January, 1971 □ 75 cents

A HOWARD W. SAMS PUBLICATION

Electronic Servicing

Servicing Cassette Tape Player/Recorders

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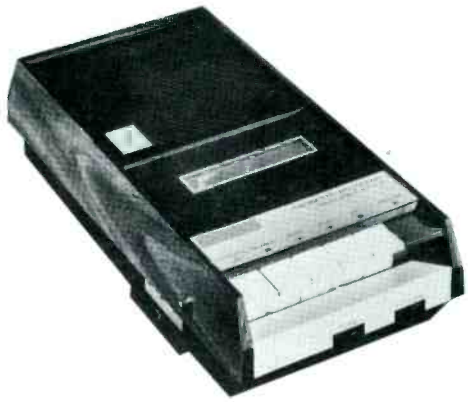

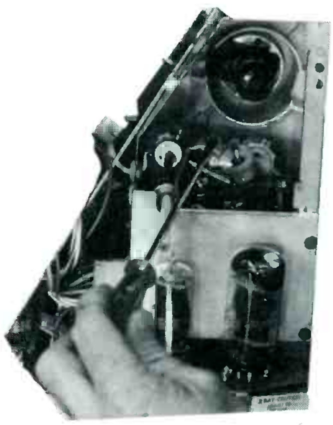

Troubleshooting Horizontal Deflection/High-Voltage Circuits

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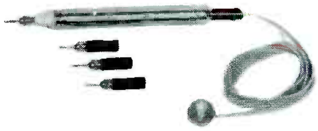
Index of 1970 Content

FROM THE COMPANY WHO GIVES YOU
THE STRONGEST GUARANTEE IN THE BUSINESS

BUY AN INSTRUMENT. GET AN INSTRUMENT FREE.*

SIGNAL TRACER PROBE



Gain 3000 at 2 KHz. Bandwidth 50 Hz to 200 MHz. Z 3500Ω to 350 KΩ. Output 0.3 p-p volts. Noise −45db. Supplied with anti-overload probe tips: Eico PST-2, Kit $19.95, Wired $29.95.

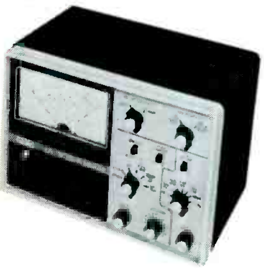
NEW OSCILLOSCOPE/ VECTORSCOPE

DC-8MHz (usable to 10 MHz). 5″ flat-face CRT. Sensitivity 12 MV RMS/CM. Negligible relative H & V phase shift. Excellent curve tracer with Eico 443 (below). Eico 465, Kit $179.95. Wired $249.95.

NEW SOLID STATE FET-TVM's

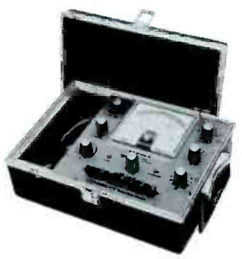
AC RMS/DCV: 0-1, 3, 10, 30, 100, 300, 1000V. P-P ACV: 0-2.8, 8.5, 28, 85, 280, 850, 2800V. DC Input Z 11 MΩ. Ohmmeter 0.2Ω to 1000 MΩ. 4½″ 200 μA meter. Eico 240, Kit $59.95, Wired $79.95. With 6½″ meter & AC/DC Current readings. Eico 242 FET-TVOM, Kit $69.95, Wired $94.50.

NEW TRANSISTOR ANALYZER



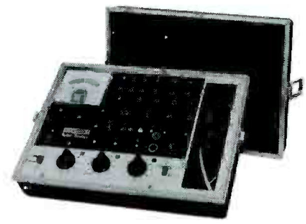
Tests trans-conductance and Beta in and out of circuit. Measures FETs, bipolars, diodes, rectifiers, SCRs, UJTs. Built-in voltmeter, ohm-meter. 50μa taut band meter movement. Eico 685, Kit $99.95, Wired $149.95.

CRT TESTER AND REJUVENATOR



For all B-W & Color Picture Tubes. Each gun of Color Tube measured individually and numerically, provides required gray scale tracking information. Eico 633, Kit $79.95, Wired $109.95.

TUBE TESTER



Tests all standard tubes plus decals, magnovals, 7-pin nuvistors, popular TV picture tubes. Professional, compact, lightweight, and modest price. Eico 635, Kit $44.95, Wired $69.95.

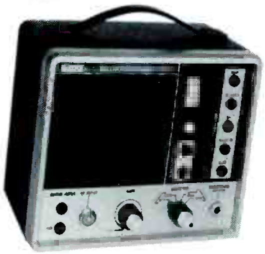
NEW CURVE TRACER

New professional transistor/diode curve tracer enables any general-purpose oscilloscope to display direct readouts of the most meaningful data. Eico 443, Kit $99.95, Wired $149.95.

NEW SOLID STATE SINE/SQUARE WAVE GENERATOR

Provides simultaneous sine and square wave outputs. Covers 20 Hz-2MHz, 5 bands. Max. distortion 0.25%. Rise time at 20 KHz <0.1 μsec. Eico 379, Kit $69.95, Wired $99.95.

NEW SOLID STATE SIGNAL TRACER



Output 400mw. Inputs: 1mv RF; 63 mv AF: Hum >60 db below 400 mv. 200 μa meter. Provides substitution output Xfmr & spkr. Eico 150, Kit $59.95, Wired $79.95.

SOLID STATE COLOR GENERATOR

Standard offset carrier type stable 10-bar display plus precision dots, crosshatch, individual series of V & H lines; gun killers. Feeds to ant. terminals. Portable, battery/AC. Eico 385, Kit $79.95, Wired $109.95.

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EICO helps it. With . . .

1. The first and only instruments with the MOST capability-per-dollar. They do more, faster — save you more time, effort, money.
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4 K Ω/V

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For latest catalog on EICO Test Instruments, Stereo, EICOCRAFT Projects, Environmental Lighting, and name of nearest EICO Distributor, check Reader Service Card or use coupon.

Circle 1 on literature card

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Circle 4 on literature card

January, 1971 • Volume 21. No. 1

Electronic Servicing

Formerly PF Reporter

in this issue...

DEPARTMENTS

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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—$5.00, 2 years—$8.00, 3 years—$10.00, in the U. S. A., its possessions and Canada.

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NOW you can measure resistors accurately IN CIRCUIT!

in solid state devices

FE21 HI-LO with 4½-inch meter $99.50

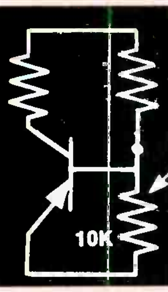
FE20 HI-LO with hi-voltage probe and large six-inch meter $129.50

WITH THE NEW HI-LO FIELD EFFECT MULTIMETERS

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

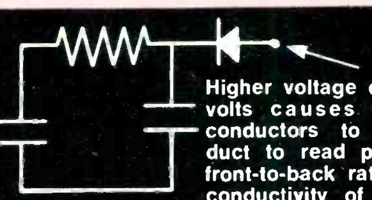
Look at these extra features to see why the Hi-Lo meter belongs on your want list:

- 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 5 on literature card

GE Tube Department Receives NEA Award For Image Building Service Dealer/Technician Aids

The General Electric Tube Department, Distributor Sales Operation, has received a "Special Recognition" award from the National Electronics Association (NEA), for its sponsorship of a series of full-page "Professional Hands" advertisements.

The award, presented to GE by Norris Browne, NEA President, at the recent 1970 NEA convention in St. Louis, was given in appreciation of GE's outstanding service to the independent electronic service dealer and technician. The award noted GE's image-building efforts to upgrade the electronic service technician and the company's placement of professional service dealer ads in support of that principle in recent industry publications.

The Professional Hands ads were created by Arthur M. Effron, Manager-Advertising and Sales Promotion for the Department, and Keller-Crescent Advertising Agency, Evansville, Ind.

Effron said the ads support the professionalism of independent TV service dealers; are designed to expand the independent dealer's professional image with the public; and serve to promote the advantages of using quality replacement parts.

The ads are now appearing in alternate issues of major industry publications.

Zenith STV System Wins FCC Approval

Phonevision, Zenith Radio Corporation's over-the-air subscription TV (STV) system, has become the first such system to be granted technical approval by the Federal Communications Commission (FCC).

Zenith's present "one-and-only" position in STV is further enhanced because, under FCC rules, no station application for STV broadcasting can be granted unless the station has an agreement to use an FCC-approved system—and Phonevision currently is the only FCC-approved STV system.

Teco, Inc., Zenith's licensee for commercial development of Phonevision in North America, has been given the responsibility for franchising organizations to use the system. Teco will supply franchise holders with encoding equipment for STV transmissions and will provide assistance in such operating areas as marketing, engineering and program services. Decoding equipment will be supplied franchisees by Zenith, for installation in subscribers homes.

Appliances/TV Is No. 2 On Consumer Complaint List

The number of consumer complaints registered against the products and services of the appliance/TV industry is exceeded only by those registered against the automotive industry, according to Virginia Knauer, the Presidents special assistant on consumer affairs.

Poor workmanship, meaningless warranties, high cost of repairs and late deliveries reportedly head the list of specific complaints.

Tech Spray Establishes "Technician's Aid Division"

Tech Spray, Inc., supplier of chemical products to the consumer electronic servicing industry, has established a Technician's Aid Division to:

- Provide up-to-date information about chemical products and their applications.
- Assist the technician in maintaining correct service procedures.
- Help technicians solve specific service problems.

Correspondence relating to these three areas should be addressed to:

T.A.D.
Tech Spray, Inc.
P. O. Box 949
Amarillo, Texas 79105

Specialized Service for All European Audio Equipment

Bulow International Audio, 44 Purchase Street, Rye, New York, has announced that it will specialize in the servicing of all European audio equipment, including Arena, A.G.A., Bang and Olufsen, Braun, Blaupunkt, BSR, Danica, Dual, Eltra, Grundig, Kirksaeter, Luxor, Metz, Nordmende, Philips, Saba, Telefunken and many others.

Panasonic Names Three New Auto Sound Product Distributors

Three new distributors have been named to handle Panasonic auto sound products: National Sales Company, 56 Rutter St., Rochester, New York; T.D.A. Inc., 3035 W. 47th Street, Chicago; and Custom Auto Accessories, 276 Union Avenue, Memphis, Tennessee.

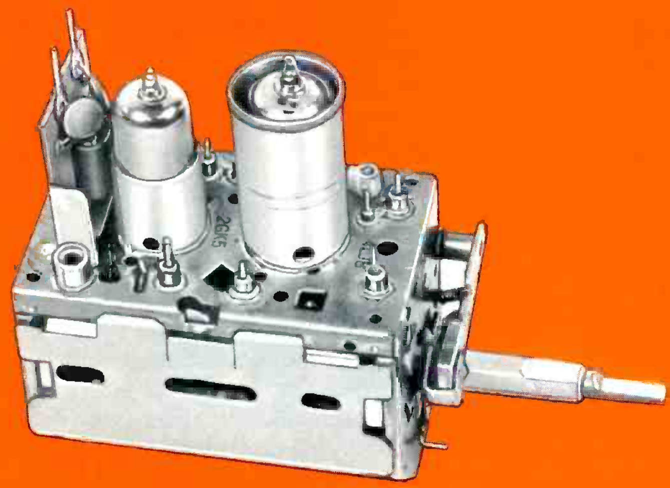
Sylvania Offers Two-Year Warranty On New Long-Life Tubes

Sylvania Electric Products, Inc., has introduced a series of "long-life" tubes with life expectancies of 40,000 hours.

The new tubes, which are backed by a two-year warranty, reportedly were designed to meet the extended life span, electrical stability and reliable performance requirements of community antenna television systems (CATV).

Designations and prices of the tube types are GB 1330/12BY7A ($3.05), GB 1331/6EV5 ($2.90), and GB 1332/6CY5 ($2.90).

(Continued on page 6)



$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 . . . . . TEL: 317-632-3493
(Home Office)

EAST . . . . 547-49 TONNELE AVE., Jersey City, New Jersey . . . . . TEL: 201-792-3730

SOUTH-EAST . . 938 GORDON ST., S. W., Atlanta, Georgia . . . . TEL: 404-758-2232

WEST . . . . SARKES TARZIAN, Inc. *TUNER SERVICE DIVISION*
10654 MAGNOLIA BLVD., North Hollywood, California . . . TEL: 213-769-2720

Circle 6 on literature card

Sylvania attributes the life expectancy of the tubes to highly stable and specially selected materials used in production and to stringent quality control including complete incoming material and in-process inspections. In addition to electrical and environmental tests normally performed, each tube reportedly is subjected to 50 continuous hours of power-on "burn-in" under actual operating conditions.

Zenith Urges FCC To Prescribe Broadcast-Quality Standards For CATV Signals

Zenith Radio Corporation has urged the Federal Communications Commission (FCC) to adopt community antenna TV (CATV) engineering standards equal to broadcast requirements to protect the public's multi-million dollar investment in TV sets, and to provide an orderly transition to new electronic services for the home.

In comments on CATV technical standards filed Oct. 13 with the FCC, Zenith strongly recommended that standards for CATV signal quality be equivalent to those for broadcast signals. "The fundamental reason for this concern is that the design of nearly 90 million TV sets in the hands of the U.S. public . . . has been controlled by broadcast standards," the company document said.

In contrast to the public's multi-million dollar investment in broadcast TV receivers, the "investment by CATV system owner is comparatively small, even on a per-home basis. Existing CATV systems now serve no more than 7 percent of the U.S. TV homes and are primarily located in relatively small population areas or regions where the quantity and/or quality of broadcast signals are inadequate.

"No one knows," the Zenith study continued, "how many of the other 93 percent of U.S. TV homes will be willing to pay the costs of whatever benefits new or extended cable systems have the potential of eventually providing."

Zenith further urged that future cable systems be designed for the later addition of two-way capability at minimum cost, following general guidelines for return communications as suggested by the FCC.

"Subscription and educational cable TV services have already demonstrated some market potential, and two-way communication appears to be essential to the most efficient cable utilization of both services. The same is true of other services whose market potentials do not appear as imminent," the Chicago electronics firm said.

Zenith recommended that FCC rules "expressly require" CATV-originated signals to meet the same technical standards for quality as those required of TV broadcast stations. "In the abscence of these requirements, the Commission's stated purpose of ensuring the quality of pictures delivered to the subscriber's terminal might be nullified by inferior local origination signals."

Zenith also recommended that minimum channel capacity for CATV systems be specified by the FCC as the 12 VHF channels, because all receivers can tune at least VHF channels 2-13, and because cables now used will carry at least these same 12 VHF channels. This eliminates an expensive converter for the subscriber.

To further safeguard the vast public investment in receivers, Zenith recommended that when more than 12 channels are needed in a system, additional cables be brought into the home to accommodate them, with each cable carrying channels 2-13. A simple and inexpensive multi-position switch would permit switching between cables, or between each block of 12 channels, while the TV receiver would continue to tune channels 2-13 in the normal way.

The company cited such systems in Philadelphia and Akron and noted that another promising multichannel approach is the type system installed in Sunnyvale, California, where a common trunk line is used to carry 24 channels in the 98-250 MHz range. This type of dual or multi-cable for standard channels, plus a subscriber cable selection switch, not only fully preserves the simplicity and integrity of TV receiver tuning, but also avoids the tuning pitfalls of the set-top CATV converter or adaptor.

Zenith further pointed out that set-top CATV converters cause tuning complications and should be ruled out unless they fully meet appropriate restrictions consistent with the Commission's tuning equality regulations for television receivers.

All CATV and cable systems "must be required to interface with receivers now in existence without increased complication of tuning or loss of picture quality or picture stability," the Zenith document stated. Any equipment required to bring in a converted signal to

(Continued on page 8)

TV TUNER SERVICE

Castle, the pioneer of television tuner overhauling, now offers the following services

EXACT REPLACEMENTS

Purchase outright . . . no exchange needed. **$15.95 ea.**

Castle replacements made to fit exactly in place of original tuner. Available in the following popular numbers.

ADMIRAL
94E210-1, 94E210-3, 94E227-2, 94E228-1, 94E229-4, 94E229-8, 94D257-1, 94D257-7, 94D257-49, 94E260-8H, 94E260-11, 94E261-1B, 94E261-1C, 94E261-1D, 94D261-4, 94C273-2, 94C273-4, 94C273-7, 94C273-8, 94C273-9, 94C273-10, 94C273-13, 94C273-15, 94C281-1K, 94C286-1D, 94C286-1E, 94C286-1J, 94C286-1L, 94C286-4J, 94C286-5, 94C286-12, 94C286-16, 94C289-1

CURTIS MATHES
7A11, 7A17, 7A38, 7A48, 7A050, 7A53-001, 7A056-001, 7A59-001

EMERSON
471351, 471512, 471515, 471678, 471682, 471700

G E
ET86X188, ET86X208, ET86X212, ET86X213, ET86X214, ET86X215, ET86X221, ET86X224, ET86X227, ET86X230, ET86X231, ET86X232, ET86X236, ET86X242, ET86X244, ET86X255, ET86X256, ET86X265, ET86X277, ET86X281

HEATHKIT
110-17, 110-24, 110-25, 110-33, 110-38

MAGNAVOX
340009-1, 340010-1, 340017-1, 340038-1, 340040-1, 340042-1, 340052-1, 340053-1, 340066-1, 340067-1, 340069-1, 340078-1, 340078-2, 340095-2, 340125-1, 340130-1

MOTOROLA
OPTT123C, OPTT123D, TT133A, TT133YA, LTT307A, RTT322A, CPTT332A, CPTT338B, DCPTT338B, CMTT340A, CMTT340B, TT348B, MTT348A, VTT348B, VTT349B, CPTT350B, CPTT356YA*, TT361Y, OPTT361YB, CPTT366Y, CPTT366YD*, OPTT366YD, NCPTT376YA, CPTT378YA, NCPTT378YA, OPTT385Y, OPTT385YA, OPTT386YA, OPTT388YA, CPTT390YA, OPTT390YB, OPTT394, SCPTT394, AOPTT399, LOPTT399Y, LOPTT399YA, OPTT399YA, OPTT402, LOPTT402, CPTT403, OPTT404, OPTT404A, CPTT405, OPTT414A

MUNTZ
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OLYMPIC
CL4692-1, CL5220-1, CL28874-1, CL29554, CL29566, CL29650, CL33579, CL33858, CL34190, CL34835, K24013USA-1C, K5001 1USAH-3

PHILCO
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RCA
KRK103A, KRK103C, KRK103F, KRK103L, KRK104A, KRK104C, KRK104F, KRK104L, KRK107A*, KRK107B*, KRK107C*, KRK107D*, KRK107E*, KRK107F*, KRK108A*, KRK108B*, KRK108C*, KRK108D*, KRK108E*, KRK108F*, KRK113B, KRK116B, KRK118A*, KRK118C*, KRK118D*, KRK123A, KRK123D, KRK124AA, KRK124U, KRK127AA, KRK127AB, KRK127B, KRK127BA, KRK127E, KRK127L, KRK127T, KRK127U, KRK127W, KRK128AB, KRK128AE, KRK128U, KRK133A, KRK133BC, KRK133D, KRK133U

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TA82, TA124, TA129, TA131, TA133, TA136, TA138, TA147, TA150, TA157, 25A1241-002B, 25A1241-004B, 25A1241-005B, 25A1241-006B, 25A1245-005D, 25A1245-006D, 25A1245-009, 25A1245-011, 25A1246-001, 25A1246-003, 25A1246-004, 25A1246-005A, 25A1247-002, 25A1249-001A, 25A1249-001E, 25A1253-001, 25A1253-001B, 25A1253-001D, 25A1256-001C, 25A1258-001A, 25A1258-001C, 25A1263-001, 25A1264-001B, 25A1265-001B, 25A1268-001, 25A1270-001, 006-014700, 006-015000, 006-015700, 006-016500, 006-017300, 006-017700, 006-018600, 006-020100, 006-020900, 006-021000

*Supplied with new channel indicator skirt knob, original illuminated dial is not used.

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CR9S	Series 450mA	1¾″	3″	41.25	45.75	9.50
CR6XL	Parallel 6.3v	2½″	12″	41.25	45.75	10.45
CR7XL	Series 600mA	2½″	12″	41.25	45.75	11.00
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*Supplied with max. length selector shaft (measured from tuner front apron to tip) . . . you cut to suit.

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

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Overhaul includes parts, except tubes and transistors.

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Your tuner will be expertly overhauled, aligned to original standards and warranted for 90 days.

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Circle 8 on literature card

home sets should be supplied by the CATV system operator.

Sanyo To Market Color TV In U.S.

Sanyo Electric, Inc., one of Japan's largest electronics manufacturing firms, has announced its intention of marketing color TV under its own brand name in the U.S.

The initial Sanyo offer to U.S. retailers is four models of color receivers.

Through its parent company, Sanyo Electric Co., Ltd., Sanyo previously has supplied b-w and color TV receivers to U.S. merchandisers for marketing under a variety of private brand names.

MGA Appoints Regional Service Engineers

The MGA division of Mitsubishi International Corporation has announced the appointment of their Eastern and Western Region Service Engineers.

Edmund Clegg, former director of RETS Electronic School, Nutley, New Jersey, has been named Service Engineer of MGA's Eastern Region, and will coordinate the activities of all independent MGA authorized service contractors and the service departments of MGA dealers in that area. He also will be in charge of service training programs to be initiated by MGA in the Eastern Region.

Performing the same MGA functions in the Western Region will be Jack W. Strickland, former TV sales and service operator in Texas and Colorado.

T.E.S.A. of Wisconsin Hires Association Management Firm

Association Management Services, Inc. has announced that an agreement has been signed for that organization to manage the Television and Electronics Service Association (T.E.S.A.) of Wisconsin. Joining in making the announcement was the association president, Ken Mueller, owner of Mueller TV and Electronics in Milwaukee.

T.E.S.A. of Wisconsin is composed of 219 member firms located throughout the State. The purpose of the association, according to Mueller, is the promotion of professionalism and ethical conduct within the television service industry.

Association Management Service, Inc., a subsidiary of Association Corporation, a Milwaukee based holding company, was formed in August of 1970 and is specializing in providing executive services to trade, professional and other associations.

RCA Enters Car Stereo Market, Introduces Three Tape Players

RCA's entry into the car stereo tape player market has been announced by Paul R. Slaninka, Manager, Commercial Operations, RCA Parts and Accessories.

