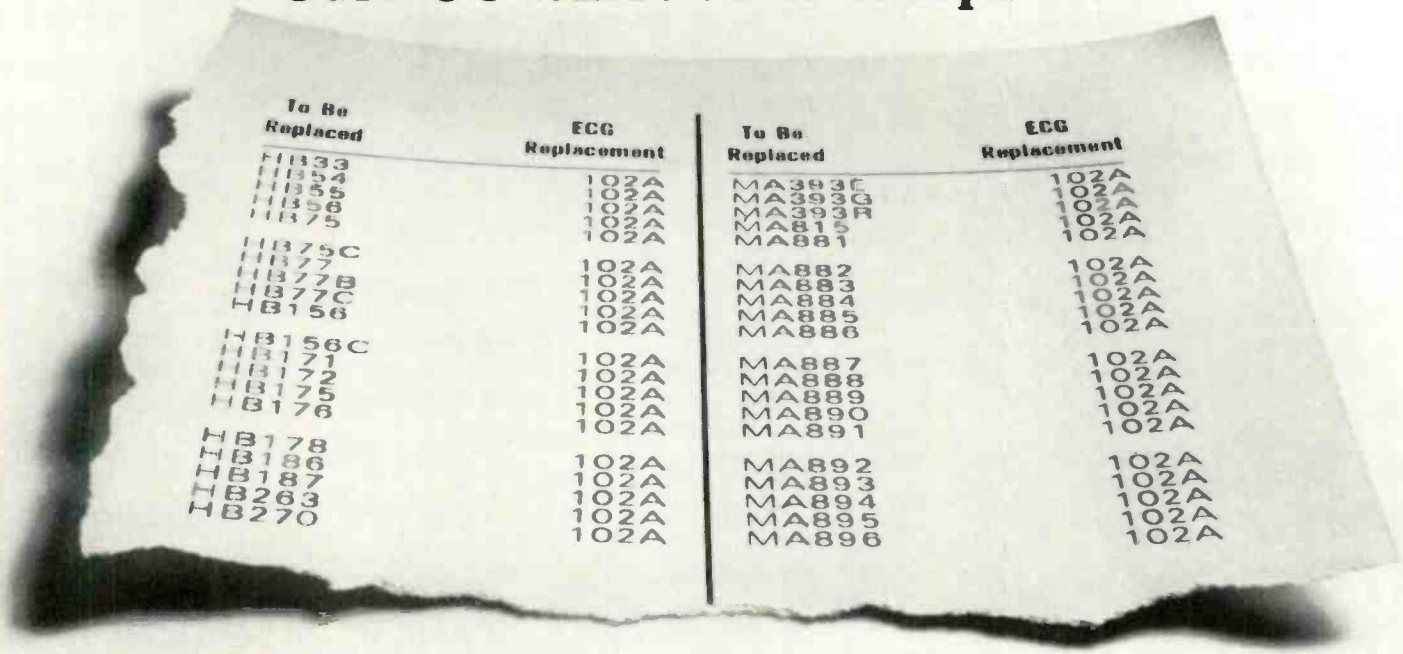
To encourage qualified electronic technicians to take the Certified Electronic Technician (CET) test, the National Electronics Association, in cooperation with the International Society of Certified Electronic Technicians (ISCET), has announced another nationwide "T-", or test, Day. The first "T-" Day was March 15.

On June 15, T-Day No. 2, qualified electronic technicians nationwide can take the CET test at the following locations. Specific information about the test and the time can be obtained from the "contact" listed for your area. If a test site for your state or locality is not listed, contact your local service association or call or write: ISCET, 1309 W. Market Street, Indianapolis, Indiana, phone (317) 632-2469.

State	City	Contact	Address	Telephone
Alabama	Decatur	J. Yarbrough	Calhoun Tech. Sch. N US 31	205-353-3901
Arizona	Phoenix	Kay Runzer	2200 W. Indian School Road	602-264-1726
Alaska	Anchorage	N.C. Gardenheir	3329 Briarcliff Dr.	
California	Hawthorne	Ralph Johonnot	P.O. Box 202	213-679-9186
Colorado	Denver	Paul Dontje	3825 Pierce	303-424-5503
	Pueblo	Bill Cook	110 W. 12th	303-545-0965
Connecticut	Waterbury	George Dukas	100 Larchmont	203-758-1033
Florida	Clearwater	Don McCracken	1571 Missouri Ave.	813-446-0165
	Winterhaven	Cal Reddick	920 Westlake Cannon Dr.	
	Orlando	D.W. Averett	4130 Conway E.	305-422-8156
Georgia	Albany	Ralph Bruneault	808 Oglethorpe	912-432-7520
Hawaii	Honolulu	Cliff Lum	2911 Kapiolani Blvd.	808-734-8911
Idaho	Boise	Guy Blakeslee	107 S. Orchard	208-342-8624
	Coeur D'Alene	Jack Bennett	1602 N. 4th	208-664-5177
Illinois	Chicago	George Sopocko	5–631 Irving Park Rd.	312-KI5-4740
	Bloomington	Bob Griffin	208 Magnolia	309-662-3110
	Kunkakee	Olen Lamb	Route 6, Box 310	815-365-4018
	Maple Park	Lester Knapp	MidValley Area Vocational School	
	Springfield	Ron Broyles	616 W. Lawrence	217-522-4870
Indiana	Indianapolis	Mike Tapp	1309 W. Market Street	317-632-2469
	Vincennes	A. Donovan	843 Ritterscamp Ave.	
	Hartford City	James Smith	409 W. Commercial	
	Griffith	Al Powers	139 N. Griffeth Blvd.	219-923-4650
	Ft. Wayne	John North	1214 Well, S.E.	
Iowa	Ames	Ron Crow	1306 Douglas	515-294-5060
Kansas	Goddard	John Krier	331 Wind Rows Lake Court	316-722-6706
	Lenexa (Kansas City)	Carl Babcoke	9221 Quivira	913-888-4664
	Liberal	Keith Knox	Box 764	316-624-5908
	Salina	Jerry Seim	909 - S. 11th	913-827-6581
Kentucky	Barboorville	J.B. Sellards	443 S. Main St.	
	Louisville	Charles Cave	7902 Bardstown Rd.	502-239-3718

(Continued on page 12)

Our ECG 102A transistor replaces...



To Be Replaced	ECG Replacement
HB33	102A
HB54	102A
HB55	102A
HB56	102A
HB75	102A
HB75C	102A
HB77	102A
HB77B	102A
HB77C	102A
HB156	102A
HB156C	102A
HB171	102A
HB172	102A
HB175	102A
HB176	102A
HB178	102A
HB186	102A
HB187	102A
HB263	102A
HB270	102A

To Be Replaced	ECG Replacement
MA393C	102A
MA393G	102A
MA393R	102A
MA815	102A
MA881	102A
MA882	102A
MA883	102A
MA884	102A
MA885	102A
MA886	102A
MA887	102A
MA888	102A
MA889	102A
MA890	102A
MA891	102A
MA892	102A
MA893	102A
MA894	102A
MA895	102A
MA896	102A

and hundreds more.

The 102A is only one big part of our very small line.

Just 124 Sylvania ECG semiconductor parts will replace over 41,000 manufacturer's part numbers and JEDEC types.

Our new ECG semiconductor replacement guide makes it easy for you to find out exactly which one of ours is the one you need.

With our guide and our 124 replacements, you can service practically any solid-state entertainment product on the market.

No more lugging sets back to the shop because you couldn't carry all the parts you needed.

With Sylvania's 124 semiconductors you can handle almost all of your repair jobs right in your customer's home.

Stock up on Sylvania ECG semiconductors now.

It's just another small thing from GTE Sylvania that can take a big load off your back.

Sylvania Electronic Components, Waltham, Mass. 02154

GTE SYLVANIA

State	City	Contact	Address	Telephone
Louisiana	LaPlace	William Borstel	412 Belle Alliance Dr.	504-652-6234
	Sulphur	Roger Drost	502 Pecan Street	318-527-6700
Maine	Augusta	Maynard Young	97 Stone Street	207-622-0539
	Lincoln	Harley Sproul	60 Main Street	207-794-6385
	Westbrook	Al Hawkes	10 Hardy Road	207-854-2044
Maryland	Baltimore	Joe Uhlfelder	7206 Hartford Road	301-444-6000
	Linthicum	Jesse Leach	69 Old Annapolis Rd.	301-789-8668
Michigan	Dearborn	Al Moskal	8840 W. Warren	313-933-3210
	Sandlake	Tom McDonald	US 131 at Lake St.	616-636-5530
Minnesota	Duluth	Phil Dahlen	1 - East 1st St.	218-727-8511
Missouri	Joplin	T. Oviatt	942 Main	417-623-2231
	St. Louis	Vince Lutz	1546 Sells Ave.	314-EV1-9944
Nebraska	Lincoln	Dean Diamond	Box 80359	402-466-1088
Nevada	Las Vegas	Ted Wagner	301 S. Highland Dr.	702-385-0161
New Jersey	Trenton	Lew Edwards	1451 Hamilton Avenue	609-396-2452
New York	Albany	Warren Baker	514 Second St.	518-462-2309
	New York City	Larry Steckler	200 Park Avenue	212-PL7-2800
	Elmira	Edward Flynn	107 W. Church St.	
North Carolina	Winston-Salem	W.D. Cartrette	4008 Fargo Dr.	919-924-8206
Ohio	Akron and others	Art Clough	31 S. Martha	216-784-0413
Oregon	Salem	Richard Roberson	3096 Liberty Rd.	
Pennsylvania	Altoona	H.E. Montgomery	Rd No. 2 Box 168	
	Dunmore	Joe Risse	1223 Monroe	717-342-7701
	Philadelphia	Lew Russell	254 E. Penn.	215-GL7-1862
	Scranton	Tom Haughter	340 Phelps	717-342-0161
	Lafayette Hill	Juhn Guinan	2178 Joshu Road	215-982-6404
Rhode Island	Pawtucket	Tom Plant	29 Dean St.	401-725-8719
Texas	Houston	E.C. Larson	1308 Aldrich	
	Lampasas	Scott Witcher	Witcher & Darnell Elect., Austin Hwy.	
	Ft. Worth	J.W. Williams	TEA 2708 W. Berry	817-926-9204
Utah	Salt Lake City	Rob Werner	6274 Cobblecrest Rd.	801-277-0200
Virginia	Hampton	Walter Cooke	957 King St.	703-723-7578
	Charleston	R.L. Monroe	1400 Bigley Ave.	304-343-1661
	Springfield	Gene Scott	8408 A Old Keene Mill Rd.	703-569-0990
Washington	Seattle	Enos Rice	1605 8th St.	206-MA2-3240
	Van Couver	Frank Long	8202 Mill Plain Road	
	Paseo	Mylo Candee	424 Ninth	
West Virginia	Charleston	R.L. Monroe	1400 Bigley Ave.	
Wisconsin	Beloit	Bob Podewils	2133 Riverside Dr.	608-362-1444
	LaCrosse	R.E. Thomas	2320 Sisson Dr.	
Wyoming	Casper	Marlin Engel	1348 W. 29th	

Now–Just 3 RCA Hi-Lite "V" Type Color Picture Tubes Replace 195 ~~185~~ Types

Replaces 98 19″ types

18VABP22
18VACP22
18VADP22
18VAHP22
18VAJP22
18VAQP22
18VARP22
18VASP22
18VATP22
18VBAP22
18VBCP22
18VBHP22
19EXP22
19EXP22/ 19GVP22
19EYP22
19EYP22/ 19GWP22
19FMP22
19FXP22
19GLP22
19GSP22
19GVP22
19GVP22/ 19EXP22
19GWP22
19GWP22/ 19EYP22
19GXP22
19GYP22
19GZP22
19HBP22
19HCP22
19HCP22/ 19HKP22
19HFP22
19HJP22
19HKP22
19HQP22
19HRP22
19HXP22
19JBP22
19JDP22
19JHP22
19JKP22
19JNP22
19JQP22
19JYP22
19JZP22
19KEP22
19KFP22
490AB22
490ACB22
490ADB22
490AEB22
490AFB22
490AGB22
490AHB22
490AHB22A
490AJB22
490AJB22A
490AKB22
490AKP22A
490ALB22
490AMB22
490AMB22A
490ANB22
490ARB22
490ASB22
490ASB22A
490BAB22
490BCB22
490BDB22
490BGB22
490BHB22
490BRB22
490CAB22
490CB22
490CHB22
490CUB22
490DB22
490DB22A
490EB22
490EB22A
490FB22
490GB22
490HB22
490JB22
490JB22A
490KB22
490KB22A
490LB22
490MB22
490NB22
490RB22
490SB22
490TB22
490UB22
490VB22
490WB22
490XB22
490YB22
490ZB22

Replaces 22 21″ types

19VABP22
19VACP22
21AXP22
21AXP22A
21AXP22A/ 21AXP22
21CYP22
21CYP22A
21FBP22
21FBP22A
21FBP22A/ 21GUP22
21FJP22
21FJP22A
21FJP22A/ 21GVP22
21FKP22
21GUP22
21GUP22/ 21FBP22A
21GVP22
21GVP22/ 21FJP22A
21GXP22
21GYP22
21GZP22
21HAP22

Replaces 75 25″ types

23EGP22
23EGP22A
23VABP22
23VACP22
23VADP22
23VAHP22
23VALP22
23VAMP22
23VANP22
23VAQP22
23VARP22
23VASP22
23VATP22
23VAUP22
23VAWP22
23VAXP22
23VAYP22
23VAZP22
23VBAP22
23VBCP22
23VBDP22
23VBEP22
23VBGP22
23VBHP22
23VBJP22
23VBRP22
23VBTP22
25ABP22
25ADP22
25AEP22
25AFP22
25AGP22
25AJP22
25ANP22
25AP22
25AP22A
25AP22A/ 25XP22
25AQP22
25ASP22
25AWP22
25AXP22
25AZP22
25BAP22
25BCP22
25BDP22
25BFP22
25BGP22
25BHP22
25BJP22
25BMP22
25BP22
25BP22A
25BP22A/ 25YP22
25BRP22
25BSP22
25BVP22
25BWP22
25BXP22
25BZP22
25CBP22
25CP22
25CP22A
25FP22
25FP22A
25GP22
25GP22A
25RP22
25SP22
25VP22
25WP22
25XP22
25XP22/ 25AP22A
25YP22
25YP22/ 25BP22A
25ZP22

Stock these three RCA Hi-Lite color picture tubes and have immediate replacements for the fastest moving industry types—195 of them. It's the way to save yourself time, give your customers faster service, improve profits.

RCA Hi-Lite types are all new, made to OEM specifications and contain the newest RCA manufacturing technology, including Perma-Chrome and the latest X-ray attenuating glass.

Order these three RCA Hi-Lite tubes, and other types you may need, from your RCA Distributor. He also has the complete RCA Interchangeability Guide, available free of charge.

RCA | Electronic Components | Harrison, N.J. 07029

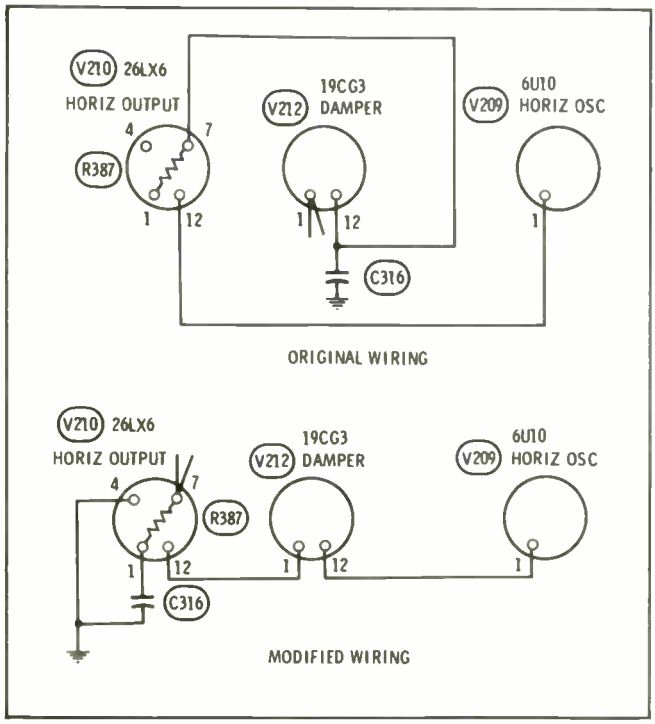
RCA Electronic Components

service bulletin

a digest of info from manufacturers

Modification of heater wiring of the damper
Zenith 14CC14 and 14CC16 TV chassis

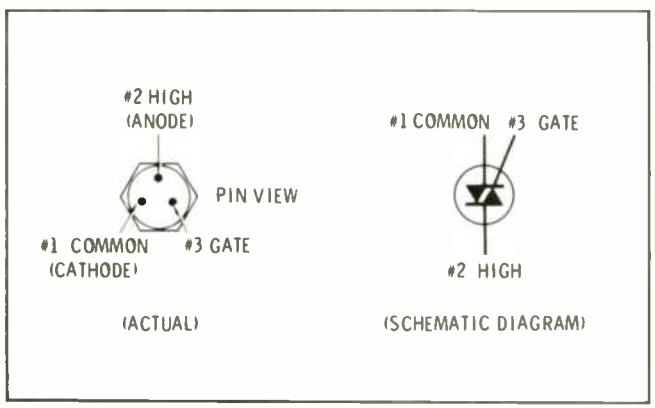
Late production runs of these Zenith chassis use a modification of the damper heater wiring, as shown in the two schematics, to improve damper reliability.



Whenever a failure of the damper heater is found in these early chassis, modification of the wiring is suggested.

Actual pin connections of remote on/off triac compared to schematic symbol
RCA CTC54 color-TV chassis

A comparison of the actual pin arrangement of a triac used by RCA and the schematic symbol are



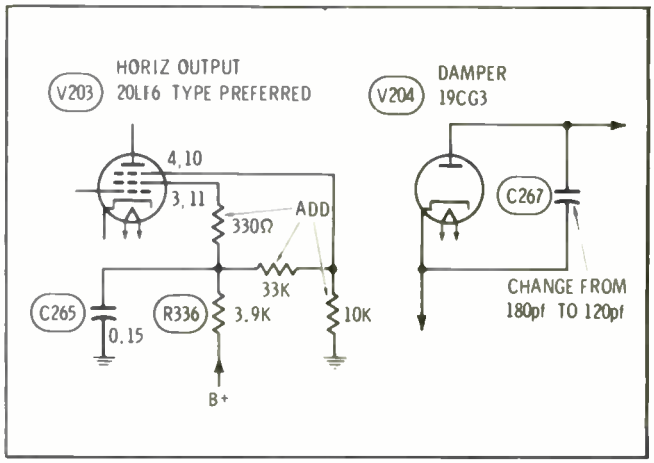
shown here. The triac is used in the on/off function of the remote-control system of RCA CTC54 chassis.

Correction of horizontal "hook"
Magnavox T952 color-TV chassis

A horizontal bend, or hook, at the top of the picture in early-production T952 color-TV chassis usually can be corrected by connecting a 2200-pf capacitor from the cathode of D19 to the junction of R262 and C201.

Snivet elimination
Zenith 4B25C19 and 19CC19 color-TV chassis

If early-production runs of these chassis produce snivets, the chassis should be modified, as shown in the accompanying schematic. (Snivets are black,



vertical lines on the right side of the picture.)

Of the two types of horizontal-output tubes which have been used in these chassis, Zenith recommends the 20LF6, to minimize snivets.

Drifting tint during warmup
Magnavox T939 and T950 color-TV chassis

Drifting tint or loss of color locking during the first few moments of operation occasionally have been caused by a defective 3.58M-Hz crystal. Replace the crystal only with a unit designated by Magnavox part number 560314-5.

Damage to the contrast control caused by tube failure
General Electric KE and KE-II color TV chassis

Short circuits in the 6AG9 video amplifier tube (V4A) which cause excessive cathode currents often burn an open spot on the element of the contrast control (R5 365 ohms) or cause a reduction in the total resistance

If the 6AG9 video tube is replaced but the value of the contrast control has been reduced by excessive current through the original tube, critical adjustments of the brightness and contrast controls will be required to prevent blooming during normal changes in the TV programs.

When the video amplifier tube is checked and replaced, also check the resistance of the contrast control. Replace the control, if the resistance is less than 290 ohms.

Prevent possible future failures of the 6AG9 video amplifier tube by bending away from the glass of the tube a steel-wire support that is located near pin 12.

(Parts identitication numbers are from Photofact 1028-1.)

(Continued on page 16)

THE MONEY TREE

ZENITH INTRODUCES

CHROMATENNA™

ANTENNAS

A whole new line of antennas from Zenith built to deliver a peak picture...and peak profits for you.

Zenith's new Chromatenna line incorporates all the electronic knowledge and "know how" of Zenith engineering. 20 different antennas, for color and black & white TV, meet every reception condition. Result: a *superb picture* for your area.

The new line includes 7 antennas for VHF/UHF/FM, 5 for VHF/FM and 8 for UHF. And a complete line of antenna accessories.

The sales skills that helped make Zenith a sales leader have been used to put together a complete merchandising package. Convenient Display Rack. Display Header. Wall Banner. Presentation Catalog. Ad Mats. Result: more antenna sales, *peak profits* for you.

Ask your Zenith Distributor for full information about the new Chromatenna line.

ZENITH®

The quality goes in before the name goes on

Circle 11 on literature card

Avoid applying chemicals to RCA modules
RCA CTC49 and CTC46 color-TV chassis

RCA recommends that spray chemicals, especially circuit coolers, not be applied to sockets and edge connectors on RCA modules. Some chemicals might cause open circuits or intermittent operation.

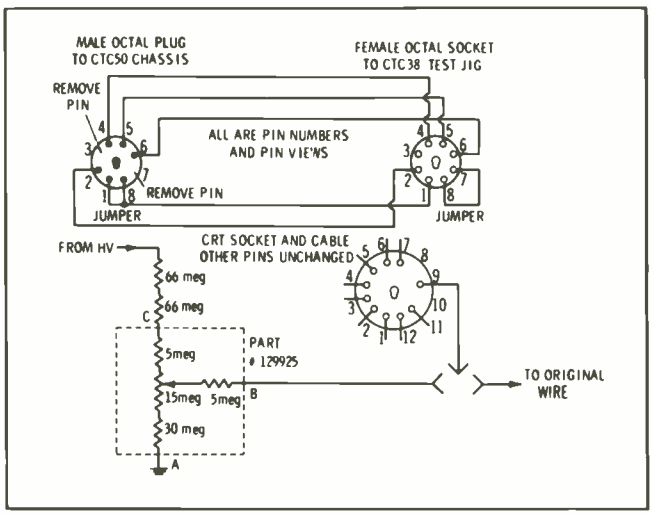
Use the following method, which is approved by RCA, to clean the edge connectors of the plug-in modules.

- Turn off the line voltage to the receiver, remove the module and clean the edge connectors with an ordinary pencil eraser.
- Install and remove the module several times before final installation and testing with power applied.

Yoke and focus adapters for test-jig operation
RCA CTC50 color-TV chassis

RCA CTC50 chassis can be operated on the tube-type RCA color-TV test jig by the use of a yoke-adapter cable and modification of the focus wiring in the picture-tube-socket extension cable.

Remove pins 3 and 7 from a male octal plug and connect it to a female octal socket or jack as shown here.



Because the picture tube used with the CTC50 chassis is a low-voltage-focus type, and the picture tube in the test jig requires a focus potential of between 4.6 and 5kV, no raster will be produced by the test jig when connected to the CTC50 unless an external source of sufficient focus voltage is applied to the test-jig picture tube.

To accomplish this, modify the picture-tube socket and plug-extension cable assembly by adding insulated connectors, so the focus pin (No. 9) can be connected to the original wire from the chassis or to the external focus adapter, which is shown in the lower schematic. The two external 66M-ohm resistors should be deposited-carbon types (RCA part number 114651), *not* carbon types.

The focus control assembly normally used in the CTC44 chassis (RCA part number 129925) can be used as the focus adjustment control. Insulate the focus wiring and connectors, to avoid high-voltage shocks.

(Continued on page 18)

We're in this business together.

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

Tube Products Department, Owensboro, Kentucky 42301

GENERAL ELECTRIC

BEST BUY

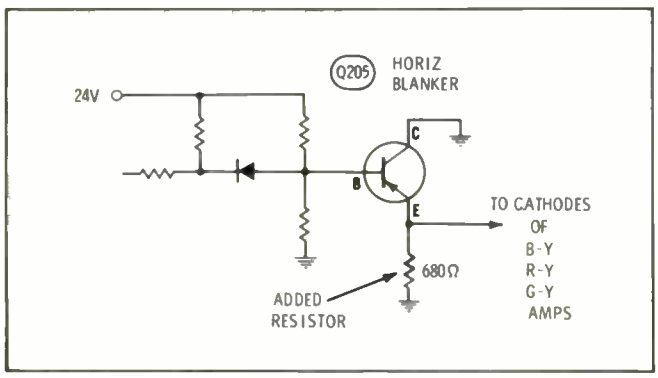
OUR NO. 1 GOAL: TO MAKE GENERAL ELECTRIC YOUR BEST BUY

(Continued from page 16)

Modification to protect against raster blooming Zenith 12A8C14, 12A10C15, 14A9C50 and 14A9C51 color TV chassis

Late production runs of the listed Zenith chassis have had a 680-ohm resistor added to the blanker circuit, to prevent excessive brightness and blooming in the event the blanker transistor (Q205) opens.

Without the resistor, if the blanker transistor opens, the common cathode circuit of the -Y amplifier tubes has no return to ground. Therefore, these tubes cannot conduct, and the voltages on their plates (and the grid voltages of the color picture tube) increase significantly. The resultant higher voltage at the grids of the picture tube cause excessive picture-tube conduction, which, in turn, can



cause damage to the high-voltage components or to the picture tube.

It is advisable that this 680-ohm resistor be added to early-production versions of the listed chassis. □

bookreview

Industrial Electronics Principles & Practice
Author: Alfred Haas
Publisher: TAB Books, Blue Ridge Summit, Pa.
Size: 5⅝ x 8½ inches, 416 pages
Price: Softcover, $5.95; hardcover $8.95.