The company's initial product offerings include a stereo 8 player, a stereo cassette player, a stereo cassette player/recorder, and universal-mount stereo speakers. The car tape products will be sold to retail dealers through selectd RCA Parts and Accessories distributors. ▲

readers exchange

■ Electronic technicians and owners or managers of electronic service shops who need assistance obtaining a part, service literature or any other item related to the servicing of electronic equipment, or who have for sale such an item, are invited to use this column to inform other readers of their need or offer. Requests or offers submitted for publication in this column should be sent to: Readers' Exchange, ELECTRONIC SERVICING, 1014 Wyandotte St., Kansas City, Mo. 64105. Include a brief but complete description of the item(s) you need or are offering for sale, your complete mailing address and how much you are willing to pay or want for the item(s). Individuals responding to a request or sale offer in this column should write **direct** to the requestee or seller.

I am retiring from the electronic business world and would like to sell my business:
Claude's Radio & TV Service, St. Jean Baptiste, Box 69 Manitoba, Canada. Modern house adjoining repair shop on same lot, very reasonable price, good business especially in Color TV, RCA franchise.

Claude Ayotto
St. Jean Baptiste
Box 69
Manitoba, Canada

I have an International FM 5000 frequency meter to sell and would like to hear from anyone who might be interested in it. They can get more information about it by writing to me.

Loren Weaver
5008 Elmhurst
Royal Oak, Mich.

I am employed full time as an electronic technician and have a hobby of antique radio repairs (particularly auto radios). I would like to obtain tubes, parts, schematics and manuals for old radios (pre-1942). If any readers would like to dispose of their obsolete stock, please write me and state description and price. I will even purchase complete old auto radios.

W. D. Wilkes
Box 43
Brisbin, Pa.

I need the schematic diagram of the DeLuxe Signa-Tone Audio Oscillator, Model No. 4300. This has a speaker with jack for a key and/or phones. It uses a 117P7 tube. This was made by Insuline Corp. of America, Long Island City, New York.

C. B. Kaczynski
120 Minsom Ave.
Cheektowaga, N.Y.

I have all of the issues of ELECTRONIC SERVICING from April of 1955 to August of 1970. Anyone can have them free, provided they send the cost of postage and handling. Please write me first.

John M. Swenson
Box 422
Mastic Beach, N. Y.

I have, for sale, all of the copies of PF REPORTER and ELECTRONIC SERVICING since the first copy was issued to the present. Volume 1, No. 1, Jan. 1951 to Volume 20, No. 10 are all collectors items.

Leo J. Janiga
98 Choate Ave.
Buffalo, N.Y.

I need a take-up reel belt for a Cipher 77 tape recorder. The part number is 77-124-33301 take-up belt. Can anyone help me?

J. Hofslund
1011 South 10th St.
Manitowoc, Wisc.

I need some information as to where I can obtain a diagram for a Day-Fan radio OEM-7, Type No. 5106 and Serial No. 18120. The company is the Dayton Fan & Motor Co., Dayton, Ohio.

Francis L. Murphy
308 Emery St.
Joliet, Ill.

I am interested in obtaining old radio parts catalogues issued by Newark, Allied, Concord and Lafayette for years 1941 through 1957. I will be happy to pay postage and a reasonable price for each catalogue accepted.

Lawrence Walpole
1514 Third St.
Manhattan Beach, Calif.

▲

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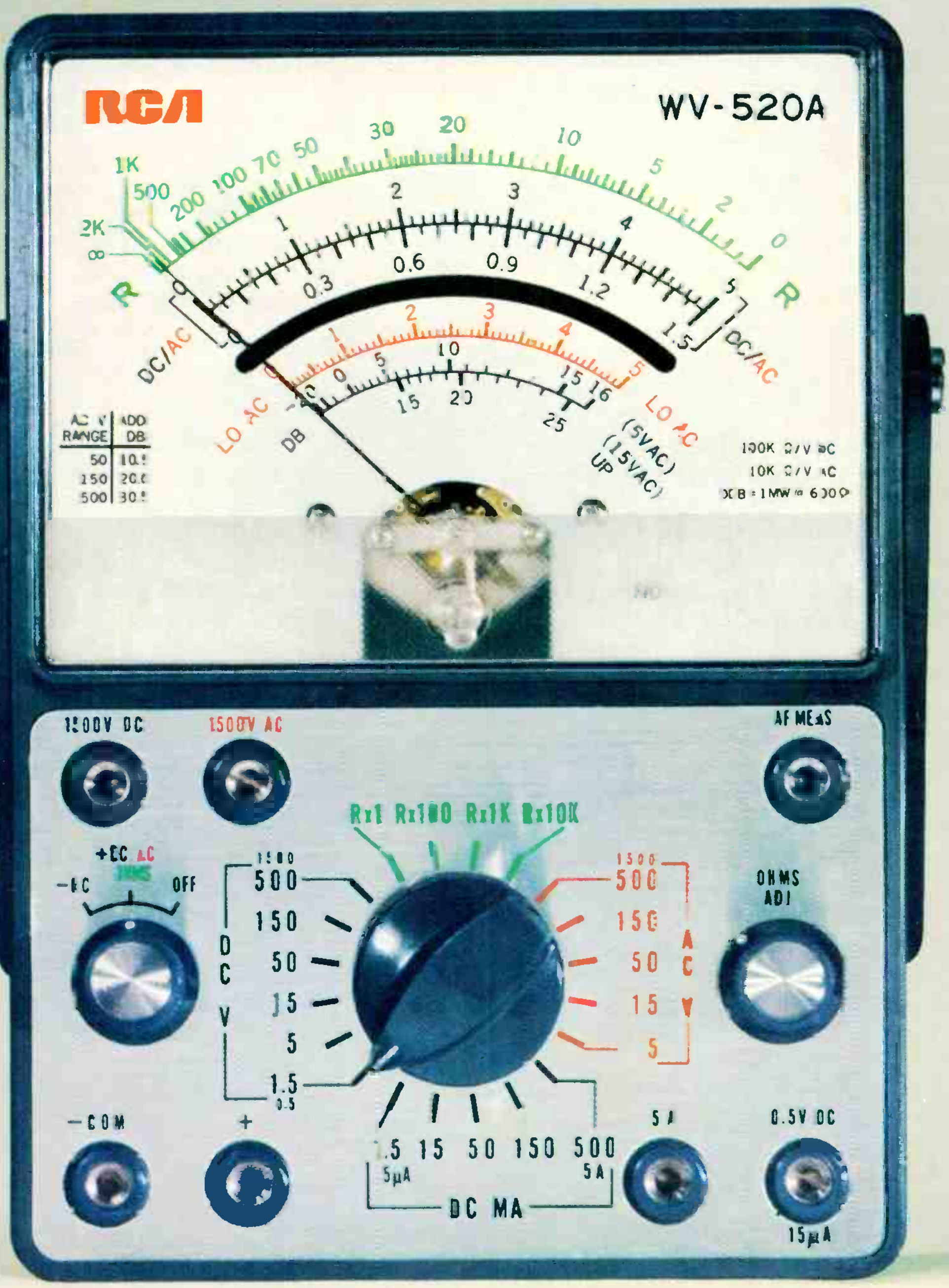

RCA

RCA|Electronic Components|Harrison, New Jersey 07029

letters to the editor

Let's continue to give our customers the best in service and fair, ethical business practices. We can be successful without blackening the name of a company that has always been a friend.

Paul Goldenberg
La Habra, California

Opposes Castigation of RCA Over ServiceAmerica

After reading reams of material castigating RCA I hope you will be fair enough to give a little space to an opposing view.

For the past 17 years I have been a sales/servicing dealer in the Los Angeles/Orange County area. As a member of NARDA and the CSEA I support my industry when its voice is raised in honest protest against unfair practices of any manufacturer.

I read article after article citing RCA for supposedly not caring about the independent service dealer. Are we independents so much in love with ourselves we can't give any credit where it's due?

RCA has helped me (and you) in my (our) business. Let's look at the facts:

(1) RCA Service Company has always charged top dollar for service, enabling our fair prices to seem reasonable to the public. (Had RCA chosen to service sets for a $5 or $7 labor charge, how then would we have fared?)

(2) RCA Service Company uses a tube price list 10% higher than the industry. My prices to my customers at full list price are still 10% lower than theirs. (If RCA had wanted to hurt the independent and sold tubes at a 25% discount, how then would my prices seem to my customer?)

(3) RCA, and only *RCA, set up a warranty labor program on all new electronic products, allowing the customer to go to* any *shop for service and paying that dealer's going rate. (RCA could have set up only certain dealers and paid from a fixed rate schedule.)*

(4) To preserve the integrity of its products and our industry, RCA initiated a safety check program on certain of its models. Again, any *servicing dealer could perform this service and be paid by RCA. (Surely RCA could have had its own personnel do this work at a lower price, and gained a lot of customers but they did not.)*

Of Course, I wish there were no ServiceAmerica; but I can understand RCA wanting to make more bucks, just as you and I do. Expanding their service just seems to be good business sense.

Now, how can we combat this new competitor? Let's take a tip from giants and try to humanize our advertising approach. The slogan "Independent Service Is Best" doesn't seem to me to go far enough. I would like to see an ad campaign showing a "typical" independent dealer and some of his local background and affiliations. Copy would be along these lines: "Remember Joe, your local independent dealer? He's there when you need him, treats you fairly, and personally backs up every repair job. His future depends on you and he knows it. He's not the biggest in the world but he knows your community, your TV problems and how to solve them. Call your 'Joe', or 'Bill' or 'Homer' when you need service, he's there to help." Then follow up with the CSEA standards, etc.

Replacement Semiconductors

I was most interested in the article on "Transistor Substitution", by Mr. Wayne Lemons, which appeared in your October issue.

I was surprised and disappointed, however, to see Sylvania excluded from the manufacturer's cross reference charts shown on page 44. As you must be aware, Sylvania offers one of the most comprehensive lines of replacement semiconductors in the industry. Our products replace over 35,000 domestic and foreign types, as indicated in our catalog. I realize that Mr. Lemons is not a regular member of your staff, but, if he is qualified to write on the subject, then he must realize that RCA and GE are not the only two major suppliers of replacement semiconductors, as intimated in Fig. 1 of the article.

Donald W. Emden, Manager
Sylvania Electric Products, Inc.

It certainly was **not** our intention to imply that RCA and General Electric are the only manufacturers of replacement semiconductor devices. Their replacement guides were used as examples only because they were immediately available at the time.—Ed.

Reaction to ServiceAmerica and Licensing

I have read the article on RCA's plan to set up service centers all over the USA that will service any electronic component, regardless of brand name or manufacturer, and it makes me sick to think of it.

How can they do this when the existing service centers can't even turn out a repaired TV from the bench in not less than three weeks from pickup to delivery in my area alone? We have been the scapegoat for everything you can think of, starting from no parts, charges of over-pricing when other trades get twice as much, and now they want to license all of us.

As far as licensing goes, I think that there ought to be a nationwide association for television servicemen open to all repairmen in the field, and also an organization to help newcomers get started. It would also protect us against any of the aforementioned or otherwise.

I think we ought to lift our heads out of the years of bootstraping and start hitting back. Maybe we can get back some of the respect that has been long overdue. I am ready to throw my hat in the ring, so let me know your view.

Dennis TV
32 Maple Lane
Monroe, N.Y. 10950 ▲

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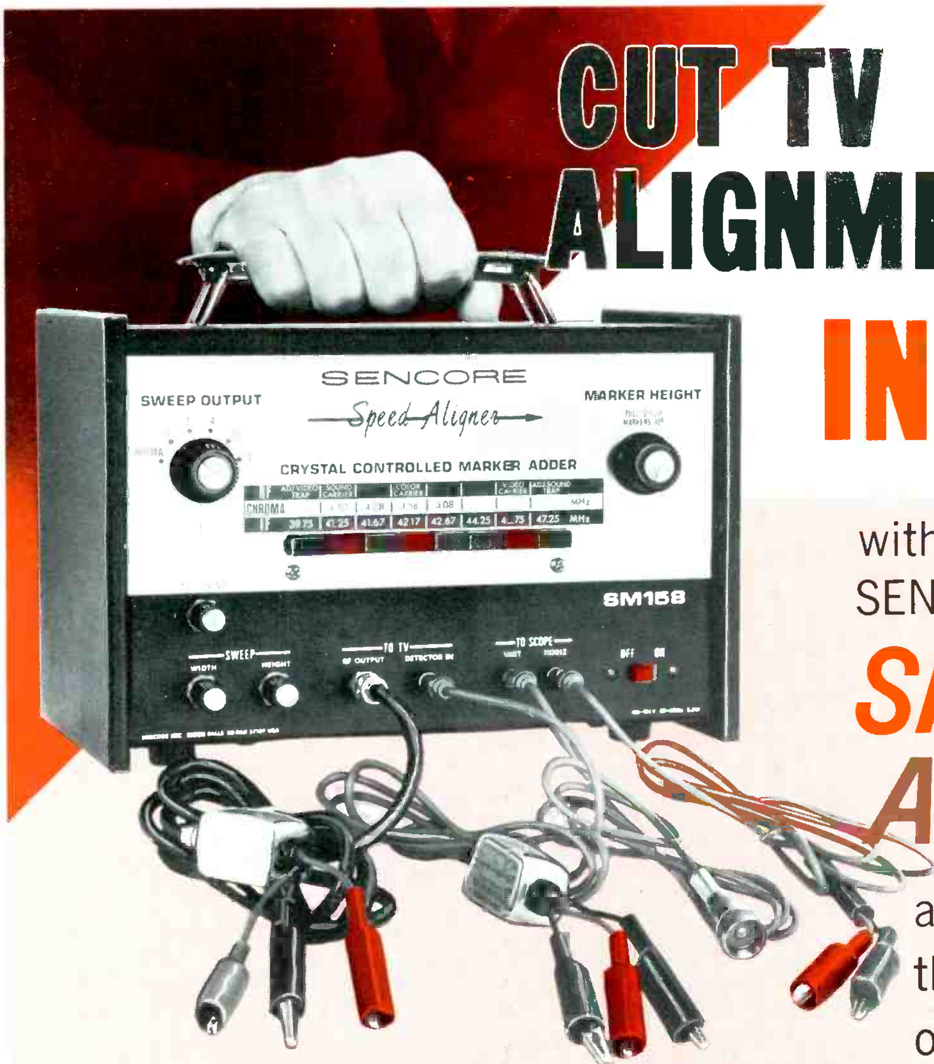

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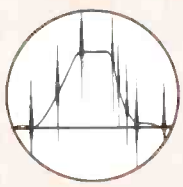

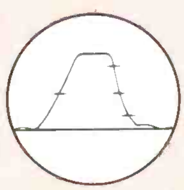

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GENERATES A ZERO REFERENCE BASE LINE: You know where zero is with the SM158. All alignment instructions show a base line, yet some competitors do not generate a base line. You can follow TV manufacturers' instructions to the "T", easier and faster with the SM158 . . . that's why we call it the speed aligner.

SWITCHABLE HORIZONTAL OR VERTICAL MARKERS: want to tilt markers 90 degrees so you can view markers better in traps or for leveling? Merely pull the MARKER HEIGHT control out and markers appear horizontally — a real plus feature.

THE IDEA PEOPLE

SENCORE

3200 Sencore Drive
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Circle 13 on literature card

Dale's service bench

by Allan Dale

Horizontal deflection high-voltage systems

How to cope with the interaction of the many individual circuits and stages that comprise or are supplied by this section and, consequently, directly or indirectly affect its operation.

Despite more than twenty years of television servicing, a technician who is a good friend of mine still turns pale when faced with horizontal sweep troubles. If the set is color—forget it. He'll bring it over to me without even turning it on.

His "fear" isn't uncommon. Lots of technicians haven't found out how to service that mess of interdependencies that forms the horizontal output and high voltage section. And those who do okay with this section in ordinary black-and-white often try to avoid color and transistors.

All the bother is pointless. Everyone should know by now. There hasn't been a major change in horizontal output and high-voltage systems for 20 years (excluding the silicon-controlled rectifier sweep in one RCA color chassis). All are the same, basically. Learn to service one and you've got them all whipped.

Interdependency Examined

Most of the difficulty with this section is caused by the fact that if one operation fails often the whole section shuts down, because many of the individual functions depend on each other.

For example, let the horizontal oscillator quit and there's no sweep or high voltage. Let boost develop a trouble, and it's possible nothing will work. Certain defects in high-voltage stages can load down the rest of the section so that it cannot function properly. A sweep failure kills high voltage, and the accompanying boost failure may foul up operation in stages all over the chassis. Even a minor disorder in this section can reflect a fault in the IF stages (through the AGC system, which depends on keying pulses from the flyback).

So, as you can see, trouble in even one sweep or high-voltage circuit can cause trouble symptoms in a number of other stages. Sometimes the shut-down is so widespread, it's hard to figure out just what started it. And that scares off anyone who doesn't thoroughly understand the sweep high-voltage system.

The block diagram in Fig. 1 should help you understand how this system functions. There are three major types of dependency involved in this system:

- **Direct dependency.** This is because of the normal progression of signals from stage to stage in any kind of section. High voltage depends on the flyback transformer. The flyback and the damper stage depend on the horizontal output stage. The horizontal output stage depends on the oscillator, which, in turn, depends on the AFC. In this chain, each stage depends on the one that precedes it.

This dependency might be complete—that is, the stage might quit operating altogether without the preceding sages. An example of this is the high voltage, which disappears if the horizontal output stage fails. Or, the dependency may be only partial—for example, the horizontal oscillator functions incorrectly if the AFC circuit is bad, but it doesn't completely quit just for that reason.

- **Feedback dependency.** Certain functions in this section of a TV receiver form closed loops. As an example, the horizontal AFC circuit depends on pulses from the flyback, which depends on the horizontal output stage, which depends on the horizontal oscillator, which is controlled by the horizontal AFC. Sometimes this closed-loop relationship creates a problem: You don't know where to **start** looking for the root of the trouble.

Another example: The horizontal output stage drives the flyback transformer, which drives the damper, which develops boost voltage, which in some sets, powers the horizontal stage. Let any part of that loop fail and it all does. But where do you start looking for the trouble?

- **Reciprocal, or indirect, dependency.** Certain facets of operation of this system depend on each other. For example, the flyback transformer drives the horizontal windings in the deflection yoke. Yet, it is the inductive kickback from the yoke that provides the flyback transformer its high energy. This has a further implication: Many functions that depend on the flyback transformer

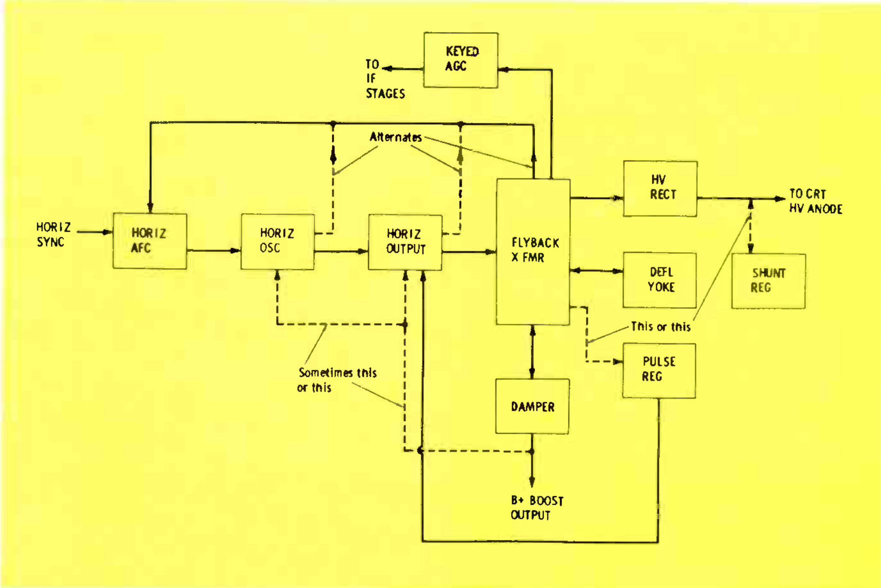

Fig. 1. This block diagram shows the individual functions and their interrelationships in the horizontal sweep and high-voltage stages of a television receiver. Some alternate connections show how different brands and models do the same job. There are other variations, but all operate much like this version.

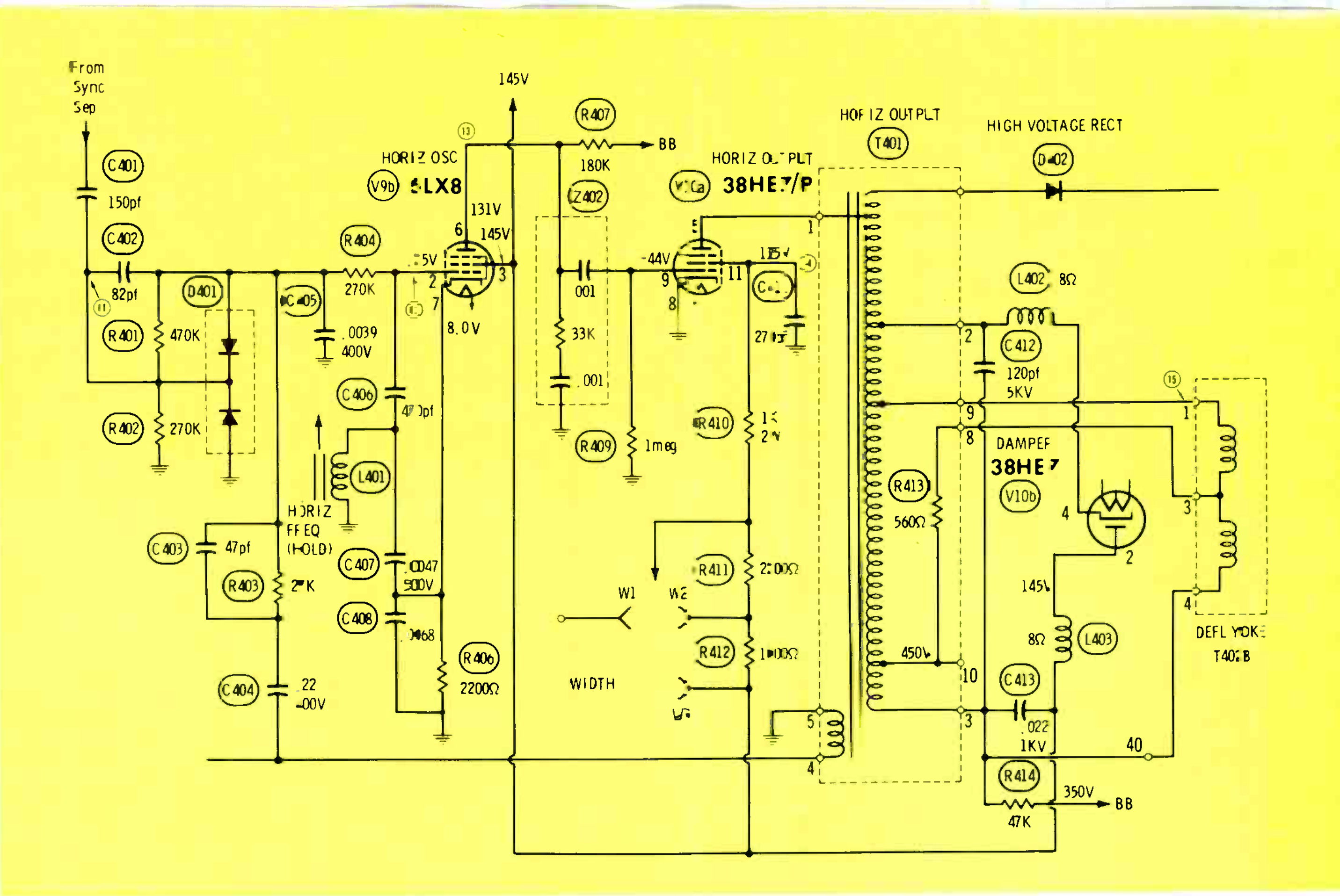

Fig. 2. Typical horizontal sweep/high-voltage circuitry employed in monochrome television chassis. Text tells how some stages are related to each other directly, some by a feedback network or loop, and some reciprocally. The relationships dictate what method you work out for pinpointing faults in the stages.

are equally dependent on the relationship between it and the yoke.

Another example: The damper stage takes energy from the yoke, to generate the boost voltage. However, having absorbed energy from the flyback, it returns that energy at just the right moment to smooth out a "crossover" point in the conduction cycle of the horizontal-output/flyback combination. Thus, a faulty damper stage can interfere with flyback action in ways other than by merely not producing sufficient boost voltage.

Isolating Functions

When you are confronted by so many interdependencies the only way to make heads or tails of a section is to get a good handle on how it operates. Then, with some careful reasoning, you can identify what's basically responsible for each major function.

Once you do that, you can use troubleshooting methods adapted to each function. There are methods that suit each dependency situation I've described. If you have the right methods in mind as you approach each one, an effective troubleshooting procedure isn't as difficult as you have expected.

The Easy Ones

Troubleshooting a function that involves **direct** dependency is the simplest. You just use signal tracing or signal injection. You can treat many of the stages in a sweep/high-voltage section this way.

For example, suppose there's no high voltage in the section diagramed in Fig. 2. This one is simple, because it's part of a black-and-white receiver. The circuit design is fairly common.

You determine the presence or absence of the high voltage by checking it with scope and high-voltage probe. Clip a scope to the insulation of the wire running from the plate of the horizontal output stage to flyback terminal 1. If there's no sign of a horizontal sweep waveform you know the horizontal output stage is dead. Next, the scope will tell you if there is a drive signal at the grid of V10; if there is, you know the oscillator is running. By signal tracing, you have isolated the trouble to the horizontal output stage.

You could use the signal injection technique, too. A plate-drive pulse from a sweep-signal substitutor would produce high voltage in this case. A grid-drive pulse would not. Again, you have proven the output stage faulty.

Pinning down the fault should be comparatively simple. Signal tracing or substitution indicated the flyback is okay; it produced high voltage. You'd probably find an open screen resistor or some such defect in the horizontal output stage.

When There's A Loop

Feedback dependency needn't cause you a serious troubleshooting problem, either. Again using Fig. 2 as an example, suppose the horizontal oscillator is off frequency.

The horizontal AFC employed in Fig. 2 is a common design—diodes back-to-back. Compare the schematic diagram with the block diagram of functions in Fig. 1. This will help you know what to look for on the schematic, in case you're not familiar with the set.

The input from the sync separator is through C401. The sync input goes to the common cathode of the dual-diode. A feedback pulse from terminal 4 of winding 4-5 on the flyback transformer is applied to the anode of one diode via C404, C403, and R403. The other anode is grounded.

DC output from the AFC circuit goes through R404 to the grid of the horizontal oscillator. The AFC diodes compare the phase of the flyback pulse and the incoming sync pulse. If there's any deviation, a correction voltage develops and is applied to the oscillator grid. This pulls the oscillator into exact phase with the station sync pulse.

You know the off-frequency fault is located in the horizontal oscillator or in the AFC stage. But which**?** The AFC stage is directly dependent in one way, but also is feedback-dependent. It depends on the sync input, but it also depends on feedback pulses from the flyback.

There is an excellent way to troubleshoot feedback-dependent stages: Open up the feedback network and treat them as directly dependent stages. In this case, just disconnect the feedback network from the AFC diode.

You can inject a correct sync pulse from an external source and see if it cures the problem. However, signal tracing with a scope is often easier. Trace the feedback pulse from the flyback through the feedback network. Disconnect the diode end of C401, to eliminate the confusion of the large horizontal oscillator pulse there, and check for the input sync pulse.

If both pulses are present at the input of the AFC circuit the trouble is in the AFC diodes or in the oscillator stage. Check the frequency-determining components: L401, C407, and C408.

There's another form of injection that will help you make sure the oscillator can be pulled into frequency normally: Apply a DC voltage from some external bias supply; be sure to use an isolating resistor—1 meg is adequate. Vary the voltage at pin 2 of the oscillator tube above and below the voltage normally expected there. If the oscillator is okay, the picture should come close to normal frequency at some voltage. The picture won't lock completely, of course, because normal AFC action is overridden by the external supply voltage.

The Tough Ones

Running down faults where **reciprocal** dependencies exist is where technicians encounter the most difficulty. For example, once more using the circuit in Fig. 2, suppose there's no high voltage.

Begin by injecting a signal at the plate of the horizontal output stage. If it fails to get anything going, the trouble must be in the flyback or beyond.

Leaving the external plate drive hooked up as a signal source, do some tracing. If you find only a slight signal at the plate of the high-voltage rectifier, the flyback isn't stepping up the voltage as it should.

Probing at each terminal of the flyback transformer might reveal that all the outputs are low. However, if a part of the flyback winding is open, some of those terminals will produce **no** scope waveform at all.

With so many external circuits, a flyback transformer bears a heavy load. If one of those circuits overloads the transformer, it drags down the efficiency of all the windings. So, with the horizontal plate-drive signal still applied, and monitoring the high-voltage rectifier plate with a scope (clipped to the insulation, not to the wire), unload the flyback by disconnecting one winding at a time.

Suppose when you disconnect the yoke, the amplitude of the scope pattern increases to normal. It isn't unusual—a shorted horizontal yoke winding is something you learn to expect. Hopefully, it hasn't damaged the flyback. Another typical fault is a shorted C412 or C413.

If you get all the windings disconnected and still get no indication of proper "RF" output from the flyback, you have a faulty flyback. But you can only be sure of it after you've disconnected all the circuits that are dependent on the flyback.

Suppose, however, you apply the drive pulse at the horizontal-output plate and get what seems to be a good pulse at the high-voltage rectifier, yet the section won't function properly on its own. The yoke might be **open.** Boost and high voltage both depend on the energetic kick-back from the yoke inductance. If it's not there, you get no flyback operation.

Another probable source of trouble, when the stage won't run on its own, is the damper stage. Without it, several things don't happen. No B-plus boost is developed, and the horizontal output tube in this design (Fig. 2) depends on the B-plus boost for its plate voltage (from the damper cathode through L402 and terminal 2 of the flyback to terminal 1). Also, the shape of the sweep will be wrong if the damper isn't working, so the yoke will not be driven properly and there will be no kick-back to operate the flyback transformer.

Color Flyback/High Voltage

The preceding principles of operation also apply to the horizontal sweep/high-voltage section in color receivers. There are more functions to worry about, but you can use the same troubleshooting principles I have outlined for black-and-white receivers.

One popular color chassis uses the sweep/high-voltage section diagramed in Fig. 3. Notice how much it is like the system in Fig. 2. However, there are differences, and I'll explain some of them.

First off, you probably spotted that 6HS5 high-voltage regulator. This stage is reciprocally dependent on the flyback. Its job is to control high voltage, but it does that by acting as a variable load on one of the flyback windings. Anything that lets high voltage increase also increases the amplitude of pulses in the flyback transformer. Higher flyback pulses raise the DC level at the 870-volt boost source; more positive voltage is suplied to the grid of V21, through R76 and the 10K- and 100-ohm resistors; this increases the conduction of V21, and the tube loads down the winding. The flyback pulses are then reduced to normal.

If you suspect that the regulator stage is loading down the flyback so heavily it kills the sweep, simply disconnect the lead to the plate of the regulator tube. If this is the case, and if everything else is okay, the high-voltage and sweep

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circuits will begin functioning once again.

The flyback winding with the red, yellow, black, and green wires supplies horizontal pulses to the convergence system. Black is ground, and the other three go to a convergence-panel socket. If you ever suspect that a defect in the convergence panel is overloading the sweep section, just pull the convergence plug. If your suspicions are true, high voltage will return to normal operation.

The green wire of the same winding also supplies the feedback pulse to the horizontal AFC stage. Trouble in both AFC and convergence waveforms means a fault in that winding. Your scope will tell.

Likewise, you can see, by examining the schematic, that a certain kind of short in the convergence panel can upset the horizontal oscillator frequency, because of the common connection between the AFC and convergence circuits. You have to watch for little things like this in the multi-winding flybacks employed in color receivers.

Pulses to develop focus are taken directly from the plate of the horizontal output tube. A solid-state rectifier and capacitor C139 develop DC across the divider made up of R72, R73 and R74. R70 and the slider of R72 apply the voltage to the CRT focus anode. Consequently, a shorted focus rectifier can cause trouble in the sweep section. Don't overlook this when you're tracking down an overload.

Summing Up The Methods

Once you get the knack, you can service any kind of electronic circuit or stage. Part of acquiring the knack is developing sensible troubleshooting methods based on peculiarities of operation.

The three "dependency peculiarities" in the horizontal sweep/high-voltage system are the basis for the troubleshooting method I've outlined here. The explanation of those dependencies also should have helped you understand how a sweep/high-voltage system operates. It's the same, whether in a black-and-white set or color.

You treat directly dependent stages just like any others. You inject an appropriate signal and either trace it or note its effect on the stages that follow the injection point. Or, you use the scope alone to trace the signal as far as possible.

You can treat feedback-dependent stages as direct stages, sometimes. That is, you can trace signals through them with your scope. If you have a stage with more than one input or more than one feedback, be sure you devise a way to check each one independently. Or, you can open up the feedback path and use signal injection to see if the stages work.

The best method of seeking out trouble in a stage that is reciprocally dependent on another is by driving one stage externally and seeing if it works. You may have to disconnect one or more branches, as you do with flyback transformers, to eliminate the effect of a defective stage on these stages it depends on and that depend on it. But the act of disconnecting usually leads you to the faulty stage—even if it's the one you're disconnecting **from.**

Put these logical methods to work next time you have a horizontal sweep or high-voltage problem. You'll be surprised how easy such problems suddenly become. ▲

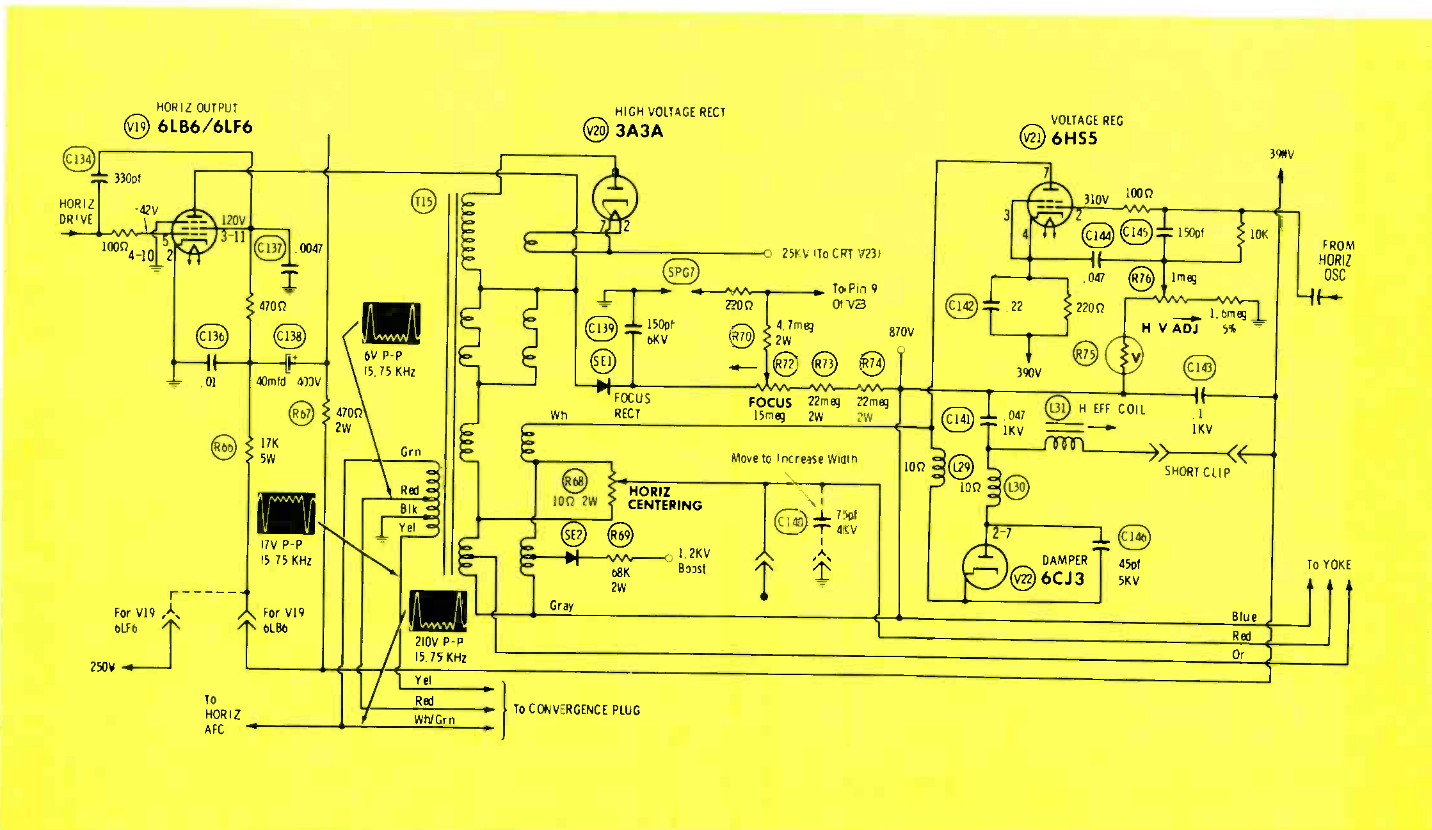

Fig. 3. Color chassis has more complicated sweep/high-voltage section, but dependencies among the stages are about the same as those in black-and-white TV. Methods of troubleshooting are essentially the same, although some special stages require a slightly altered approach, as explained in text.

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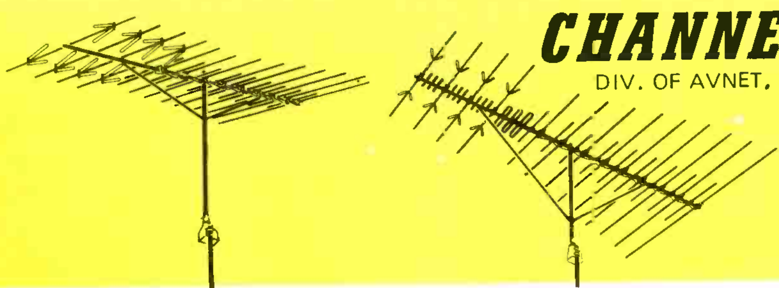

Circle 15 on literature card

Servicing cassette tape player/recorders

Mechanical operation and troubleshooting

by Forest H. Belt and C. Milton Lowell

The electronics used in cassettes are mainly simple amplifiers, so we won't discuss electronic repair in this article. It's the mechanics that bug most technicians, so cassette mechanics is what we'll explain.

The North American Philips (Norelco) cassette system is the one in general use today. Cassette machines are so standardized, many of them seem to be made by the same company. Many parts are actually interchangeable from one brand to another. When you've seen one, you've practically seen them all.

Of course, there are differences. There may be an elaborate array of buttons that makes the front look like a missile-firing panel. Or there may be just one or two simple operation buttons. A unit may be mono, stereo, four-track, or whatever else comes along. Whether the cassette machine you have to service is a player or a recorder/player, has one head or four, is AC-powered or battery, has a radio with it or not, the mechanics of operation are still essentially the same.

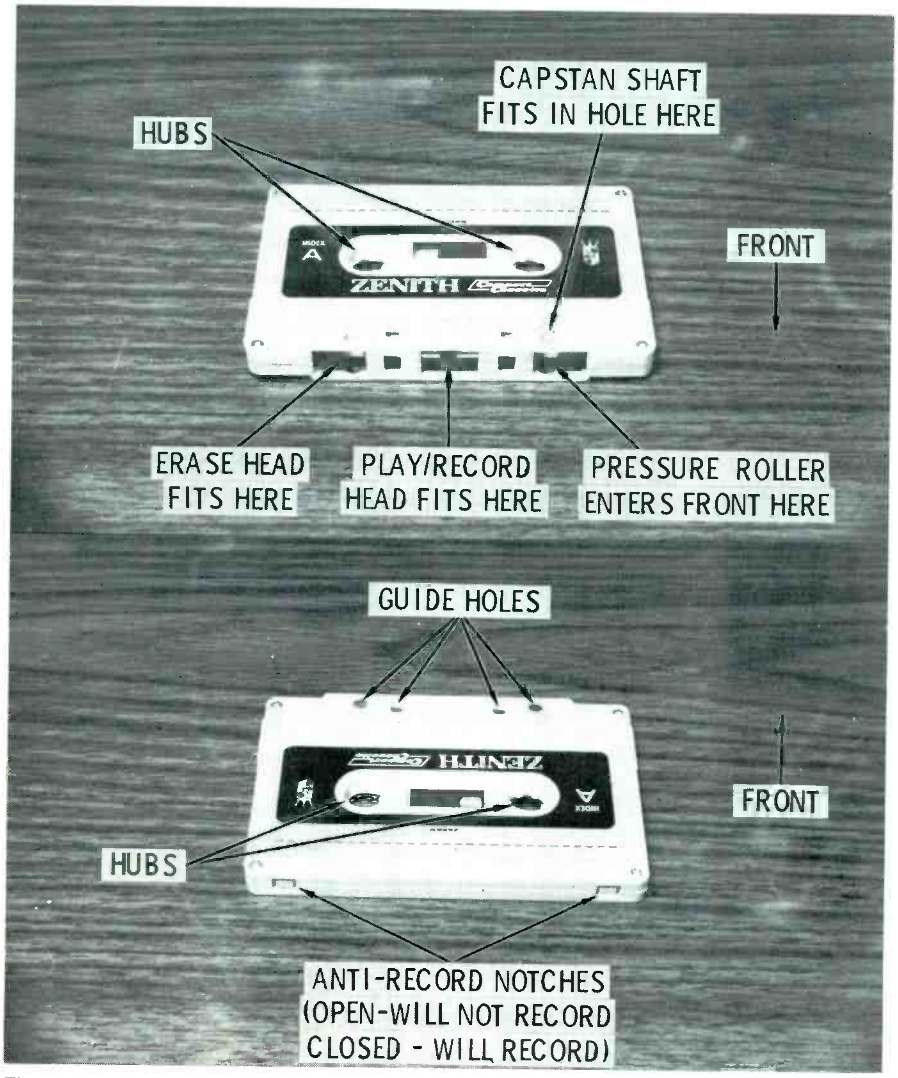

Fig. 1. Philips-type cassette uses ⅛-inch tape and enclosed reels. Holes near front are positioning guides. When the square holes at rear are open they prevent recording.

The Cassette Cartridge

First, take a good look at the cassette cartridge itself (Fig. 1). It contains a length of ⅛-inch tape, wound between two reels. This makes it an enclosed reel-to-reel device. Each reel has six sprockets protruding from its hub.

Near the front, the plastic case has four holes to guide it into position in front of the head assembly. No matter which side of the cartridge is up, the holes line up the same.

The front edge has three places for the tape heads to fit in. Which side is up makes no difference here, either. The play/record head fits into the center opening. The erase head (if the machine records) fits into the left one. The capstan shaft fits behind the tape in the right opening. A rubber pressure roller enters the right opening from the front, pressing the tape against the capstan shaft.

At the rear are two small, square holes, one at each end. Each is an "anti-record" notch. If these holes are open, the Record button can't be pushed in. (In some recorders, the button will go in but no power is applied to the motor.) This prevents accidental erasing or recording on a tape you want to preserve.

Conversely, if you want to record, these holes must be closed. Blank cassettes, like the one in Fig. 1 have knockouts in case you want to open the notches after you've put something on the tape. Covering over the notch (Scotch tape is useful for this) pushes an interlock out of the way in the machine so the Record button can be pushed in.

A lot of "won't record" problems can be solved by looking at the cartridge first.

Playing The Cassette

For a start, let's go through a playback sequence. First thing to do, of course, is to insert the cassette cartridge (Fig. 2). Place the **back** edge of the cartridge in the transport well on the player. Push backward and down until the sprockets of the takeup and rewind hubs are engaged and the cartridge snaps down into place. You'll notice a slight pressure against the cartridge as you do this. A leaf spring at the rear of the transport deck keeps the cartridge firm against the guides and against the heads during operation.

With the cartridge firmly seated, press the Play button. This makes several things happen:

(1) The entire head assembly moves forward about a quarter-inch, pushing the heads against the tape.

(2) The pressure roller moves forward to press the tape against the capstan, which is now inside the cartridge.

(3) A switch applies power to the drive motor.

(4) In some machines, a switch also sends power to the electronics. In others, especially those with built-in radios, the main on-off switch keeps the amplifier on even if the tape isn't running.