This overview of electronics applied to industrial operations explains and illustrates in a practical, instead of theoretical, context the fundamental principles of and the present methods and state-of-the art circuitry used to perform representative industrial functions, including automatic inspection, sorting and counting; various digital process-control techniques, used to "guide" machines which perform repetitive operations; electronic heating, welding and machining; ultrasonic cleaning; liquid processing; laser applications; and accident prevention.

Contents: Industrial Electronics: Purpose & Means—Transducers—System Building Blocks—Automatic Inspection, Sorting & Counting—Digital Process Control—Electronic Heating, Welding & Machinery—Electronic Safety Services—Power Conversion & Control. □

Solving Contrast–Circuit Defects

Circuit operation, defects and troubleshooting procedures.

by Bruce Anderson/ES Contributing Author

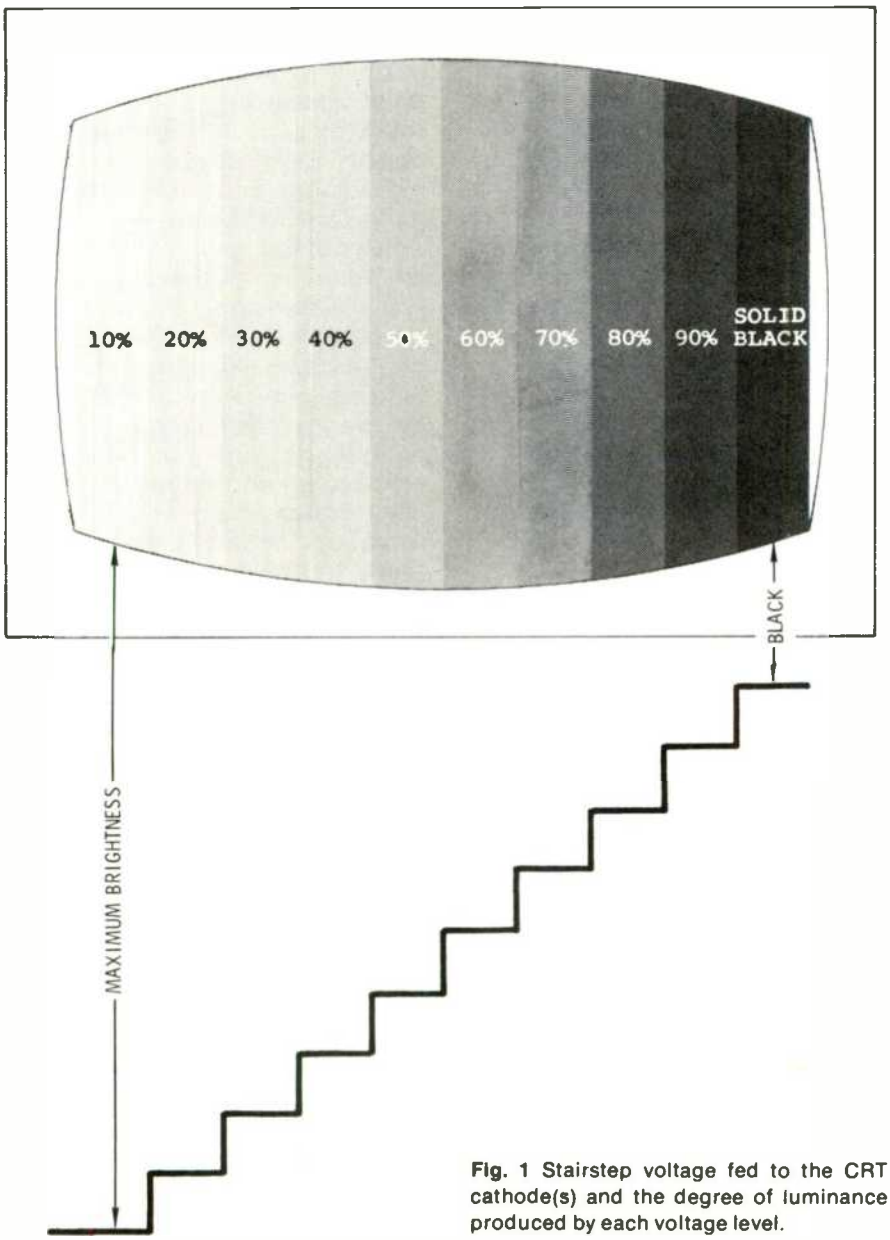


Fig. 1 Stairstep voltage fed to the CRT cathode(s) and the degree of luminance produced by each voltage level.

Lest we become too preoccupied with all the exotic circuits of the chroma system, we occasionally have to remind ourselves that color is really only the "frosting on the cake." No matter how well the color circuits are performing their jobs, if the luminance system is deficient, the picture which is produced is bound to be below par.

Sometimes the symptoms and/or causes of luminance troubles are evident; complete loss of black-and-white video, for example, is easy to spot. Often, however, deficiencies in the luminance channel are much more obscure. Smearing and ringing are examples. Even the relatively simple contrast circuitry can be the source of a variety of troubles.

What Contrast Is

Before examining some of the problems commonly caused by defects in the contrast-determining circuits, it will be useful to pinpoint exactly what contrast is, and how it can be affected.

The maximum amount of contrast obtainable is ultimately determined by the amount of light which a given area of the CRT screen can produce. Assuming that the video amplifiers can drive the CRT into cutoff in all cases, the CRT with the maximum brightness capability will have the greatest contrast—in theory. However, several factors modify this concept. First, if

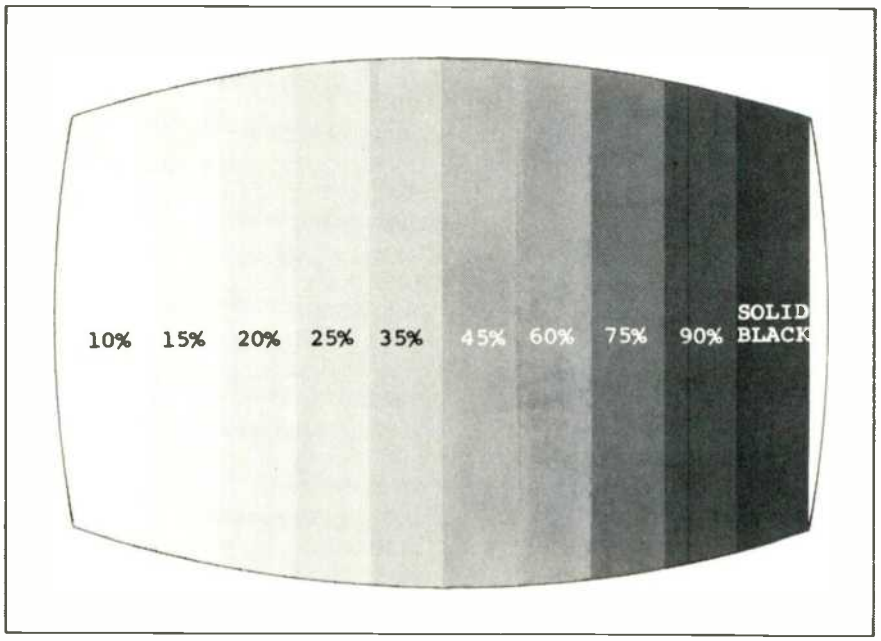
there is ambient light, no area of the CRT screen will be completely black, because of reflection. The use of non-reflecting faceplates, and now the use of light-absorbing materials to surround each phosphor dot, overcome to a degree this loss of contrast caused by reflected light.

The high-voltage system also modifies the situation in some instances. If the high voltage is reduced when a sizeable portion of the screen is driven to maximum brightness, the brightness will decrease and some contrast will be lost. Closely related to the "high voltage" affect is a limitation related to focus. If the raster goes out of focus at maximum brightness, the brightness control must be turned down again, causing less contrast.

Finally—and this is the area of most interest to the repairman—the assumption that the video amplifiers can always drive the CRT into cutoff and to the brightness limitations of the system, as outlined previously, is not always true. If the gain of the video amplifiers is inadequate, either it will be impossible to drive the CRT to cutoff, or it will be impossible to drive it to maximum brilliance. One or the other of these limits can be obtained by resetting the brightness control, but not both.

Closely related to the requirement for sufficient video gain, is the requirement for gain "linearity," or to use the correct term, "minimum differential gain." Fig. 1 illustrates what this means. A "stairstep" is regularly broadcast by the networks and used at the transmitter to check the video amplifiers in the modulators. However, for illustration, a drawing more clearly illustrates the concept. Let the stairstep represent the voltage fed to the cathodes of the CRT. Ideally, the minimum voltage produces maximum usable brightness and the top step just extinguishes the raster. Each succeeding step would then produce a slightly darker shade of gray.

But, if the gain of the video amplifiers is not the same for all steps in the signal shown in Fig. 1, some levels of gray will tend to be the same, while the difference between other adjacent steps will be exaggerated. This is illustrated in Fig. 2. During actual broadcast reception, the effect is that some areas of a scene will tend to be too "contrasty" while other areas will tend to lose detail, or "wash out."



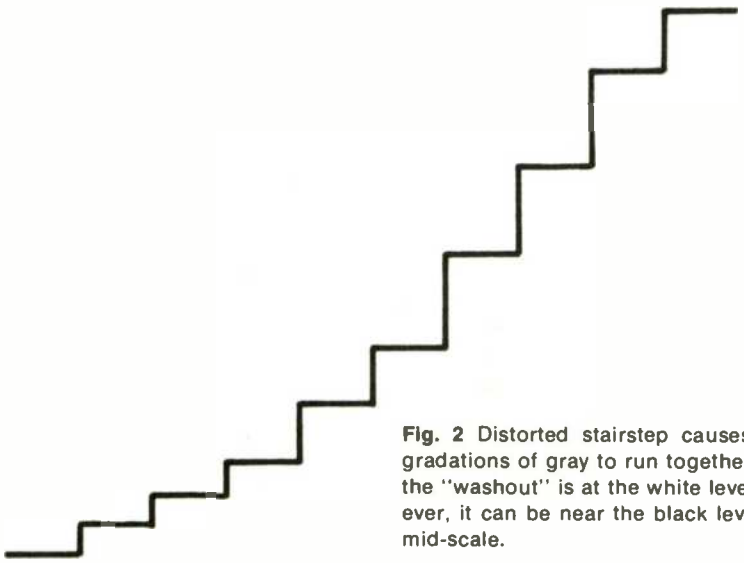


Fig. 2 Distorted stairstep causes some gradations of gray to run together. Here, the "washout" is at the white level; however, it can be near the black level or at mid-scale.

The Contrast Control

Fig. 3 shows two typical contrast-control circuits, one using a tube for the amplifying device and the other a transistor. Note that there is little difference in the configuration of the control circuit itself. In both circuits, the DC bias of the cathode (or emitter) is established by the resistance from that element to ground. However, the gain of the stage is determined by the impedance of the cathode or emitter. If all of the cathode resistance is shunted by the capacitor, the impedance is very low, degeneration is minimum, and the gain of the stage is maximum. When the contrast control

is turned to the other extreme, the impedance is high, degeneration is maximum, and the gain is reduced.

There are two modes of failure for the capacitor used in the contrast control; it can become leaky (perhaps to the point of a short circuit) or it can lose some of its capacitance. Each of these modes of failure produces its own peculiar symptoms.

Leaky bypass

A leaky capacitor causes an effect similar to that of a resistance connected across the capacitor. When the contrast control is set to produce maximum contrast, as shown in Fig. 4A, this resistance decreases the total cathode-to-ground resistance of the cathode (or emitter) circuit. In turn, the increased current through the device reduces the plate (or collector) voltage, and the raster becomes brighter than normal. When the contrast control is set for minimum contrast, as in Fig. 4B, the leakage resistance of the capacitor has no effect on brightness, because both ends of the capacitor are at ground potential. Consequently, the most noticeable symptom produced by a leaky contrast capacitor is a change of brightness as the contrast-control setting is changed.

Bridging the leaky capacitor with another one will not alleviate this symptom, because the shunt resistance still is in the circuit. The trouble symptom can be eliminated only by removing the leaky capacitor and replacing it with a good one.

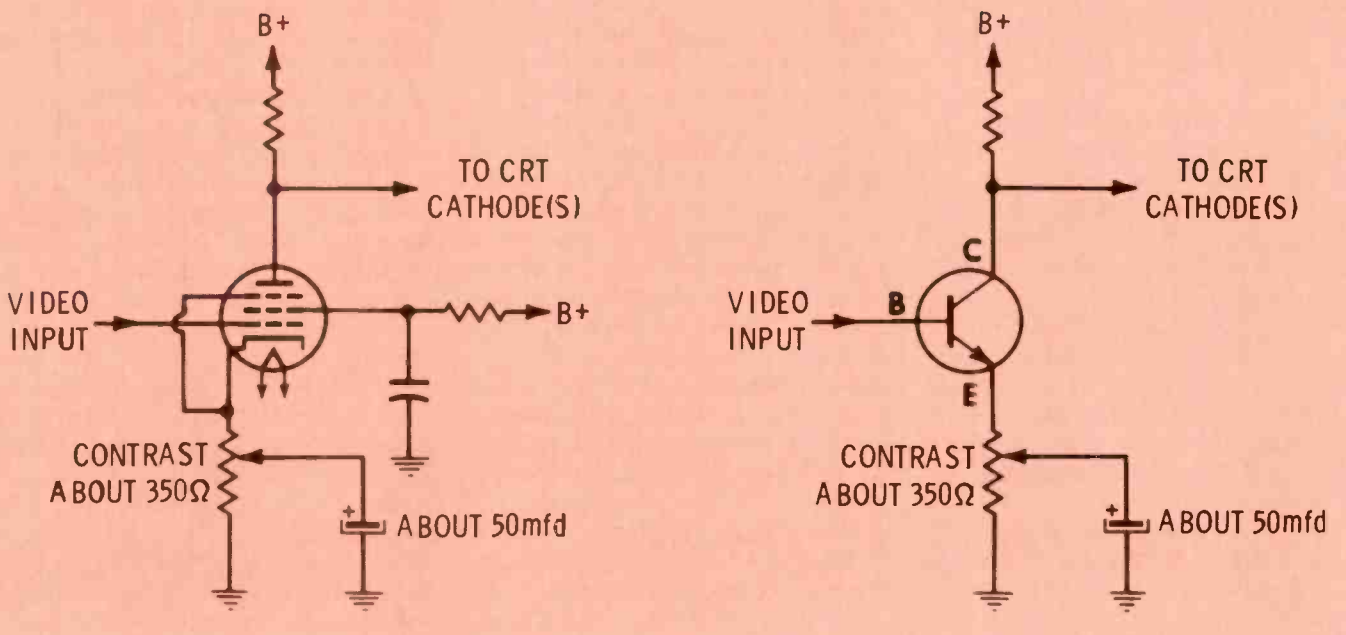
Open bypass

A completely open contrast capacitor causes the receiver to operate always at minimum contrast; however, the chances of the capacitor becoming completely open are limited. In practice, it is much more likely that the capacitance will decrease to some fraction of the original value. If, for example, the capacitance is reduced from 50mfd to .05mfd, there indeed will be a noticeable loss of contrast. On the other hand, a reduction of the capacitance to 0.1 or .01 of its original value will tend to reduce the gain of the video amplifier primarily at low frequencies.

The reasons for this are not at all mysterious. In a normal circuit, the capacitance is several times greater than that which is required to bypass the resistance of the contrast control. (Bypassing is considered "complete" when capacitive reactance is one-tenth the resistance it shunts.) Therefore, the only impedance seen by the signal is the unbypassed portion of the contrast control; and, because this is totally resistive, the impedance remains constant for all frequencies. But, if the capacitance decreases, the impedance has a component which is reactive, and this component decreases as frequency increases. The result is a poorly bypassed amplifier at low frequencies, leading to reduced low-frequency response and phase shifts at the lower frequencies. This can lead to streaking on the CRT.

Bridging the capacitor with a good one will correct this symptom, because all that is needed is some additional capacitance. Nevertheless, always remove the original capacitor, after its failure has been verified, because leaving it in place is simply asking for trouble. It might short or become

Fig. 3 Typical contrast-control circuits, vacuum tube and solid state.



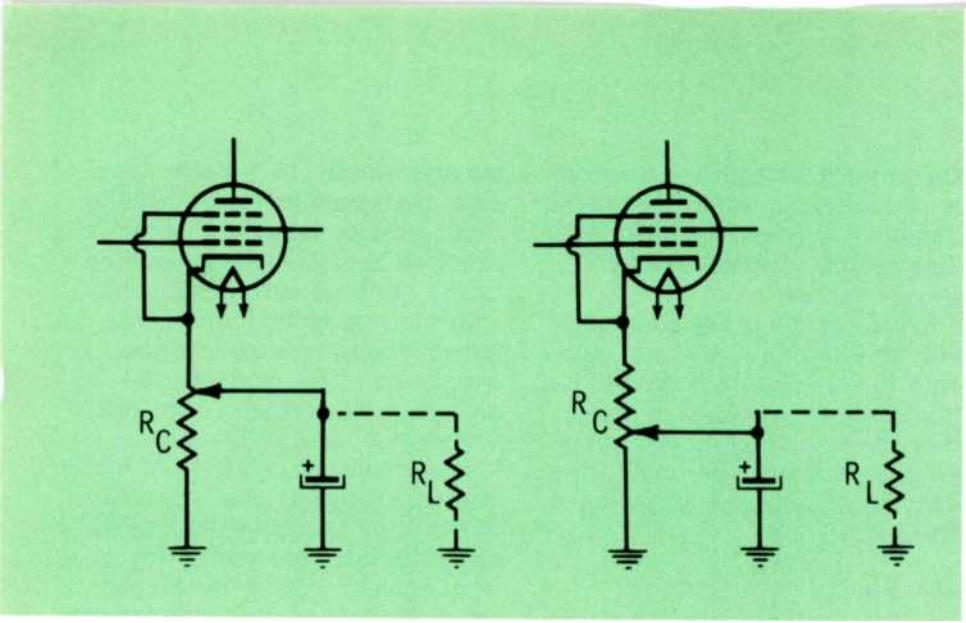


Fig. 4 How a leaky capacitor affects the cathode resistance. **(A)** Maximum contrast **(B)** Minimum contrast.

leaky in the future.

Open control

A third type of failure which happens occasionally is an open contrast control. At the time of failure, the cathode voltage increases toward B+, but when it exceeds the rating of the capacitor, the tube conducts and clamps the cathode voltage. Because the tube is practically at cutoff, the capacitor might not short. The trouble symptoms are a very dim raster, practically no video, and abnormally high voltage on the cathode and plate of the video amplifier. If the capacitor does short, the plate and cathode voltages of the video amplifier decrease, producing excessive brightness.

Other Contrast Problems

The understanding of how faults in the contrast-control circuit produce their symptoms can be extended to help in troubleshooting other parts of the video-amplifier section of the receiver. For example, a leaky capacitor in the contrast-control circuit has been shown as a cause for a change of brightness, because it changes the DC operating voltages of the video amplifier to which it is connected.

A leaky bypass capacitor in any of the video amplifiers can have the same effect, if there is direct coupling from that stage to the CRT. If the stages are not direct-coupled, there will be no change of brightness, but a second effect will still be present. Insufficient cathode resistance will cause the stage to go into saturation at a lower signal level, and consequently, two or more gradations of gray will appear the same on the CRT. As a general rule, therefore, a change in cathode biasing will cause an increase in differential gain.

Going a step further, the basic reason for differential gain problems is an upset in the operating potentials of one of the video amplifiers. This can be caused by improper cathode biasing; it also can be caused by a leaky coupling capacitor, an off-tolerance plate-load resistor, or simply a tube with low emission. From a servicing angle, these aren't too difficult to find. Because the problem is related to a change of operating voltages, a voltmeter will usually locate the trouble.

It has been shown how a decrease in the capacitance of the contrast-control capacitor decreases the low-frequency response of the video system. This same symptom will appear if the bypassing of some other video amplifier is inadequate. A voltmeter will not be useful for troubleshooting these problems, because operating potentials usually are not affected. The scientific approach in such cases is to check the frequency response of the video system. A quicker method is to bridge the bypass capacitors. Because a below-tolerance coupling capacitor will produce the same symptom, bridging each of these also is a good idea.

Summary

The contrast circuit of a television receiver basically allows control of the degeneration of the final video amplifier, without changing its DC resistance. This is accomplished by bypassing a portion of the cathode resistance and allowing the remainder to be unbypassed.

In types of failures in which the **resistance** of the cathode circuit is affected, there will be a change in the brightness of the raster. If the cause is a leaky capacitor, the brightness will vary when the contrast control is adjusted. If the control itself is at fault (almost always open), a very dim raster will be produced. However, an open control might cause the capacitor to short, in which event excessive brightness will be produced. The fault can be located with a voltmeter.

The second type of failure is partial or complete loss of capacitance of the bypass capacitor. Complete loss of capacitance (an open) will cause a drastic reduction of contrast. A decrease of bypass capacitance will cause the response of the amplifier to fall off at low frequencies, producing streaking of the picture. Bridging the capacitor is the recommended method for locating this fault.

The preceding defects are characteristic of many failures in the video system. Practically any fault which upsets the operating voltages of a stage will cause that amplifier to be nonlinear (have different gains at different signal levels). A VOM normally is adequate to locate the trouble.

Faults which involve changes of reactance without changing the operating potentials will probably make the amplifier frequency sensitive. Because capacitors are much more prone to value changes than are inductors, bridging the various bypass and coupling capacitors usually will locate the defective component. □

june 11 thru 14, 1972
McCORMICK PLACE, CHICAGO

the annual meeting place for the people & products of the industry

the people Over 35,000 retailers, sales representatives, distributors, importers and manufacturers from all 50 states and many foreign countries.

the products over 300 exhibitors will introduce the 1973 lines of television, radios, phonographs, audio components, tape equipment and accessories, displaying over 25,000 products in the world's largest trade show devoted exclusively to consumer electronics.

Produced and sponsored by
CONSUMER ELECTRONICS GROUP—ELECTRONIC INDUSTRIES ASSOCIATION

the program

conferences
Mon.—Retail Marketing Conference
Tues.—Video Conference
Wed.—Audio Conference

exhibits
Sun., June 11 ..... 12 noon-6 pm
Mon., June 12 ..... 9 am – 6 pm
Tues., June 13 ..... 9 am – 6 pm
Wed., June 14 ..... 9 am – 3 pm

social highlight
CES Champagne Party on the exhibit floor • Monday, June 12, 5 pm-6 pm

plan now to attend

Register today! Send for your FREE BADGE OF ADMISSION

ADVANCE REGISTRATION

Save time, fill in and mail this coupon now. Your free badge of admission will be mailed back to you. (Please print)
Hotel reservation blanks will be forwarded to you with your badge.

Name _____ Title _____

Firm _____

Street _____

City _____ State _____ Zip _____

Please check below the classification of your business

☐ RETAILER ☐ DEPT /CHAIN STORE BUYER ☐ DISTRIBUTOR
☐ MANUFACTURER'S REPRESENTATIVE ☐ MANUFACTURER
☐ OTHER _____

Minors under 18 years of age will not be admitted under any circumstances

CONSUMER ELECTRONICS SHOW, 331 MADISON AVE., NEW YORK, N.Y. 10017

Circle 15 on literature card

troubleshooter

The Video Detector—

Theory of operation and recommended troubleshooting procedures

Video Detectors

The function of the video detectors is to extract the composite video signal from the amplitude-modulated (AM) picture carrier. This process is often called "envelope" detection, because the detected signal assumes the general waveshape of either the negative or positive peaks of the carrier "envelope."

Fig. 1A shows the carrier and modulating waveforms before they are combined. The upper waveform in Fig. 1B is the 860-Hz carrier, after amplitude modulation by a 60-Hz signal. The lower waveform in Fig. 1B is the output signal from the detector before filtering to remove the ripple. The actual zero-voltage line was added to the output waveform by use of the DC function of the scope and two exposures, one for the output signal and one for the line. A line drawn through the center of the small sawteeth of the ripple of the output waveform would produce a good facsimile of the original modulation. Such a waveform actually is obtained following filtering by a secondary action of the peaking coils.

A Typical Video Detector

A typical video-detector circuit, shown in Fig. 2, is basically a series, peak-reading rectifier circuit the component values of which are chosen for optimum operation with video frequencies. For more details about peak-reading rectifier characteristics, please refer to the article starting on page 56 of the September, 1970, issue of ELECTRONIC SERVICING.

Peaking coils

Peaking coils are used to improve the high-frequency response. In addition to the increase of high frequencies, the peaking coils roll off the response above the video range, to eliminate the ripple (45.75MHz in a color TV) before the signal is presented to the video amplifiers.

The detector time constant

The sequence of waveforms shown in Fig. 3 proves that a larger peak-reading capacitor reduces the amplitude of the ripple and increases the average DC voltage (which is the video, or recovered modulation, in detectors). To improve visibility by spreading the tops of the waveforms, R1 was removed during the photographing of waveforms "B" and "C".

From this data, it would seem logical to use large values for R1 and C1 (long time constant), to produce maximum video and less ripple. However, this principle, which works very well for power supplies, easily can be overdone when applied to the detection of a modulated carrier.

In Fig. 4, the top waveform is unfiltered (capacitor omitted) half-wave rectification of an AM carrier. In the center waveform, a small amount of capacitance produces some peak-reading

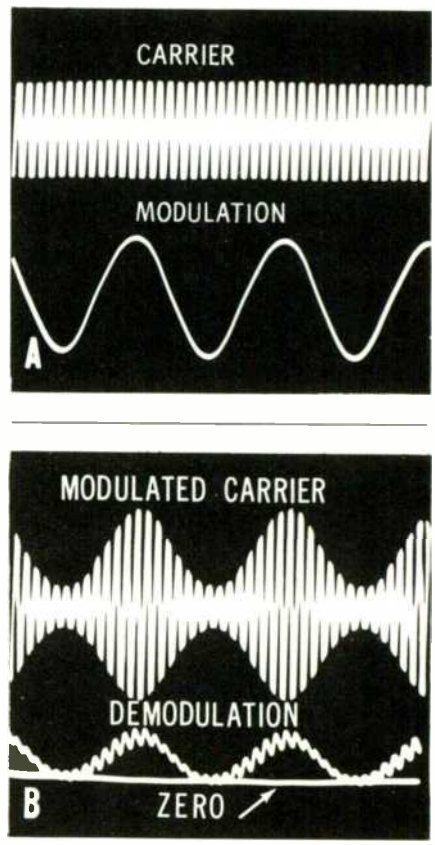


Fig. 1 Waveforms involved in the processes of amplitude modulation (AM) and demodulation, or detection. **(A)** The amplitude of a carrier sine wave (RF) is changed by a lower-frequency signal (usually AF or video). **(B)** The envelope, or outline of the modulated carrier corresponds to the general shape of the modulating signal. The output of the video detector diode in the receiver, the recovered modulation (bottom waveform), has a ripple which actually is that part of the carrier not eliminated by the detection action. The ripple is eliminated by a filter which follows the detector and is part of the video detector circuitry.