(5) The brake shoes (indicated by fingers in Fig. 3) are pulled away from the takeup and rewind hubs.

If all these things happen, the tape starts, and you hear whatever is on it.

Recording

The record operation is similar to that in most small open reel-to-reel tape recorders. The Record button is depressed along with the Play button. Consequently, the five functions for play are also in operation for record.

However, the Record button pushes on a spring-metal strip that engages a slide-type function switch. This operation:

(1) Changes the input and output connections between the center head and the amplifier.

(2) Connects the erase head to the bias oscillator.

(3) Connects the level meter.

The only hitch here is the knockout notch on the back of the cartridge. There is a lever in the machine (Fig. 4) that **must** be pushed back when you supply power to the unit in the Record mode. Or, as in the photo, pushing the lever back might merely clear the path for the Record button to slide the function switch.

(Continued on page 24)

Fig. 2. Cartridge goes into machine rear-first. Leaf spring behind cartridge snaps it into place as front is pushed down.

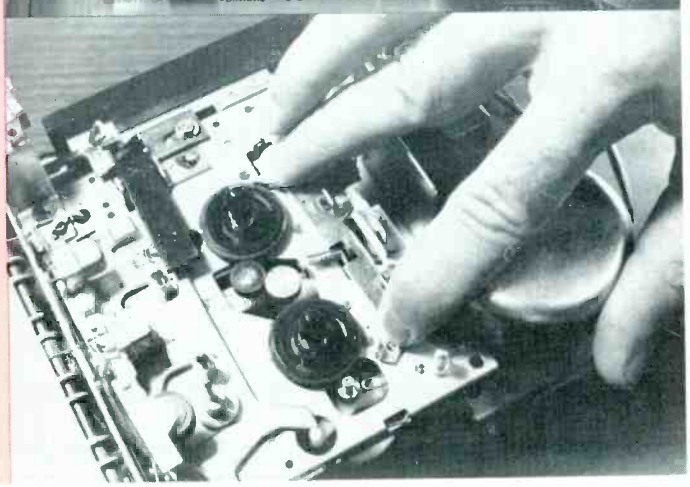

Fig. 3. Brake bar with metal shoe on each end rests against take up and rewind hubs until pushbutton pulls it away during operation.

Troubleshooting Hints

WON'T RUN AT ALL

- Power switch not closing
- Bad motor
- Broken main drive belt
- Capstan idler frozen
- Power supply faulty

NO TAKEUP OR REWIND

- Broken takeup drive belt
- Broken spindle on either side
- Stripped sprockets in tape cartridge

WOW OR FLUTTER

- Capstan pressure low
- Slipping drive belts
- Oil or grease on belts
- Main drive belt too tight
- Weak motor
- Broken sprocket cogs

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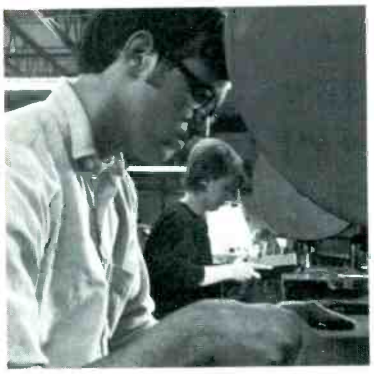

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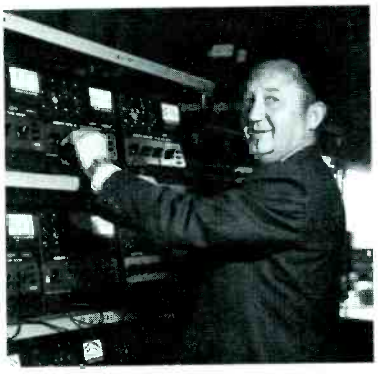

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The Drive Mechanism

The drive motor in cassette machines usually is operated by 6 volts DC and has a built-in speed governor. For operation from 117 volts AC, a stepdown transformer and bridge-type rectifier produce the 6 volts DC for both motor and amplifier.

A pulley is located on the end of the motor shaft. A thin rubber drive belt running between this pulley and the one on the flywheel spins the flywheel. The center of the flywheel in some machines has a spindle which is the capstan. In the machines shown in Fig. 5, the belt that drives the flywheel also passes over another pulley. This pulley is on the capstan shaft, which extends through the main deck.

The flywheel of some units has another drive groove, too. It drives a belt which operates the takeup reel. For rewind, this belt is moved from the takeup spindle to the rewind spindle.

This action is different in some machines. A friction wheel is driven by the flywheel (see Fig. 6). A belt from that wheel turns a fast-speed pulley. Idlers above deck (Fig. 7) transfer this fast rotation to the takeup and rewind hubs, usually by friction drive.

Troubleshooting

You can eliminate some things right off the bat:

(1) Is the unit plugged in, or does it have its batteries installed properly?

(2) Are the batteries in good condition?

(3) Like you, we always believe what the customer tells us; but try a known-good tape cartridge anyhow.

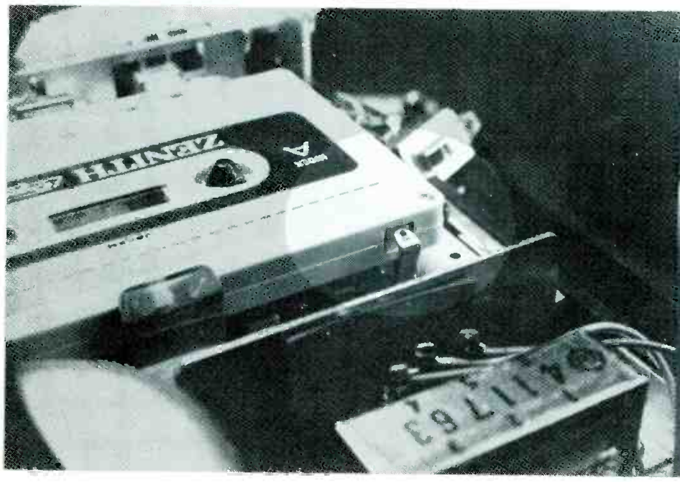

Fig. 4. Lockout lever prevents recording unless the back of the cassette cartridge is solid. Here, it is pushed back, so record lever can be engaged.

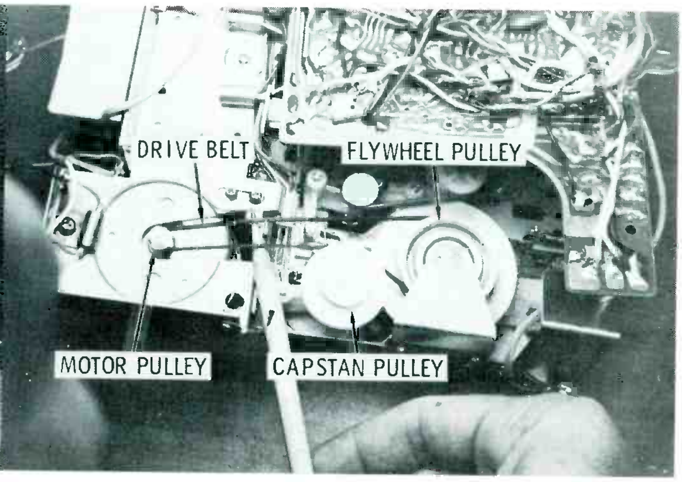

Fig. 5. Motor pulley is at left, flywheel at right. Belt between the two also turns capstan by passing over white nylon pulley at bottom of capstan shaft.

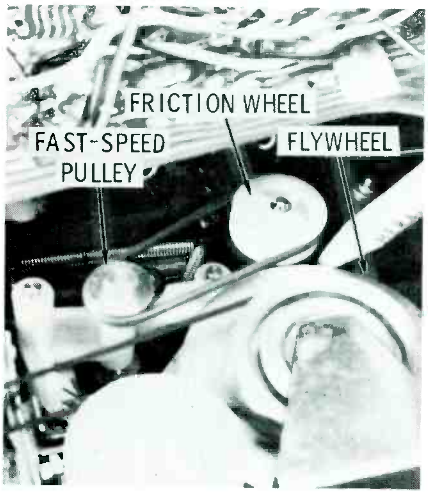

Fig. 6. Fast speed for rewind and fast-forward comes from this setup. Pulley near pencil is friction-driven by flywheel. Belt drive idlers on top of deck.

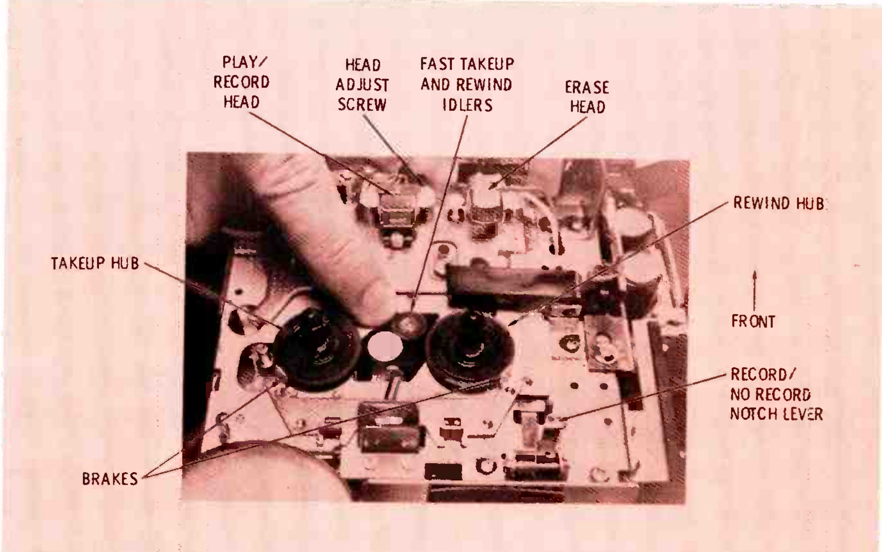

Fig. 7 Fast-speed idlers above-deck can press against either the takeup hub (for fast forward) or the rewind hub.

If the trouble seems to be mechanical, inspect the sequence of actions just described. Everything is accessible once the case is removed.

If any parts are bent, don't try to straighten them out. Replace them. Once a metal part has been bent, it becomes a weak spot in the system and certain to cause trouble later.

Inspect for springs that have slipped off or become stretched. A photo or exploded diagram of the mechanism is valuable here, to help you spot where springs should be. Check the drive belts; be sure they're not stretched, broken, or cracked.

How about the rubber rims of friction-drive wheels? Dried-out ones should be replaced. Be sure there are no low spots in them to cause WOW. Clean rubber rims and drive belts only with rubbing alcohol, or a substitute recommended by the manufacturer.

There are very few adjustments. Unless some critical part has been replaced, factory settings should not require attention. Follow this principle: If the unit was working properly before the trouble started, just repair the fault. (That's called the "IIWWODMWI" system: "If it was working okay, don't mess with it.")

Head alignment, if it is required, is simple. A short note on this point: All tapes do not run over the heads at the exact same place. The designers have allowed a little tolerance. Just adjust them for "best."

Other adjustments you might need to check are: capstan pressure, take-up spindle pressure, and rewind spindle pressure. The rest of the stuff is spring-loaded and is pretty well preset.

There is a tiny amount of lubrication to be done. Moving parts, such as the head-assembly slide and pushbutton slides, can be greased with whatever you use on slide-type assemblies in phonos. BE SPARING. Tape-head cleaner should be used when a head looks discolored (the result of oxide from tape.) Also, the heads collect residual magnetism, and should be demagnetized periodically. ▲

Troubleshooting video IF with sweep alignment gear, Part 2

The response curve—how it should look and how it is obtained.

by Larry Allen

Last month you got a close look at a unique way to troubleshoot IF strips. What it boils down to is this: You set up a response-curve display with sweep generator and scope. Then you analyze the curve. From the shape of a bad curve, you can deduce what frequencies are not being amplified in the strip. And that leads you to the component causing the trouble.

Helping you become familiar with the response-curve patterns is the purpose of this second installment.

You don't need fancy equipment. You can use whatever sweep alignment instruments you have. The equipment shown in Fig. 1 is representative of modern alignment equipment. It makes setting up the curve quick, and the multiple markers it generates are more informative. But you can troubleshoot just as quickly with your own sweep-alignment setup, just as long as your instruments can display a response curve and accurately mark it without distorting it.

A Curve That's Correct

To know when something's wrong with an IF response curve, you have to know what a good one looks like. Not all IF strips produce the same shape of curve. Some color sets, for example, are aligned to a different response than a black-and-white receiver. Transistor-TV IF's are sometimes slightly different than tube models.

But even at that, variations are few. Learning to recognize the correct shape of the curves produced by the most popular chassis designs takes care of the majority of sets.

There are some things to remember. The response curve depends on several factors in the IF strip. One of them is the AGC voltage. Whenever you align a receiver, you clip a bias supply to the RF and IF AGC buses. You need to do this when you set up a response curve for troubleshooting, too. Just follow the manufacturer's instruction about where to connect how much voltage. The TV alignment generator I use has three bias supplies built in, but you can use separate bias boxes if that's what you have handy. But get those biases right, or you can't depend on the curve you see.

Another thing. Don't overload the receiver input with too much sweep-generator signal. You probably know not to, but it's worth mentioning. It would distort the curve, and mislead you.

Best way to handle that is to set the scope vertical controls so the trace is 2 or 3 inches high with 2 volts of scope input. Then don't change that setting. When you apply the sweep generator signal to the set, turn up the generator output control only enough to make a 2-inch display on the scope, which is connected to the video detector. If you do that, you won't cause overloading. If the size of the scope dis-

Fig. 1. With modern equipment, such as the Sencore unit shown here, sweep alignment is much simpler than in the old days, when it took many instruments and a couple dozen connections to get hooked up and ready to view a response curve.

play changes, correct it by changing the sweep output, not by changing the scope controls.

Be sure grounding is good between the instruments and the TV chassis. If bringing your hand near the chassis or near one of the instrument cables changes the curve, you have a bad ground in the hookup. Cure that before you try analyzing any curves.

Also kill the VHF oscillator, or tune the receiver to a dead spot in the UHF band. This eliminates distortions from station interference and from stray oscillator RF. Only when everything is set to show a correct curve can you figure out accurately what's causing a bad one.

Running Down A Resistor

I promised you some case histories to help you understand (1) how to determine which coil peaks at which frequency, (2) how to recognize an IF response curve that's not shaped right, and (3) how to reason out what's fouling up the IF response. Here's one case, just about as it happened.

When the set was brought to me it would produce only a picture that looked like that in Fig. 2. Fine tuning has some effect, but not enough to give me a good look at the picture. It looked like extreme IF misalignment, except for one thing (which I promptly ignored): The snow produced by the set without a station tuned in, was almost normal. Usually, when the IF stages of a TV are trying this hard to oscillate, the snow between stations is elongated and smeary.

When I encounter such IF trouble, I always run a sweep-response curve. I got this one hooked up and everything set, and saw the response curve in Fig. 3A. I had the usual five markers on—39.75, 41.25, 42.17, 45.75, and 47.25 MHz.

Because the "spires" were so overpeaked, I couldn't determine their frequency very well; the markers blended in with the vertical parts of the curve. As it happens, the generator I use has a switch for flipping the markers sideways. I switched them, and got the scope display in Fig. 3B.

The overpeaked spires explained the tendency to oscillate. But the significant thing about the response curve was that deep "trough" in the middle. The two markers—the 42.17 and the 45.75—told me the trough was at about 44 MHz. That's roughly in the middle of the IF passband. Something was really dragging down the gain over a wide segment of the curve.

The alignment sheet for the set showed me the correct curve shape (Fig 4). It and the schematic (Fig. 5) also revealed that none of the transformers peaked at 44 MHz. So I ruled out the idea that one transformer somehow was loading down the curve. I also decided no single decoupling capacitor could cause so deep or broad a dip.

I looked for something common to more than one stage in the IF strip, something that involved several of the transformers. The traps seemed okay, the skirts of the curve

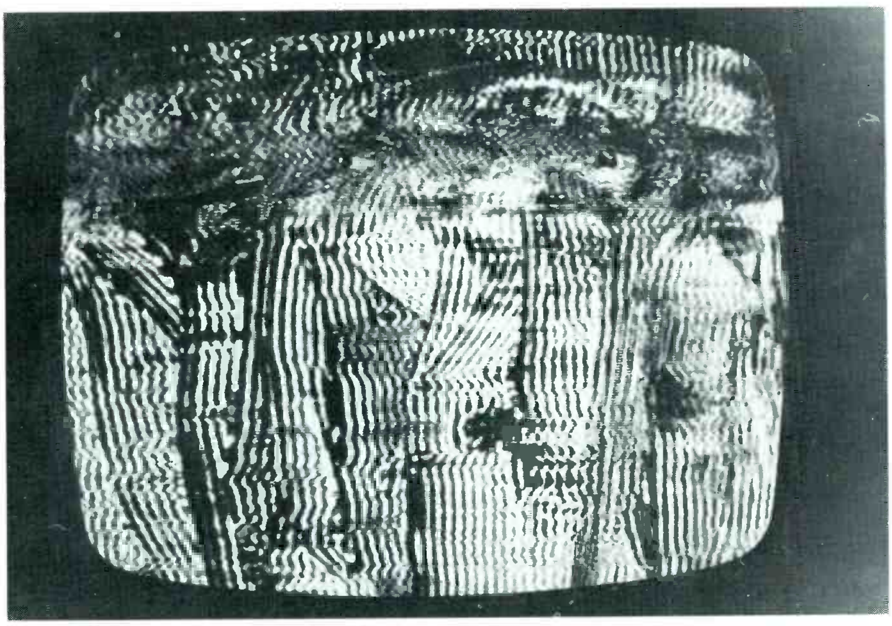

Fig. 2. Complete lack of viewable picture, with RF patterns moving over the screen indicate tendency to oscillation. This usually is caused by IF overpeaking, resulting from misalignment or a bad decoupling capacitor.

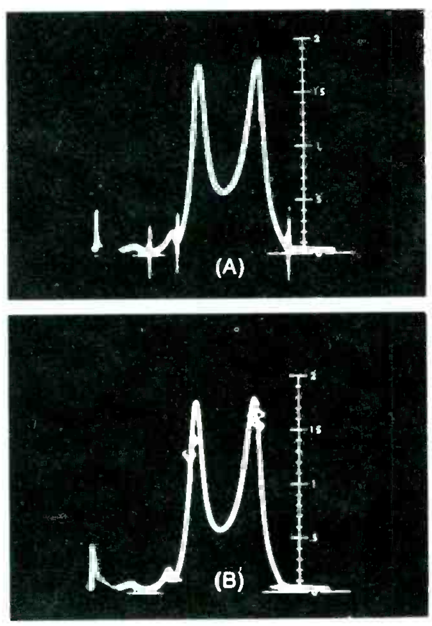

Fig. 3. Overpeaking at both ends of IF response curve. Markers at top in (A) are less visible because of steepness of curve. Generator that produces "sideways" markers (B) makes them more visible.

were where they belonged, at the correct markers. The fourth transformer (not shown) peaked at 42 MHz, so that wasn't the trouble.

After I mulled the situation over for a while, a light suddenly glimmered. One thing common to all three transformers in Fig. 5 is the AGC. It controls V1 directly and V2 indirectly through V1. Capacitor C5 was okay, **but R3 was wide open.**

The fact that removing signal seemed to stop the IF strip's tendency to oscillate should have been a clue for me. But it worked out okay anyway. I got to the AGC circuit in what seemed a roundabout way, but almost as quickly as if I'd traced the trouble from the AGC-stage end. Which proves that using the response curve is an effective way to find **any** IF defect.

Clue To a Bad Coil

Another trouble that seemed fairly easy using the alignment method was a tough dog for the technician who brought it over. He'd spent a lot of time on it, and had already tried alignment. The set was a little portable, and used an IF similar to Fig. 5, so I'll just use that schematic for explanation.

First thing I did was prealign the traps with just the marker signals from my generators. I connected my VTVM at the video detector, and tuned each trap for minimum reading. Then, still using marker signal without sweep, I peaked the transformers. I assumed they were standard and peaked T1 at 42.5 MHz, T2 at 45.0 MHz, and T3 at 43.0 MHz, and T4 (not shown) at 42.0 MHz.

Then I ran a response curve with the sweep signal and scope. It looked like Fig. 6. The whole right side of the curve was collapsed. This meant something was badly amiss at the upper-frequency side of the response curve. The only transformer that should peak at that frequency was T2.

I then remembered how T2 had tuned somewhat broadly as I had tried to peak it. You don't always notice little things like that. Anyway, it took only a matter of minutes to try a couple of new decoupling capacitors. They didn't help, so it had to be the coil. A new one fixed the trouble.

When You Don't Know Frequency

One color set with transistors in the IF section got me back into my curve-troubleshooting groove one afternoon. I didn't photograph what the screen looked like, nor the response-curve shape, but I'll tell you about the job anyway. There were several things about it that were very instructive for anyone just beginning to use the curve way to find IF trouble.

A partial diagram of the IF section is drawn in Fig. 7. I've included the numerical order of alignment adjustments; I got them from the alignment notes for the chassis. I didn't include the DC voltages on the transistors; they were so near correct I received no clues from them.

As in most schematics, the traps are labeled with their frequencies. Always preadjust them.

Connect your VTVM to the output of the video detector. Feed in a 41.25-MHz unmodulated marker signal, with the generator output at the minimum level that still produces a useable reading on the VTVM. Tune both 41.25-MHz traps (Adjustments 1 and 2) for a **minimum** reading on the voltmeter.

While you're dipping traps, look over the schematic for a "Sound Reject" potentiometer. If the set has one, turn it for minimum VTVM reading after you've dipped the 41.25-MHz sound traps.

Change the marker frequency to 47.25 MHz and tune Adjustment 3 for minimum reading. If the strip has a 39.75-MHz trap, feed in that frequency and dip that adjustment too.

I prealigned the traps in this transistor set, and then set up a response curve with sweep generator and scope. Because the IF was badly misaligned, the shape of the response curve was completely wrong. I decided to roughly prealign the rest of the coils.

When you don't know the specific frequency of each coil, a quickie way is to peak them all at 44.0 MHz. That's about the center of the IF passband. When you've done that, the set is far from aligned, but you have somewhere to start from to reshape the curve. So that's what I did. With a very weak 44.0-MHz signal, and with the VTVM still at the detector output, I peaked Adjustments 5 through 8.

This gave me a reference from which to determine what coils are for which frequencies in this particular IF strip. I can tell this by looking at where the tuning slug is for each coil.

If a slug is at the end of its range or nearly out of the winding when tuned to 44.0 MHz, its slug has to be turned in to tune it to its intended frequency. This means greater inductance, which means lower frequency. Consequently, the coil must be intended for 42.5 or 43.0 MHz.

If the coil is almost all the way into the coil, its intended inductance must be less, and its intended frequency therefore, higher. A slug in the center of its travel suggests an intended coil frequency near 44.0 MHz.

I then labeled the coils on the schematic, "lower" and "higher". From these labels I then made fair guesses at the frequencies. I decided Adjustment 5 was probably for 45.0 MHz, and I labeled it. I did the same for Adjustment 6 at 42.5

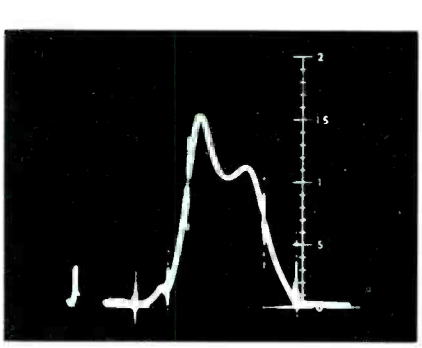

Fig. 4. Normal response produced by chassis discussed in this article. This curve is common to many models, instead of the flat-topped symmetrical curve drawn in many textbooks.

(Continued on page 30)

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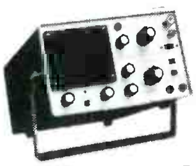

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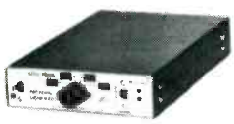

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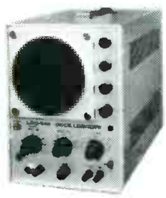

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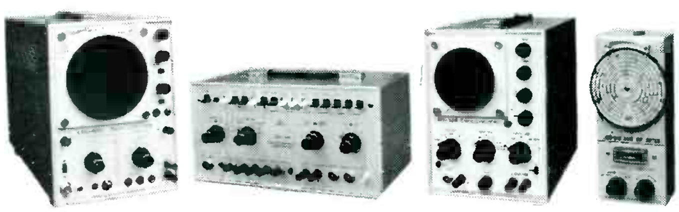

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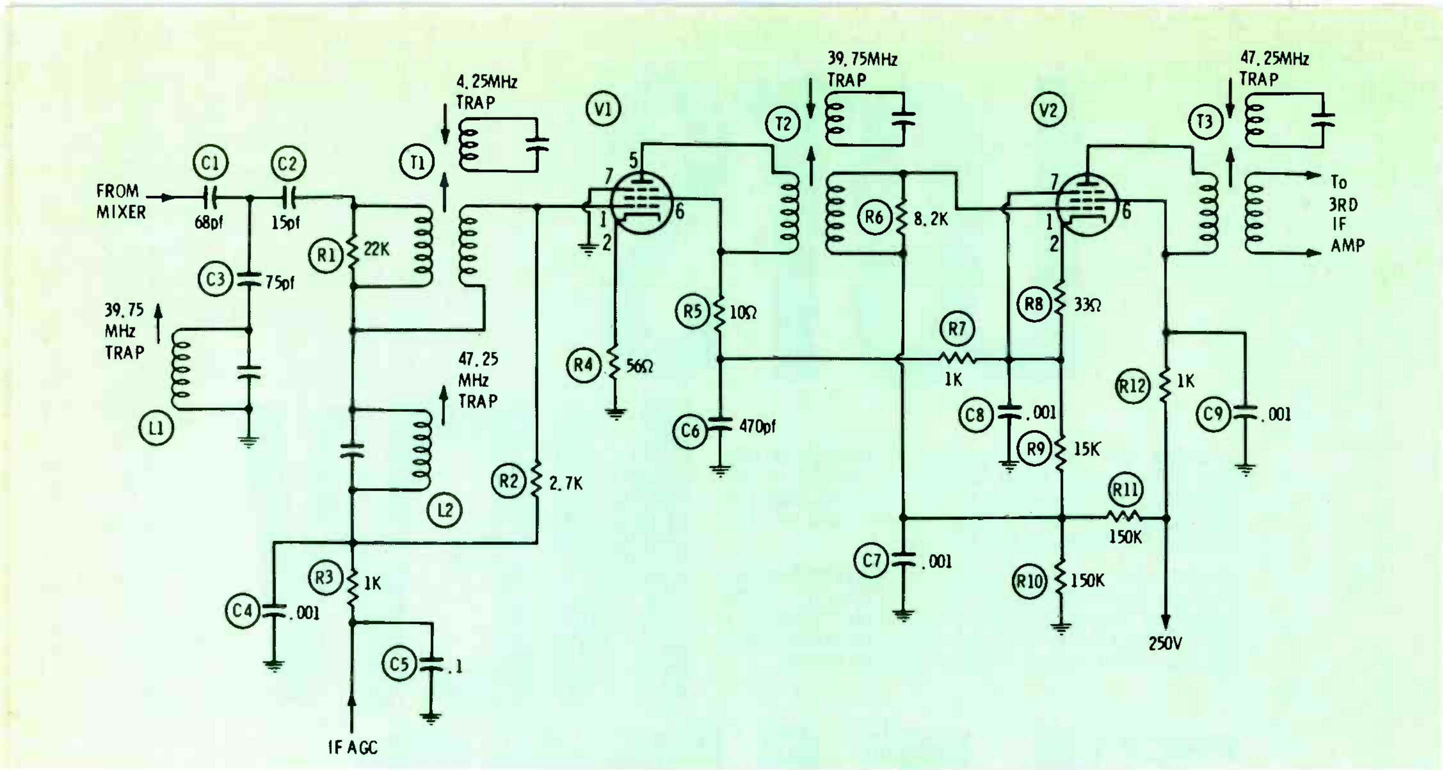

Fig. 5 Schematic of typical stagger-tuned IF strip. This is same kind of receiver mentioned in first installment of this series.

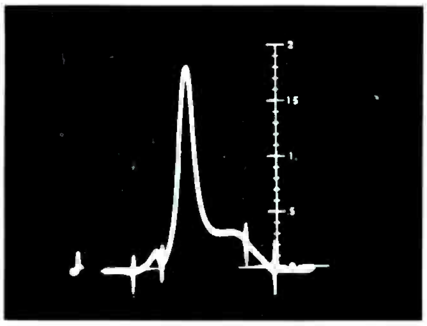

Fig. 6 Collapsed right side of response curve is clue to fault that alters curve on 45.0-MHz end of IF passband. Specific portion of curve points to which stage is at fault—in this case, the stage with the transformer that normally peaks at 45.0 MHz.

MHz, Adjustment 7 at 44.0 MHz. Those are the frequencies generally used in staggered IF strips. If you guess wrong on one, it usually must be interchanged with one of the others.

There were two ways I could set these transformers: One was by peaking with marker signals and the VTVM. However, I prefer a method that used the response curve, so I can quickly tell if the frequencies I chose are correct.

The idea is to use a coil to peak the curve **at that frequency point.** To get an idea of the procedure, look at the curves I've drawn in Fig. 8. The heavy line is the curve produced with all tuning slugs, everything except traps, peaked at 44.0 MHz.

I set up an imaginary frequency scale along the bottom of the curve display. The traps at 41.25 and 47.25 MHz pull the skirts to zero at each end, which gives you a fair notion of where the frequencies in between are situated. With the scope positioning controls, I moved the curve sideways until the 42.5-MHz point on the curve was positioned on a vertical line on the scope graticule. Using this procedure, I can ignore the overall curve shape and concentrate on one frequency point.

Then I tune. On this particular transistor chassis, I first twisted Adjustment 6, watching only the point where the curve crossed the vertical graticule line (42.5 MHz). I adjusted the slug until the curve trace no longer moved upward along that vertical graticule line. At this point if I twiddled the slug back and forth, the curve trace moved only downward along the graticule line. The coil was peaked at 42.5 MHz, and the overall curve looked like the dashed curve (1) in Fig. 8.

Adjustment 7 was at 44 MHz, to which all the slugs had been previously adjusted, so I assumed that it needed no further adjustment.

Adjustment 8 was for 43.0 MHz. Using the Horizontal Position control of the scope, I moved the response curve sideways until that spot (43.0 MHz) was under a graticule line. Then I peaked Adjustment 8, watching the curve only where its 43.0-MHz point crossed the graticule line. It peaked reasonably well.

The response then had the shape of dashed curve 2 in Fig. 8. Notice how the overpeaking at 44 MHz was disappearing. The curve was getting lower there but higher at other points as energy began to be concentrated at the proper frequencies.

Finally, I moved to Adjustment 5. Again, using the scope horizontal position control, I moved the response curve until the 45.0-MHz point was under a graticule line. The coil peaked a bit broadly. The curve ended up with a downward slant (dashed curve 3, Fig. 8) at the 45.0 MHz point, but it looked almost right. When I put the five markers on it, their relative positions were okay, but the response still had that downward slope to the right of 44 MHz.

The Tired Transistor

The coil peak wasn't too broad, so I decided it and its decoupling capacitor were okay. In fact, some technicians might have accepted curve 3 in Fig. 8. The video was a little weak, because the 45.75-MHz

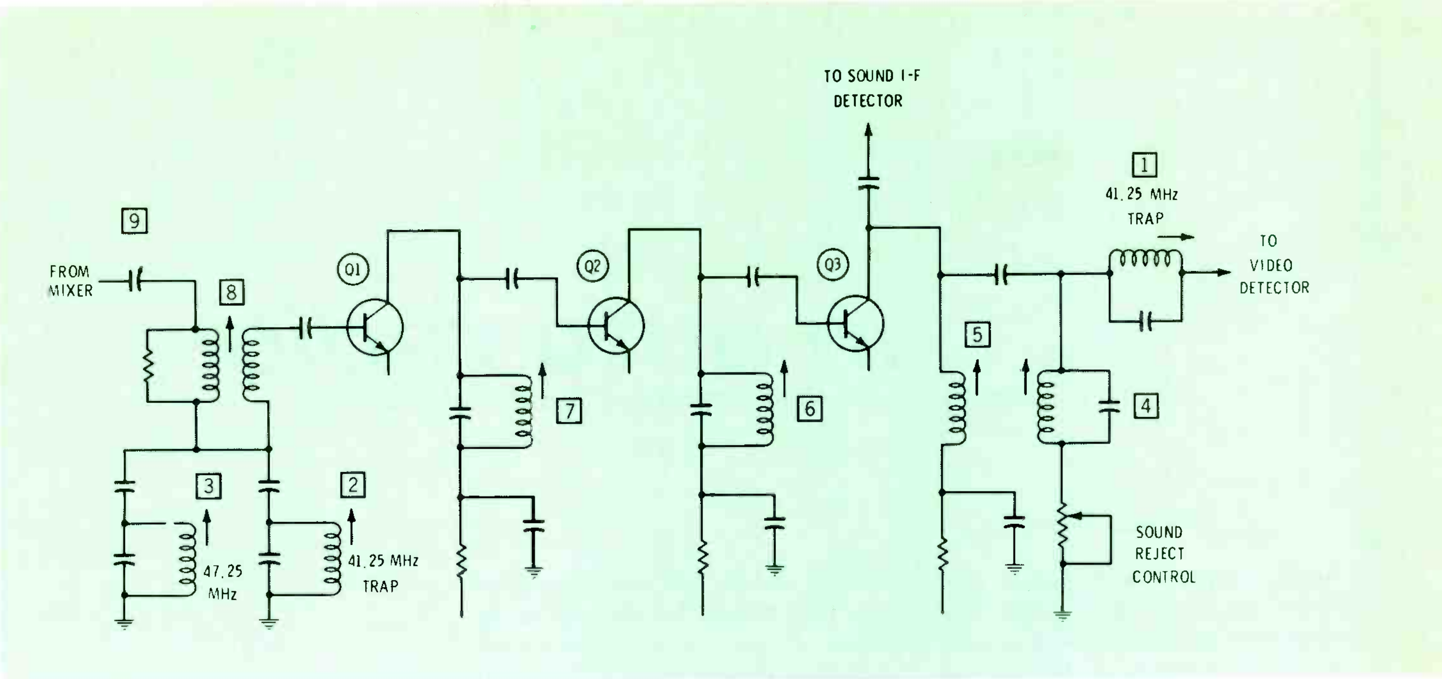

Fig. 7 Transistor IF strip in color receiver; it has many similarities to schematic shown earlier. Another transistor color set has an IF strip that isn't stagger-tuned; all coils peak at 44.0 MHz.

marker was lower than it should be but the set functioned almost normally.

Since everything else seemed normal, on a hunch I removed transistor Q3 (Fig. 7) and tested it. Gain was very poor. The DC operation had not changed, but the transistor had minor leakage and just wasn't up to snuff. A new transistor put the response curve right up to dashed curve 4 at 45.0 MHz.

Try It!

All this really took no more time than you spent reading about it. Once you catch on to the procedure, and start thinking about a response curve analytically, alignment and troubleshooting will go hand in hand for you. Both become easier than you once thought alignment could be.

You can extend the preceding alignment and troubleshooting principles into other tuned stages, such as the chroma section of a color receiver, which has tuned circuits and must be aligned.

Next

In the third and final installment of this series, I'll show you how a chroma response curve can be used for troubleshooting. It's even easier than with the IF curve, because tuning is simpler. ▲

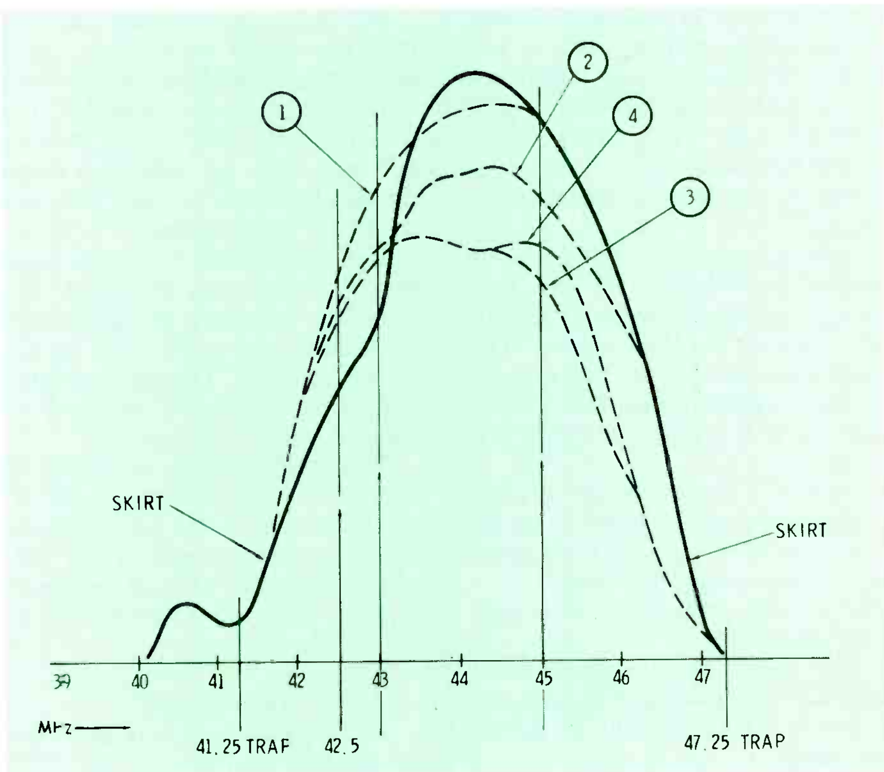

Fig. 3 Evolution of correct response curve from overpeaked curve with all coils peaked at 44.0 MHz. (1) When 42.5-MHz coil has been peaked. (2) With 43.0-MHz coil peaked. (3) When 45.0-MHz coil is peaked, but with trouble still in IF strip. (4) With trouble cured (see text for the fault).

IC's in auto radio

Operation and servicing of integrated circuits in car receivers.

by Joseph J. Carr

Auto radio manufacturers tend to try out on a small scale new component and circuit designs prior to total conversion to the new design. We witnessed this in 1957, with the introduction of hybrid (tube & transistor) car radios. After this design was used for several years there was ample evidence of the practicality of transistor circuits in auto radios, and there was a firm base of solid-state repair experience in the field. As a result, during 1961-63 auto radio design converted completely from tube technology to the newer transistor technology.

1968 started what appears to be another hybrid era. We are now seeing transistor/integrated circuit (IC) hybrids on the market. The electronics service industry can probably expect to see full conversion to IC's within the next few years.

Now is a good time for all electronic technicians to bone up on IC applications, design and servicing techniques—especially those technicians who service car radios and solid-state TV's.

The following paragraphs will treat IC's generally, with special emphasis on those already in use in car radios.

What is an IC?

All solid-state electronic circuits use combinations of transistors, diodes, resistors, capacitors, and so forth, to perform certain circuit functions. The manufacturers of integrated circuits build all of these components (as needed) on a single piece of silicon, called a "substrate", or "chip". The circuit design engineer considers this device as a single unit whose function is to increase the gain of or process a signal in a certain way. This "circuit unit" will respond in a predictable manner to external circuit conditions and component values.

(Do not confuse integrated circuits with the ceramic modules used in some Delco auto radios and all Philco-Ford sets since 1965. These are network modules made from discrete components embedded in a ceramic body. IC's are totally different. They are built on a single silicon chip using various thin-and-thick-film technologies.)

IC's can reduce the total number of components in a set, improve the reliability of the set and, surprisingly, simplify the service technician's job. This last attribute is what we technicians are most interested in.

Two general classes of IC's are of interest to us at this point: RF/IF amplifiers and audio preamplifiers. We will consider "special use subassemblies", such as those employed in some Delco auto radios, later in this article.

Typical IC's

As examples, let's look at a couple of IC's available in the RCA line of linear devices. Fig. 1A shows the internal circuitry of the RCA CA3028A RF/IF amplifier. The three transistors are all closely matched because they are all made from the same unit of semiconductor material. They also share a common heat system because they are within the same case and are on the same substrate. This means that they will stay more closely matched over a

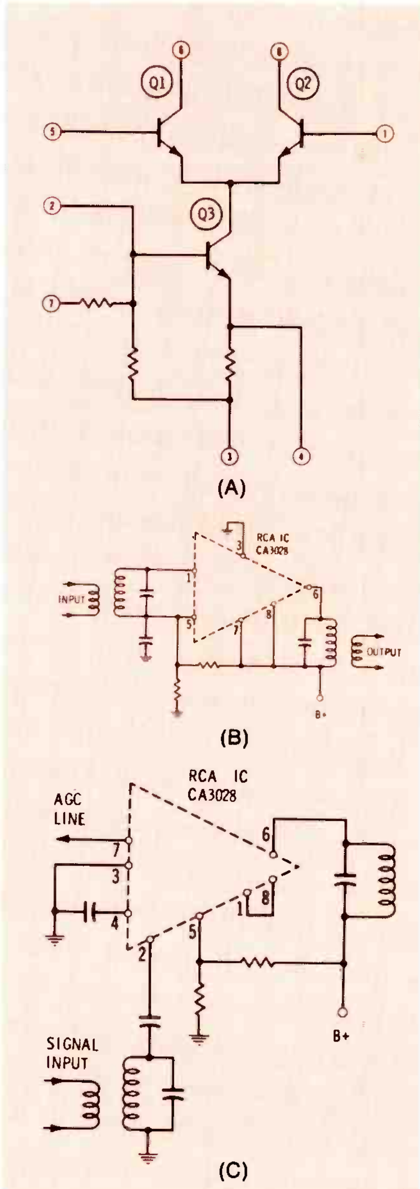

Fig. 1 Design and typical applications of RCA's CA3028 integrated circuit. A) Schematic diagram of internal circuitry. B) CA3028 connected in differential amplifier configuration. C) Cascade configuration.

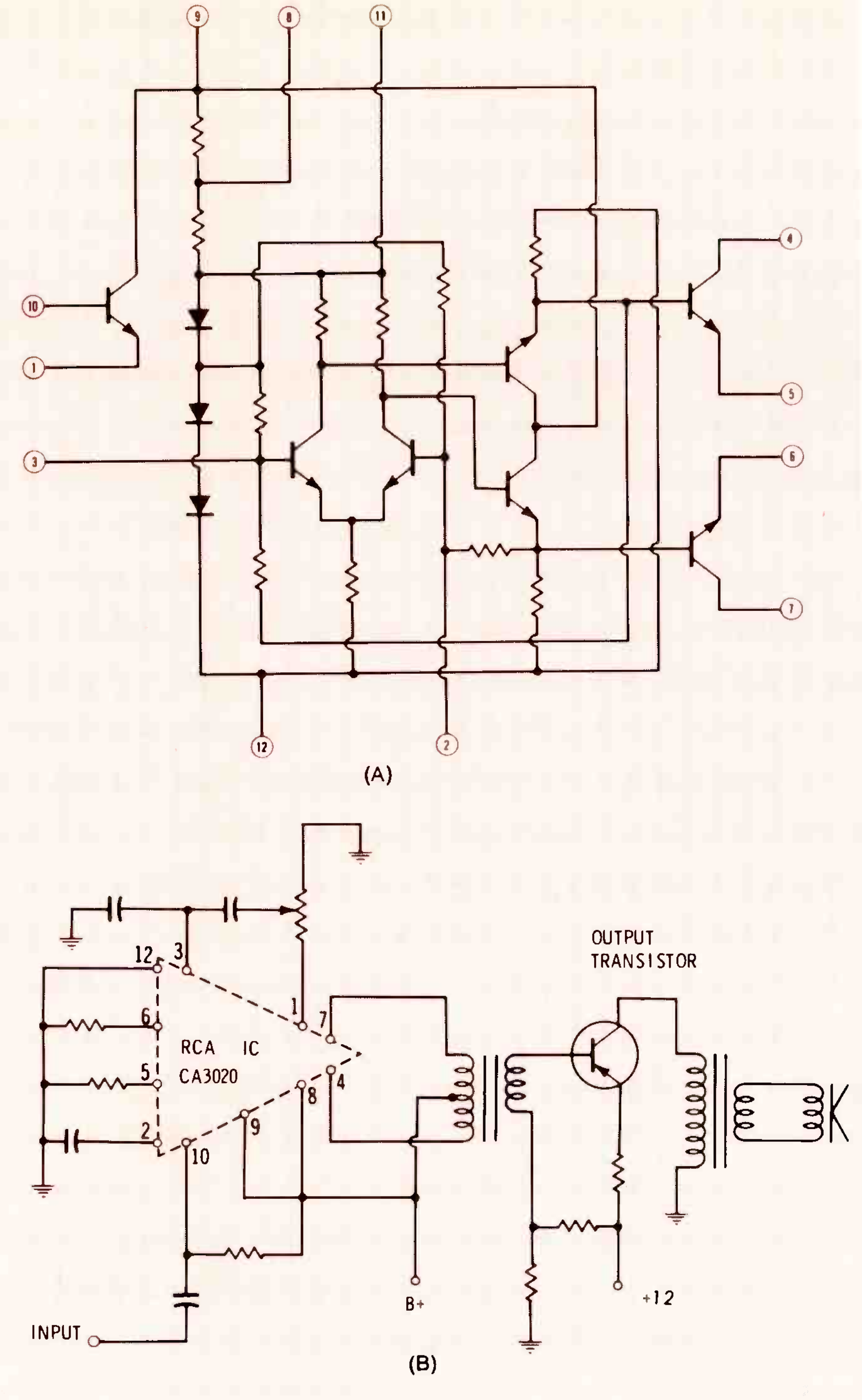

Fig. 2 RCA's versatile CA3020 IC. A) Internal circuitry. B) CA3020 connected as audio preamplifier.