NOW you can measure resistors accurately

IN CIRCUIT !

in solid state devices

FE20 HI-LO
with hi-voltage probe and large six-inch meter **$129.50**

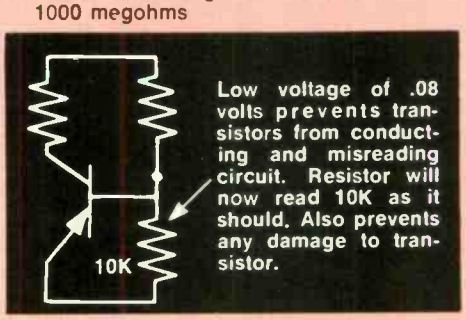
FE21 HI-LO with 4½-inch meter $99.50

WITH THE NEW HI-LO FIELD EFFECT MULTIMETERS

USES ONLY .08 VOLTS TO POWER OHMMETER TO PREVENT TRANSISTORS FROM CONDUCTING AND UPSETTING READINGS

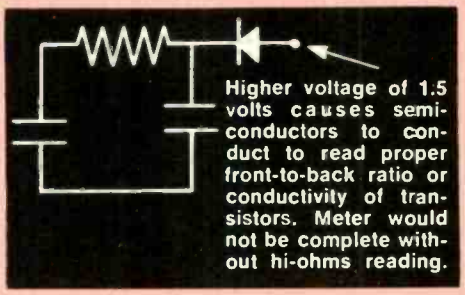
Look at these extra features to see why the Hi-Lo meter belongs on your want list:

- Unbelievable specifications of 15 megohm input impedance on DC and 12 megohms on AC
- Laboratory accuracy of 1.5 percent on DC and 3 percent on AC
- 9 DC voltage ranges from as low as .1 volts full scale to 1000 volts
- 3 hi-voltage ranges of 3 KV, 10 KV and 30 KV
- 9 DC zero center ranges from .05 volts to 500 volts . . . a must for delicate transistor bias measurements
- 7 resistance ranges from 1000 ohms full scale to 1000 megohms
- 9 DC current ranges from 100 microamps to 1 amp
- Automatic built-in battery test . . . never a worry about rundown batteries, just push the switches under the meter and read.
- Standard .6 amp fuse to protect the ohms and milliamps scales if voltage or overload is accidentally applied. No more need to return the meter to factory for repair . . . just replace the fuse.
- Special probe with 100K isolation resistor in probe to prevent AC pickup or to prevent loading oscillator circuits. Leave in normal position for most tests.



Low voltage of .08 volts prevents transistors from conducting and misreading circuit. Resistor will now read 10K as it should. Also prevents any damage to transistor.

Here is why you should have both Hi and Lo battery voltages for correct in-circuit resistance measurements in solid state circuits:



Higher voltage of 1.5 volts causes semiconductors to conduct to read proper front-to-back ratio or conductivity of transistors. Meter would not be complete without hi-ohms reading.

SENCORE INC. 3200 Sencore Drive • Sioux Falls, South Dakota 57107

Circle 16 on literature card

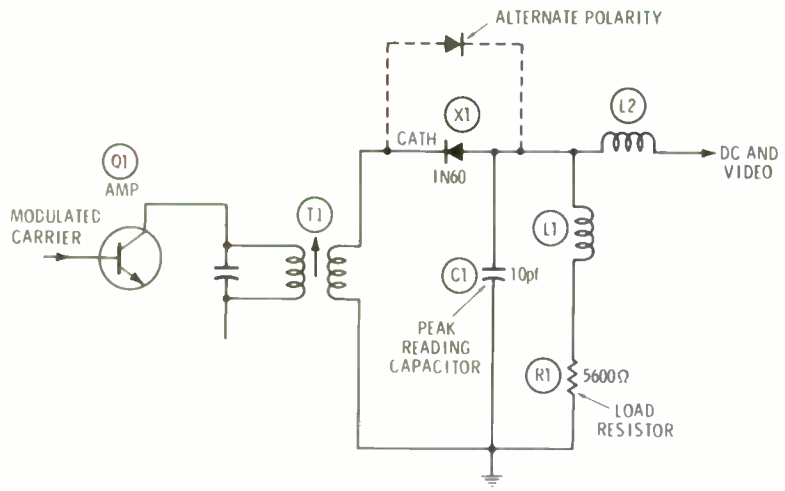


Fig. 2 The schematic diagram of the video detector of a typical television receiver. The polarity of both the DC and the AC (video) signals is determined by the polarity in which the diode is connected into the circuit.

action, which increases the DC voltage and reduces the ripple. In the bottom waveform, the use of a capacitance that was five times larger has prevented any rectification on the downward slope of the modulation.

From Fig. 4, it can be seen that although higher efficiency is obtained by production of an increased demodulated signal, the waveshape is distorted. Because such a large value of capacitance stores too much voltage between cycles of the carrier, the average DC voltage cannot decrease quick enough to follow the contour of the negative-going peak of a high-frequency signal. This phenomena is called "negative-peak clipping", and is a serious form of distortion which can occur in any variation of AM detection if the time constant of the filter circuit is too long.

Visual symptoms produced by excessive time constant

When C1 is too large or R1 is open, the picture produced on the screen of a TV receiver displays relatively sharp detail of any strong, black, narrow vertical lines. But to the right of the vertical lines appears a gradually brightening gray smear which has no detail, as shown in Fig. 5E.

Poor high-frequency response in the video amplifiers also blurs the picture; however, some smeared detail remains although **none** of the vertical lines have sharp edges, as shown in Fig. 5H and I.

Fig. 5 shows comparisons of normal waveforms and picture-tube displays and abnormal ones caused by excessive values in the filter of the detector and reduced video bandwidth.

Positive Or Negative Detection

Video detectors rectify either the positive or negative peaks of the carrier sine wave, depending on the polarity of the diode. If the output is taken from the anode of the diode, the average DC is negative, and the recovered video is negative-going. Conversely, if the output signal is taken from the cathode of the diode, the average DC is positive and the recovered video is positive-going. A diode which is installed backwards will produce a picture that is reversed, like a negative in photography, as shown in Fig. 6.

Certain defects in the video IF or the video amplifiers can cause

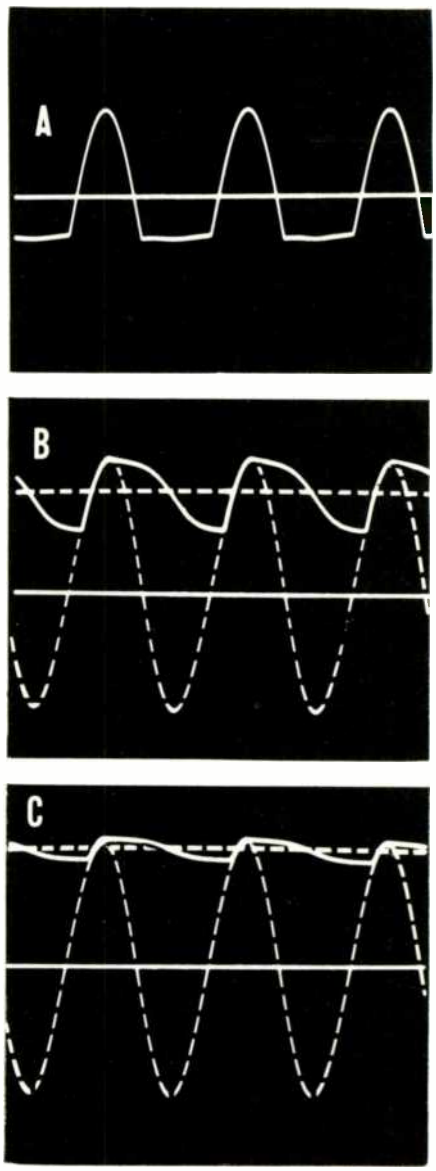


Fig. 3 Waveforms here show how the size of the capacitor in the filter of the detector affects the ripple and the DC voltages produced by rectification of an unmodulated sine wave. **(A)** Half-wave rectification with no filtering yields low DC and a ripple with high amplitude. **(B)** Normal amount of capacitance in filter following detector diode produces good level of DC and some ripple. This is about the average for video detectors. **(C)** Excessive amount of capacitance relative to the load produces more DC (video) and less ripple but can distort the demodulated signal. See the text for details.

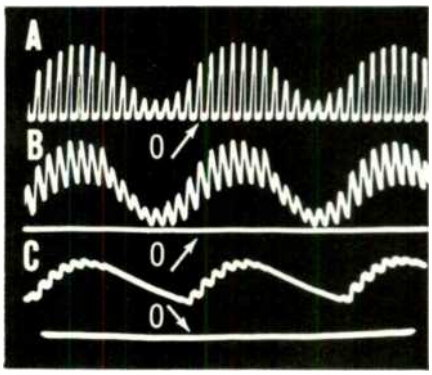


Fig. 4 How size of filter capacitor affects the rectification of a modulated carrier. **(A)** Half-wave rectification with little or no capacitance in filter produces little video after filtering. Average DC voltage is about 30 per cent. **(B)** Optimum amount of capacitance produces about 70 per cent DC voltage with reduced ripple which must be filtered out. **(C)** Excessive amount of detector filter capacitance (C1) yields about 100 per cent DC voltage and very low ripple, but C1 holds the DC voltage too long and causes loss of detection and resultant distortion of the downward slope.

a "negative" picture; however, the polarity of the DC at the detector is not affected. Consequently, measurement of the DC voltage across the video detector load resistor will reveal whether or not the diode is installed properly.

Some video detector circuits do not return directly to ground. For example, the base supply for the 1st video amplifier transistor of a solid-state receiver might be connected to the "low" side of the video detector circuit. Also, the low side of the video detector in a few of the older color receivers is connected to the cathode of the 1st video amplifier tube.

Keep these exceptions in mind. When in doubt, find the low side of the detector circuit, and use that point as "ground" when you measure and analyze the AC (video) and DC voltages produced by the detector.

Troubleshooting Video Detectors

Because video detector circuits contain only a few components, they seldom produce hard-to-solve problems. However, because the video detector usually supplies the control signal for the AGC keyer stage (either directly or from a video amplifier), excessive leakage in the detector diode can produce symptoms which indicate an AGC defect.

Conversely, an AGC defect might cause too much or too little signal to reach the detector. Or, AGC overload in the video IF's might cause a reversal of the modulation of the carrier and thus produce a negative picture.

As revealed by these two examples, the interdependency between AGC and video detection operates in both directions. Remembering this can make servicing of either function much easier.

The component in the video detector which is most likely to fail is the diode. Video detector diodes can open or short.

Diode leakage which becomes worse as the temperature increases is more difficult to analyze than complete opens or shorts. A heat lamp or a soldering iron tip can be used to slightly warm the diode. If the symptoms rapidly become worse, spray the leads of the diode with coolant. (Glass-encased diodes might crack if the coolant is sprayed directly on the glass, so don't overdo the cooling process.) A return to normal operation proves that the diode is defective.

Ohmmeter measurements of the components in video detectors often help locate defects more quickly than other methods.

The following series of tests is recommended for checking circuits similar to that in Fig. 2 and in which the cathode of the diode is connected to T1:

- With the receiver turned off, connect the positive ohmmeter lead to the anode of X1 (or the junction of L1 and L2, if the diode is hidden), and connect the negative lead to ground.

- Select a low ohmmeter scale, such as X10. A normal reading should be between 50 and 200 ohms. Use of the X1000 scale will produce a confusing reading of around 1000 ohms, and consequently is not recommended.

- A reading of less than 50 ohms indicates that the diode is shorted. A reading of 5.6K ohms suggests that the diode or the secondary winding of T1 is open.

- Reverse the polarity in which the ohmmeter leads are connected to the circuit. The normal reading should be 5.6K ohms, because the diode is reverse biased and the only path to ground is through L1 and R1. A higher reading indicates that R1 or L1 is open, or that the value of R1 has increased.

In the likely event that the resistance of R1 is only a few hundred ohms, the contrast will be reduced, and a black outline will be seen on the right of white objects, or a white outline around the right side of black objects in the picture will be seen, as shown in the white crosshatch pattern in Fig. 7. Overly sensitive action of the

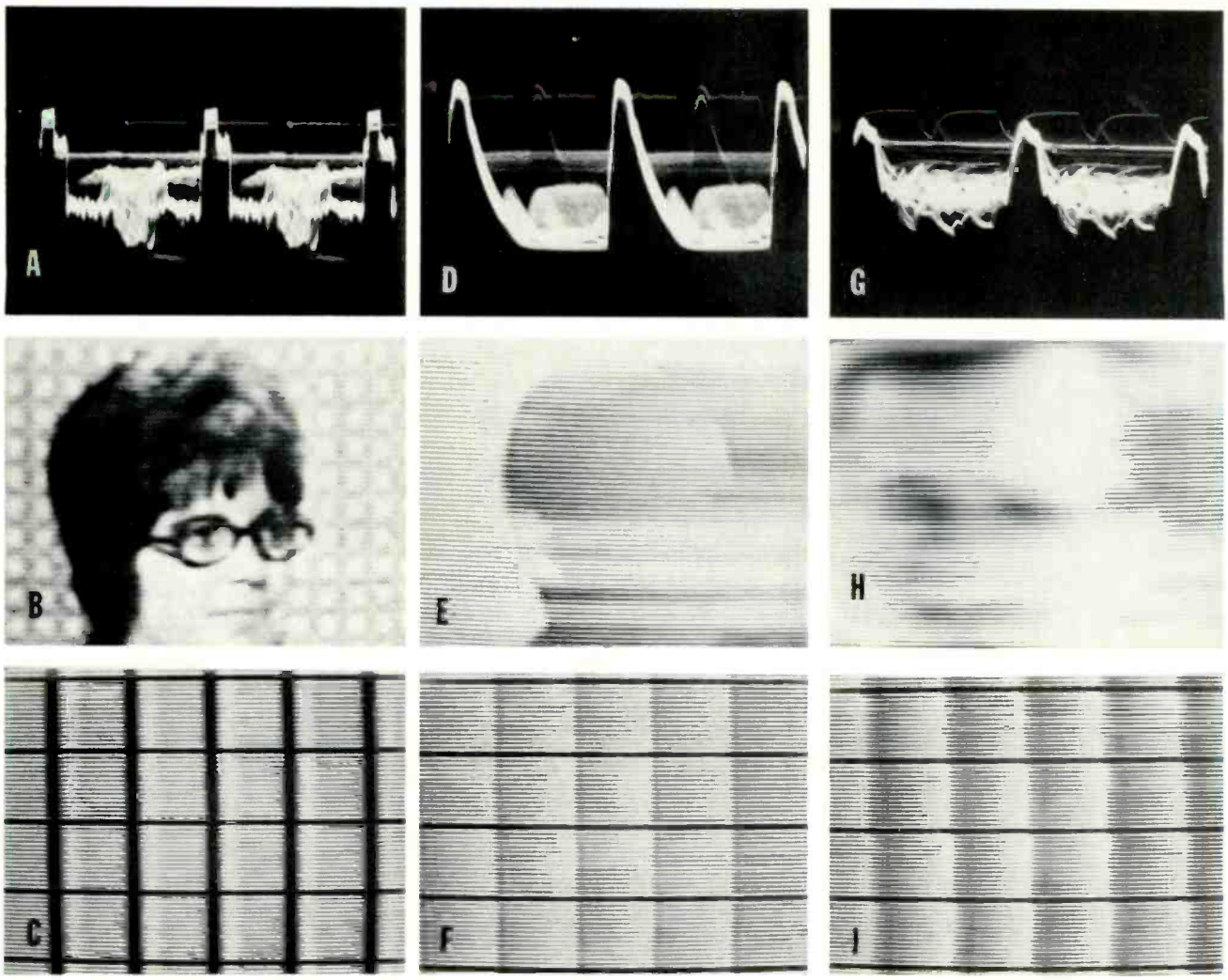
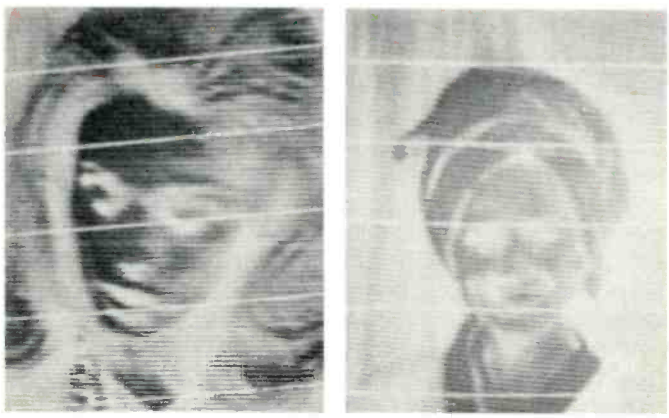


Fig. 5 The pictures produced on the screen and the scope waveforms shown here provide comparisons of the effects of normal detection, excessive detector time constant, and loss of high frequencies in the video. **(A)** Normal video detector output waveform scanned at 7867 Hz. **(B)** Normal picture on the screen of the CRT. **(C)** Normal crosshatch produced on the screen of the CRT. **(D)** Smeared scope waveform produced by an open R1 (Fig. 2). **(E)** Picture produced on screen with R1 open. Note the sharp vertical edges with no details in the smear on the right. (Picture is a person looking to his left.) **(F)** Crosshatch produced with R1 open reveals good sharpness of horizontal lines and fair sharpness of vertical lines. **(G)** Note the absence of sharp edges in the video waveform produced with a video peaking coil in Fig. 2 open. **(H)** Screen display produced with a peaking coil open. All details of this part of a face are smeared. **(I)** All vertical lines of the crosshatch are blurred when a peaking coil in the circuit of Fig. 2 is open.

Fig. 6 A "negative" picture with poor locking was produced when the video detector diode, X1, in Fig. 2, was installed backwards.



sync and the AGC adjustments are additional symptoms.

- Test the resistance of both peaking coils. The resistance of each should be less than 100 ohms.

Some peaking coil assemblies include a damping resistor which is connected in parallel to the coil. In such assemblies, if the coil is open, a resistance of several thousand ohms will be measured.

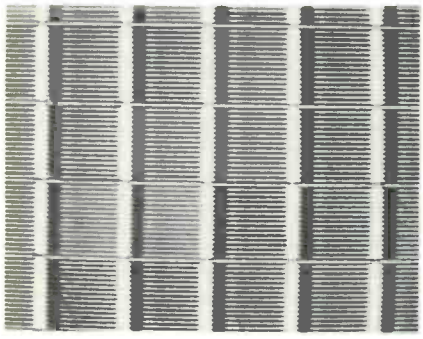


Fig. 7 A low value of R1 in Fig. 2 causes low contrast and a black outline on the right of white objects and a white outline on the right of black objects, as shown here.

Shorted turns in peaking coils usually do not produce any definite symptoms, although this defect can reduce the inductance and cause a very slight blurring of the fine detail. A quick test for an open peaking coil is to short across the leads of the coil; if the sharpness of the picture improves, the coil is defective.

Any detector circuit which passes the preceding tests should operate well enough to produce seemingly normal video. If leakage of the diode is suspected in borderline cases, the diode should be removed from the circuit, for further testing.

Next Month In Troubleshooter: Chroma Demodulation

There are no obvious similarities between the actions involved in video detection and chroma demodulation. Video detection recovers the modulation by rectification of the varying amplitude of the carrier. Phase is not involved, because there is essentially only one signal and one detection.

Chroma demodulation involves a comparison of the chroma signal—the amplitude and phase of which are constantly changing—and the "reference" carrier, the phase and amplitude of which are fixed. Without some understanding of phase, it is impossible for anyone to understand chroma demodulation. Consequently, the analysis of chroma demodulation next month will start with an in-depth look at phase. □

test equipment report

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

Vector Monitor

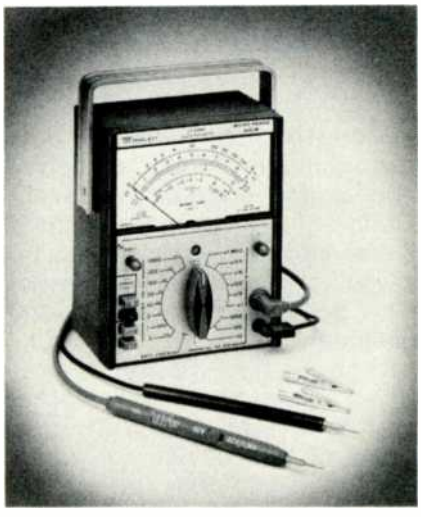
Product: Model IO-1128 Vector Monitor
Manufacturer: Heath Company
Function and/or Application: Measures the phase angle of the demodulators and evaluates chroma alignment when used with a color-bar generator, such as the Heath IG-28.

Features: Three gun-killer switches are mounted on the front panel, a grid-cathode switch to maintain the same vector pattern is on the rear panel, a four-conductor cable with clips is furnished for connection to the receiver, and the scope tube is 3 inches in diameter. Assembly time is approximately 8 hours.
Specifications: Not Available
Price: The IO-1128 Vector Monitor scope sells for $49.95.

Circle 50 on literature card

FET VOM

Product: Model 603 VOM
Manufacturer: Triplett Corporation
Function and/or Application: Measures voltages, currents and resistances
Features: The internal circuitry draws only 10 microamperes from the two self-contained 9-volt batteries; therefore, operating lifespan of the batteries is nearly equal to the shelf life. The batteries are not discharged, if the meter is left on. Because of linearity made possible by internal feedback, only two scales on the meter are necessary for DC voltages, AC voltages and AC/DC current ranges. "Auto Polarity" feature changes the polarity of the DC scales by means of two pushbuttons; reversal of the test leads is not necessary. Another feature, "Low Power Ohms"®, reduces the voltage applied during tests of resistances and minimizes undesired changes in the measurement which might result from conduction through solid-state devices.
Specifications: DC voltage ranges: .3, 1, 3, 10, 30, 100, 300 and 1000 volts full scale at 3 per cent accuracy. Input impedance is 11.12 megohms. **AC voltage ranges:** .3, 1, 3, 10, 30, 100, 300 and 1000 volts full scale at 3 per cent accuracy. Input impedance is 10 megohms, and the frequency response (on all but the 300 and 1000 volt ranges) is 20 Hz to 10K-Hz. **Ohmmeter ranges:** RX1, RX10, RX100, RX1K, RX10K, RX1M-ohm in both conventional and low-power functions. **AC/DC current ranges:** 1 milliampere, 10 milliamperes, 100 milliamperes, and 1000 milliamperes.



Decibel ranges: −30 dB to +62 dB in 8 ranges. Accuracy is ±3 per cent on all ranges. Model 603 measures 5⅛ inches x 6½ inches x 3 3/16 inches, and the weight, with batteries, is 2½ lbs, with one probe, one ground lead, two alli-

gator clips, three batteries and an instruction manual.
Price: The Model 603 VOM sells for $150.00.

Circle 51 on literature card

Pushbutton FET Multimeter

Product: Model FE160 Multimeter
Manufacturer: Sencore, Inc.
Function and/or Application: Measures DC and AC voltages, currents, and resistances
Features: FET and solid-state devices employed, a total of 112 ranges are selected by pushbutton switches. The high-power ohmmeter function uses 1.5 volts, and the low-ohmmeter

function applies .08 volt. This low voltage is used to minimize unwanted current through solid-state devices during ohmmeter measurements. The lowest full-scale DC range is 0.1 volt, and a low-current range of 30 microamperes at full-scale is supplied. The meter is protected against overload.
Specifications: The accuracy of reading on DC voltages is 1.5 per cent, and on AC voltages 2.4 per cent.
Price: The Model FE160 FET Multimeter sells for $190.00.

Circle 52 on literature card

Color-Bar Generator/Signalyst

Product: RCA Chro-Bar IC Color-Bar Generator/Signalyst Model WR-515A
Manufacturer: RCA Electronic Components
Function and/or Application: Source of color bar, crosshatch

and dot patterns at RF, IF, and video frequencies.
Features: The keyed-rainbow type color bars can be displayed in the usual way, or markers can be added to the 3rd, 6th and 9th bars. Vertical crosshatch lines can be switched from none, to 3 or to 10. Horizontal crosshatch lines can be switched from none, to 3 or to 11. Dots are in 10 vertical and 11 horizontal rows. A "blank" function displays a clear raster without video or color for ease of adjusting color purity. A "Superpulse" pattern is a horizontally-centered (nearly vertically-centered) rectangle which is useful for video signal injection or signal tracing, or for evaluating video response or gray-scale tracking. Each function is available at video frequencies, as modulation of a 45.75M-Hz carrier, or as modulation of a channel 3 carrier. One control adjusts the polarity and amplitude of the video signals, and another control adjusts the amplitude of both IF and RF carriers. Gun "killer" switches and a plug-in cable with clips are furnished. The generator employs all IC's and diodes.
Specifications: Not Available
Price: The RCA WR-515A Chro-Bar Generator/Signalyst sells for $179.00.

Circle 53 on literature card

Multitester

Product: Model F-70
Manufacturer: Speco
Function: Measures DC and AC voltages, DC currents, resistances, and decibels
Features: 20,000 ohms-per-volt sensitivity; molded plastic case; batteries, test leads and instructions included.
Specifications: 5 DC voltage ranges—5, 25, 100, 500 and 1000

volts full scale; sensitivity is 20,000 ohms per volt. **5 AC voltage ranges**—5, 25, 100, 500 and 1000 volts full scale; sensitivity is 10,000 ohms per volt. **4 DC current ranges**—50 microamperes, 5, 50 and 500 milliamperes full scale. **4 resistance ranges**—6K ohms, 600K ohms, 6 megohms and 60 megohms full scale. **5 decibel ranges**—from −20 dB to +62 dB. **Price:** Not available

Circle 54 on literature card

Digital Multimeter

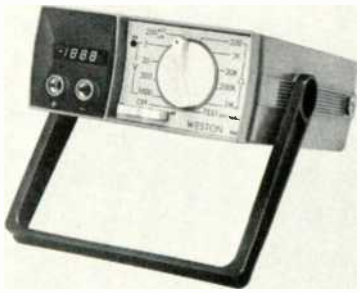
Product: Model 4440 battery-operated portable digital multimeter

Manufacturer: Weston Instruments, Inc.