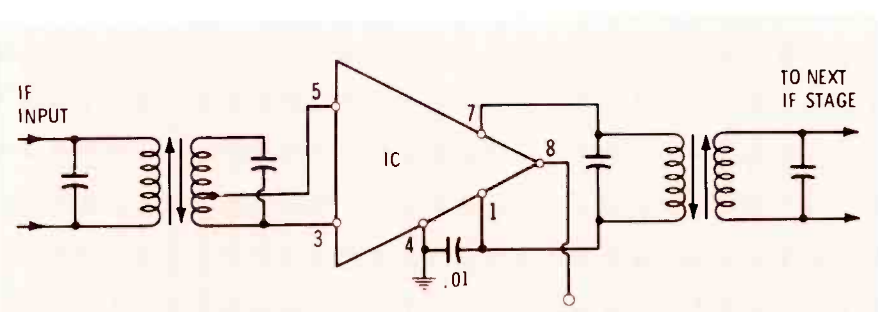

Fig. 3 Schematic diagram of FM IF amplifier integrated circuit used in Motorola's line of universal FM auto receivers.

wider thermal range than would an equivalent circuit made from discrete components. This matching enables this IC to function stably as a differential amplifier (Fig. 1B) without any external compensation. Such a configuration is usually found with balanced input and output tuned circuits.

This IC also can serve as a two-stage cascode amplifier if the collector of the "input" transistor is connected to the emitter of the "output" transistor and if one of the "differential" pair is disabled. The cascode configuration is shown in Fig. 1C.

The CA3028A becomes a mixer if the constant-current-source transistor, Q3, is switched on and off by a signal from a local oscillator. In addition to possible applications as RF amplifier, mixer, or IF amplifier in radio and TV receivers, this IC also will function as a product detector or balanced modulator in single-sideband (SSB) communications systems.

The audio amplifier IC illustrated in Fig. 2A is the RCA CA3020. It can be used either to supply a low-wattage signal through a miniature output transformer to a small speaker, or it can be used to drive a larger transistor power amplifier (Fig. 2B). RCA's **Linear IC Handbook** shows the application of this IC in one circuit that has an 8-MHz bandwidth. This wide-band capability might make this IC adaptable to future use in color television receivers.

There are several publications that are useful for learning IC technology. One of these, mentioned previously, is titled **RCA Linear Integrated Circuits Handbook** (RCA publication No. IC-41).

IC's in Auto Radio Circuits

One of the earliest uses of integrated circuitry in auto radio was in the Motorola line of universal FM equipment, which used an FM IF amplifier IC (Fig. 3). These sets are FM68M, FM-to-AM converter; FM-991X, FM stereo receiver; FM-108M, AM/FM radio; and FM-210A, AM/FM receiver. The unit mentioned last also includes an insulated-gate field-effect transistor in the FM RF amplifier circuit. The basic IF amplifier circuit shown in Fig. 3 is common to all of these

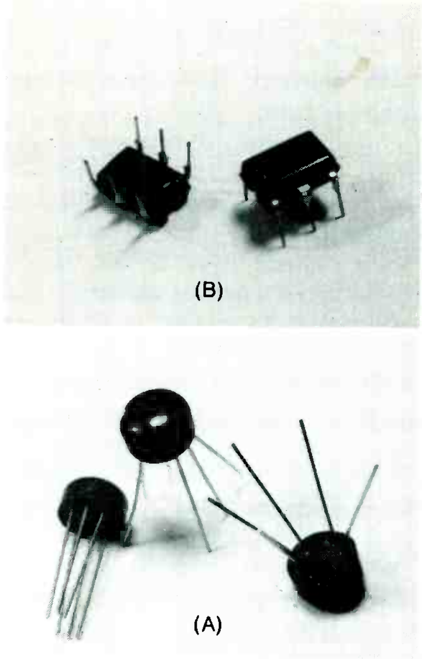

Fig. 4 Two types of Motorola IC's. A) Six-lead, molded-epoxy, TO-5-type IC used as FM IF amplifier in Motorola universal FM auto radios. Circuit configuration is shown in Fig. 3. B) Six-lead, dual in-line type IC used as audio preamplifier in 1970 Volkswagen radios (Model 1VW1003) manufactured by Motorola.

sets. Most of them use four such stages in cascade. The actual IC is shown in Fig. 4A. It is a six-lead IC packaged in an epoxy version of the familiar TO-5 transistor case.

Fig. 4B shows another integrated circuit used by Motorola in car radio circuits. This IC is the audio preamplifier used in the 1970 contract Volkswagon radios. The circuit in which this IC is used is shown in Fig. 5. Notice that it is directly coupled to the power transistor.

Two different types of IC final FM stages are employed in some Delco car radios. Both are classified in IC terminology as "special-use subassemblies". A few Delco models, notably 1969 Pontiac radio Model 92BFP1, use the type DM-1 integrated circuit. This device includes in one case both the last FM IF amplifier and the FM limiter circuits (Fig. 6). These sets use the standard twin DC-39 diode ratio detector to demodulate the FM signal. As evident in Fig. 6, the circuit employing the IC is a lot simpler than the older circuit which used two transistors, an extra IF transformer, and a handfull of additional passive components.

Some newer Delco sets use the type DM-11 integrated circuit (Fig. 7). The DM-11 is an FM limiter and quadrature detector packaged in an epoxy case which is best described as resembling a large-size, blue centipede. The quadrature detector, while familiar to TV technicians, is a radical departure from the detectors normally found in auto radios.

Delco has introduced another rather interesting IC in their 1970 line of auto radios. It is the type DM-14 FM stereo decoder IC. As can be seen in Fig. 8, this device processed "raw" audio, from the FM detector, into left- and right-channel signals.

Fig. 9 shows the internal schematic of the Motorola MC1304P monolithic FM stereo decoder IC. Comparison of the internal circuitry of the Motorola and Delco IC's makes the author suspect that the Motorola MC1304P and the Delco DM-14 are the same unit.

Take a good look at the schematic of the internal circuitry of the MC1304P (Fig. 9). This IC contains ten diodes, thirty-one transistors, and more than two dozen resistors. The functions performed by this IC are: 19-KHz amplifiers, a 38-KHz doubler, composite signal stages, a stereo-indicator lamp driver, audio muting, mono/stereo switching, 67-KHz (SCA) suppression, and a 38-KHz synchronous stereo detector. The size of the case of this IC is approximately .3 X .75 inch.

The Motorola stereo decoder has three inputs. One is a mono/stereo switching circuit. Another is for audio muting. The third, and primary, input is the composite audio signal from the FM detector circuit. When the radio is tuned to a stereo station, there will be three types of signals at this input: the 19-KHz pilot signal (for synchronization), the L+R monosignal, and the coded L–R stereo signal. This last signal is a suppressed carrier affair with sidebands 15-KHz above and below a 38-KHz center frequency.

The MC1304P processes this signal so that the L+R and L–R information can be presented together and demodulated in the 38-KHz **KHz** synchronous detector.

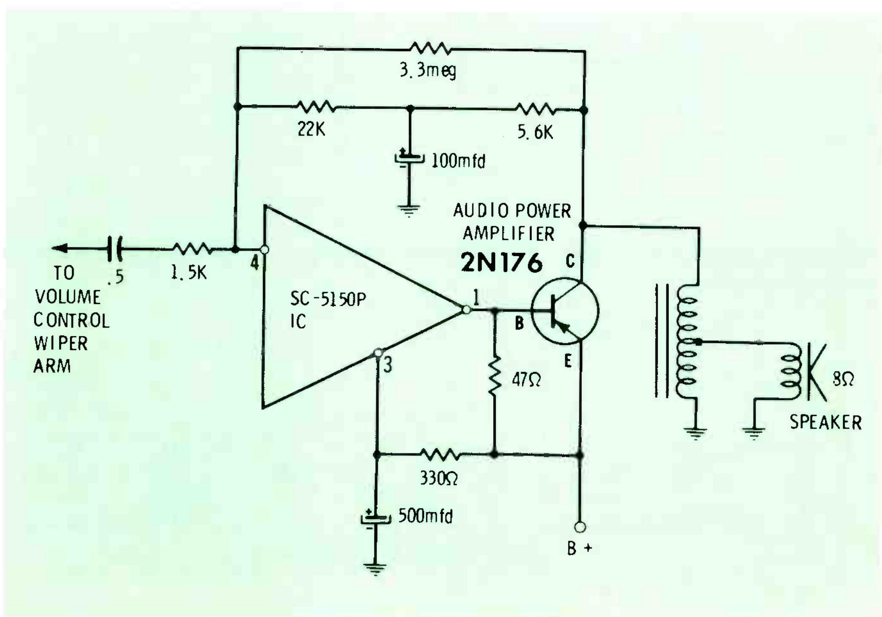

Fig. 5 Circuit configuration of audio section employed in Motorola-produced 1970 Volkswagen auto radio (Model 1VW1003). IC used as audio preamplifier is Motorola SC-5150P, shown in Fig. 4B.

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Circle 20 on literature card

The audio outputs of the detector are left- and right-channel signals.

Another output of this IC is the stereo-indicator lamp driver. The 40 milliamp current capability of this driver can be increased by using the lamp driver output to trigger a higher-current transistor lamp switch.

The DM11 was mentioned earlier as a radical departure from the usual car radio design. One of Delco's 1970 receivers is a really radical departure. It is an eight-track stereo tape player/AM and FM stereo multiplex radio combination. It uses the DM-11 quadrature FM detector IC to drive a DM-14 stereo decoder IC. This, in turn, drives the Delco DM-8 audio preamplifier. This last may or may not be a true integrated circuit. It seems to depend on who you ask. To the author, however, it appears to be a ceramic module containing transistors. If it is an IC, Delco has produced a super set with four IC's.

IC Case Styles

My first encounter with an IC left me wondering whether the thing was an electronic component or something to be sprayed with a bug bomb. Since that time, the number of different IC case designs has increased—and they all look like something from the insect world. Fortunately, all of these styles can be divided into two basic categories (see Fig. 10).

The first category could be called the "modified-TO-5" package. This is the standard transistor case that has been with us for years. The IC "TO-5", however, tends to be a little bit larger than it's transistor cousin. The various TO-5-like IC's have 6, 8, 10, or 12 leads. The Motorola FM IF amplifier shown in Fig. 4A is a 6-lead, molded epoxy (economy) version of this basic package.

"Flatpacks" and "dual in-line packs" make up the other basic IC case category. These are the centipedes mentioned earlier. They can be found in both epoxy and ceramic versions with 6, 10, 14, 16, or 24 leads. The most common is the 14-lead, dual in-line case. The Motorola Volkswagen preamplifier and the Delco DM-11 are 6- and 14-lead versions, respectively, of the dual in-line case style. The flatpack differs from the dual in-line in that it is made from ceramic and is flatter, wider and shorter. These two types make up a large majority of the digital IC types.

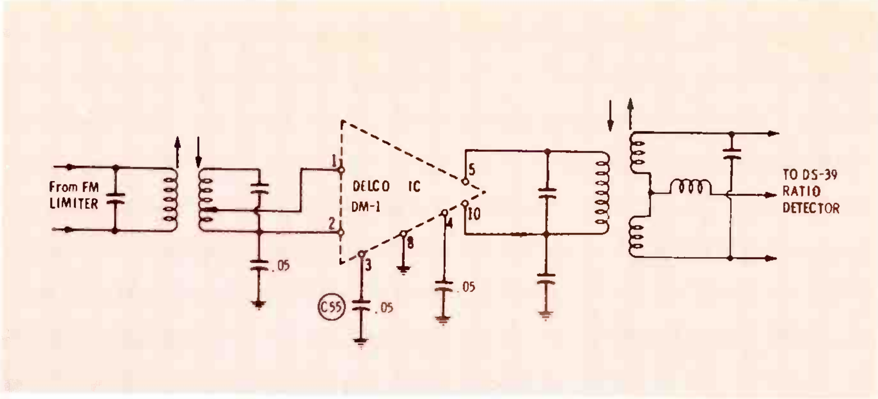

Fig. 6 The 2nd FM IF amplifier and the FM limiter of Delco-produced 1969 Pontiac radios are contained in Delco DM-1 type IC, classified as "special-use subassembly."

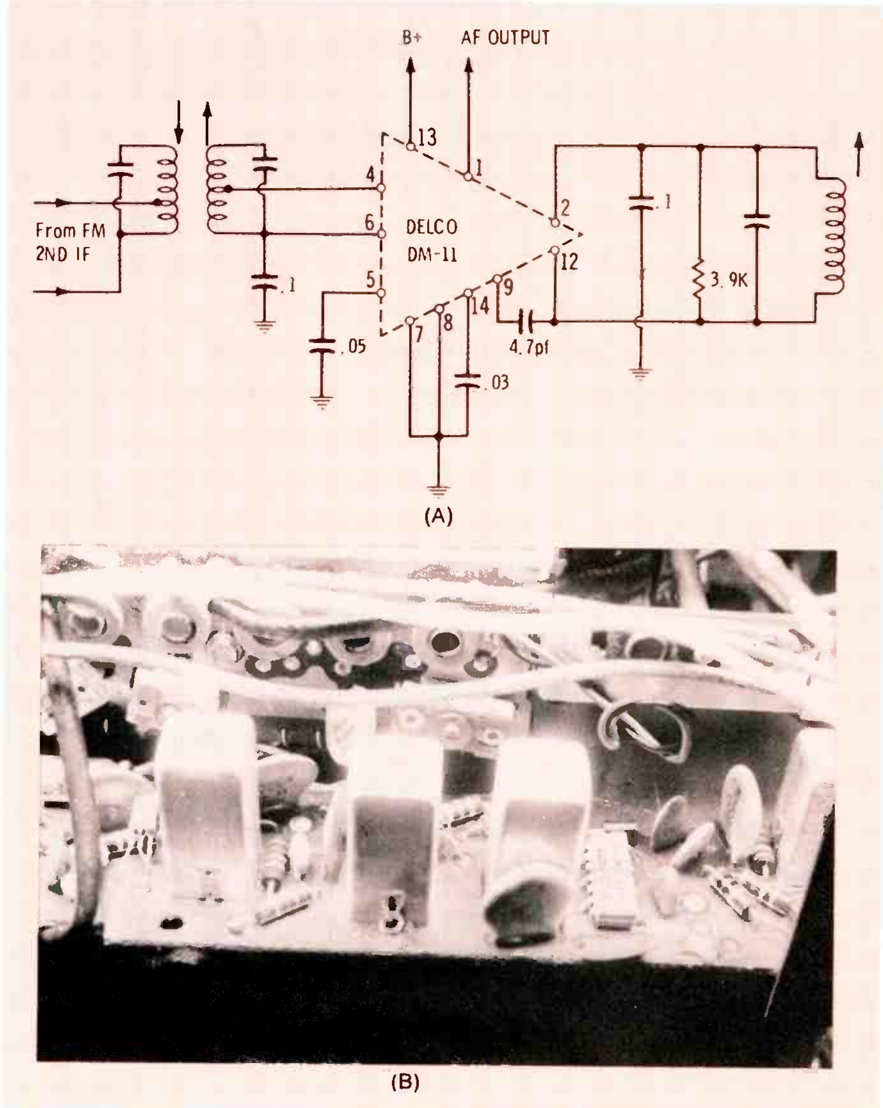

Fig. 7 FM limiter and quadrature detector of newer Delco auto receivers are contained in a Delco DM-11 type integrated circuit. A) Circuit configuration. B) Actual IC, on right of circuit board, resembles a large, blue centipede.

Troubleshooting IC's

IC servicing requires very little knowledge that is not already in most service technicians' store of general troubleshooting knowhow. The basic test instruments are those already used by most technicians.

To date, there is no commercially built IC checker available for field testing of IC's in consumer products. The technician, therefore, must rely on his VTVM, signal generator, signal tracer, and scope.

The author prefers "quiet" signal tracing over that involving "live performance". Because of this personal idiosyncrasy, my favorite signal-tracing instrument is an oscilloscope equipped with a demodulator and low-capacitance probes.

If the DC on the terminals of the IC are normal, as is often the case, I revert to the oscilloscope for a bit of signal tracing.

IC servicing can be easy because the absence of output simultaneous with a presence of input to a stage means that we get to replace the whole stage without further probing to pinpoint a specific component.

Dangers to IC's

There is, as usual, a dark lining to this cloud: IC's can be supersensitive. Consequently, use tools and instrument probes with extreme caution on all IC's. Otherwise, an IC or two might be destroyed easily. As an example, the B+ line in Motorola's IC-equipped FM car radio is routed directly above the integrated-circuit IF amplifier. It is possible to short this line to one of the input leads of the IC, thereby destroying the IC. The author learned this from a sad experience.

AC-operated signal generators are another source of potential danger to IC's. There sometimes exists a relatively high leakage voltage across the leads of a signal generator. This voltage is sufficient to ruin most IC's.

The accidental short to ground is another threat to IC's. This can cause excessive, usually fatal, current flow through the IC. Convenient as IC's can be, they also can be a bit of a headache because most of them have a notoriously low heat-dissipation rating.

Lead Identification

All IC's have some sort of "keyway" lead-numbering system, similar to that used for tubes. On transistors this system is of limited value because physical location of the three leads can be the key. IC's, however, usually have a larger, even number of leads arranged in a symmetrical pattern. Metal TO-5 like IC packages usually employ a paint dot or case protrusion adjacent to the **highest** and **lowest** number leads. Numbering is **clockwise** (see Fig. 10). The protrusion indicating the highest number lead is similar to the protrusion used to indicate the collector on the TO-5 and T018 bi-polar transistor cases.

Molded epoxy TO-5 IC's usually are marked with either a paint dot or flattened rim adjacent to the **highest** number lead.

Flat-packs and dual in-line packs are usually marked with a notch.

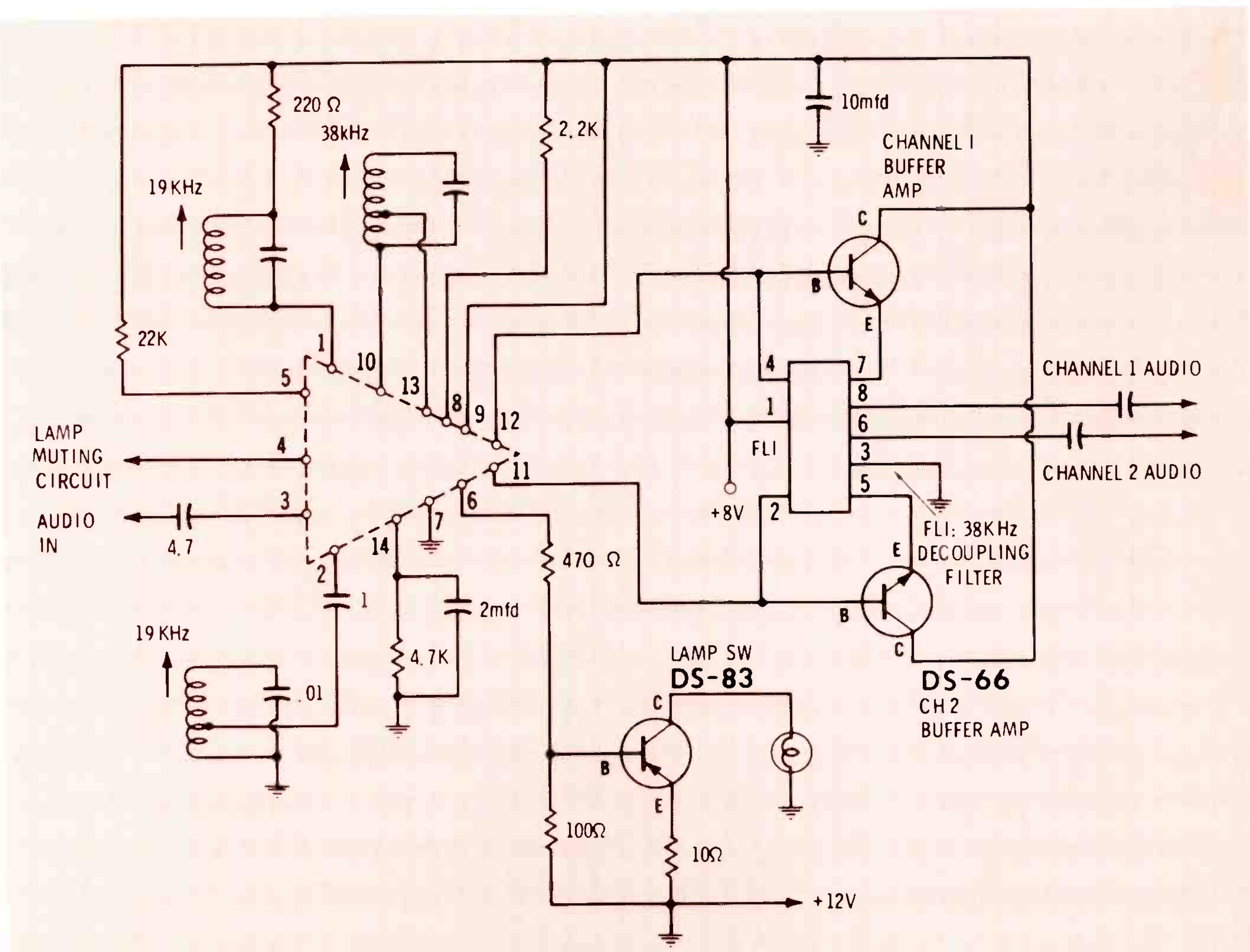

Fig. 8 Delco 1970 auto radios employ Delco DM-14 type FM stereo decoder IC, which processes "raw" audio from the FM detector into left- and right-channel signals. Circuit configuration of DM-14 is shown here.

paint dot or indented circle on the end where lead numbering begins. Fig. 10 shows these various lead-numbering systems.