Function: Measures AC and DC voltages, resistances and currents

Features: Four internal nickel-cadmium size "C" cells provide 8 to 12 continuous hours of operation. The battery charger permits normal measurements during charging time, and it plugs into a standard AC outlet. A dual-slope high-impedance bipolar A/D converter, a single MOS LSI plug-in chip, solid-state LED readouts, automatic polarity and overload protection are additional features.

Specifications: 5 DC voltage ranges—from 200 millivolts to 1 kilovolt; minimum impedance is 10 megohms; accuracy is ±.3 percent of reading ±1 digit. **5 AC voltage ranges**—from 200 millivolts to 1 kilovolt; input impedance is 10 megohms; accuracy is ±.5 percent of reading ±1 digit; frequency response is between 40 Hz and 10K Hz. **1 DC current range**—200 microamperes; accuracy is ±.4 percent of reading ±1 digit. **1 AC current range**—200 microamperes, accuracy is ±.7 percent of reading ±3 digits. **5 resistance ranges**—from 200 ohms to 2 megohms; accuracy is ±.5 percent of reading ±3 digits. **Conversion rate**—approximately 4 per second. **Common mode rejection**—80 dB when AC powered; approaches infinity when battery powered. **Normal mode rejection**—35 dB. The Model 4440 measures 5.45 inches X 2.25 inches X 7 inches and weighs less than 2½ lb.



Price: Model 4440 digital multimeter sells for $285.00 including test leads, batteries and battery charger.

Circle 55 on literature card

Circuit Analyzer

Product: Serviset Model E-C

Manufacturer: Lee Electronic Labs, Inc.

Function and/or Application: Instrument for circuit analysis and testing

Features: Tests for voltages between 60 volts and 20K volts, functions as an AF or RF signal injector or signal tracer, tests for continuity, tests and substitutes for high or low capacitance, tests

and substitutes for low, medium or high resistances, and tests transistors. Compact, portable

and self-contained instrument. No switches or dials to adjust. Supplied with a carrying pouch, battery, two test leads, an earphone, one earphone extension, high-voltage adapter, Klipzon adapter, and a 30-page instruction manual.

Specifications: Weight of the E-C kit is less than 1 lb.

Price: The Serviset Model E-C sells for $34.95.

Circle 56 on literature card

Digital Multimeter Kit

Product: Model IM-102 Digital Multimeter

Manufacturer: Heath Company

Function and/or Application: Provides a 3½ digit readout of voltages, currents and resistances.

Features: Five DC voltage ranges from 100 microvolts to 500 volts, five AC voltage ranges from 100 microvolts to 500 volts, six resistance ranges, which measure from 0.1 ohm to 20 megohms, and 10 AC/DC current ranges from 100 nanoamps to 2 amperes can be selected by the two switches. The multimeter selects positive or negative DC polarity and displays a "+" or "−" on the readout. Other features include an automatically-placed decimal point, overrange light and overload protection on all ranges. Assembly time for the kit is approximately 15 hours. Operated from the AC line; no batteries are required.

Specifications: Input impedance is 1000 megohms on the 2 volt range, and 10 megohms on the higher ranges. Accuracy of reading of 0.2 per cent on the DC scales can be obtained by use of the DC calibrator, which is furnished preassembled. Accuracy can be increased to 0.1 per cent by calibration against laboratory equipment.

Price: The IM-102 Digital Multimeter sells for $299.95.

Circle 57 on literature card

Portable Color-Bar Generator

Product: Model LCG-384 Color-Bar Generator

Manufacturer: Leader Instrument Corp.

Function and/or Application: Supplies color bars, dots and crosshatch patterns to aid in the adjusting of color TV receivers.

Features: Choice of 10 color bars, or just the 3rd, 6th and 9th bars. The crosshatch has 18 vertical bars and 14 horizontal bars, and the same number of rows of dots. These are available as a white pattern on a black background, or as a black pattern on a white background. Also a pattern, consisting of one vertical bar and one horizontal bar which intersect at the center of the screen, is available in white-on-black or black-on-white. Either channel 5 or channel 6 can be selected by means of a pushbutton switch.

Specifications: The generator is powered by 4 size "AA" penlight cells, and has a jack on the front panel for connection to an external 6 volt DC power source. The generator is 5 inches x 1⅜ inches x 7¾ inches, and weighs 2 lbs, with batteries, carrying case and two battery clips.

Price: The LCG-384 sells for $109.50.

Circle 58 on literature card

Field Strength Meter

Product: Model FS-3-S

Manufacturer: Sadelco, Inc.

Function: Measures the strength of signals between 54M-Hz and 300 M-Hz.

Features: Full CATV frequencies, tuned bandpass filters, di-

rect reading VSWR and Return Loss scales for use with the optional Spectrum Analyst or Porta-Bridge, FET metering circuit taut-band suspension in the meter, and gold-plated attenuator switch contacts.

Specifications: Input impedance—75 ohms. **Frequency coverage**—VHF band 54M-Hz to 216M-Hz; super band 216M-Hz to 300M-Hz. **Attenuators**—three 20 dB pads, one 6 dB pad. **Accuracy**—±1.5 dB, or better. **VSWR ratio**—1.4 maximum on VHF. **Temperature**

range—±2 dB variation from +20 degrees Fahrenheit to +100 degrees Fahrenheit. **Power supply**—four 9-volt batteries; battery check switch; internal voltage regulation. **IF bandwidth**—0.5M-Hz at the 3 dB point. **Adjacent channel rejection**—35 dB between video and nearest adjacent sound carrier. **Shipping weight**—6 lbs.

Price: The FS-3-S sells for $295.00.

Circle 59 on literature card

General-Purpose DC Power Supplies

Product: Model 6211A and 6212A Power Supplies

Manufacturer: Hewlett-Packard Co.

Function and/or Application: Furnish regulated power for the operation of external equipment

Features: Voltage adjustable from zero to 100 volts at zero to 100 milliamperes, load and line regulation of 0.01 per cent, p-p ripple and noise of 200 microvolt rms/1 millivolt, isolated output terminals, and a meter, which can be switched to read either voltage or current, on the front panel. The case is of impact-re-

sistant plastic. The stacking of several power supplies is made possible by interlocking feet on the cases. Model 6211A has a DC output which is constant voltage, and current limited. Model 6212A has a DC output which is constant voltage and constant current.

Specifications: Each model, 6211A and 6212A measures 8 inches x 5½ inches x 3¼ inches, and each weighs 4½ lbs.

Price: The Model 6211A sells for $105.00, and the Model 6212A sells for $130.00. □

Circle 60 on literature card

better
managementguides

by Robert G. Amick/ES Business Consultant

Flat-rate pricing:

SELLING RESULTS VERSUS SELLING TIME

Sources of Data For Flat-Rate Pricing of Service Labor

ELECTRONIC SERVICING magazine, in association with John Sperry, Sperry TV, Lincoln, Nebraska, presently is developing, for publication and sale, a comprehensive guide which lists the average times required to perform the individual diagnostic and repair/replace functions encountered in the servicing of entertainment electronic products. The flat-rate guide should be available to servicers late this summer.

Two service-connected associations, NARDA and NEA, have published lists of common service functions and the average times required to perform them. Data for these lists reportedly have been compiled through membership surveys. Information about these lists can be obtained by writing:

- **National Appliance & Radio-TV Dealers Association (NARDA)**
  318 W. Randolph Street
  Chicago, Ill. 60606
- **National Electronic Associations**
  1309 W. Market Street
  Indianapolis, Ind. 46202

Basic Philosophy Governing Profitable Service-Labor Pricing

You're in business—a business furnishing **Service** to others—to make money.

Whether or not you make money, and how much money you make, depends primarily on just one thing: How you price your service. (Assuming, of course, that you perform a needed and useful service, perform it honestly and competently, and that you diligently seek customers for your service.)

Two factors determine what you charge for your service:

- **Your need to recover what it costs you to produce the service you sell**—You must get back what you spend producing service—the labor and materials you buy, the value of the time you put into your share of the productive effort, your investment in tools and equipment to work with, the cost of a place to work, the money you must keep in reserve for business operations and the cost of labor and materials supporting the productive effort. Each of these items has value and their contribution to your service must be compensated. The time you contribute to your business could be sold to an employer. The money you've invested, and risk, could produce returns as savings interest or stock dividends. (With greater safety!) You pay your help whether or not your customers pay you, or even hire you to serve them. These are your costs—and your risks—to be met before the question of profit even arises.
- **Your need to make a profit**—To have reserves against future needs, technological changes, disasters (natural or economic) and the slow losses of creeping inflation, you must make a profit.

From the preceding, you can derive the simplest possible philosophy of pricing:

1) **Make back your costs or go broke**
2) **Make a profit or be vulnerable, defenseless before every little wind-shift of technology, economics or public tastes.**

How Much Is Profitable Pricing?

It's reasonable to infer, from the preceding philosophy, that your **minimum** price for your service is that which recovers your cost of doing business, and that your **maximum** is that which your customer sees as a fair value on the service you render him. Your customer is willing to pay for service according to how much he needs it or wants it, and what he must pay to get comparable service elsewhere.

Profitable pricing lies between those two—higher than mere cost recovery, lower than the level at which too many customers challenge the value of your service.

The Two Basic Pricing Methods

There are just two basic pricing systems:

Hourly

You can charge each customer for the time his job actually consumes. You keep a job ticket, recording all time spent on that customer's work. Your labor charge then is the time multiplied by the hourly rate you charge. If your hourly rate is correct, you'll recover your cost and make a fair profit.

Flat rate

Or, you can charge a, flat rate, or fixed fee, for labor on all operations of a similar type. Your fee is

based on a standard job-time, multiplied by your hourly rate. The standard job-time comes from a table compiled after studying the times required by the same operations on a substantial number of equipment. These tables give you a guide to the **average** time requirement for an operation when a competent technician, using good equipment, performs it.

Hourly Pricing—Selling *Time* Imposes A Ceiling On Profits And Negates Increased Productivity

Comparing the two systems, you'll see that hourly rate pricing guarantees you a profit on every job. However, it also puts a pretty inflexible ceiling on your profits, because you only have so many productive man-hours to sell. If you have one technician who works 40 hours a week, and you're able to put in 30 hours at the bench yourself, then you have 70 work-hours to sell. If you sell all work-hours available at an hourly rate of $10, you will gross $700. You're pretty well stuck there, because increasing your profit is a matter of either increasing the number of hours you have to sell, or increasing the rate you charge for them. Regardless of how productive you become, the most gross income you can receive is the product of your labor hours available for sale multiplied by your hourly rate.

Worse yet, even that gross profit level is impossible to attain. No shop owner or manager yet has managed to turn 100 per cent of the service-labor time he buys into productive, saleable time. Coffee breaks, parts chasing, minor interruptions, sick time and vacations eat away part of the total time you buy from your help, or from yourself. If you're reasonably efficient and well-organized, and if you're lucky in your choice of help, you'll be able to sell 80 or 85 per cent of the time you buy or contribute. That's a fairly high **labor recovery rate,** 70-75 per cent is a more realistic range.

On the hourly rate pricing system, you're selling **Time** as the primary unit of value to your customer.

Flat-Rate Pricing—Selling *Results,* Not Time, Enables You To Gain From Increased Productivity

With flat rate pricing you shift the emphasis to selling **Service.** Your time has value, of course, but the customer buys **results,** not hours or tenths of hours. And, results are not solely the product of time spent, they also involve several important intangibles.

- **Your skill and judgement**—You and/or your technicians took training to learn electronics. You acquired experience to sharpen your skills. You buy and read service literature, trade journals, training courses to advance your knowledge. Knowledge, plus skill, plus experience add up to judgement. All four add up to competency.
- **Your integrity**—The thing people trust is what gets you customers and holds them. Intelligent pricing helps, but your competency and personal and professional investment in giving them fair value for their money goes farther. That investment shows in the facilities you provide to back up your competency. It's not simply a financial investment, it's a declaration of your intention and desire to give **Service.** Furthermore, it declares your permanent intention to serve instead of just sticking around until the easy money runs out.
- **Your back-up resources**—If you've been in the business long, you've made some "connections" which add to the value of your services: Factory and manufacturers' representatives, sales engineers, parts distributors and others. They're a special kind of resource to you, to help with sticky service problems, procurement of scarce and hard-to-find parts, or to recommend new equipment or procedures which improve your service. They can also help you help your customers with warranty adjustments.

So, you see, you're just selling **Time.** If you're pricing on the basis of time alone, you're undervaluing the **Service** you perform. You're ignoring the value of those intangibles.

Still worse, you're limiting your ability to serve your customers and yourself. If you're selling 70 work-hours, it really doesn't matter to you whether you perform 30 jobs or 50 in that period of time. Either way, you get paid. If you're inefficient. those 30 customers pay for your inefficiency. If you're efficient, it doesn't make you any more profit. Each of your 50 customers benefits from your efficiency, but **you** don't.

If you've invested in additional equipment, newer and better equipment, to attain increased efficiency, you've really boxed yourself in. You're doing more work for the same money. You can't recover your investment in higher efficiency without increasing your hourly charge. You can sell more hours—your own or those you buy from your benchman. You pay for the hours you contribute by giving up time for other things you'd like to do. You pay time-and-a-half for additional hours from your help.

Either one can be seen as an increase in costs.

The only way out of that box is to sell **Service** instead of time. To price **Jobs** rather than hours used. That's what flat-rate pricing does.

Basically, flat-rate pricing begins with a couple of assumptions:

- **The value of your *Service* is not completely governed by the *Time* it consumes**—A given job has a definite value to the customer—restoring his TV set to operation before next Sunday's football game is missed; getting hers to work before she misses too many episodes of "As The World Turns," are services they will pay for. (They do!)
- **It is more desirable to maintain a high *average profit* per job limited only by the share of the available market you can satisfy, rather than make a profit on every job under the rigid limits of time available for sale**—Make no mistake about that; using the standard job-time tables is using an averaged time allowance. A very few jobs will take more, a few will take substantially less time. The great majority—reportedly 80 to 85 per cent—achieve profitability in a reasonably well-equipped shop with reasonably competent technicians.

Obviously, when you sell the service or job, you're trying to beat those average-time allowances. The minutes you shave off each job can go into the next one. Under the flat rate plan, it really matters whether you turn out 30 jobs or 50 each week. Your efficiency rewards **you,** as well as your customers. (When you gain efficiency through equipment and personnel upgrading, your customers benefit because the quality of your work probably will improve, too.)

Other Significant Advantages Of Flat-Rate Pricing

Aside from higher profits, flat-rate pricing has some advantageous side-effects:

- A standard labor charge for a given operation relieves you of problems that arise when two customers compare charges.
- With efficiency as a goal, you're encouraged to upgrade and you're rewarded for it.
- Part of the rewards are directed to your technicians, encouraging them to perform more efficiently.
- That reduces the supervision time you must expend, because your benchmen have an incentive to improve their performance rather than just 'put in their time.'
- Estimating and billing are simplified. Your labor estimate is based on the tabled time allowance for the operations involved.
- Making up the customer's bill is simpler, because each operation is listed, along with its price.
- It's more satisfying to the customer to see what the job involved.

In Part 2

What the flat-rate method of service-labor pricing requires of shop management and technicians and how these can be achieved will be discussed in part 2 of this three-part series. □

Counterfeit Currency:

A Guaranteed Loss On Every Sale. How to avoid it.

by James Scott No. 30171
(As told to John R. MacIsaac)*

Late last summer, I walked into a St. Louis radio/TV repair shop, purchased a package of antenna wire and made payment with a mint-new-looking counterfeit twenty-dollar bill. When the technician came to the counter and took my money, he snapped it across his fingers and jokingly remarked, "Looks like you printed this while you were parking your car."

I was so startled that I almost fainted. But as he proceeded to make change, it was immediately evident that he was only kidding, and I pocketed nineteen dollars in perfectly good Federal Reserve notes. And although I hadn't printed that phony twenty in my car, it was only a little over a week old and had been printed by a fellow in Philadelphia who operated on the theory that the surest way to have money of his own was to make it himself.

I made mine by disposing of his. I was a passer—just one of many small-time criminals, unemployed burglars and whatnot who supplement their income by putting counterfeit money into circulation. The idea is to buy, say, a bunch of "queer" ten-dollar bills from an underworld distributor for one dollar apiece, then to dispose of them at face value. It's a racket that expands more every year as more low-priced photo-engraving equipment comes onto the market.

And it's a racket aimed almost exclusively at retail businessmen.

Passers of counterfeit work almost like rubber-check artists, by converting their worthless paper into valuable merchandise, or by purchasing some small item with a large bill and accepting change in real honest-to-goodness money. And the pros aren't the only ones you have to worry about. If a bad bill is good enough, there is a fair chance that even your best customer might innocently hand it to you.

There was never anything innocent about me. When I handed that St. Louis technician such an obviously new bill, I really was playing it quite safe. That twenty would have fooled David M. Kennedy himself. As a matter of fact, only a week earlier a fellow passer had used one just like it to pay *me* for a bet I'd won on a ball game.

Not all phony money, of course, is that hard to spot. I had some counterfeit tens once that looked like top-quality merchandise... until I handed one to the operator of an electronic equipment repair shop who had been wiping off shelves when I entered. His hands were still damp—and when he picked up the bill, the ink smeared like butter. Luckily, he didn't notice it until he had put the bill in the cash register. When he came back with my change, he was looking curiously at his green fingers. And, as I hastily left the place, I could see that he was still puzzling over a perfect impression of Alexander Hamilton's face on the ball of his thumb.

Over the years, I have run into "queer" money that was even worse than that. Some was so badly printed that all of the bills had registered twice—the fives looked like fifty-fives and Lincoln seemed to be siamese twins. I've seen art work so bad that the presidents could have been mistaken for Whistler's Mother and one pack of bills that I picked up in Cleveland had been printed with an ink that was almost turquoise—absolutely beautiful, but a trifle frivolous for my tastes.

Some passers specialize in this low-grade cabbage because it retails on the underworld market for almost nothing. And, surprisingly enough, because it passes almost as easily as the better stuff. One associate of mine used to boast that he could pass an old sock for legal tender. He may not have been far wrong. I once watched him buy a vacuum tube with a twenty that had been very economically printed on both sides with the same plate. I would have cut my hand off at the wrist before touching one of those bombs; but the electronic technician tucked it away as happily as if he had never been robbed.

How Businesses Contribute To The Bogus Bill Passer's Success

The simple truth is that all of us tend to take money for granted. No matter how highly we may regard it, we don't really *look* at it. And the more we are called upon to handle it, the truer this becomes. We accept a bill and glance at it just closely enough to determine the denomination. If the color and the texture are approximately right, and there's

*Mr. MacIsaac, now a successful book author and free-lance writer of articles for a variety of top publications, can write with authority about the modus operandi and rationale of criminals because he himself has spent time in a penal institution for armed robbery. His own hilarious and wildly improbable adventures outside the law are described in his book, *Half the Fun Was Getting There* (Prentice-Hall).

- *Fives, tens and twenties are the denomination most likely to be counterfeited*
- *Don't expect most counterfeit to appear new—counterfeiters usually "age" their bills before passing them*
- *Check the color, the details of the printing and the texture of the paper*
- *When in doubt, compare a bill with known legitimate currency of the same denomination*
- *Don't expect the counterfeiter to look like one—concentrate your attention on the bills, not on the person who gave them to you.*

nothing there to jar us, then it's money.

This casual attitude toward money, the almost automatic assumption that the bill you accept is genuine, is exactly what makes it possible for small-time crooks to spend a poorly printed bill or even a bill that has a portrait on both sides. I've known men who thought nothing of taking pen and ink to a one-dollar bill and changing it into a ten. "Raised" bills of this sort are always turning up in the banks. No one ever knows how many unsuspecting hands they pass through before being turned in with the receipts—and finally being rejected.

Another common trick is the split bill. The idea here is to take, for example, a one and a ten and split them so that you have four separate pieces—each with a blank back. Then you glue them together so that the two ones show a ten on the reverse sides. The results almost always pass as two tens, unless you run into some fanatic who wants to look at both sides of every bill he accepts.

In actual practice, you can give yourself adequate protection against bad money without submitting every single piece of it to a microscopic examination.

Guidelines For Detecting Bogus Bills

Fives, tens and twenties

The only bills you really have to worry about are the fives, tens, and twenties. One dollar bills just aren't worth the trouble of counterfeiting. A phony one, in fact, is so rare that a passer would be more inclined to hold onto it as a collector's item. Anything above a twenty usually gets more than a casual glance, so very few of these ever get into circulation.

Color, detail and texture

As a businessman, you are already quite familiar with money as a commodity of exchange—but see to it that you are also *aware* of it. Be conscious of its *color*, the *details of the printing* and the *texture of the paper*. Many an electronic technician has saved himself a loss when he noticed that a bill "didn't feel right."

Most counterfeit has a certain flimsiness about it. Real currency paper cannot be duplicated, so the bogus stuff is printed on a high-grade bond paper instead. It is less substantial, less supple than the real stuff, and it tears much more easily.

New bills are seldom counterfeit. Because defects show up more conspicuously on new money, counterfeiters usually "age" their product by soaking it in coffee or rolling it in a barrel of gravel. So give most of your attention to the scruffiest looking bills, especially if they are mixed in with eye-catching new ones.

If any bill definitely arouses your suspicion, take a good close look at the scrollwork. Most counterfeit plates are made by photoengraving and the fine lines always show evidence of breaking down, or blurring.

Compare it with another of the same denomination

If you are still in doubt after checking the bill, it's a good idea to compare it with another of the same denomination. But make sure you take it from *your own* wallet or from your cash register. On one occasion when a radio/TV technician wanted to check a bill I had given him, I handed him another piece of counterfeit with which to compare it. They matched just fine.

Don't depend on the counterfeiter looking like one—he probably won't

Concentrate your attention on the bills themselves, and not on the person who handed them to you. Apparent, unwarranted nervousness *might* be a tipoff, but you won't be dealing with a crook who "looks like a counterfeiter." The average passer probably would look more at home at your family reunion than in a rogue's gallery. He is just another customer.

A bogus bill is a loss, no matter who gives it to you

But even if the person presenting the bill is a regular customer, no less scrutiny is in order. Unwittingly, he may be giving you a bad bill received in change elsewhere. And to avoid offending your customer, simply say that the Treasury Department has ordered a close check of incoming bills because a rash of counterfeit is being circulated in the area—which is exactly what the Treasury Department would order, if such were the case. It's an easy matter to notate the bill number along with the name of the customer. Doing so might prove worthwhile later.

When You Accept A Bad Bill, You're Accepting A Loss

The attention you pay to the money you accept is the only guarantee you have that you are not letting yourself in for a loss. Remember, without proper precaution, once you accept a bad bill, you are stuck with it. Actually, you're not even that well off... in most cases the authorities will confiscate it before you have a chance to stick it on someone else. □

audio systems report

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

Audio Plugs

Product: Stereo plugs and jacks
Manufacturer: The Weltron Co.
Function and/or Application: Plugs and jacks for stereo tape and record unit connections.
Features: Six different models are available for inline connectors and speaker connections

with many European units such as Norelco Wollensak, Bell and Howell, and Telefunken. Two, three, and five PIN DIN types are available.
Specifications: N/A
Price: The audio plugs sell for $.50.

Circle 65 on literature card

Intercom/Paging/Program System

Product: Series STA system for intercommunication, paging or program distribution
Manufacturer: Bogen Division of Lear Siegler, Inc.
Function: Program distribution or voice communications from a central station.

Features: The control center contains a solid-state amplifier, 20-station switching, and has an All-Call function which overrides other functions when voice announcements are made. Add-on modules increase the maximum number of remote stations to either 40 or 60.
Specifications: Amplifier power—35 watts rms. **Output impedance**—25-volts balanced, constant-voltage line.
Price: The STA-20/PRSTA master station sells for $550.00.

Circle 66 on literature card

Tape Machine Accessories

Product: QM-series of accessories for reel-to-reel, cartridge, and cassette recorders and reproducers
Manufacturer: Nortronics Company, Inc.
Function: Professional recording accessories
Features: Liquid and spray head cleaners, cartridge and cassette

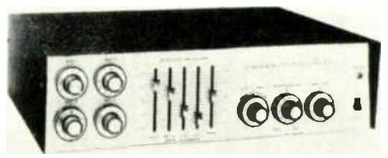
head cleaners, head demagnetizers, splicers, splicing tape, alignment tapes and bulk-tape erasers.
Specifications: Not Available

Price: Not available.

Circle 67 on literature card

Public Address Amplifiers

Product: CT series amplifiers with Acousta-Master equalizer
Manufacturer: Bogen Div. of Lear Siegler, Inc.
Function and/or Application: Amplifies audio signals.
Features: The CT series incorporates built-in acoustic filters and built-in compressors to minimize problems in public address applications. The all-silicon solid-state amplifiers are available in three different output wattages: 30 (CT30), 60 (CT60), and 100 (CT100). Each unit contains five acoustic equalizer slide controls and each slide control provides up to 10 dB boost and up to 10 dB cut to facilitate reduction of feedback. The CT series is protected against misuse or shorts



by a heat sensing cutout in the output circuit that protects power transistors. Tape, booster, bridging and telephone line outputs are located on the rear panel as well as two phone jacks for speaker outputs.
Specifications: The controls boost or attenuate the output at five selected frequencies: 80 Hz, 300 Hz, 1 KHz, 3 KHz and 10 KHz. Output taps are for 4-, 8-, and 16-ohm speakers and for 25-volt and 70-volt balanced constant voltage lines.
Price: The CT series is priced from $300.00 to $428.90.

Circle 68 on literature card

Diamond Stylus For Quadrasonic Records

Product: Duotone Quadrasonic Stylus
Manufacturer: Duotone Company
Function: Replacement needle.
Features: The diamond tip is polished twice during manufacturing. Both the sides and the tip are polished.
Specifications: Not Available
Price: Prices start at $9.95 on most types. □

Circle 69 on literature card

For more information about above products use reader service card

Troubleshooting Solid State Test Your Skill

The following test will help you evaluate your knowledge of the operation of a simple solid-state audio circuit and your ability to "read" trouble symptoms. **by Wayne Lemons**

Troubleshooting is an art as well as a science. You use science to determine "yes" and "no" answers, but it's an art when you are able to get most of the time the right answer to questions that must be answered "probably," "maybe," or "unlikely."