Handling IC's

Integrated circuits packaged in to TO-5 style case usually can be handled in the same manner as a transistor. Because of their low heat dissipation, however, always use a light-duty soldering iron. Many IC manufacturers specify the maximum temperature and length of soldering time for each IC. A typical rating is 300 degrees F for 60 seconds. At the higher temperatures needed to melt resin-core solder, it is necessary to reduce the time. It also is advisable to allow a short cooling off period of several seconds between soldering adjacent leads, to prevent excessive heat from accumulating.

Flat packs and dual in-lines involve another danger from handling. The leads are not wires as they are on the T0-5 styles. They are strips of metal. This type of lead has the nasty habit of breaking off at its junction with the case after only a few bendings. As is usual in such cases, these leads break off too short for any effective repair.

Several commercially built IC removal tools and desoldering aids are available, and will help prevent damage to IC's.

Casebook of Typical Troubles

Case 1

The first case concerns a Motorola Model FM68M, FM-to-AM converter. This model uses a Mallory solid-state FM IF strip. The 10.7-MHz FM signal is demodulated by the converter. The resultant audio signal is used to amplitude modulate an oscillator that operates in the 1400-KHz region.

The customer had two complaints. His first complaint was that there was "a constant whistle whenever the converter was in use." The other complaint was that "the converter now only receives one station, but previously had received a dozen or more."

The DC on the input pins (3 & 5) of all IC's was 1.45 volts. The output pins (1 & 7) read 10.0 volts. According to the schematic, these were all within tolerance.

A signal tracer revealed that the 3rd FM IF integrated circuit was not passing the signal applied to its input. A new IC in this stage restored the set's sensitivity.

However, one problem remained. Where was that incessant whistle that the customer had taken pains to be so specific about? The customers addressed showed that he lived in a community about 40 miles down the road. It is known that the only AM broadcast station serving this community operated on

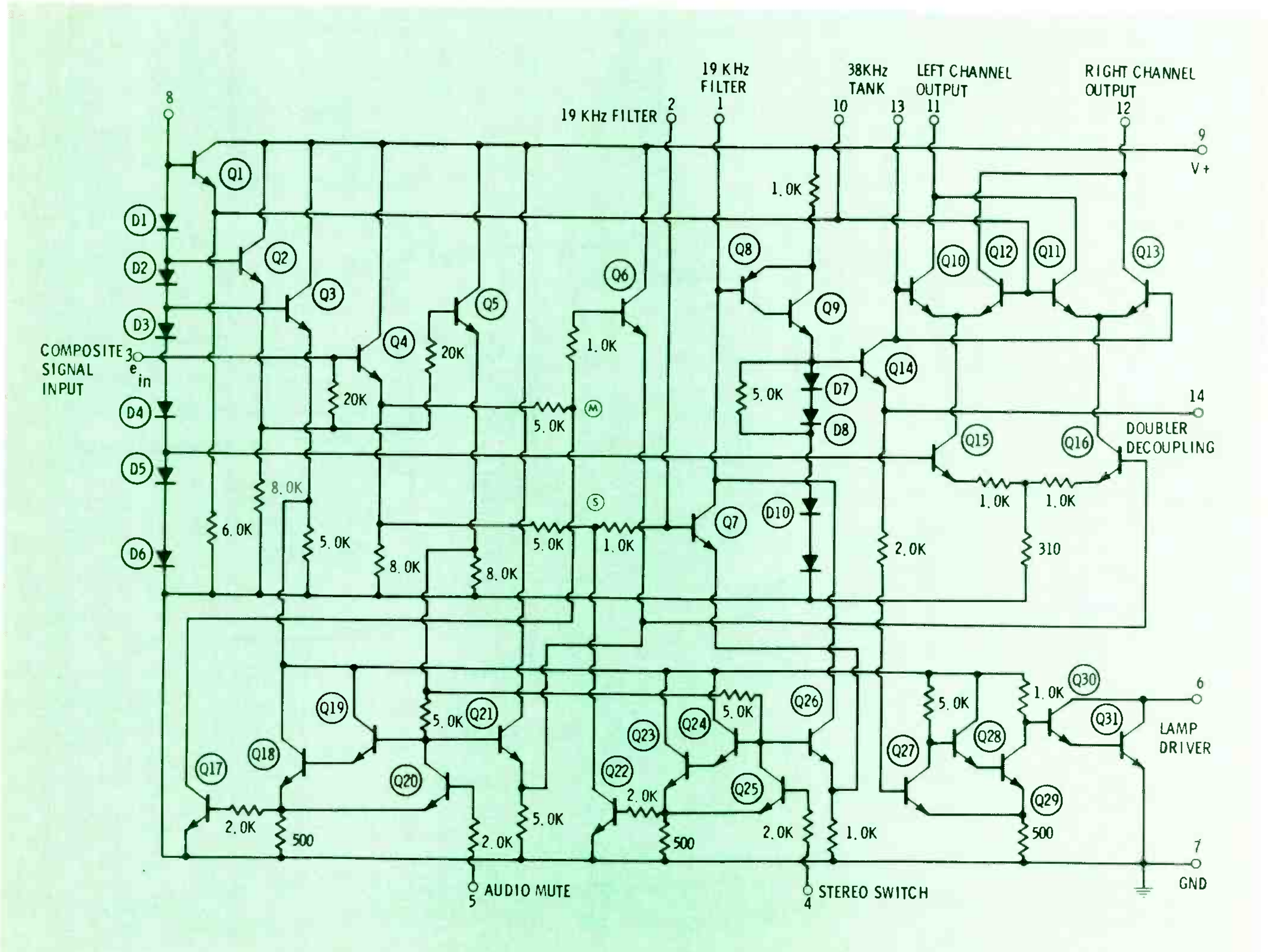

Fig. 9 Internal circuitry of Motorola's MC1304P monolithic FM stereo decoder IC, which contains ten diodes, thirty-one transistors and more than twelve resistors. See text for the many functions this IC performs.

a frequency of 1390 KHz. The whistle, in all probability, was a beat between that station and the AM carrier local oscillator in the converter. The only cure for this was to readjust the oscillator to approximately 1450 KHz. The customer was, of course, informed of this so he could reset the FM pushbutton on his car radio.

Case 2

The next case involved a Motorola FM991X FM-stereo multiplex radio. This set also uses the Mallory tuner and the Motorola integrated-circuit IF strip. It is a self-contained, universal receiver designed primarily for underdash installation. The set contains the FM tuner, IF strip (IC), detector, multiplex decoder, and two direct-coupled "bootstrap" audio amplifier chains capable of producing several watts of output power.

The customer's complaint was that the receiver would receive FM but would not pick-up any stereo stations. The actual problem turned out to be poor sensitivity. The set's demodulators were producing enough signal to drive the high-gain audio stages, but not enough to drive the multiplex section.

One of the symptoms was the absence of background hiss between stations. The VTVM showed that the voltages on three of the IC's were normal. The voltage on the fourth, which functioned as the 3rd FM IF amplifier, drastically varied from normal. The input pins (3 & 5) of this type amplifier usually operate at about 1.4 volts. On this set, however, the voltage reading was 8.8. Such abnormal readings can usually be accepted as proof that the IC is defective.

Case 3

The owner of a Delco FM set, model 92BFP1, out of a 1969 Pontiac, complained that "the set remained dead until the volume control was advanced to it's maximum position." At this setting, the output was weak and distorted.

All voltages were normal except for that on pin 3 of the integrated-circuit IF/Limiter stage. The DC on this pin normally is approximately 2.2 volts. In this set it was close to zero.

An ohmmeter set to the RX1 scale showed almost no resistance between pin 3 and ground. The culprit turned out to be a shorted capacitor, C55 in Fig. 6.

Case 4

The fourth and last case involves a 1970 AM/FM stereo receiver made for Cadillac by Delco. Technicians who encounter this radio marvel at the job of packaging all that circuitry in one standard-size Delco FM radio case. It is completely self-contained—no more "dual audio" or other split-chassis arrangements.

The customers complaint was that "off-station there was a ter-

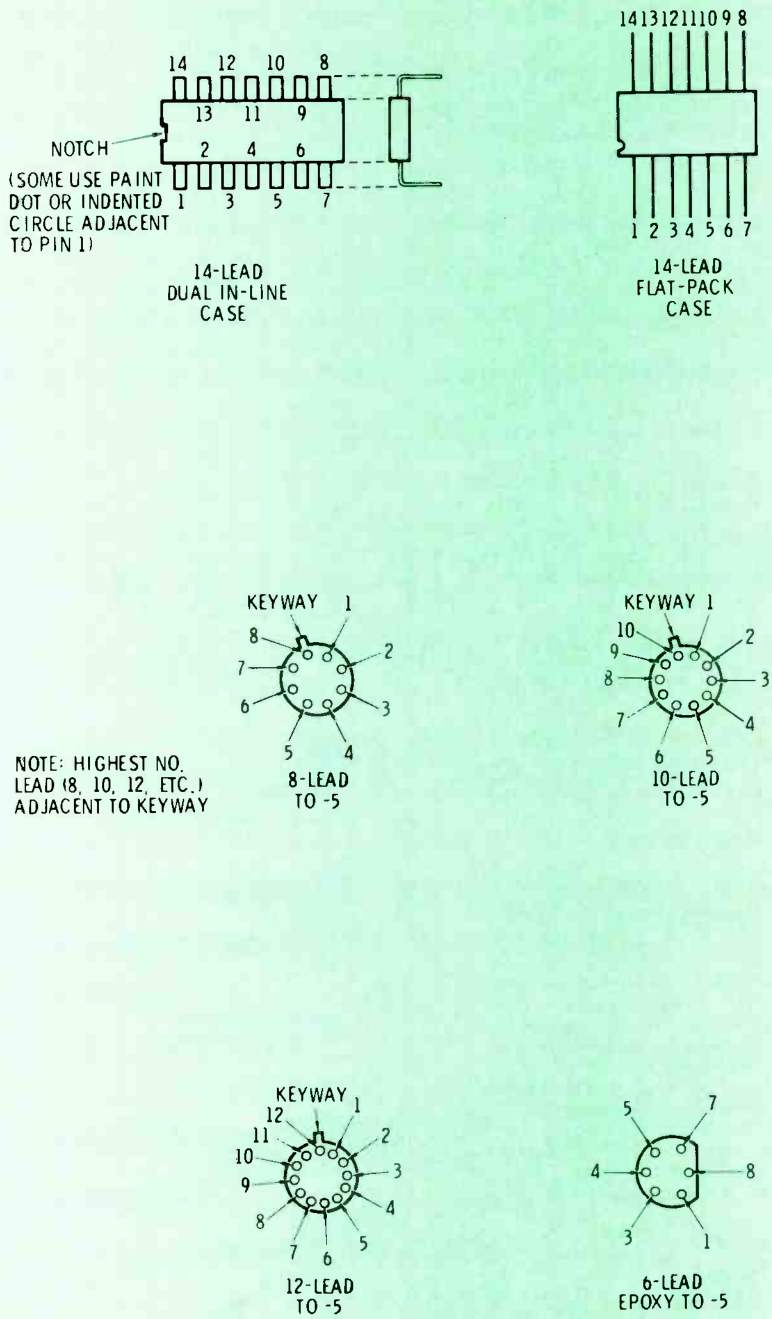

Fig. 10 Common IC case designs can be divided into two basic categories: Flat-packs and dual in-line packs which resemble centipedes, two examples of which are shown at top; other four designs are TO-5 types.

rific buzzing sound." At first, the description of the trouble symptom sounded like it was motor noise. It wasn't.

The scope revealed the set to be free of noise between the tuner and the output of the stereo decoder IC. At this point, the characteristic noise "spike" began to appear along with the audio waveform. All DC potentials were within the ranges specified. The 19- and 38-KHz waveforms also looked close to normal.

Then I noticed that the stereo-indicator lamp was occasionally flickering off station. (Delco designs normally have very good lamp muting characteristics.) The cause of the flickering was a misadjusted stereo lamp trigger control, a potentiometer mounted on the printed-circuit board in front of the tuner along the front edge of the radio. Service instructions call for turning this control all the way counter clockwise and then, with the receiver tuned off station, slowly adjusting it clockwise to extinguish the lamp. To eliminate the buzz, it was necessary to turn this control just a little further than the "threshold" point.

Future Auto Radio Design

It is very probable that low-cost integrated circuits will become available to auto radio manufacturers in ever increasing numbers and varieties. In the next two or three years we should see all-IC AM/FM stereo signal seeker radios. Although undoubtedly some will use FET's in the FM tuner, others will use IC's in that function. RCA already is making IC's that are suitable for use in FM receiver front-ends.

Because variable capacitance diodes (varicaps, varactors, etc.) and the newly discovered piezoelectric ceramic inductors are capable of the 10:1 ratios required to tune the AM broadcast band, we can expect these devices to replace the more cumbersome tuning devices now in use. Such tuning methods will allow the use of recessed push-buttons for individual station selection, which would be in line with Federal automobile safety guidelines. Conventional mechanical pushbuttons are not as easy to recess as would be the micro switches used to control varicap tuning. It should not prove too difficult to build the tuning diodes inside a special-purpose IC front-end subassembly.

It is quite likely that IF transformers will no longer be used in car radios. In the home high-fidelity market, piezo-electric ceramic filters already have replaced the IF can, which once reigned supreme.

Some IC audio amplifiers have approached, and even passed, the power levels used in car radios. The RCA CA3020, for example, will deliver with ease 1 watt. Other RCA IC's can produce up to 5 watts. One IC by Bendix is reported to be able to deliver up to 15 watts of audio with acceptable distortion.

Special-purpose IC's should become ever more prevalent. Delco already has demonstrated this concept with their DM-1, DM-8, DM-11, and DM-14 IC's.

It is the opinion of this writer that near-future designs of auto radios will include both hybrid solid-state (discrete transistor circuitry combined with IC's) and all-IC circuitry. ▲

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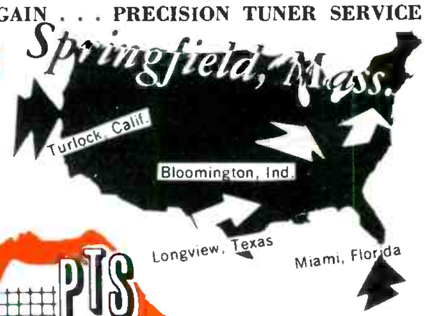

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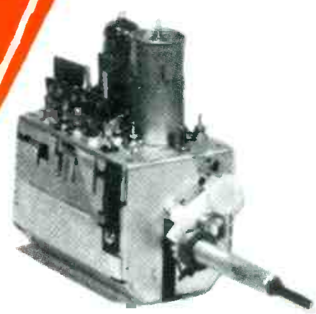

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WEST—	Box 1431—Turlock, Calif. 95380	Tel. 209/632-2928

Circle 22 on literature card

troubleshooter

Green Screen or Flesh Tones Caused by Defective Neon

The original complaint on this GE KC color chassis (Photofact 903-1) was "no raster, sound okay."

After we replaced a defective 6EJ4 high-voltage regulator tube, the picture came back, but the high voltage was 5 KV too high. Adjustment of the high-voltage control solved the high-voltage problem.

After about 10 minutes of operation, we heard a snapping noise and the skin hues turned green. A color-bar pattern verified this change—the bars from left to right were green, red and blue.

After the chassis cooled, it would operate correctly for about ten minutes, then the snapping noise and the wrong hues would reoccur. Arcing in the high-voltage regulator and "lightning" in the front of the CRT were observed at the same time.

John R. Zanath
Aliquippa, Pa.

This problem is with a General Electric KC color chassis. I replaced the high-voltage transformer, but when the picture came on, the screen was green.

In "Color TV Servicing Made Easy," Sams book No. 20523, page 92, it is mentioned that weak color or loss of color can be caused by the neon bulb. This neon bulb was not lighting; I replaced it but the new one did not light either. All parts are good, from the transformer to the neon bulb. Please give us some suggestions.

Kasimir Petrowski
Philadelphia, Pa.

A neon bulb usually consists of two metallic elements (plates) inside a glass envelope filled with neon gas. Suppose a source of variable DC voltage is applied to the two leads of the neon bulb, while a voltmeter measures the voltage across it, and a milliameter measures the current through it. As the voltage is increased from zero, nothing happens to the zero current reading, and no glow is seen through the glass. The neon bulb is an open circuit. Finally, at a level of approximately 80 volts the neon bulb glows a dim orange color around *one* plate and the current meter reads a small amount of current (when supplied with AC, both plates glow). If the voltage is increased slightly, the glow and current increase drastically. In other words, the neon bulb is an open circuit until the voltage across the terminals increases enough to ionize the gas, then the bulb is a voltage regulator.

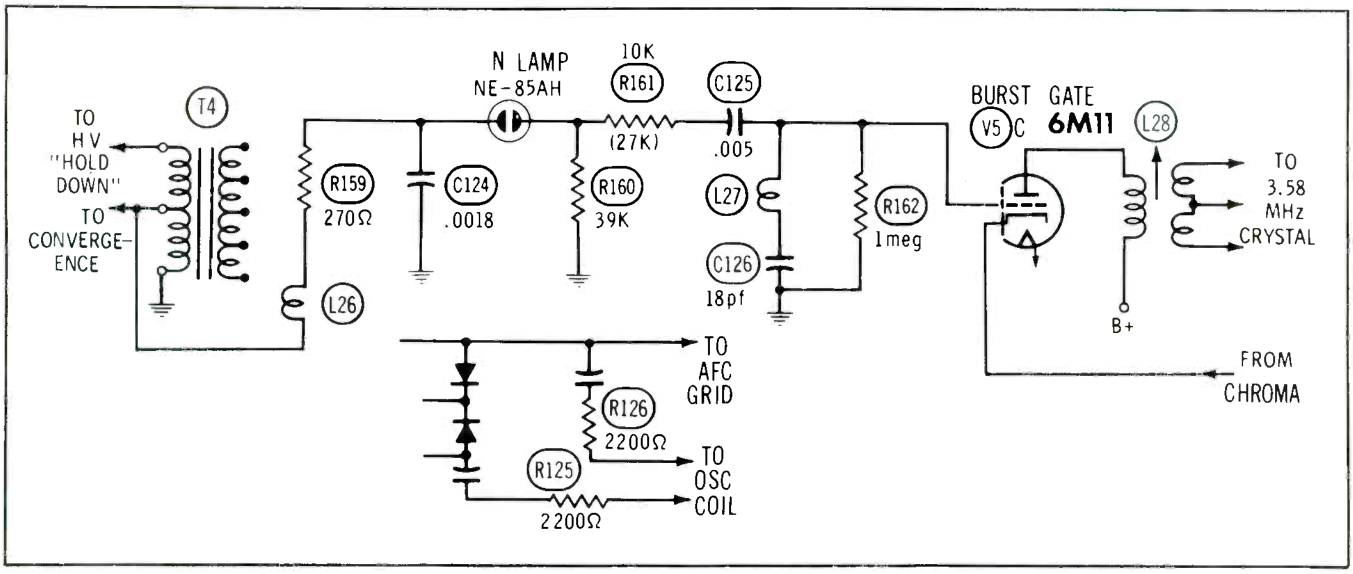
The large amount of current flow caused by a slight increase in voltage above the conduction (ionization) point usually necessitates a series resistor to limit the current to less than the amount that would destroy the neon bulb.

When the DC voltage is decreased until the current stops and the glow disappears, the voltage is found to be much lower than the voltage that caused the start of ionization and conduction. This characteristic of neon bulbs is used to advantage in some circuits--for example, in the relaxation oscillator, in which a voltage sawtooth is formed when the neon bulb partially discharges the capacitor which is in parallel with it.

In the General Electric KC chassis, the neon bulb is used to clip a portion of the horizontal pulse that is applied to the grid of the burst gate, or keyer. The bulb should glow at all times when the horizontal sweep is in operation. (Be certain any neon bulb you use for replacement in this receiver does NOT have a built-in limiting resistor, for such a bulb will not work correctly.)

The burst in many GE models, including this one, rings a 3.58-MHz crystal so it produces a continuous-wave chroma reference subcarrier, the phase of which is compared to that of the chroma signal in the color demodulators. Without burst, there is no 3.58-MHz subcarrier and, thus, no demodulation and no color signal on the screen of the CRT.

A defective neon bulb will interfere with the passage of the horizontal keying pulse and upset the burst gate function. Symptoms of no color, weak color or color of the wrong hues are dependent on the exact type and extent of the bulb failure. Many neon



bulbs exhibit a darkening of the glass when they are defective; replace the bulb if it is blackened. Other defective bulbs exhibit clear glass, but very tiny strain cracks appear where the lead wires penetrate the glass.

Another circuit defect can cause symptoms which are nearly identical to those produced by a bad neon bulb: A defective ground for the utility winding on the high-voltage transformer which supplies pulses for burst gating, horizontal dynamic convergence and the high-voltage "hold down" circuit can cause low pulses at these points and will exhibit most of the symptoms of a bad neon bulb.

Although the continuity of such ground connections might appear to be normal, the only positive check is to connect a wire from the ground wire on the high-voltage transformer to the nearest ground lug (the original ground need not be disturbed).

Either a defective neon bulb or transformer ground will reduce the DC voltage (normally −125 volts) at the grid of the burst gate, and, consequently, the neon bulb will not light.

Now, back to our readers' problems. The source of the hue change in the chassis Mr. Zanath is servicing is undoubtedly the result of a defective neon bulb or an improper ground on the transformer winding. These two potential defects should not cause the arcing; however, the arcing could trigger the hue change by changing the sweep voltages distributed by the horizontal output transformer.