It is also part of the troubleshooting art if you can make a "quick and dirty" diagnosis instead of a time-consuming sophisticated one that tells you no more, or even less, than the "quick and dirty" one.

Want to see how well you score as a troubleshooter? Take the following test, and see if you agree with the author.

First, look at Fig. 1. This is a simple, but practical, audio amplifier circuit. Only one voltage is given, that of the collector. With only the information given on the schematic, answer the following questions or statements in this manner: Y for yes, N for no, P for probably, M for maybe, and U for unlikely.

1. The transistor is defective.
2. The transistor is not conducting.
3. The transistor has no bias voltage.
4. R1 is open or changed to a high value.
5. R2 is shorted.
6. C2 is leaky or shorted.
7. C1 is shorted or leaky.
8. The source voltage is of incorrect polarity.
9. A resistor is needed between base and emitter.
10. An emitter resistor is needed.

The answers should be:

1. Maybe. Because there is no voltage drop across R2 (same voltage on each end as read to ground), you can assume there is no current through the collector circuit. But the reason does not have to be a bad transistor.

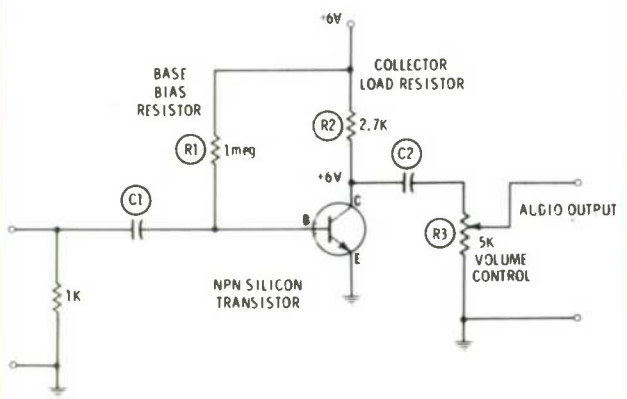


Fig. 1 Schematic diagram of a simple, solid-state audio amplifier circuit.

2. Yes. The transistor is not conducting (assuming of course that R2 is not shorted, which is highly unlikely, or that there is a circuit short from the source voltage to the collector, which also is not too likely.)

3. Maybe. Insufficient bias could be the cause of the transistor not conducting, but we have too little information to be sure.

4. Maybe. Same reason as for No. 3.

5. Unlikely. It is so seldom that a resistor shorts that for all practical purposes it can be discarded as a possible trouble, unless the resistor shows obvious signs of burning. In this circuit a burnt resistor would be next to impossible because even with the transistor shorted the resistor would dissipate less than 14 milliwatts.

6. No. Any significant leakage in C2 would cause a voltage drop across R2. This would occur because of the current path to ground through R3.

7. Maybe. This could cause the bias voltage to be low enough to cut off the transistor.

8. No. This is an NPN transistor. The middle letter of the type designation indicates the polarity of the collector and the bias voltage with respect to the emitter. Because here the middle letter is "P" (nPn) we know that the collector and base bias voltages should be positive with respect to the emitter.

9. No. We are assuming that this is the correct circuit, and even if it were not, a resistor between base and emitter would lower the available bias voltage, and al-

ready we know that the transistor is not conducting.

10. No. An emitter resistor is necessary mainly for protection of the transistor against excessive current. In this circuit the resistance in the collector circuit is sufficient to limit the collector current well below the danger level.

Answering the first 10 questions did not enable us to make a sure diagnosis. We must have more information.

We are relatively sure the transistor is not conducting, but we can only guess **why** it is not conducting. Is the transistor defective, or is the bias voltage too low? Suppose we take another voltage measurement and find that the base-to-emitter voltage is +0.2 volt, as illustrated in Fig. 2. Consider the following five statements and indicate your decisions as you did before.

1. The transistor is defective.
2. R1 is open or the resistance of it has increased to a much higher value.
3. C1 is shorted or leaky.
4. The emitter circuit is open.
5. The transistor bias is normal.

The answers should be:

1. Unlikely. This is a silicon transistor and so requires at least 0.4 volt bias before it will "turn on." Since the bias is insufficient it would seem that the trouble likely is in the bias circuit. Even in the unlikely event that the base-emitter circuit inside the transistor is shorted, the short in all probability would be of such low resistance that the bias voltage would be near zero—at least, considerably below 0.2 volt. A high-resistance short between base and emitter is possible but not probable.

2. Probably. This is the most likely cause, but not the only possibility. C1 could be shorted or very leaky.

3. Maybe. It could be, and the fact that the bias voltage is not all the way down to zero indicates strongly that R1 is not completely open, or that C1 is leaky.

4. No. If the emitter circuit were open, the base voltage would increase because of no current flow through R1 (except the current required by the meter itself). Measured with a high-impedance meter (VTVM or FET VOM), the voltage on the base would produce a reading of about 6 volts if the emitter circuit were open.

5. No. See No. 1 above.

With 15 decisions made we still do not know for sure what the trouble is. At this point, which of the following six techniques do you think would be the best troubleshooting procedure?

1. Remove the transistor and check it with a good transistor tester.
2. Disconnect one end of C1 and see if the base bias voltage returns to normal.
3. Disconnect one end of R1 and check its resistance with an ohmmeter.

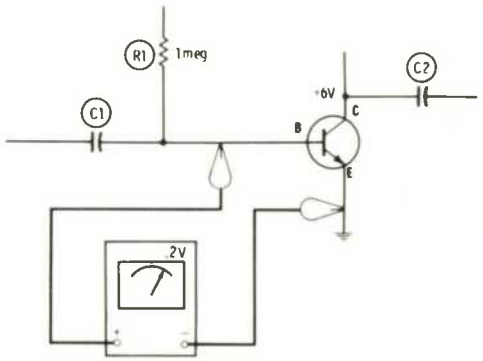


Fig. 2 Measurement of the voltage between the emitter and base reveals that the transistor is biased off. Silicon transistors require at least .4 volt forward bias between base and emitter. Value measured here is only .2 volt.

4. Check across R1, with an ohmmeter, without removing it from the circuit.
5. Shunt a 1-megohm resistor across R1 and see if the collector voltage lowers or the circuit starts working normally.
6. Shunt a 1M-ohm resistor between the collector and the base of the transistor and see if the collector voltage lowers or the circuit starts operating normally.

You might disagree with the following answers under specific conditions, but basically the answers reflect what the author believes is the fastest and most practical way of troubleshooting this sort of circuit with this kind of symptom.

1. No. This is time-consuming, and besides, we have a relatively well-founded idea that the transistor is not defective.

2. No. Again, too time-consuming, and also there is a possibility of component or circuit damage. This test should be used only if other quicker tests fail to reveal the trouble.

3. No. For the same reason as No. 2 above.

4. Probably. This is probably the best test for this particular time both because it is quick and we know or strongly suspect that this is the most likely trouble. If a "low-voltage" ohmmeter is used, the transistor will not be turned on by the ohmmeter lead voltage; consequently, the in-circuit reading should be accurate. If you use a regular ohmmeter, you will have to take two readings: first, you will have to take a reading across the resistor and note the reading, then you will have to reverse the ohmmeter leads across the resistor and read again. The highest of the two readings will be the correct one. Unfortunately, in any case, if C1 is leaky, you will get a false indication of the resistance of R1 (the reading will be less than 1M ohm).

5. Maybe. This is a good dynamic test. If you either can listen to or otherwise check the performance of the amplifier while making the shunt test, and if the amplifier returns to normal performance, you can be almost sure you have found the trouble. (We say "almost" because the right amount of leakage in C1 could reduce the bias just enough so that another 1M ohm resistor shunted across the original might restore normal performance. But this isn't too likely.)

6. Maybe. For the same reasons as in No. 5. There is one advantage of this test over the one suggested in No. 5, especially in an unfamiliar physical circuit layout: It is often easier to find the base and collector terminals than to find both ends of the bias resistor, at least from the printed side of the circuit board.

Conclusion

When any troubleshooting problem is dissected, as we have this one, it shows how important it is to have as much information about the circuit as possible.

For example, if both the collector and base voltages had been read at the beginning, several of the "maybe" solutions could have been skipped. Perhaps after making these two measurements the technician would have immediately suspected that the value of R1 had changed. His next step then would have been to prove or disprove his suspicions. This is what is called an "educated guess," but don't belittle it. It is the best, or one of the best, tools of the mind used in the art of troubleshooting.

Finally, we never did absolutely prove that C1 was not leaky just by testing or shunting R1. For this reason, **never** install a "shunted" part as a permanent cure for a circuit trouble. Remove the suspected part and install a new one, and then check the circuit performance. Shunting a part across a suspected defective one might not correct the trouble at all, even though it appears to for a time. Instead, it might be compensating for a defect in another part of the circuit. □

carr electronics

by Joseph J. Carr/ES Auto Electronics Consultant

Stereo-indicator circuits

Theory Of Operation And Servicing Procedures

Early (1965) Delco

Delco developed and produced one of the earliest stereo FM car radios. These early Delco stereo units were optional adapters which were mounted beneath the dashboard. Fig. 1 shows the lamp circuit from one of the earliest Delco stereo units (1965). The stereo lamp either illuminates a translucent copy of the particular automobile's trademark (as in the case of the Chevrolet) or the word "stereo".

Circuit operation

The stereo-indicator circuitry of the 1965 Delco unit is somewhat more complex than later designs. It samples the 19K-Hz pilot signal through a .07m-fd disc capacitor. This signal sample was applied to the base of the "lamp preamplifier." The collector circuit of this stage is tuned by a coil/capacitor combination. Because of the low frequencies involved, this capacitor is too large (.01mfd) to be placed inside the same can with the coil. Instead, it is mounted on the printed-circuit board.

The amplified signal from the preamplifier is then passed on to a two-stage relay-control amplifier. The first transistor in this section of the circuit, the "relay control", is biased very close to cutoff. Diode DS31 rectifies the incoming 19K-Hz signal and the resultant positive voltage forward biases the relay-control transitor, causing it to conduct. Conduction of this transistor, in turn, causes current flow through the 2.2K-ohm resistor in the emitter-ground circuit. This produces a voltage drop large enough to turn on the relay-switching transistor, the emitter current of which energizes the stereo-indicator relay. In turn, the contact arms of the relay close, turning on the stereo-indicator lamp.

Common troubles

Leakage of a transistor or replacement of a transistor with a lower-gain type can cause erratic operation of the stereo-indicator lamp. A typical trouble symptom is that the lamp turns on only

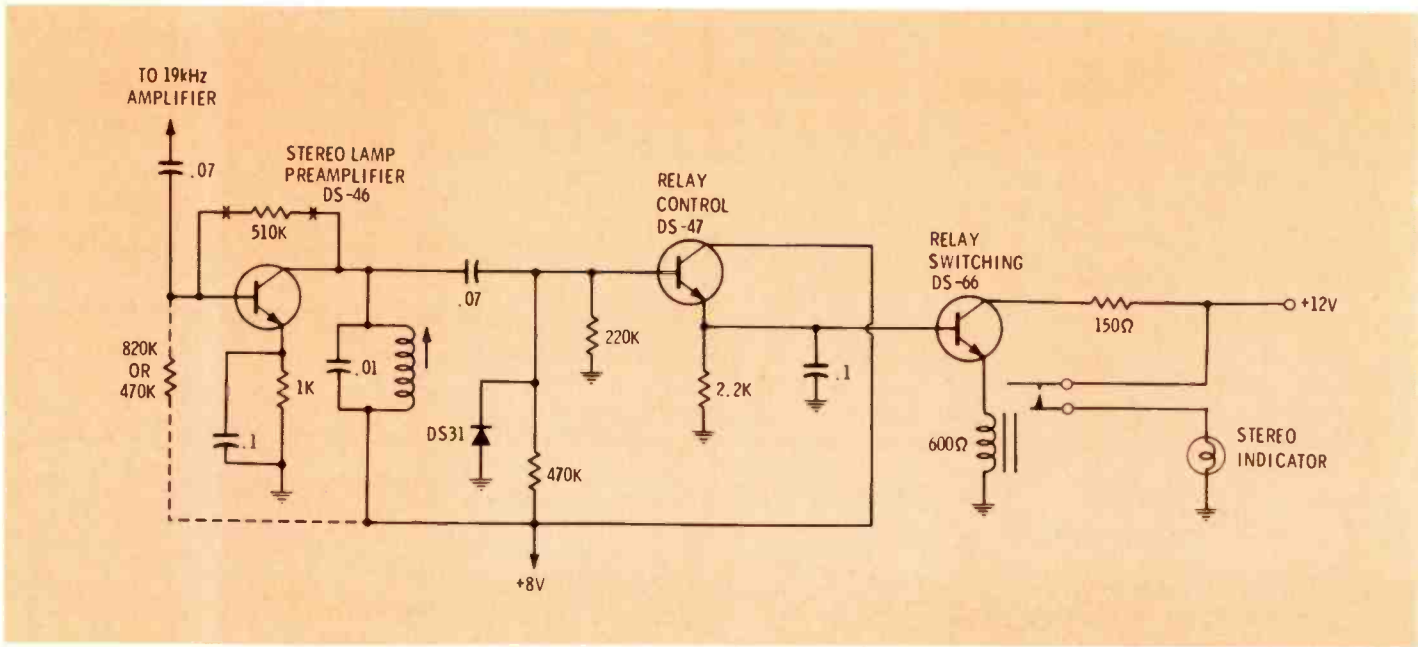


Fig. 1 Stereo-indicator circuit of an early (1965) Delco stereo-FM radio.

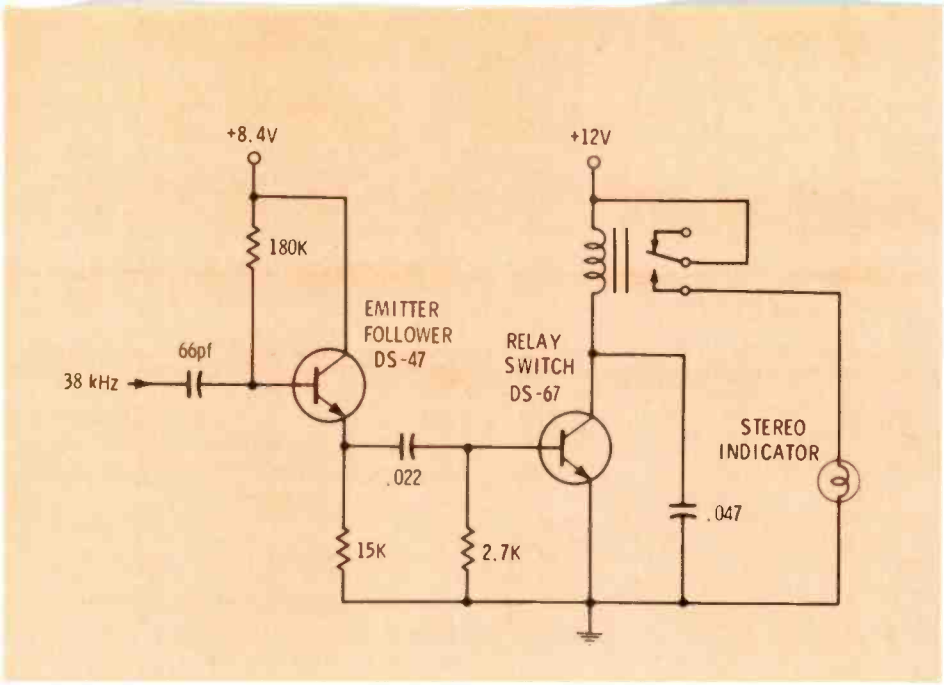


Fig. 2 A third-generation version of the stereo-indicator circuitry used in the 1969 Delco stereo-FM adapter.

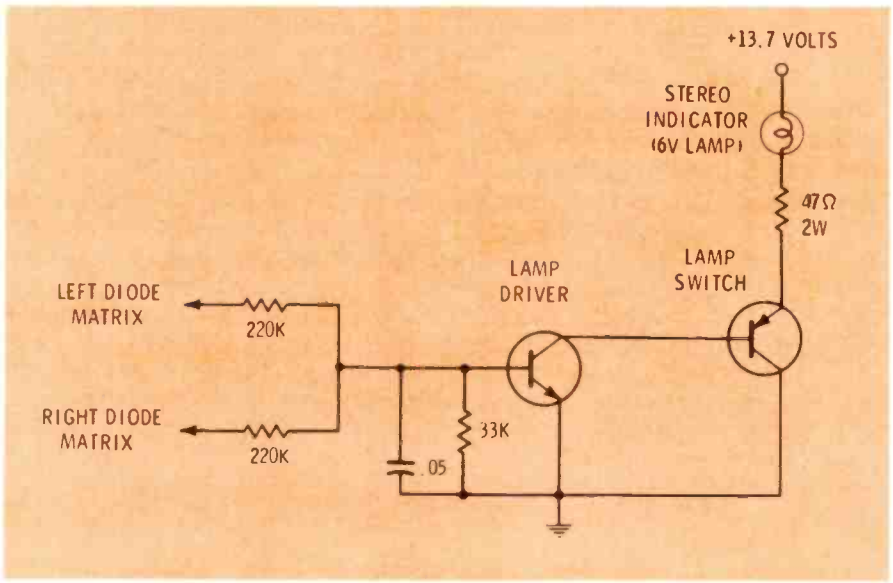


Fig. 3 An early-design Motorola 91BMP21 circuit.

when an exceptionally strong stereo signal is received.

To improve the overall operation of the circuit, remove the 510K-ohm resistor which is connected between the collector and base of the lamp preamplifier. In place of it, connect between the +8-volt line and the base of the lamp preamplifier another resistor the value of which is determined experimentally with an RC substitution box. The value will be between 470K and 820K ohms.

In most of these older sets there is now a certain amount of leakage current through the transistors and the capacitors. This current can cause the stereo-indicator lamp to stay on when the radio is tuned off a stereo station. Unless the leakage currents are extremely large, it will prove difficult to trace such a problem. In fact, the relay contacts frequently are erroneously blamed for this symptom whenever the problem is intermittent. To improve the functioning of the circuit, is to reduce the base-to-emitter bias on the relay-control transistor by paralleling the 220K-ohm base-bias resistor with another high-value resistor in the 470K-820K-ohm range.

Another possible source of trouble to remember when servicing intermittent problems in older auto sets (five or six years in an automotive environment makes a set really old) is oxidation of contact surfaces. Grounds on the printed-circuit board, relay contacts, and even the stereo lamp socket assembly itself have all proven to be sources of elusive intermittent problems. Because almost all of these early-production stereo adapters use volume and tone controls which are mounted on the adapter (the controls on the radio are disconnected), you also will have to occasionally clean them.

Later (1969) Delco

A third-generation version of the stereo-indicator circuitry, from the 1969 Delco stereo adapters, is shown in Fig. 2. By this time, the adapter on most GM cars had been moved behind the dashboard and out of sight. In fact, on certain models, it might take an inexperienced technician several minutes to locate the adapter. Remember, however, that it is almost always at the end of a thick black connecting cable—except for a few models which are mounted on top of the radio.

Circuit operation

Compared to the design of earlier models, the circuit in Fig. 2 uses one less stage. The type DS-47 transistor amplifies the 38-KHz signal very little, because it is an emitter-follower. The signal is passed directly from the emitter-follower stage to the relay switch via a .022m-fd capacitor. As in the earlier circuit, the signal forward biases the relay-switch transistor, energizing the relay, which, in turn, closes the contacts, which apply voltage to the stereo-indicator lamp.

Common troubles

The .047m-fd capacitor connected from the collector of the relay-switch transistor to ground is a decoupler which prevents the 38K-Hz voltage from interfering with the relay operation. If you encounter one of these ra-

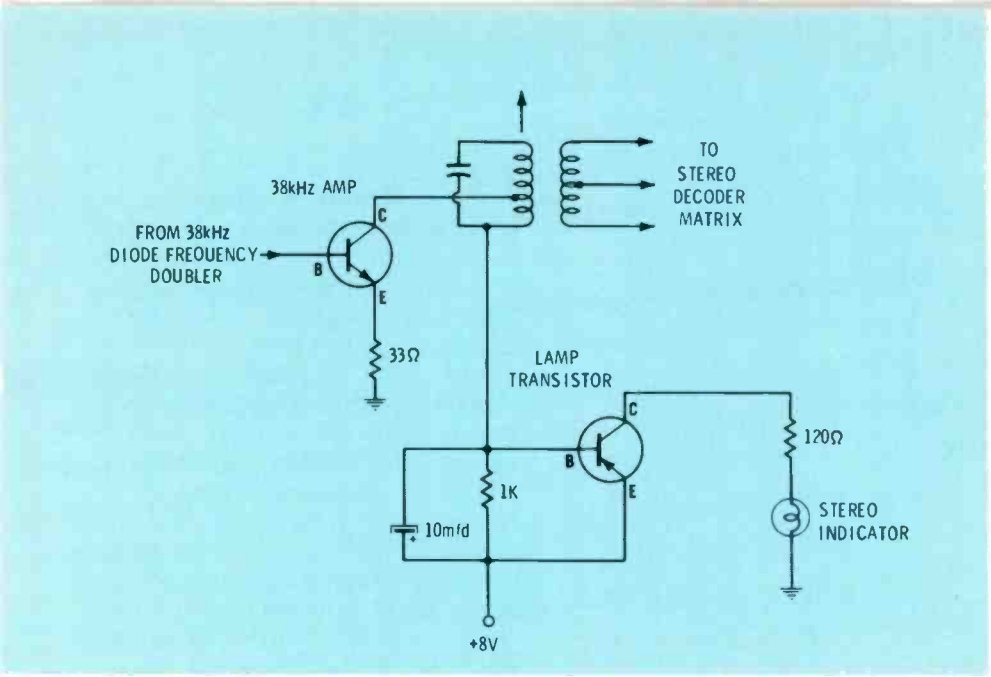


Fig. 4 Stereo-indicator lamp circuitry of a Craig Model 3117 eight-track tape player/stereo-FM radio.

dios in which the lamp stays on, check the voltage at the collector of the relay-switch transistor. It probably will be close to zero. If so, either the relay-switch transistor is shorted or the .047m-fd capacitor is shorted. Repetitive failure of either of these components can be prevented by connecting a 100 PIV silicon diode across the relay coil. The cathode of the diode should be connected to the +12-volt source.

The circuit in Fig. 3 represents a different approach taken by Motorola in some of their universal stereo FM underdash autoradio models. This particular circuit is from the earlier designs of the 91BMP21 series.

The lamp-switch transistor appears to be unbiased. There is, however, a voltage fed through from the emitter circuit. When the driver transistor is turned on by the presence of the 38K-Hz signal from the decoding matrix, the collector-to-emitter resistance of the transistor drops drastically. This, in turn, lowers the voltage between ground and the collector, which is at the same electrical point as the base of the PNP transistor. This provides the necessary forward bias for the PNP transistor. The stereo-indicator lamp is a 6-volt type. The other 6 volts is dropped by the 47-ohm resistor in series with the lamp. The two 220K-ohm resistors at the input of this circuit are each connected to one side of the stereo-decoding matrix. This provides a more constant voltage at the base of the driver transistor, which prevents lamp flicker.

Craig Model 3117

A third approach to stereo-indicator design in auto radios is shown in Fig. 4. This circuit is from the Craig Model 3117, a combination eight-track tape player/stereo FM radio.

The base of the 38K-Hz amplifier is connected directly to the output of a full-wave frequency doubler, which provides the bias for the transistor. Although the decoding matrix in any stereo receiver requires a pure sine-wave, the signal at the collector of the 38K-Hz amplifier is actually 38K-Hz pulses. The flywheel-effect action of the tuned circuit smoothes out the nonlinearities before the signal is passed on to the diode matrix. An advantage to this type of circuit is that there will be little or no voltage drop across the 1K-ohm resistor in the collector circuit until a 38K-Hz signal is present. This makes a

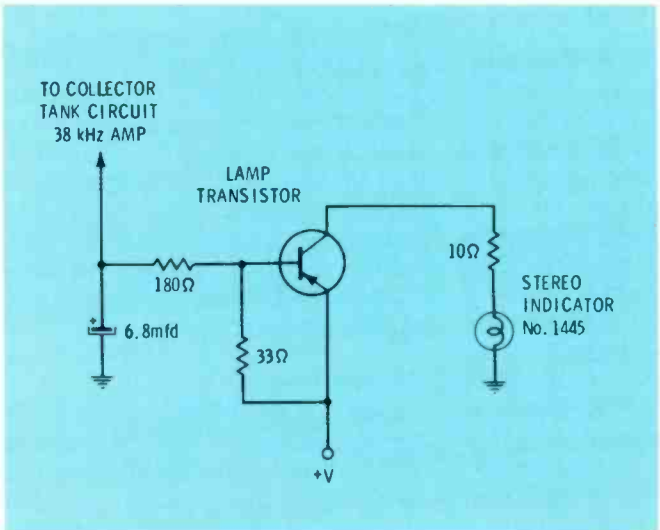


Fig. 5 Stereo-indicator circuitry of 1970-71 Philips (of Canada) auto radios used in Chrysler Corporation automobiles.

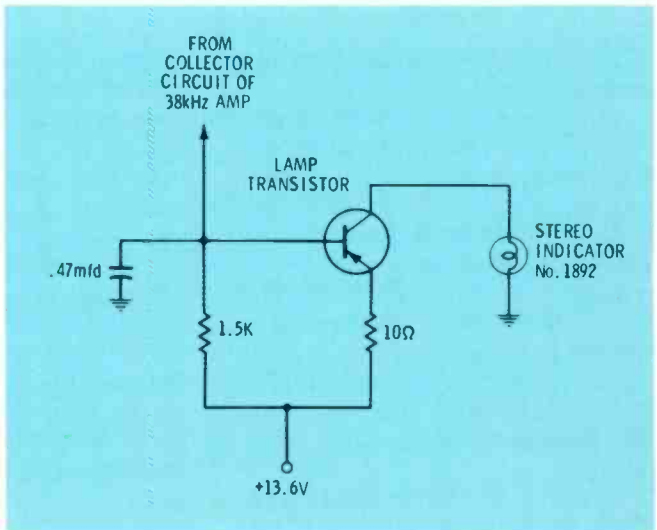
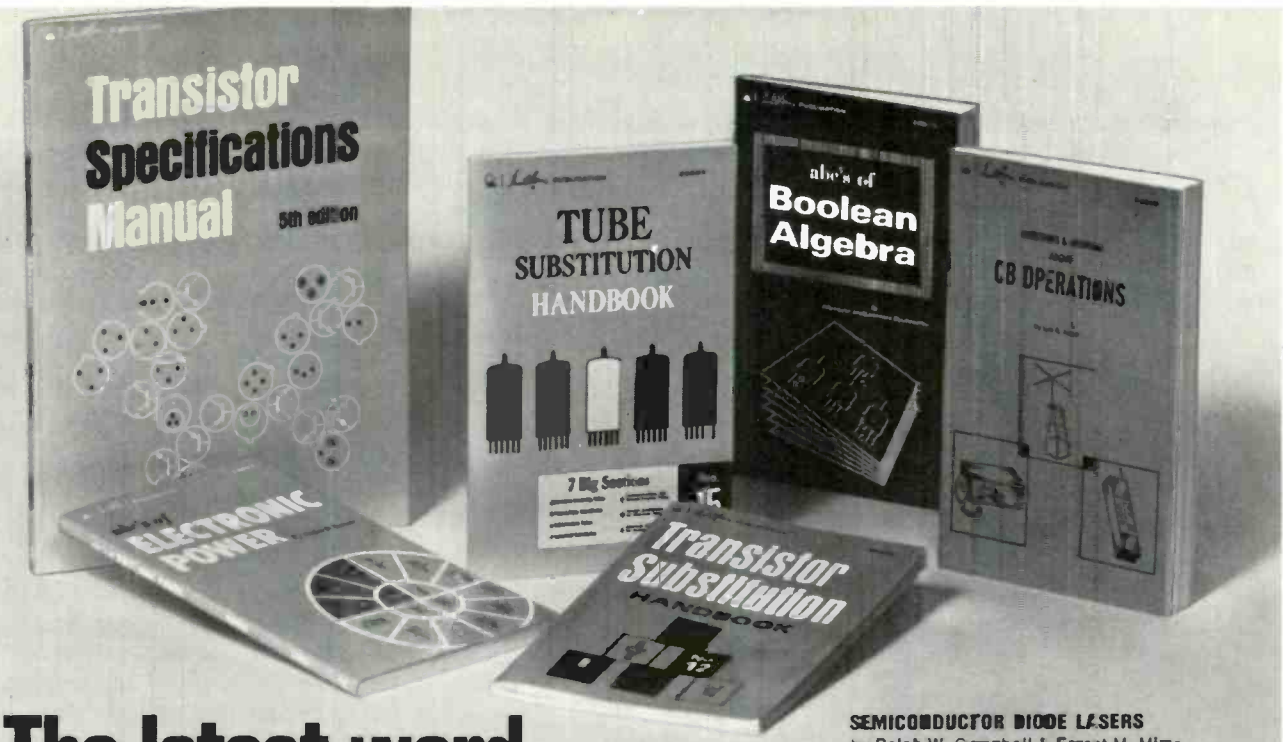


Fig. 6 1971 Ford stereo-FM radios made by Bendix use the stereo-indicator circuitry shown here.



The latest word on Electronics!

Sams presents 9 brand new or completely revised books ...invaluable working aids for anyone in electronics.

TRANSISTOR SPECIFICATIONS MANUAL 5th Edition

by the Howard W. Sams Engineering Staff

160 fact-packed pages of electrical and physical data for nearly 10,000 transistor types. Lists electrical and physical parameters, essential facts for servicing, and manufacturers of each type. All EIA-registered TO outlines are shown and dimensioned drawings are provided for nonstandard cases.

No. 20883 $4.50

ABC's OF ELECTRONIC POWER

by Rufus P. Turner

A clear explanation of electronic power and how to measure it, each point clearly illustrated by worked-out examples. No step in the mathematical solution is omitted. Covers: fundamentals, dc power measurement, ac power measurement, af power measurement, rf power measurement.

No. 20884 $3.50

TUBE SUBSTITUTION HANDBOOK 15th Edition

by the Howard W. Sams Engineering Staff

The most complete, up-to-date direct tube substitution guide you can use. Includes over 12,000 substitutions for receiving and picture tubes. Easy to use. Sections cover: cross reference of all American receiving tubes, picture tubes and recommended substitutions, cross reference of subminiature tubes, industrial substitutions for receiving tubes, communications and special-purpose tube substitutions, cross reference of American and foreign tubes.

No. 20889 $1.75

TRANSISTOR SUBSTITUTION HANDBOOK 12th Edition

by the Howard W. Sams Engineering Staff

Here is the answer if you can't get an exact replacement for a failed transistor. Using computers, the Sams Engineering Staff made over a billion comparisons of electrical and physical parameters of all transistors. The over 100,000 substitutions that can be safely and satisfactorily made are listed here in easy-to-find order.

No. 20899 $2.25

ABC's OF BOOLEAN ALGEBRA 3rd Edition

by Allan Lytel and Lawrence Buckmaster

A knowledge of Boolean algebra, the algebra of logic, is essential for anyone wishing to understand the logical functions of computer circuitry. This text introduces and explains symbolic logic and shows, with simple block diagrams and examples, the relation between language and switches, and the principles of logical design. It shows how to write logical expressions, expand and simplify them, and how to use relays and switches in circuits.

No. 20867 $3.50

QUESTIONS AND ANSWERS ABOUT CB OPERATION 2nd Edition

by Leo G. Sands

A quick and handy reference source of information about CB radio; its classes and uses, licensing and FCC rules, operating procedures, selection of CB equipment, and installation of transceivers and antennas in mobile and fixed-station locations. As valuable for anyone who works with CB radio as it is for electronics engineers and technicians.

No. 20893 $2.95

SEMICONDUCTOR DIODE LASERS

by Ralph W. Campbell & Forest M. Mims

This introduction to the rapidly expanding use of the injection laser shows how the science progressed from ruby rods to its present compact, highly efficient, and economical form of the semiconductor diode laser. It gives information on construction methods, circuits, conventional and infrared photographs, power requirements, power output, practical uses and future possibilities.

No. 20887 $5.95 (tentative)

SOLID STATE SERVICING

by William Sloot

Easy-to-understand, practical service information to aid the service technician in repairing any solid state electronic equipment used in black and white TV, color TV, and radio circuitry. Includes troubleshooting hints and procedures.

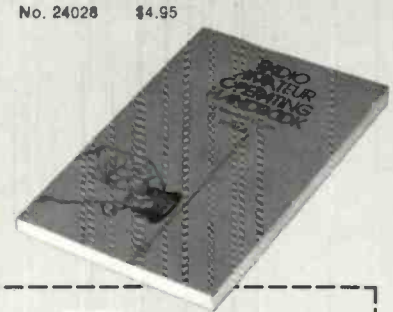
No. 20888 $4.95 (tentative)

RADIO AMATEUR OPERATING HANDBOOK

by Marshall Lincoln, W7DQS

While it is not a technical book on electronics, this book is a practical single-source working guide for hams. It covers all facets of on-the-air operating activities as well as the building, testing, and modifying of equipment. It is particularly intended to improve the ham's operating methods and techniques in radio communication.

No. 24028 $4.95



HOWARD W. SAMS & CO., INC. ES052

Order from your Electronics Parts Distributor, or mail to Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis, Indiana 46268.

Send books checked at right. $_____ enclosed. Please include sales tax where applicable. Canadian prices slightly higher.

_____Send Free 1972 Sams Book Catalog.

Name_____

Address_____

City_____ State_____ Zip_____

☐ 20883 ☐ 20893
☐ 20884 ☐ 20887
☐ 20889 ☐ 20888
☐ 20899 ☐ 24028
☐ 20867

Circle 27 on literature card

good trigger source for the stereo-indicator lamp.

The base of the lamp transistor is connected to the "tuned-circuit" end of the 1K-ohm resistor and the emitter is connected to the "power-supply" end. When the signal from the frequency doubler drives the 38K-Hz amplifier into conduction, collector current flows through the 1K-ohm resistor. The resultant voltage drop turns on the lamp transistor, which, in turn, lights the stereo-indicator lamp.

Lamp flicker is reduced by the time constant of the 1K-ohm resistor and a parallel-connected 10m-fd capacitor. Because this capacitor tends to resist any change in its state of charge, it also tends to increase the time required to turn on the stereo indicator. This prevents spurious turn-on, usually caused by transient signals.

Another function of the 10m-fd capacitor is to provide a low impedance path to ground for the 38K-Hz signal. If open, it can cause an impairment of the 38K-Hz decoding signal, and a resultant loss of separation. Bridge a known-good 10m-fd capacitor across the 1K-ohm resistor, if such symptoms are encountered. Use of a capacitance which is too large will cause a delayed-turn-on and-turn-off symptom.

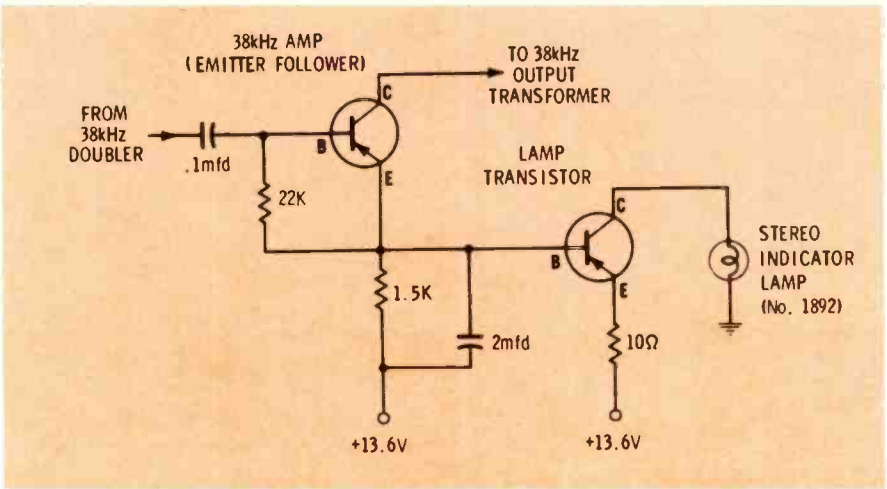


Fig. 7 A different version of the same basic designs in Figs. 4, 5, and 6 is found in Bendix models prior to 1971 for Ford.

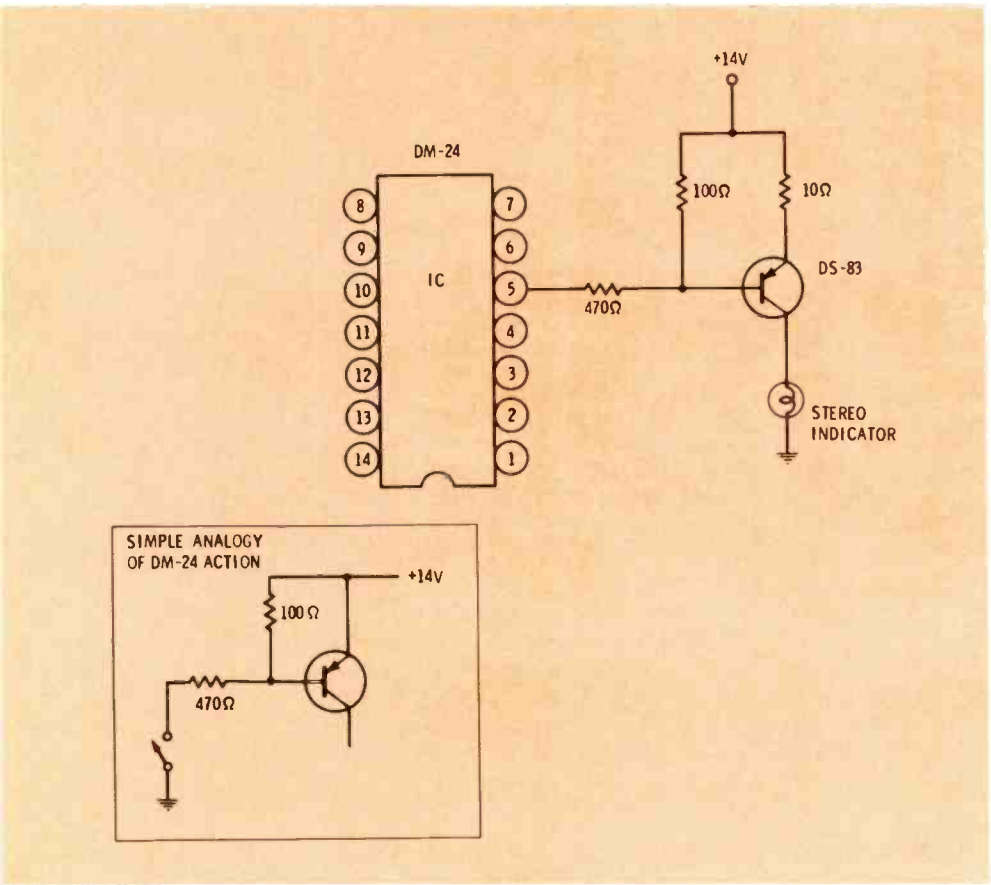


Fig. 8 Both Delco IC's, the DM-14 used in 1970 and the DM-24 used in 1971, use the internal beacon switch of the IC to trigger an external stereo-indicator transistor and lamp.

Philips And Bendix

Figs. 5 and 6 are additional examples of the basic design of Fig. 4. Fig. 5 is from the 1970-71 Philips (of Canada) auto radios used in Chrysler Corporation automobiles. Fig. 6 is from the 1971 Ford radios made by Bendix. It essentially is similar to Figs. 4 and 5. Note that although the 10-ohm resistor is in the emitter circuit of Fig. 6 and in the collector circuit of Fig. 5, in both circuits it is in series with the stereo-indicator lamp.

A slightly different version of the same basic design is shown in Fig. 7. This circuit is from Bendix models made prior to 1971 for Ford. The emitter-base circuit of the 38K-Hz amplifier rectifies the incoming 38K-Hz signal. Taken from the emitter circuit of the 38K-Hz amplifier, the negative-going rectified 38K-Hz signal forward biases the lamp transistor. The collector current of the conducting lamp transistor lights the stereo-indicator lamp.

IC Stereo Demodulator Systems

Delco

Car radio manufacturers seem-

(Continued on page 51)

READER SERVICE CARD

Electronic Servicing

Use the handy card below to obtain free catalogs and literature . . . and to subscribe or renew your subscription.

Read instructions carefully.

As a service to its readers, ELECTRONIC SERVICING makes the card below available for your convenience in obtaining current manufacturer's literature.

To use the card, simply:

a. Circle the numbers corresponding to the numbers of the items about which you would like to receive additional information.
b Print your name and address and check your occupation.
c. Include ZIP code—requests may not be filled without it.
d. Tear out lower half of this insert and place in mailbox.

Note the deadline date—Requests received after this cannot be filled.

▼ Free catalogs & literature

Subscribe or renew your present subscription to the nation's favorite electronic servicing magazine . . . ELECTRONIC SERVICING (formerly PF REPORTER).

Now with expanded editorial coverage of the entire electronic servicing business, ELECTRONIC SERVICING is more valuable to you than ever! Monthly it brings you the latest solutions to service problems on home entertainment electronics, including concise, timely coverage of new testing methods, product reports and practical service procedures!

Start ELECTRONIC SERVICING coming by sending in this order form . . . TODAY!

▼ Subscription offer

MAY 1972
OFFER EXPIRES AUGUST 1, 1972

Please indicate number of items you have circled→ ____

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108
109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126
127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144
145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162
163	164	165	166	167	168	169	170	171	172	173	174	175	176				

Print plainly or type below:

Name .....

Firm .....

Firm Address .....

City ..... State ..... Zip .....

Did you receive this issue through ☐ Distributor ☐ Subscription

Subscription Offer

Enter my subscription to ELECTRONIC SERVICING

☐ 3 Years $13.00 ☐ 2 Years $10.00 ☐ 1 Year $6.00

☐ Bill Me ☐ Remittance Enclosed ☐ Extend Present Subscription

IMPORTANT! Please check your business classification.

Type of Business	Position
Check One	Check One
A. ☐ Independent Electronic Service Organization	H. ☐ Owner, Manager
B. ☐ Retailer with Electronic Service Department.	I. ☐ Ser. Manager
C. ☐ Independent or Self-Employed Service Technician	J. ☐ Technician
D. ☐ Electronics, Radio, TV Manufacturer	K. ☐ Other
E. ☐ Industrial Electronic Service	
F. ☐ Wholesale, Jobber, Distributor	
G. ☐ Other (Specify)	

Be sure you have checked one box in each column above!

WRITING TO Electronic Servicing?

Help us prevent delay

If your comment or question is about . . .

YOUR SUBSCRIPTION

Changes of address or any questions about your subscription should be sent to the address at right. Please advise us of a change of address at least 4-6 weeks in advance of your move, if possible.

Evelyn Rogers, Circulation Manager
ELECTRONIC SERVICING
1014 Wyandotte St.
Kansas City, Mo. 64105

ANY OTHER SUBJECT

If you have a comment or question about an article, condition in the industry, a service tip or problem, need a part or schematic, or would like to pass along information about an industry oriented event, etc., write to:

J. W. Phipps, Managing Editor
ELECTRONIC SERVICING
1014 Wyandotte St.
Kansas City, Mo. 64105

6 CENTS
POSTAGE
REQUIRED

Electronic Servicing

P.O. Box 21501
El Paso, Texas 79998

(Continued from page 48)

ingly have been more eager to try out new technologies than have the makers of comparably priced home equipment. The use of the several versions of an integrated circuit stereo demodulator is an example.

Delco was the first car radio producer to use such an IC, which they did in 1970. They labeled it the DM-14 in 1970 and DM-24 in 1971. Although the two IC's are similar, they are entirely different from a replacement point of view. Consequently, do not attempt to interchange them.

Both Delco IC's use the internal beacon switch of the IC to trigger an external stereo-indicator transistor and lamp, as shown in Fig. 8. An analogy of this action is shown by the inset in Fig. 8. A pair of transistors inside the IC shorts to ground the end of the 470-ohm resistor whenever a 38K-Hz signal is present.

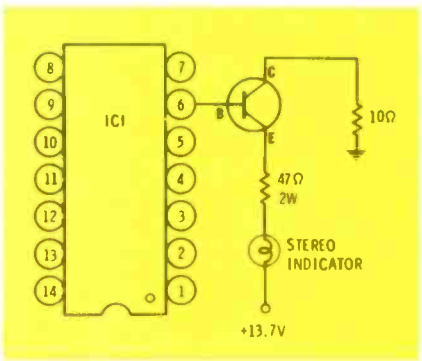


Fig. 9 Motorola Model FM992X stereo-FM car radio uses essentially the same IC stereo-demodulator design circuit as Delco. However, in the Motorola version the lamp switch is connected to pin 6 of the IC.

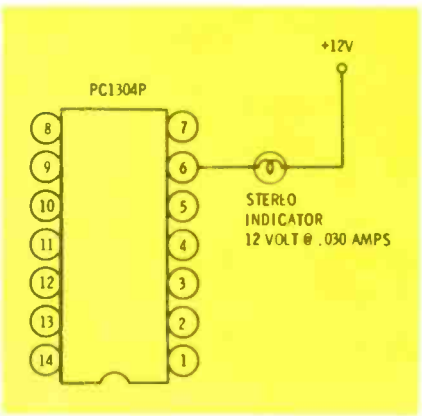


Fig. 10 Becker uses a .030-ampere lamp instead of adding another transistor to handle heavier loads.

Motorola

In the latest version of their underdash, universal stereo FM car radio line (Model FM992X) Motorola has used essentially the same IC stereo-demodulator circuit as Delco, as shown in Fig. 9. However, in the Motorola version the lamp switch is connected to pin 6 of the IC and in the Delco unit it is connected to pin 5. Note, also, that Motorola has retained the 6-volt bulb and the 47-ohm, 2-watt resistor.

Becker

The German radio manufacturer, Becker Autoradio, uses the same Motorola MC1304P IC. They call theirs the *PC*1304P. In their Europa Stereo MU model, the complete stereo-decoder circuit is built on a tiny printed-circuit board which is hinged at one end. This both saves space for Becker and makes the technician's job easier.

Becker uses a slightly different configuration for the stereo-indicator circuit. The internal switch of the MC1304P (or PC1304P, if you please) has a .040-ampere limit. Instead of adding another transistor to handle heavier loads, Becker uses a .030-ampere lamp, as shown in Fig. 10.

The internal functioning is essentially the same for all of the following IC's: MC1304P, MC1305P, MC1306P (all Motorola), DM-14 and DM-24 (Delco), and PC1304P (Becker).

As shown in Fig. 11, the two output transistors of the IC's are connected as a Darlington pair. They function as a simple SPST switch. (A better analogy might be a SPST switch in series with a diode, because current can flow only in one direction through this swtich.) The switching action is triggered by the presence of a 38K-Hz signal from the synchronous detector.

General Troubleshooting Procedure For Stereo Indicators

Technicians often hear the complaint that "the little light doesn't come on any more". In such cases, the first step is to determine whether the lamp circuit is malfunctioning or whether the whole stereo function is impaired. Aural testing with off-the-air signals is rarely sufficient to determine which is the case. A

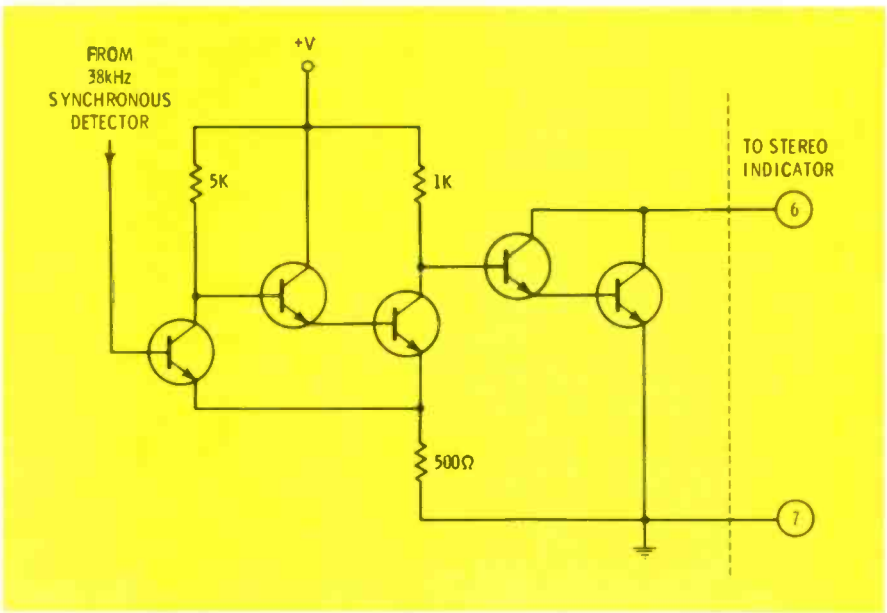


Fig. 11 The two output transistors of the IC's are connected as a Darlington pair, as shown here.

good stereo generator which provides a right-only or left-only output will provide a better test. So will an oscilloscope, with the vertical input connected across one speaker terminal and the horizontal input connected across the other speaker. If the scope pattern looks like a plate of spastic worms, the receiver is tuned to and receiving a stereo station and producing good separation.

The troubleshooting procedure for receivers which are equipped with an IC stereo decoder is extremely simple. With the set tuned to a stereo station and producing good output, ground the "switch" pin of the IC. (Be careful not to short out any other pin, or you might have to change that IC anyway.) If the stereo-indicator lamp still fails to turn on, the trouble is in the circuitry external to the IC—either the lamp transistor or the lamp itself. If the light does come on, the trouble probably is a defective "switch" inside the IC. Usually, if the IC is defective, the receiver will produce poor or no stereo output and, you'll change the IC before worrying about the "lamp" trouble.

The procedure for other types of stereo-indicator circuits depends on the particular design. In one circuit, for example, DC voltage analysis might be the best method. Or you might find one in which it is necessary to short together base and emitter pins. In circuits like those in Figs. 4, 5, and 6 connect a low-value resistor (about 100 ohms) from the collector end of the 1K-ohm resistor to ground.

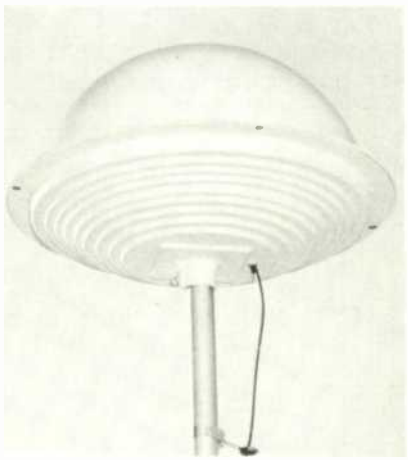
Transistors and shorted capacitors still cause most of the problems in many types of stereo FM car radios. In some of the Delco radios, there was a problem with open 19K- and 38K-Hz tuning capacitors. These are .01m- to .033m-fd disc ceramics mounted on the printed-circuit boards near their associated transformers. □

antenna systems report

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

Outdoor Dome Antenna

Product: Model Mark-III Metro Antenna
Manufacturer: Vorta Systems, Inc.
Function: Receives signals from television and FM-radio stations.
Features: Fastens to the mast by means of one setscrew. Antenna components are enclosed against the weather in plastic. Signal response pattern is non-directional.

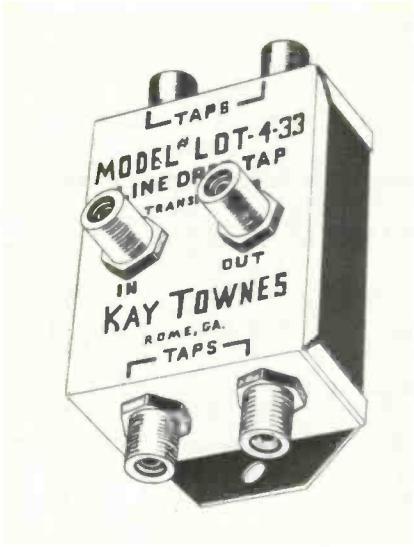


Specifications: The Mark-III Metro measures 10 inches high and 18 inches in diameter and comes complete with 50 feet of 300 ohm heavy-duty foamed lead-in.
Price: Model Mark-III Metro antenna sells for $44.95.

Circle 70 on literature card

Line Drop Taps

Product: Model LTD line drop taps
Manufacturer: Kay-Townes, Inc.
Function: Couples from a MATV or CATV cable to the cables for one, two or four receivers.
Features: Transformer-coupled, low-loss, AC/DC type passive units which are backmatched to eliminate the necessity for the termination of any unused taps. Available in 14 variations.

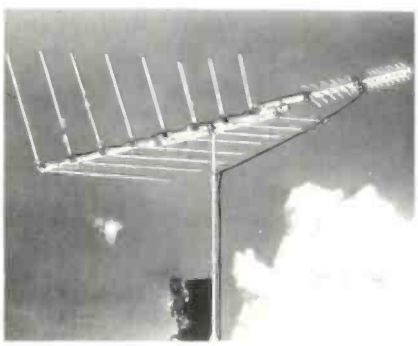


Specifications: Not available.
Price: Model LTD-1 line drop tap sells for $5.88, Model LTD-2 sells for $8.90, and Model LTD-4 sells for $13.20.

Circle 71 on literature card

Swept-Element Antenna

Product: Model CF-8-38 Antenna
Manufacturer: Gavin Electronics, Inc.
Function: Receives signals from FM-radio and television stations.
Features: Designed for fringe area reception of VHF, FM, and UHF bands. Swept-element "V" design with 35 active elements. Flip-Eze boom extension for the UHF elements. The finish is gold vinyl. A signal splitter is included.

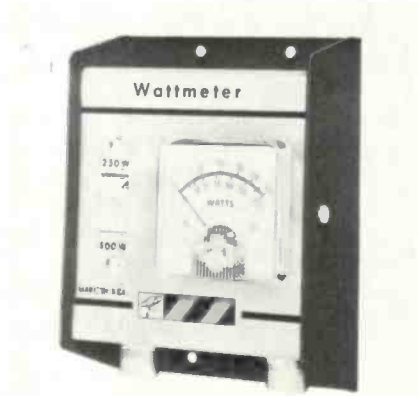


Specifications: 300 ohms impedance. For 75 ohm installation, use the AMB-375 kit. Polar pattern and gain specifications not given.
Price: The Model CF-8-38 antenna sells for $75.00.

Circle 72 on literature card

RF Wattmeter For Transmitters

Product: Model 257 Wattmeter
Manufacturer: Antenna Specialists Company
Function and/or Application: Measures the RF wattage supplied to an antenna by a transmitter
Features: A rocker switch selects full-scale power ranges of 250 or 500 watts. Standard coaxial connectors are mounted on the bottom of the case for insertion in the antenna cable. The unit can be mounted on a wall or a desk top.



Specifications: Accuracy of full-scale reading is ±5 per cent.
Price: The Model 257 RF wattmeter sells for $27.95.

Circle 73 on literature card

Single-Channel Filter Traps

Product: Single-channel filter traps
Manufacturer: Kay-Townes, Inc.
Function: Reduces the signal strength of the channel to which it is tuned.
Features: Weatherproof housing for either indoor or outdoor mounting. Available for both 300 ohm and 75 ohm operation, and with either 15 dB or 30 dB attenuation.
Specifications: Not available
Price: Model SCT-315 (300 ohm 15 dB) trap sells for $8.55, Model SCT-715 (75 ohm 15 dB) trap sells for $11.16, Model SCT-330 (300 ohm 30 dB) trap sells for $9.85, and Model SCT-730 (75 ohm 30 dB) trap sells for $13.00.□

Circle 74 on literature card

For more information about above products use reader service card

shoptalk

Horizontal Sweep And High Voltage In Color TV, Part 3

This final installment of a series outlines specific procedures for isolating defects in the horizontal-sweep/high-voltage section which eliminate and/or distort the raster or produce excessive damper or horizontal-output tube current.

Possible Causes For Loss Of Raster

A loss of the raster does not always indicate a loss of high voltage. The symptom of "no raster" also can be caused by:

1) Insufficient focus voltage to a color picture tube which normally requires nearly 5K volts for good focus. (The raster of picture tubes equipped with low-focus-voltage guns is not eliminated if the focus voltage is reduced or eliminated.)
2) Insufficient DC voltages at the control grids of the picture tube.
3) Excessive DC voltages at the cathodes of the picture tube.
4) Insufficient DC voltages at the screen grids of the picture tube.
5) Insufficient heater voltage at the picture tube.
6) A defective color picture tube.

Measure The High Voltage

Considerable time is required to measure all of the voltages listed previously. Usually, these measurements should be made only if the picture tube and the high-voltage section pass the following sequence of preliminary tests:

1) After the power to the receiver has been applied for about 1 minute, look carefully at the neck of the picture tube.
a) If there is no light around the heater/cathode areas of the guns, the picture tube is defective, or no heater voltage is applied to the tube.
b) Occasionally, loss of light from the heaters indicates that air has leaked into the vacuum of the picture tube. If so, the neck of the tube might be warm.
c) A purple glow inside the elements of the guns indicates a gassy or overloaded picture tube. If the tube is gassy, an arc often will follow the base socket, if the socket is removed from the picture tube while power is applied to the receiver.

2) Measure the high voltage and focus voltage, using a high-voltage meter and probe.
a) If both voltages are within tolerance, the DC voltages at the elements of the picture tube should be measured.
b) If the focus voltage is missing or excessively low, but the high-voltage is normal, search for a defect in the focus circuit.
c) If both the focus voltage and the high voltage are abnormally low, the defect is in the horizontal-sweep or high voltage circuits.

Diagnosing The Cause(s) Of "No High Voltage—Horizontal-Output Plate Red"

Many defects which eliminate the high voltage also cause excessive current through the horizontal-output tube, which, in turn, causes the plate to produce a red glow. This red glow can be used as an indication of the presence or absence of excessive current while various tubes or components are removed one by one to determine the source of the overload. Continued presence of the red glow indicates that the component or tube which was last removed was not the source of the overload. Fading of the glow after removal of a component or tube indicates that it caused the overload.

Such tests have universal application to most tube-equipped horizontal sweep circuits. Exceptions which are peculiar to the RCA CTC7AA (schematic in Fig. 1) will be noted.

When the plate of any tube exhibits a red glow, apply power to the receiver only long enough to perform one test. Then turn off the power, to permit the tube to cool before the next test. Operation of an overloaded tube for more than a few seconds might cause permanent damage to the tube, or to other components.

When tubes are removed or installed, the power to the receiver should be turned off to prevent possible shocks to the technician. If the plate of the output or damper tube glows red, determine the source of the overload by performing the following tests and noting the related conditions in the sequence in which they are listed:

1) **During the first two or three minutes after applying power to the receiver, visually examine the horizontal-sweep tubes and replace any which:**
a) Exhibit a purple glow inside the **metallic** parts. This indicates that the tube is gassy. Gassy tubes draw excess current. (Ignore any purple glow on the glass of the tube; this is harmless fluorescence.)
b) Do not exhibit light around the heater element.
c) Exhibit a white instead of black "getter area" on the glass bulb.
d) Exhibits evidence of a broken glass bulb.
2) **Plate of damper tube exhibits a red glow before that of the output tube**—The defect probably is either a loss of drive signal applied to the grid of the output tube or a heavy leakage to ground from either the B-boost circuit or a winding of the high-voltage transformer. The plate of the output tube will glow brightly if the grid drive is missing, but will not glow if heavy leakage reduces the B-boost voltage. Although the plate current

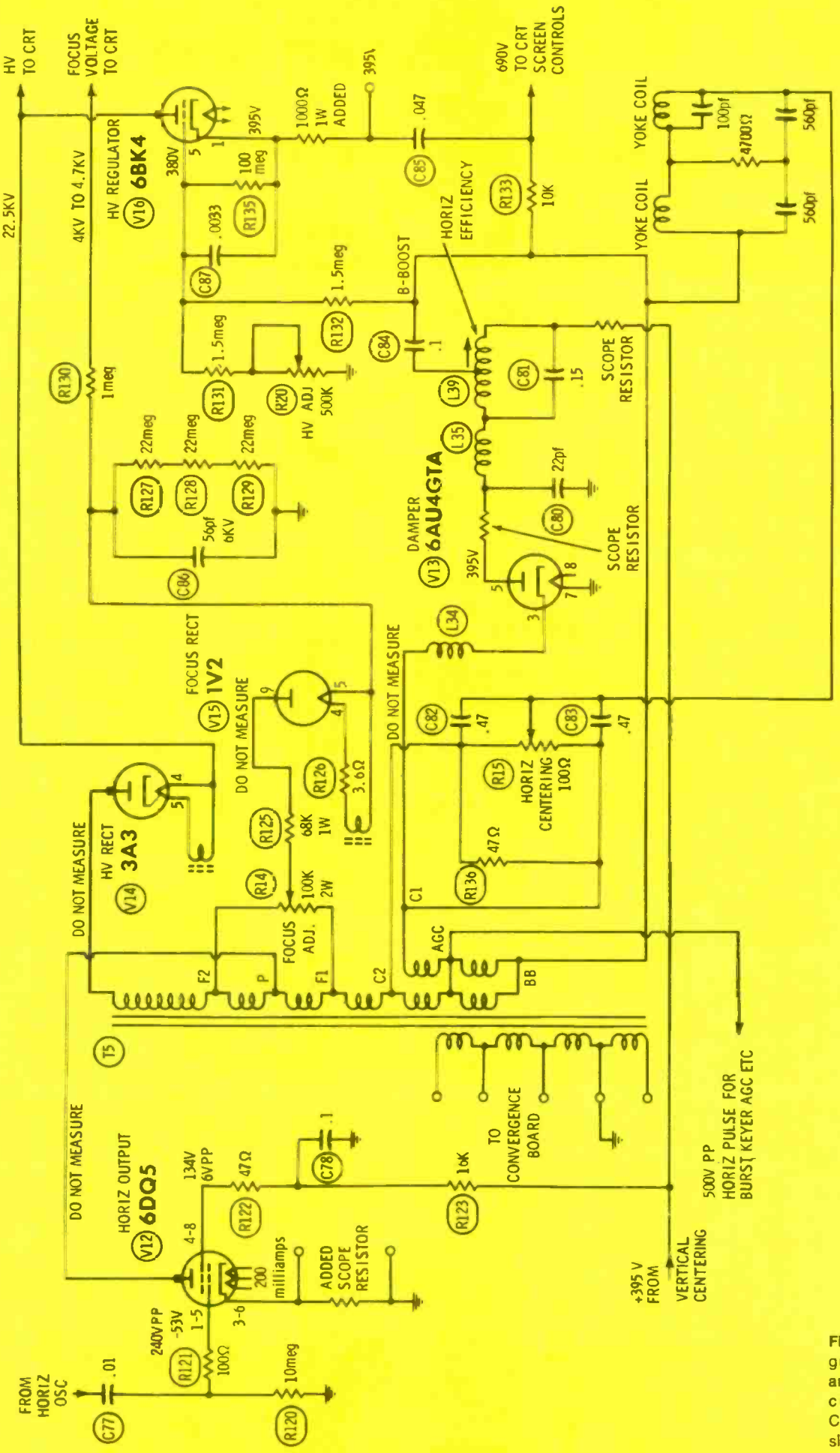


Fig. 1 Schematic diagram of the sweep and high-voltage circuits of the RCA CTC7AA color television chassis.

might be above normal, a B-boost voltage which is reduced by leakage prevents the wattage from being excessive. Therefore, the plate does not glow.

3) **Plate of the output tube glows red but that of the damper tube does not**—The defect probably is an excessive AC load on the plate circuit of the output tube. Remove the high-voltage rectifier tube from the socket, apply power to the receiver, and check for the following conditions:

4) **Plate of the output tube continues to glow red after the high-voltage rectifier is removed**

Yes—Replace the damper tube with one known to be good. Proceed to step 5.

No—Proceed to step 6.

5) **Plate of the output tube continues to glow red after the damper tube is replaced.**

Yes—Indicated an excessive AC load on the high-voltage transformer. Prime suspects are: shorted turns in the yoke, shorted turns in the high-voltage transformer, shorted or leaky capacitors inside the yoke, shorted turns in the focus coil (other models), carbonized focus control (CTC7AA), shorted turns in a pincushion transformer (other models), or a shorted B-boost capacitor.

No—Damper was shorted or gassy.

6) **Color of the plate of the output tube returns to normal after the high-voltage rectifier is removed**—This indicates that the excessive current through the output tube might be caused by one of the following conditions:

a) A shorted or gassy high-voltage rectifier;
b) Excessive current in the high-voltage shunt regulator;
c) Excessive current through the guns of the picture tube.

Proceed to the following steps to determine which of the preceding conditions is the cause of the excessive current through the output tube.

7) **New high-voltage rectifier tube installed but the plate of the output tube continues to glow red**

Yes—Proceed to step 8.

No—If the picture and raster are restored and the plate of the output tube no longer glows red, the original high-voltage rectifier tube probably was shorted, leaky or gassy.

Table 1—Voltages And Currents Produced At Key Points By Various Degrees Of Failure Of The Horizontal Output And Damper Tubes

Defect or condition	6DQ5 DC grid voltage	6DQ5 cathode mills	6DQ5 screen voltage	B-boost voltage	6BK4 cathode milliamps	High voltage kilovolts	Remarks
A) Normal	-53	200	134	740	.80	22.5	Normal crosshatch
B) 6DQ5 slightly weak	-53	160	180	690	.00	20.0	1" narrow each side
C) 6DQ5 very weak	-53	60	275	510	.00	00.0	No raster, output tube cooler
D) 6AU4 open	-53	15	75	00	.00	00.0	No raster, output tube cool
E) Insufficient drive	-44	210	145	740	.60	22.7	1" narrow narrow side
F) Screen voltage low	-53	150	105	740	.10	22.0	½" narrow each side
G) Yoke open	-53	70	85	820	.70	6.5	No raster
H) No regulation	-53	200	132	790	.00	25.0	Size changed with brightness level
I) C84 leaking	-53	185	140	690	.00	20.0	1" narrow each side
J) Osc dead	0	600+	110	300	.00	00.0	No raster, damper & output red
K) HV control open	-53	215	150	600	1.80	10.0	Narrow on left, and poor focus

8) **Removal of the high-voltage regulator tube and insulation of its cap eliminates the red glow of the plate of the output tube and restores the raster**

Yes—Indicates that the high-voltage regulator tube is defective, or that the grid bias of the regulator is insufficient, and, when the tube was in the socket, was causing excessive regulator current. Install a new regulator tube and attempt to adjust the HV ADJ control for the correct cathode current, as outlined later in this article. If the current can be adjusted to the normal limits, the problem is solved. However, if the regulator current still is excessive, check the resistors, capacitor and spark gap in the grid circuit of the regulator tube.

No—The picture tube might be drawing excessive current. With the regulator tube out of its socket, apply power to the receiver, wait until the plate of the output tube again glows red, then remove the socket from the base of the picture tube. Proceed to step 9, to analyze the results produced by this procedure.

9) **Color of the plate of the output tube returns to normal when regulator tube is out of its socket, power is applied to chassis, and base socket of picture tube is removed.**

Yes—The picture tube has been drawing too much current. Measure the voltages at the socket of the picture tube, to determine which element is responsible for the excessive current.

No—If the plate of the output tube continues to glow, it is possible that AC instead of DC is applied to the anode of the picture tube. Or, perhaps the anode of the picture tube is shorted to the aquadag coating on the outside of the tube. To determine which, proceed to step 10.

10) **Removal of the high-voltage connector to the anode of the picture tube eliminates the red glow of the plate of the output tube**

Yes—Either the anode of the picture tube is shorted or the voltage applied to the anode is AC. To determine which, proceed to step 11.

No—The picture tube is not the cause of the excessive current through the output tube.

11) **Test for application of AC to the picture tube anode** by substituting an external high-voltage filter capacitor (500 pf, 20K volt) in place of the capacitance of the picture tube. Ground one end of the test capacitor to the high-voltage cage and connect the other end to the high-voltage lead, which normally is connected to the picture-tube anode. If the plate of the output tube glows red when the high-voltage lead is connected to the anode of the picture tube, but returns to a normal, dark color when the high-voltage lead is connected to nothing, then again glows red when the high-voltage lead is connected to the "loose" end of the test capacitor, the high voltage almost certainly is AC, instead of the normal DC.

AC voltage at the anode of the picture tube can be caused by gassy or leaky high-voltage rectifier tubes, or by leakage between the filament and plate circuits of the rectifier tube. One possibility is an arc or a leakage caused by carbonization across the high-voltage transformer.

Diagnosing The Causes Of "No High Voltage—Color Of Output Plate Normal"

If there is no high voltage and the color of the plate of the horizontal-output tube is normal, the DC voltage on the screen grid of the horizontal-output tube, along with other related symptoms, can be used to localize and isolate the defect which has eliminated the high voltage.

The basis of this type of diagnostic procedure is the characteristics of pentode tubes and class "C" amplifier stages. The most important characteristics are described briefly in the following paragraphs.

Characteristics Of Pentodes And Class "C" Amplifiers

- One normal action of pentode tubes is that a change in plate current, which is caused by a change of the plate voltage or the AC loading at the plate, produces an opposite change in the screen-grid current. For example, if the plate voltage is low and the plate current is increased by an increase of the plate voltage, the screen current decreases. And vice versa.
- In a stage that is operated class "C", the plate current increases when the AC plate load is increased (decreased impedance).
- The horizontal-output stages in television receivers are operated between the conditions of class "B" and class "C". Therefore, the effect of plate loading on plate and screen-grid current is nearly the same as that of the final class "C" stage of a radio transmitter.
- If the DC voltage at the screen grid is poorly regulated, variations in the current of the screen grid cause large variations of the voltage at the screen grid. For example, if the screen-grid voltage is obtained by means of a dropping resistor connected to a source of higher voltage, the screen voltage will vary inversely to changes in the current of the screen grid. In other words, an increase in the current produces a decrease of the screen-grid voltage. During troubleshooting, this effect is important because it is much easier to measure the voltage at the screen grid than it is to unsolder some portion of the wiring and insert a milliammeter for the measurement of current.
- Increased load (decreased impedance) at the plate of a pentode tube operated class "C", causes it to draw more plate current. However, the current of the screen grid decreases, and, because of the large dropping resistor, the voltage at the screen grid increases.

Conversely, decreased plate current causes the screen voltage to decrease.

- A small amount of regeneration is at work in the horizontal-sweep/high-voltage section, and it furnishes some regulation against variations of the AC voltage at the plate of the output tube when the load is changed. For example, if the brightness of the picture tube increases but the shunt regulator is inoperative, the current drawn from the horizontal-output transformer by the rectifier tube increases more than normal. This increased load reduces the AC voltage there, and produces more current in the plate circuit of the output tube. In turn, the screen grid voltage increases, which causes more plate current which increases the voltage at the screen grid, etc., until a point of equilibrium is reached. When serious overloads occur, this inherent self-regulation can contribute to the ultimate destruction of the output tube.
- Changes of the voltage at the screen grid produced by changes in the impedance at the plate circuit can be used accurately to indicate optimum adjustment of the horizontal-efficiency circuit. The method is explained later in this article.
- Screen-grid voltage changes, which are not caused by conditions at the plate, and changes of the grid voltages affect currents of the screen grid and plate in the normal way. For example, a decrease of the negative grid voltage produces increased currents in both the screen-grid and the plate circuits. Also increased DC voltage at the screen grid caused by a decrease of the value of the screen-grid resistor produces increased currents in both the screen-grid and the plate circuits.

Examples Which Illustrate How To Diagnose By The "Screen-Grid Voltage" Method

Case 1) Symptoms: The screen-grid voltage is +180 volts or higher, as shown on lines "B" or "C" in Table 1.

Analysis: Such an increased voltage **should** produce excessive plate current, but as indicated by the lack of a red glow at the plate of the output tube, the tube current is not excessive.

Conclusion: The output tube is very weak and should be replaced.

After replacement of the output tube, carefully observe the new one. If the plate begins to glow, quickly turn off the power. Such a symptom indicates that the overload which destroyed the old tube still exists. To find the source of the overload, perform the sequence of tests described previously for cases in which the plate of the output tube is red.

Case 2) Symptoms: The screen-grid voltage measures +75 volts, as shown on line "D" in Table 1, and the damper and output tubes are cooler than normal.

Analysis: The extremely low screen-grid voltage indicates that the plate current of the output tube is zero. Cool operation of the damper tube indicates that no significant leakage to ground (which might eliminate the plate voltage of the output tube) exists.

Conclusion: An open circuit has removed the plate voltage from the output tube. Possible defects include an open damper tube circuit, an open L39, L35, or L34 or an open winding in T5, the horizontal-output transformer.

Case 3) Symptoms: The screen voltage is +84 volts, as shown on line "G" in Table 1, and the temperatures of the damper and output tubes appeared to be normal.

Analysis: The symptoms indicate that the plate current is decreased by an abnormally high value of load impedance. Additional DC voltage measurements reveal that the high voltage is decreased and the B-boost voltage is excessive.

Conclusion: The horizontal-sweep section of the deflection yoke is open.

Other Voltage Measurements Often Aid Analysis Of High-Voltage Or Sweep Defects

Some component defects do not eliminate the raster, but the picture might be narrow or nonlinear. Although an analysis of the voltage at the screen grid can reveal valuable clues about the source of such symptoms, other DC voltages also are revealing. Table 1 lists all the voltages which should be used for a complete analysis of difficult-to-find defects in the horizontal-sweep/high-voltage circuits.

The DC voltage at the screen grid often is more revealing than is the B-boost voltage. For example, the values of the B-boost and high voltage normally increase and decrease together. However, because the high-voltage rectifier conducts during the time the tip of the sweep waveform is present, and damper conduction occurs later, when the retrace waveform attempts to swing in a negative direction, if a defect drastically distorts the sweep waveform, the high voltage and B-boost cannot increase or decrease together.

Procedures For "Raster Produced But Abnormal"

After a raster has been obtained on the screen of the picture tube, or if the raster is present but abnormal, a crosshatch pattern should be used to analyze it. The following information should prove valuable for raster analysis.

- **A picture which is narrow on both edges** might be caused by a weak horizontal-output tube, insufficient grid drive from the oscillator, insufficient screen-grid voltage, excessive load on the B-boost supply, or insufficient B+ voltage.
- **A picture which appears to be narrow on only one side** might have a compression of the linearity, or the centering might be malfunctioning. If the receiver has no centering circuit, a defect in the horizontal-AFC circuit can give the effect of incorrect centering.
- **Stretching of the linearity near the left edge** indicates a weak damper tube or a defect in the

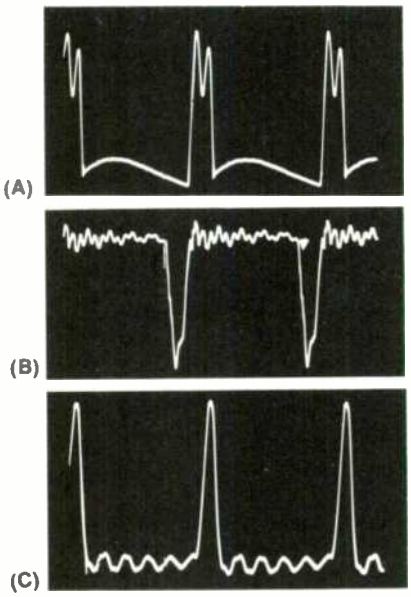
Other Normal, But Different, Waveforms Obtained From The High-Voltage Transformer

Because normal functioning of the damper tube produces clipping, the waveforms at the cathode of the damper tube and at the yoke have nearly-flat baselines between the pulses. However, waveforms produced by other windings of the high-voltage transformer often display more ringing on the base lines between pulses. The reason is that the coupling between these windings is not perfect.

Waveform (A) is produced at the "AGC" terminal of the high-voltage transformer. Because this is a comparatively small pulse voltage, the parabolic waveform from the B-boost circuit, which is the return path for the windings, becomes large enough in proportion to add curvature to the base line.

Waveform (B) shows the waveform obtained from one winding which supplies the convergence circuit.

Waveform (C) obtained by holding the scope probe near the high-voltage rectifier tube, is a more pointed pulse which displays increased ringing between pulses.



horizontal-efficiency circuit.

- **Compression of the linearity near the left edge** usually is caused by excessive current through the high-voltage rectifier. Other excessive loads affect both edges more equally. Determine whether the abnormal current through the rectifier is caused by excessive picture-tube or regulator current or is caused by leakage.
- **Compression of the linearity near the right edge** is caused by an abnormal drive signal or incorrect DC voltage at the grid of the output tube. The most probable defects are leakage of the coupling capacitor or a gassy output tube.
- **An off-center picture on the screen of the RCA CTC7AA** can be caused by an open in the horizontal-centering control, R15, or an open in the winding which connects to terminal "C1" or "C2" of the horizontal output transformer.
- **Changes in width, linearity or focus which occur when the brightness level is varied** usually indicate a loss of high-voltage regulation. Of course, the raster of any normally-operating receiver **should** "bloom" when the high-voltage current is excessive. To determine if the maximum brightness level is being exceeded, measure the current of the high-voltage regulator at different brightness levels. The brightness level at which the regulator current barely reaches zero is the maximum brightness for that individual receiver before "normal" blooming starts.

Interaction Of High-Voltage And Efficiency-Coil Adjustments

Adjustment of the efficiency coil changes the high voltage and the B-boost voltage, and the B-boost voltage, in turn, changes the regulator current. Conversely, adjustment of the regulator current affects the load which is applied to the output stage, which, in turn, affects the resonant point of the efficiency coil.

To rapidly make these two adjustments, with fewer touchups, do them alternately, but with the regulator cut off and the brightness of the picture tube set at a constant, high level. This minimizes changes of the regulator current, which otherwise would vary as the B-boost voltage changed. Use this sequence:

1) Tune in a dot or crosshatch pattern.
2) Monitor (preferably using two meters) the screen voltage of the output tube and the voltage across the 1K-ohm resistor which is in the cathode circuit of the 6BK4. If there is no 1K-ohm resistor, add one.
3) Increase the screen brightness until the voltage across the 1K-ohm resistor decreases to about .1 volt. (If necessary, to obtain enough brightness, increase the setting of the screen controls or the CRT-bias control.)
4) Adjust the core of the efficiency coil to the position which produces **minimum** voltage at the screen grid of the output tube.
5) Turn down the brightness control to eliminate the raster.
6) Rotate the HV ADJUST control to the position at which a reading of 1.1 to 1.2 volts is produced across the 1K-ohm resistor. (Newer receivers probably should read 1.4 volts.)

Those 6 steps should produce the correct ranges of horizontal-output current, high voltage, and high-voltage regulator current. In some cases, improved accuracy can be obtained by repeating steps 2 through 6. Also the high voltage should be measured by use of a probe and meter, to be certain it is within ±1K volt of the voltage listed on the Photofact or manufacturer's schematic. □

photofact bulletin

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

AMBASSADOR
AM7000WD, AM7118WD 1242-1

BRADFORD
1042B40 (WTG-61093) 1243-1

GENERAL ELECTRIC
Chassis T-6 1242-2

HITACHI
CFA-440, CNU-871, CSU-691 1241-1

MGA
CM-253A, CM-254A, CM-255A, CM-256A 1239-1

MOTOROLA
Chassis E16TS-929, F18TS-929, F18TS-929Q 1240-1

PANASONIC
Chassis N-93A 1240-2
TR-445T 1243-3

PENNCREST
2321, 2322 1239-2

PHILCO-FORD
Chassis 22QT79, 22QT80 1239-3
Chassis 20ST30AV (Run 5), 21ST31V (Run 5) 1241-2

RCA
Chassis CTC46A/B/H/P 1243-2
Remote Control Receiver, Transmitter CRK13A 1243-2-A

SONY
TV-112 1242-3

TRUETONE
MIC3912B-17 1240-3

WARDS AIRLINE
GCI-11102A/B/C/D, GCI-11132A/B/C/D, GCI-11262A/B . . . . . 1241-3 □

product report

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

High-Voltage Insulating Spray

Product: NO-ARC insulating spray
Manufacturer: Chemtronics, Inc.
Function and/or Application: Spray prevents valve clogging.
Features: NO-ARC spray is concentrated with red acrylic ingredients which provides protective coating to restore insulation. The spray is capable of withstanding

up to 25,000 volts. NO-ARC is recommended for stopping arcing and corona shorts in high-voltage circuits, especially in color sets; and for "potting" components as well as waterproofing and insulating circuit boards and exposed wiring.
Specifications: NO-ARC is available in seamless, 6 ounce cans.
Price: The NO-ARC spray sells for $1.98 a can.

Circle 80 on literature card

Burglary Deterrent

Product: Diamond-tipped marking pen
Manufacturer: General Electric Tube Products
Function and/or Application: Identification and tracing of stolen merchandise
Features: Utilization of a dia-

mond-tipped marking pencil which will write on almost any surface including metals, woods, plastics, ceramics and glass has been developed as a burglary deterrent. The service dealer can engrave the customer's social security number or other identification onto the back of the TV set or somewhere else on the chassis as a possible means of tracing stolen merchandise. The service dealer can also make a note of the identification for his records. It is hoped stolen merchandise "fences" will shy away from valuables which are permanently marked in this manner because they can be readily traced. Location of the owner of stolen merchandise can be found more easily using this method.
Specifications: N/A
Price: The marking pencil sells for $2.75.

Circle 81 on literature card

Universal HV Triplers And Quadruplers

Product: High-voltage multiplier assemblies for color TV
Manufacturer: International Rectifiers
Function and/or Application: Converts AC to DC

Circle 33 on literature card

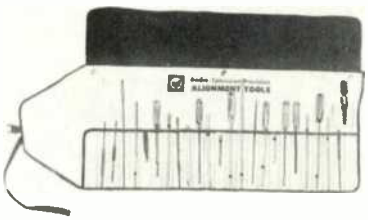
Circle 34 on literature card

Features: Model TVM-026 quadrupler meets RCA specifications. Model TVM-108, selenium tripler, is for use in Zenith and some Sears chassis. A connector for the CRT anode and a 2500 pf 10 kV capacitor is included. Model TVM-153, silicon tripler, is a replacement for Magnavox and some Sylvania models. Included is a CRT cap with a 27-inch lead. Model TVM-778, silicon tripler, can be used in many Sylvania and Zenith chassis. A connector for the CRT anode is included.
Specifications: N/A
Price: TVM-026, $79.95; TVM-108, $43.95; TVM-153, $39.95 and the TVM-778, $39.95.

Circle 82 on literature card

Tool Kit

Product: 25-tools for electronic technicians
Manufacturer: Jensen Tools and Alloys
Function and/or Application: The 23C750 is used for alignment work on radio-frequency electronic circuits, mobile and marine communication, radar and TV.



Features: Included in the kit: universal aligner, long-reach core aligner, extra-thin tuning wand, bone fiber tuner, Delrin-tipped IF transformer aligner, oscillator aligners and special TV aligners (for Motorola, Stewart-Warner, Belmont, Zenith, RCA, Westinghouse). A roll pouch for easy removal and replacement of tools with a fold-over flap is also included.
Specifications: Working ends include slotted, recessed, and hex styles, ranging in tip sizes from 1/32 inch to 1/4 inch.
Price: The 23C750 alignment set sells for $17.00.

Circle 83 on literature card

Driver's License Guide

Product: Guide for protection against fraud.
Manufacturer: Drivers License Guide Co.
Function and/or Application: Proof of identity for check cashing credit card use and valid identification.

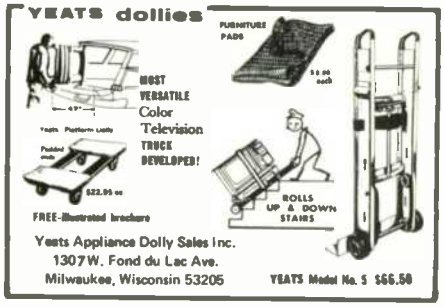
Features: The Guide shows every states driver's license in full color with special codes, required validations and other identifying marks. Originally available only to police departments, it helps control check cashing, credit card use, minor identification, right-to-drive, etc. The book measures 6 inches X 9 inches and is used in banks, rental firms, all types of retail stores and most security and law enforcement agencies. The updated 1972 Guide also has a new section covering major national credit cards.
Price: The Guide sells for $3.95 plus $.50 for postage and handling.

Circle 84 on literature card

Desoldering Tool

Product: Soldavac desoldering tool
Manufacturer: Edsyn, Inc.
Function and/or Application: Removal of molten solder from electronic connections.
Features: Thumb release of spring loaded plunger removes solder from surface. The plunger and shaft are enclosed to prevent contact with the user. The barrel can be removed from the main housing for cleaning. The Soldavac is lightweight and slim in construction for ease of handling.
Specifications: N/A
Price: The Deluxe Soldavac sells for $7.95. □

Circle 85 on literature card



Circle 35 on literature card

The MARKETPLACE

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

Advertising Rates in the Classified Section are:

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

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

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

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

FOR SALE

Sencore new test equipment in original box GC-159, $125. GC-161, $100, MU-150, $200. R.A. Coburn, RFD-2, Tinkham Lane, Londonderry, N.H. 03053 603-432-2615. 5-72-lt

I'm selling out my electronic business. All or part. Includes parts and equipment too numerous to list. 50 to 70% below wholesale. For itemized inventory and price list, send $1.00. Deductible from any order. Aktronics 2333 E. Bugle Drive, Chesapeake, Virginia. 5-72-lt

For sale: Picture tube rebuilding equipment almost new. Complete with all supplies needed to begin immediate operation. Original cost with supplies over $3500.00. Instructions included. Price $1950.00, Arnold Kading, Kading's TV Service Hackensack, Minn. 56452. 5-72-lt

WANTED

New but live wire firm wishes distributorship of quality electronic products. One to two days delivery to largest population in the east. Eastern Tech, Electronics Sales and Service, 6 Nittinger Bldg., Rensselear, N.Y. 5-72-lt

advertisers' index

catalogs literature

Circle appropriate number on Reader Service Card.

ANTENNAS

100. *Blonder-Tongue, Inc.*—announces a booklet presenting the basic facts necessary to understand MATV systems. A Glossary of Terms is included for further understanding.

101. *Gavin Electronics, Inc.*—has introduced new full color literature for its Colorfinder outdoor color TV antenna line. The 6-page brochure describes all seven Gavin Colorfinder models. Featured are antennas with a reception range from metro to deep fringe.

102. *Jerrold Electronics Corp.*—Catalog S, titled "Systems and Products for TV Distribution," lists specifications of this manufacturer's complete line of antenna distribution products, including antennas and accessories, head-end equipment, distribution equipment and components, and installation aids.

103. *Union Metal Manufacturing Co.*—announces a new 8-page catalog that illustrates self-supporting antenna poles up to 250 feet in height, design information for 25 foot through 200 foot poles, pole accessories, foundation specifications and erection information.

AUDIO

104. *Arista Enterprises, Inc.*—announces their 58-page needle and cartridge catalog. The needle cross reference reportedly has up-to-date cross references of all major needle marketers, in addition to cross reference sections of phonograph manufacturers' needle and cartridge numbers.

105. *GC Electronics*—an updated line of exact replacement rubber drives and belts is detailed in the new Walsco cross-reference catalog. Included are a variety of phono and recorder drive wheels and pulleys, pinch rollers, round rubber belts, square cross-section rubber belts, spring belts and fabric drive belts, felt pressure pads, phono mounting "E" and "C" clips in an assortment kit, motor mounting grommets, changer switches, and a kit of assorted phono drives and belts.

106. *G-V Controls*—Bulletin No. 4007 announces specifications, applications, line drawings, photographs and ordering information for the self dialing "hot-line" telephone unit.

107. *Jensen Manufacturing Div.*—has issued an 8-page catalog, No. 1090-E, which describes applications of 167 individual speaker models. Special automotive, communications, intercom and weathermaster speakers, plus a complete line of electronic musical instrument loudspeakers are featured.

108. *Nortronics*—a new publication, "Recording Equipment Maintenance Manual" describes factors that make regular maintenance important. Also, product-by-product catalog section on QM-SERIES accessories.

109. *Shure Brothers*—has published a new catalog describing their line of microphone and circuitry products for broadcasting, recording, motion pictures, and professional sound reinforcement. Included are illustrations and technical specifications.

AUTO ELECTRONICS

110. *Littelfuse, Inc.*—has released a new 32-page, 1971 automotive replacement fuse guide for passenger autos, sports cars, trucks, and taxi cabs. Fuse descriptions and circuits they protect are included.

111. *Nortronics Co., Inc.*—announces a revised brochure describing the Model 5800 replacement head for a re-

ported 90 per cent of all 8-track auto and home stereo players. A listing of players is offered by more than 70 different manufacturers in terms of model number or head part number.

CABLE

112. *Columbia Electronic Cables*—has published a 92-page wire, cable, and cordset catalog No. CEC-MC-571 which includes technical data concerning comparison charts of different types of insulating materials, copper wire specifications, estimating charts, and ampere ratings.

CAPACITORS

113. *Cornell-Dubilier Electronics*—has issued an 80-page cross-reference, 1972 catalog for location of single, dual, triple, and quadruple section replacement electrolytics.
114. *Loral Distributor Products*—has made available a 24-page electrolytic capacitor replacement guide. The catalog features replacement products by the original manufacturers part number.
115. *Sprague Products Co.*—has announced a 40-page manual which lists original part numbers for each manufacturer, followed by ratings, recommended Sprague capacitor replacements, and list prices. More than 2,500 electrolytic capacitors are included.

COMMUNICATIONS

116. *W. & G. Instruments, Inc.*—an 88-page catalog describing the complete line of measuring sets and systems specially designed for the communications industry. Individual measuring instruments and accessories are described plus a complete grouping of specialized test equipment.

COMPONENTS

117. *Bulow Internationl*—announces a new parts list for spare-parts and replacement parts for several major European radio and electronics manufacturers. Components, transistors, diodes and mechanical parts are included.
118. *Essex International, Inc.*—the new 64-page Color and Monochrome Television Parts Replacement Guide lists over 500 Stancor transformer and deflection components for 200 television manufacturers. A reported 14,000 replacements for original parts are available.
119. *P. R. Mallory & Co., Inc.*—introduces a 64-page general catalog containing approximately 10,000 items. Included in the catalog are batteries, capacitors, controls, resistors, semiconductors, switchers, and timers plus security systems, cassette recorders and cassette recording tapes.
120. *Precision Tuner Service*—announces a new tuner parts catalog, including a cross reference list of antenna coils and shafts for all makes of tuners.
121. *Workman Electronic Products, Inc.*—has released a 68-page 1972 catalog of replacement components for radio and television. Included are resistors, fusing devices, circuit breakers, sockets, convergence controls, electronic chemicals, audio cables, adapters for hi-fi and cassette type recorders battery holders and prototype kit components.

CONTROLS & SWITCHES

122. *Centralab Dist. Products*—introduces a chart which covers all Fastatch II rotary and push-pull action line switches. Diagrams are illustrated for each switch plus photographs for quick reference guide to replacement push-pull line switches.

KITS

123. *Heath Co.*—announces their 1972 Heathkit catalog, reportedly featuring over 350 kit projects. Projects for the home, the car, and workshop are included.

MARINE ELECTRONICS

124. *Raytheon Co.*—introduces the Webster antennas and seven new antennas designed for use with standard and single sideband marine radio-telephone and citizens band radios. The Webster antennas for VHF/FM radio are offered in 3 dB, 6 dB, and 9 dB models.

SECURITY ELECTRONICS

125. *Mountain West Alarm Supply Co.*—a 64-page catalog describes and offers over 350 intrusion and fire alarm products. Six-pages of Application Notes for alarm equipment also is included.

SEMICONDUCTORS

126. *Electronic Devices, Inc.*—announces a 4-page catalog on solid-state replacement and renewal parts for color TV receivers including solid-tubes, cartridges and multipliers. Solid-state solid-tube high-voltage rectifiers, focus rectifiers and damper diodes, silicon and selenium focus cartridges, diagrams showing dimensional drawings and socket connections for solid-tube solid-state replacements of vacuum tubes with maximum ratings for pulse rectifier service is also included.
127. *GTE Sylvania, Inc.*—introduces a 73-page illustrated catalog which provides information for more than 41,000 semiconductor devices, and outline drawings of the 124 components in the ECG semiconductor line. A complete alphanumeric cross-reference by type number is contained in the guide.
128. *RCA Distributor Products*—introduces a 96-page "SK Series Top-Of-The-Line Replacement Guide" (SPG-202M) which cross-references over 46,000 semiconductor device numbers. In addition a Solid-State Quick Selection Replacement Chart (1L1367A) listing entertainment SK-Series devices is included.

129. *Semitronics Corp.*—has a new, revised "Transistor Rectifier, and Diode Interchangeability Guide" containing a list of over 100 basic types of semiconductors that can be used as substitutes for over 12,000 types.
130. *Sylvania Electric Products, Inc.*—a 73-page guide which provides replacement considerations, specifications and drawings of Sylvania semiconductor devices plus a listing of over 35,000 JEDEC types and manufacturers' part numbers.

SERVICE AIDS

131. *Chemtronics*—announces a new 12-page, 1971-1972 catalog of products, including: tuner sprays, circuit coolers, insulating sprays, contact and control sprays, lubricants, tape head cleaners and conditioners, electronic glues and cements, solder, and spray paints.
132. *Kester Solder*—has released an 8-page brochure presenting the company's full line of soldering products. Presented are: "44" resin core solder, acid-core solder, solid-wire, bar solder, TV-radio solder and Metal Mender.
133. *M. P. Odell Co.*—a new 12-page booklet entitled "The Whys and Hows of Cleaning Electronic Equipment" reviews some of the effects of dirt and air pollution on electronic equipment performance together with cleaning methods and systems.

SHOP FIXTURES

134. *Bay Products*—offers a pre-engineered "Do-It-Yourself" Mezzanine Shelving Planning Kit. The brochure is complete with illustrations, charts, and diagrams of prefabricated units.

SOLID-STATE

135. *Electronic Devices, Inc.*—offers a replacement guide on tubes and parts replaced by the EDI solid-state replacement components for color TV.
136. *International Rectifier*—64-page volume, JD-451, has been revised and lists information on diodes, zeners, capacitors, rectifiers and SCR's. There are a reported 4000 new transistor listings. Specifications, characteristics, tables and wall charts are also included.

TECHNICAL PUBLICATIONS

137. *Howard W. Sams & Co., Inc.*—announces publication of a new 96-page 1972 Technical and Scientific Book Catalog. Described are over 800 hardbound and softbound books which cover "do-it-yourself" titles from the Audel Division, amateur radio publications, audio visual materials, instructor's guides and student workbooks. Titles range from "ABC's of Air Conditioning" to Writer's and Editor's Technical Stylebook".
138. *Sencore, Inc.*—Speed Aligner Workshop Manual, Form No. 576P, provides 20 pages of detailed, step-by-step procedures for operation and application for Sencore Model SM 158 Speed Aligner sweep-marker generator.
139. *Sylvania Electric Products, Inc., Sylvania Electronic Components Div.*—has published the 14th edition of their technical manual, which includes mechanical and electrical ratings for receiving tubes, television picture tubes and solid-state devices.
140. *Tab Books*—has released their Spring 1972 catalog describing over 170 current and forthcoming books. The 20-page catalog covers: schematic/servicing manuals, broadcasting; basic technology; CATV; electric motors; electronic engineering; computer technology; reference; television, radio and electronics servicing; audio and hi-fi stereo; hobby and experiment; amateur radio; test instruments; appliance repair, and transistor technology.

TEST EQUIPMENT

141. *Dynascan Corp.*–announces a new 24-page 2-color catalog of B&K Precision Test Equipment. A total of 21 instruments are reportedly presented; from a Mutual Conductance Tube Tester to a new DC to 10 MHz Triggered Sweep Oscilloscope.
142. *Eico*—has released a 32-page, 1972 catalog which features 12 new products in their test equipment line, plus a 7-page listing of authorized Eico dealers.
143. *Hickok*—has published a 4-page brochure, "Hickok Oscilloscopes," which contains descriptions, specifications and prices for Models 5000A and 5002A oscilloscopes.
144. *Information Terminals*—has introduced a new brochure featuring the M-100 Tension Monitor, the M-200 Torque Tester and the M-300 Head and Guide Gage.
145. *Leader Instruments Corp.*—announces the 1972 Catalog of Leader Test Equipment. Test equipment included is the LBO-301 portable triggered-sweep oscilloscope, LSW-300 new solid-state post injection sweep/marker generator, and the LCG-384 miniportable, solid-state battery operated color-bar generator.
146. *Lectrotech, Inc.*—announces the 1972 catalog. "Precision Test Instruments for the Professional Technician". It contains specifications and prices on sweep marker generator, oscilloscopes, vectorscopes, color bar generators and other test equipment.
147. *Mercury Electronics Corp.*—14-page catalog provides technical specifications and prices of this manufacturers' line of Mercury and Jackson test equipment, self-service tube testers, testers, test equipment kits and indoor TV antennas.
148. *Signal Analysis Ind. Corp.*—announces a 4-page bulletin describing their Model

SAI-42 real time digital correlation and probability analyzer. Computional and averaging flexibility, increased dynamic range, increased time resolution, and dial-in capability are among features described with illustrations of the instrument controls.

149. *Tektronix, Inc.*—has announced a 4-page brochure describing the 54 Series oscilloscope manufactured by Tektronix English subsidiary, Telequipment.
150. *Tektronix, Inc.*—a 14-page test equipment booklet if available presenting the Telequipment line of oscilloscopes and a curve tracer. Single-trace, dual-trace, and dual-beam scopes are discussed. Also listed are Field Engineering offices where technical assistance may be obtained.
151. *Testline Instruments*—has issued a brochure for their new Model 101 Curve Tracer for checking transistors in- and out-of-circuit. All features, specifications, applications and warranty information are included.
152. *Triplett Corp.*—announces a 6-page, two-color brochure featuring four new portable, battery-operated, FET Volt-Ohm-Milliameters and accessories.
153. *Triplett Corp.*—announces a 2-page, 2-color data sheet for Model 6028, a 2¾ digit VOM. Data sheet gives DC volts, AC volts, ohms AC and DC current ranges plus construction information, price and accessories.
154. *Speco Components Specialists, Inc.*—announces their 43-page, 1972 catalog of VOM multitesters and meters for TV technicians. Individual features and specifications for each instrument are included.

TOOLS

155. *Brookstone Co.*—announces a new 48-page, 1972 catalog which includes 185 new, unusual and useful hard-to-find tools, plus hundreds of other versatile hand tools and small power tools.
156. *Chapman Manufacturing Co.*—offers a pamphlet containing their line of tools and tool kits. Kit No. 6320, the Midget Ratchet is featured along with other available tool kits.
157. *Ideal Industries*—introduces a 2-page, 4-color brochure announcing their new Heat Gun. Performance characteristics applications, operating features, specifications and ordering information reportedly are included.
158. *Janel, Inc.*—announces a three-color catalog on precision hand tools used primarily in miniature and microminiature electronic assembly and production applications.
159. *Jensen Tools and Alloys*—has announced a new catalog No. 470, "Tools for Electronic Assembly and Precision Mechanics." The 72-page handbook-size catalog contains over 1,700 individually available items.
160. *Upson Tools, Inc.*—Catalog No. 72 contains many new service kits and metric tools. The complete line of 4-in-1 tools offers 16 combinations of double-ended screwdrivers and a variety of nutdrivers.
161. *Xcelite, Inc.*—Bulletin N770 describes this company's three new socket wrench and ratchet screwdriver sets.

TRANSFORMERS/COILS

162. *Essex Controls Division*—new Stancor Transformer Catalog No. 207 lists over 1,900 standard transformers for design engineers. Full technical data, mounting dimensions, photographs and other specifications on the line of audio transformers, power transformers, chokes and inductors are included. A complete listing of all Stancor sales offices and stocking warehouses is included.
163. *J.W. Miller Co.*—announces a new 92-page radio and TV replacement coil cross reference guide for known domestic and foreign color and black and white TV sets, home and car radios. Over 22,000 replacement coils for 327 manufacturers names reportedly are listed.
164. *Stancor Products*—pocket-size, 108-page "Stancor Color and Monochrome Television Parts Replacement Guide" provides the TV technician with transformer and deflection component part-to-part cross reference replacement data for over 14,000 original parts.

TUNER REPAIR

165. *PTS Electronics, Inc.*—62-page catalog with over 600 exact-replacement tuners listed under their original manufacturer number for ease of exchange. A replacement guide for antenna coils and shafts is also provided.

TV ACCESSORIES

166. *Telematic*—introduces a 14-page catalog featuring CRT brighteners and reference charts, a complete line of test jig accessories and a cross reference of color set manufacturers to Telematic Adapters and convergence loads.

TV PICTURE TUBES

167. *GTE Sylvania*—50-page brochure which describes characteristics of over 900 television picture tubes, plus data on interchangeability information and tips on installation and handling of TV picture tubes.
168. *GTE Sylvania, Inc.*—has published an interchangeability guide listing 191 commonly used color TV picture tubes which can be replaced with 19 GTE Sylvania Color Bright 85® types. □

You can make more money selling the Sylvania color bright 85XR.

And Olive Oyl will look just as beautiful.

Beauty is in the eye of the beholder.

And the beauty of the *color bright* 85XR is that its picture is in the same league as the more expensive "black surround" and "black matrix" color tubes.

Our bright phosphors make the *color bright* 85XR real competition for any picture tube on the market.

And our simplified manufacturing process lets us sell it to you at a lower price than any "black surround" tube.

The picture will look beautiful to your customer.

The profit will look beautiful in your cash register.

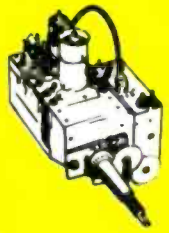
If that isn't beauty, what is?

GTE SYLVANIA

The Tuner People

Pioneers of TV Tuner Overhauling
Originators of Complete TV Tuner Service

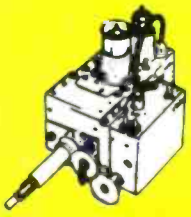
Castle offers the following services to solve ALL your television tuner problems.



Universal Replacements from $8.95

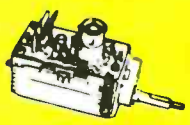
These universal replacement tuners are all equipped with memory fine tuning and uhf position with plug input for uhf tuner. They come complete with hardware and component kit to adapt for use in thousands of popular TV receivers.

STOCK No.	HEATERS	SHAFT Min.*	SHAFT Max.*	I.F. Snd.	PRICE
CR6P	Parallel 6.3v	1¾"	3"	41.25	8.95
CR7S	Series 600mA	1¾"	3"	41.25	9.50
CR9S	Series 450mA	1¾"	3"	41.25	9.50
CR6XL	Parallel 6.3v	2½"	12"	41.25	10.45
CR7XL	Series 600mA	2½"	12"	41.25	11.00
CR9XL	Series 450mA	2½"	12"	41.25	11.00



Castle Replacements $15.95

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



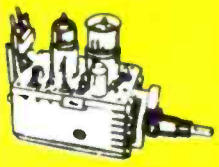
Tandem uhf-vhf replacements NOW $21.95

Available in popular models of: Muntz, Olympic, Philco, Sears, Westinghouse and private labels.

Overhaul Service $9.95

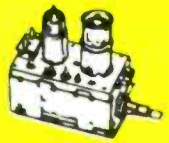
This is the service pioneered by Castle! We are now in our third decade of serving the TV Service Industry

Service on all makes and models, vhf or uhf, including transistor and color tuners . . . one price $9.95 (does not include tuners older than 10 years). Overhaul includes parts, except tubes and transistors.



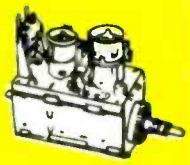
Simply send us the defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint. Your tuner will be expertly overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.

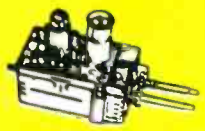
Dismantle tandem uhf and vhf tuners and send in defective unit only. Remove all accessories . . . or dismantling charge may apply.



Custom Exchange Service $17.95

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





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

All replacements are new or rebuilt. All prices are f.o.b. our plant. Add shipping and handling of $1.25 on all prepaid orders. We will ship C.O.D.

CASTLE TV TUNER SERVICE, INC.

MAIN PLANT: 5701 N. Western Ave., Chicago, Ill. 60645 • Ph. 312—561-6354
EAST: 130-07 89th Rd., Richmond Hill, N.Y. 11418 • Ph. 212—846-5300

Circle 3 on literature card