We suggest an ohmmeter test of R151, the 1K-ohm resistor in the cathode circuit of the high-voltage regulator. It might have been badly over-loaded by the original defective regulator tube, and might cause arcs if it is erratic. Make certain the aquadag on the CRT is firmly grounded. If the arcing inside the regulator tube stops when the connection to the anode of the CRT is removed, the CRT is probably the source of the arcs. A few of these tubes have had internal arcing from the anode button to the aquadag coating on the inside of the glass, and some have arced between the aquadag and the shadow mask.

It is not clear from Mr. Petrowski's letter whether the screen color is greenish with color pictures, is greenish without any color or is greenish only when a station is correctly fine tuned. If the screen color is greenish when the set is tuned to a blank channel, the gray-scale tracking needs to be adjusted. If the screen color is normal off channel but becomes greenish when correctly fine-tuned to a station and the color control turned down, the red, green or blue balance controls need to be re-set. Or if the facial hues during colorcasts are greenish, there is a good chance of a defective neon bulb or transformer ground.

The neon bulb has been eliminated in late-production receivers equipped with the KD chassis. L26, R159, C124, R160 and the neon bulb are eliminated, and R161 is changed to 27K ohms. These changes shift the phase of the pulse at the grid of the burst gate, and correction for this change of phase consists of changing R125 and R126 from 3300 ohms to 2200 ohms. The new R125 and R126 resistors should be a matched pair. ▲

bookreview

How to Use Test Instruments in Electronic Servicing (Book No. 485)
Author: Fred Shunaman
Publisher: TAB Books, 1970
Size: 256 pages, 5⅜ inches X 8½ inches
Price: Softcover, $4.95; Hardbound, $7.95.

Text tells electronic technicians how to use test instruments to perform specific tests and service procedures in home entertainment and communications electronic equipment. Emphasis is on practical applications of test instruments. **Contents:** The Oscilloscope—Servicing With The Scope—Multimeters—Putting Multimeters to Work—Signal Generators—Sweep and Color Generators—Audio Servicing Instruments—The Capacitor Checker — Probes — Tube, Transistor and Special-Purpose Checkers—Signal Tracing Instruments—Maintenance of Test Instruments.

Circle 50 on literature card

ABC's of FET's (Catalog No. 20789)
Author: Rufus P. Turner, Ph.D.
Publisher: Howard W. Sams & Co., Inc., 1970
Size: 95 pages, 5⅜ inches X 8⅜ inches
Price: Softcover, $2.95.

Text explains the structure, theory of operation, characteristics, applications and testing of field-effect transistors. Emphasis is on familiarizing technicians with characteristics of FET's, to make them more proficient at servicing FET-equipped circuitry. **Contents:** Basic Theory of the FET—Getting Acquainted with the FET—Elementary FET-Circuit Design Considerations—Typical Applications.

Circle 51 on literature card

Laboratory Manual For Electronic Shop Practices (Book No. 13-251975-5)
Authors: Alexander W. Avtgis and William F. Megow
Publisher: Prentice-Hall, Inc.
Size: 139 pages, 6¾ inches X 9 inches
Price: Softcover, $7.95.

A practical text that tells electronic technicians how to perform specific nondiagnostic procedures with hand tools in the shop. Use of hand tools and techniques for making proper connections are emphasized. **Contents:** Basic Electronics Technicians' Tools—Soldering Irons, Solder and Flux—Wire and Soldered Connections—Coaxial Cables and Connectors—Soldered Terminal Connections — Solderless Connections—Cables—Wire Harnesses—Basic Packaging Techniques—Advanced Packaging and Construction Projects—Appendix (Twist and Tap Drill Sizes and American Wire Guage Conductor Sizes).

Circle 52 on literature card

Color-TV Case Histories (Catalog No. 20809)
Author: Jack Darr
Publisher: Howard W. Sams & Co., Inc., 1970
Size: 135 pages, 5⅜ X 8½ inches
Price: Softcover, $3.50.

Concise but complete descriptions of trouble symptoms and related causes that actually have occurred in major brands of color TV, plus tips about how to quickly isolate the source of the trouble. Emphasis is on symptom-cause relationship. Symptoms categorized by brand name of set in which they occurred. **Contents:** Admiral—AMC—Curtis Mathes—General Electric — Magnavox — Motorola — Olympic — Philco-Ford — RCA — Sears-Silvertone — Sylvania—Truetone—Wards-Airline — Westinghouse — Zenith—Miscellaneous Other Chassis. ▲

Circle 53 on literature card

Sylvania Establishes Electronics Trade School

Sylvania Electronics Systems has established an electronics school in Waltham, Mass. to train men and women for technical and professional positions in business, industry, and government.

Licensed by the Massachusetts Department of Education, Sylvania Technical School offers vocational training in radio and television, communications, and computer electronics. The school, with day and evening sessions, also will conduct professional and technical seminars in such areas as printed and integrated circuit technology, total digital system and modern logic design, data communications, communications concepts and technology, and industrial pollution control.

The vocational courses, which will provide from 600 to 750 hours of laboratory and lecture instruction, are designed to qualify students for positions ranging from engineering aide to technician in the home entertainment, communications, electronics, and data processing industries. Students in the radio and television and communications programs will be prepared for state and federal licensing examinations, according to Robert M. Olsson, Manager of Sylvania Training Services.

Day students can earn a vocational diploma in 25 to 30 weeks. Evening division programs, offered either two or three sessions weekly, cover 62 to 94 weeks. Th 32- and 48-hour professional and technical seminars will be presented evenings over three to six week periods.

ITT Donates Teleprinters to Aid Deaf

Standing recently in the basement of ITT World Communications, I. Lee Brody, founder of a two-state branch of an organization called "Tele-typewriters for the Deaf", looked happily at the row of teleprinters—the third donation of such units by ITT since October of 1969. "Just think," he remarked, "each one of these gives a deaf person not only security in an emergency but also the ability to do what you and I take for granted—just have a chat."

"Tele-typewriters for the Deaf", a non-profit organization which was formed nationally three years ago, has successfully bridged the isolation gap for thousands of deaf people throughout the country by arranging to have them supplied with specially equipped teleprinters. A deaf person simply picks up his phone and dials another deaf person who sees a light come on, signaling the call (the ring of the phone would not be heard). The two then "talk" to each other over their teleprinters.

This year, the International Telephone and Telegraph Corporation subsidiary has helped lessen the silence for 30 deaf people, who have been totally deaf since birth, by giving them teleprinters with which they can "talk" to each other.

"Tele-typewriters for the Deaf" receives and distributes used teleprinters to volunteer technicians who strip, clean and re-wire them. After complete renovation, the machines then are delivered to deaf individuals on the waiting list.

To help alleviate the present shortage of skilled teleprinter technicians needed to renovate and maintain the used machines, Mr. Brody and his group are organizing training classes so that the deaf people themselves can learn how to service their own machines. But, as Mr. Brody points out, an urgent need still exists for both technicians to teach and to renovate and maintain acquired machines.

Sylvania Adds New Distribution Point

Sylvania Entertainment Products, has opened a new warehouse in Dallas, Texas, to serve customers in seven states.

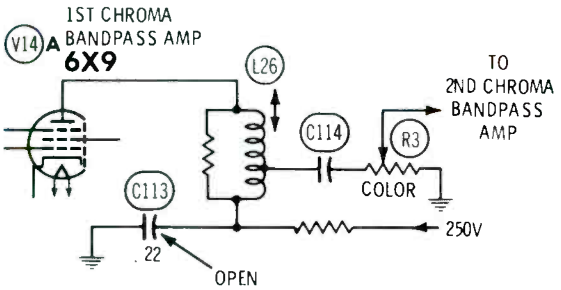
Roger P. Ranalletta, Manager of Traffic and Distribution, said Sylvania is warehousing television, stereo, radio, and tape products in the 45,000 square-feet, leased facility at 4720 Simonton Road. Dealers and distributors in Arizona, Colorado, Kansas, New Mexico, Oklahoma, Texas and southern Wyoming will be served by the facility.

Sylvania Entertainment Products also has warehouses in Pennsuken, N.J., Sparks, Nev., Smithfield, N.C., and Batavia, N.Y.

symcure

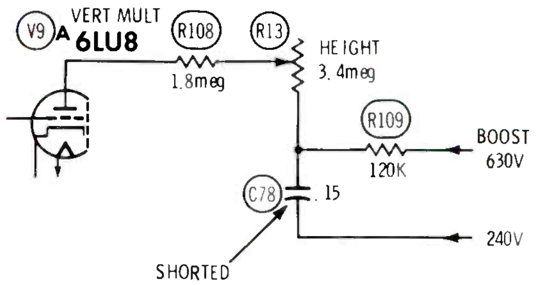
Symptoms and cures compiled from field reports of recurring troubles

Chassis—Admiral 6H10
PHOTOFACT folder—949-1



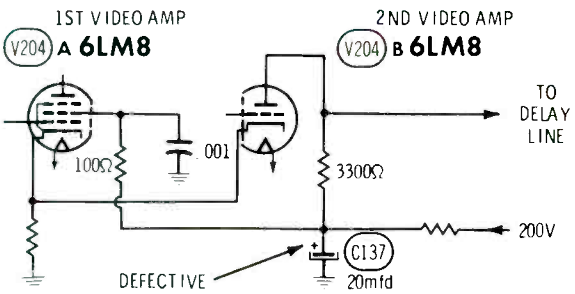
Symptom—wide, vertical color bar on b-w; no bar present if color control is turned down
Cure—replace open C113

Chassis—Admiral 6H10
PHOTOFACT folder—949-1



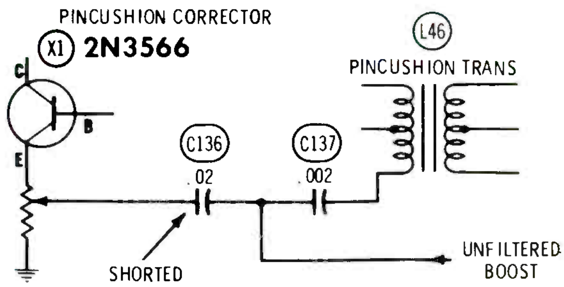
Symptom—lack of height
Cure—replace shorted C78

Chassis—Magnavox T938
PHOTOFACT folder—1037-1



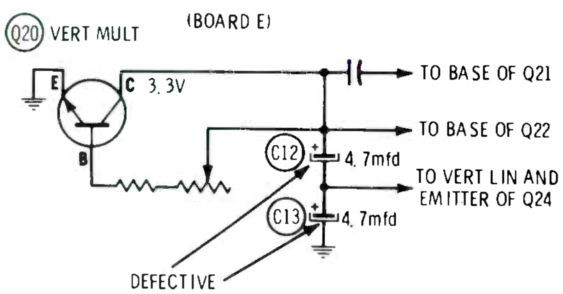
Symptom—blurred picture; weak contrast; critical vertical locking
Cure—replace open C137

Chassis—Motorola TS914
PHOTOFACT folder—798-2



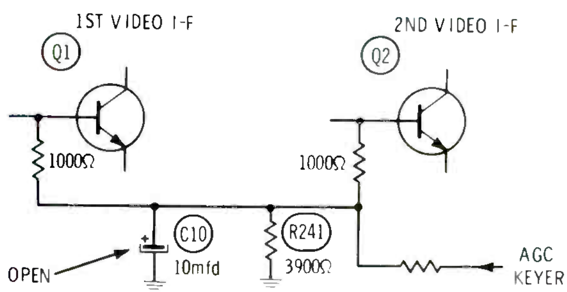
Symptom—no high voltage; damper plate glows red
Cure—check and replace C136, if shorted

Chassis—Motorola TS915
PHOTOFACT folder—953-1



Symptom—lack of height; foldover or weak locking
Cure—check and replace C12 and C13, if defective

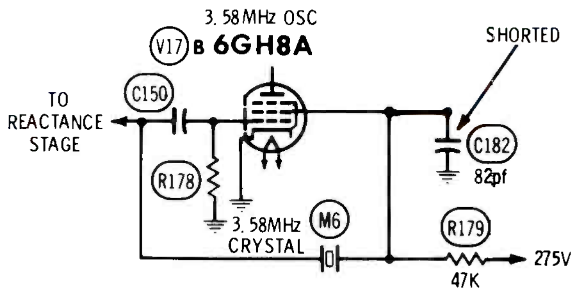
Chassis—Packard-Bell 98C18
PHOTOFACT folder—1009-2



Symptom—picture bending and vertical jitter
Cure—replace open C10

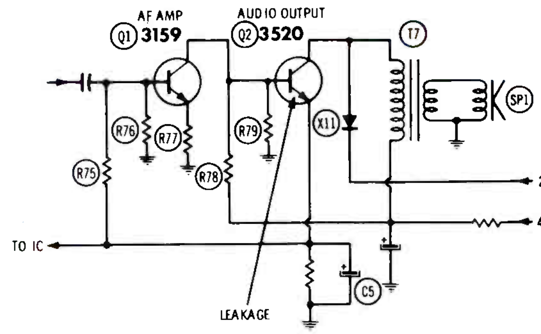
symcure

Chassis—Packard-Bell 98C18
PHOTOFACT folder—1009-2



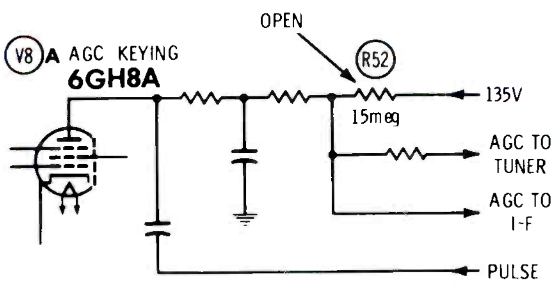
Symptom—no color; or green color only with killer defeated
Cure—check for shorted C182

Chassis—RCA CTC25
PHOTOFACT folder—879-3



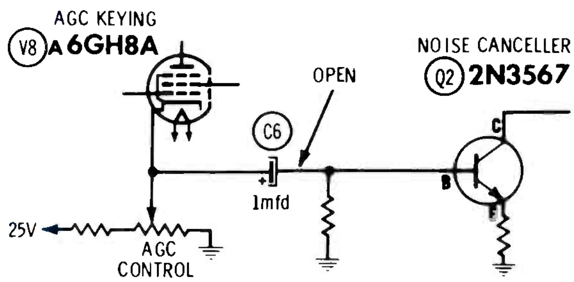
Symptom—"motorboating" in sound
Cure—replace Q2 that has base-to-emitter leakage

Chassis—Westinghouse V2656-1
PHOTOFACT folder—969-2



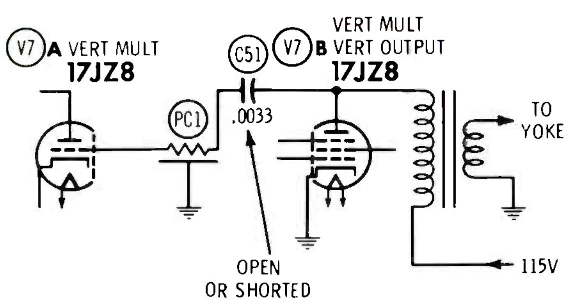
Symptom—snow in picture on strong signals
Cure—replace R52

Chassis—Westinghouse V2655
PHOTOFACT folder—920-2



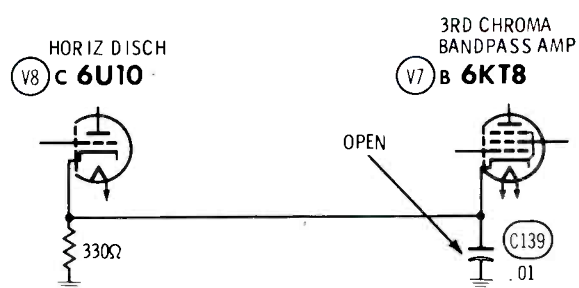
Symptom—AGC and sync critical
Cure—replace open C6

Chassis—Zenith 13Z13
PHOTOFACT folder—976-3



Symptom—no vertical sweep
Cure—check C51 and replace if it is open or shorted

Chassis—Zenith 16Z7C50
PHOTOFACT folder—1055-2



Symptom—weak color; critical hue adjustment
Cure—replace open C139

photofact bulletin

PHOTOFACT BULLETIN lists new PHOTOFACT coverage issued during the past two months for new TV chassis. This is another way ELECTRONIC SERVICING brings you the very latest facts you need to keep fully informed between regular issues of PHOTOFACT Index Supplements issued in March, June and September. PHOTOFACT folders are available through your local parts distributor.

AMC

5CP-303 1142-1
5P-106 1145-1

CLOVIS

122-1024 1145-2

EMERSON

Chassis 120976A/977A/977B/980A/980C/981A/981B/982A/938B/984A, 471965, 471918 1141-1

MAGNAVOX

Chassis T-940 Series 1144-1
Remote Control Receiver 704054-2, Transmitter 704041-2 . . . . . 1144-1-A
Remote Control Receiver 704054-1, Transmitter 704041-1 . . . . . 1144-1-B
AM-FM Chassis R228-01-BA 1144-1-C
Amp Chassis A576-03-BA . 1144-1-D

PANASONIC

AN-76/C, AN-86D/DC . . 1146-1

PENNCREST

2897A 1139-1
2884 1140-1
4832A, 4833A 1144-2

PHILCO-FORD

Chassis 19KT40B 1141-2

RCA

Chassis CTC43A, CTC43XR/XT/XU 1137-1
Remote Control Receiver, Transmitter CRK13A 1137-1-A
Chassis KCS169XA, KCS169XB 1140-2

SEARS

562.50380000, 562.50800000 1138-1
Chassis 562.10122, 564.80110/111/112 1139-2
562.50260000, 8991 1142-2
(Ch. 564.80160) 1147-1

SHARP

SU-66P 1140-3

SYLVANIA

Chassis D12-9; D12-11; D12-12; D12-14; D12-15; D12-16; D12-17 1043-1
Remote Control used with Chassis D12-16 . . . . . 1043-1-A
Chassis D12-11; D12-14 . . 1043-1-B
Chassis D12-17 . . . . . 1043-1-C

SYMPHONIC

TCT-150 1137-2

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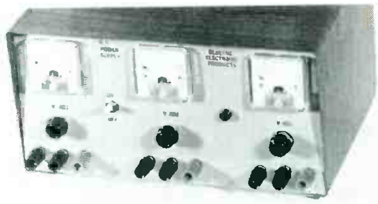
test equipment report



SM158 Speed Aligner

A new simplified sweep and marker generator called the speed aligner has been announced by Sencore.

According to the manufacturer, the speed aligner is designed to simplify alignment of IF and chroma amplifiers in any color TV receiver, and also to check the tuner response.

The SM158 is said to be simple to operate, with only two major operating controls; all markers are crystal controlled and are selected

merely by pushing in one of 8 "marker-selector" buttons. Pulling out on the MARKER HEIGHT control tilts the markers 90 degrees (horizontal), for precisely locating their position on the response curve.

The SM158 reportedly produces a base line on the response curve, as specified by many TV manufacturers. The unit also features two extra RF channels to be used as spares if co-channel interference is present, and full 15-MHz sweep width.

The speed aligner sells for $275.00.

Circle 55 on literature card

Blulyne PS-60 Series

A new line of low-voltage power supplies designed for servicing solid-state equipment has been introduced by Blulyne Electronics Corporation. Single, dual and triple units are available.

Model PS61C, the single unit, reportedly provides plus or minus 15 VDC with a load current of up to 700 mA; regulation of 0.001% VDC per mA load current; and ripple is less than 0.004Vrms at full load. The price is $49.95.

The double unit, Model PS62C, is designed for use with operational amplifiers and has the same electrical specifications as the PS61C at each output and can be used in any combination according to the manufacturer. The price of the double unit is $74.95.

Three completely independent power supplies that also can be used in any combination describes the triple unit. Each output reportedly has the same electrical specifications as the PS61C. The price of the third unit is $99.95.

Circle 56 on literature card

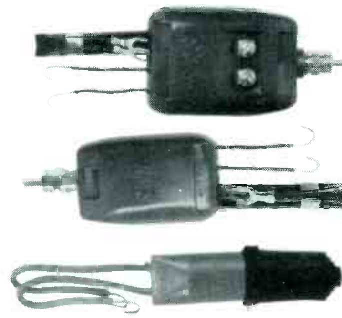
Intermodulation Meter

The Model 940 intermodulation meter, designed for measuring intermodulation distortion in audio devices, is now available from Measurements.

The unit permits direct reading of distortion using either a 1:1 or 4:1 low-frequency to high-frequency mix ratio. Low frequencies provided are 60 and 120 Hz; three high frequencies are available: 3, 7 or 12 KHz. Residual IM is reported to be less than 0.025 percent.

This solid-state, modular-designed unit measures 9½ inches X 14½ inches X 7½ inches. The list price is $475.00. ▲

Circle 57 on literature card



shoptalk

With Carl Babcoke
ES Technical Editor

New and changed circuitry in '71 color TV

Chroma circuitry, Part 2

Control of Color Saturation and Tint by Variable DC Voltages

Color and tint adjustments which are controlled indirectly by variable DC voltages instead of directly by manually adjusted controls are employed in '71 chassis of at least three manufacturers.

Such a system offers two distinct advantages: First, because the chroma IF and 3.58-MHz color subcarrier signals do not have to be routed over long wires to front-panel manual controls, radiation from these signals is minimized. Secondly, remote control by variable DC voltages does not require relays and/or motors, as does remote adjustment of manual controls.

Sylvania

One example of indirect control of color saturation and tint is found in Sylvania's all-solid-state E01 chassis. The associated circuitry is electrically located between the 2nd chroma amplifier and the chroma output stage, as shown in Fig. 1.

How the tint control circuit performs its function can be explained best by examining the results of adjusting tint control R22 to each of its extreme positions.

The actual change in the phase (tint) of the chroma signal is accomplished primarily by varying the conduction of transistor Q600. When R22 is repositioned CCW toward the position that produces greenish flesh tones, more forward bias (positive) is applied through varistor R601 to the base of Q600, increasing its conduction. The resultant increase in the emitter current of Q600 produces a larger voltage drop across emitter resistor R612, the "negative" end of which is connected to the collector of Q602. With a more positive voltage applied to its collector (relative to its base), and with a constant forward bias between its emitter and base, Q602 conducts and amplifies the chroma signal applied to its base.

Because of the inherent phase shift between the base and collector of a transistor, the amplified chroma signal at the collector of Q602 is 180 degrees out of phase with the input chroma signal at its base.

Thus, manual adjustment of the tint control to one of its extreme positions has produced a change in the DC voltages that control the conduction of the tint control transistor and, consequently, the phase of the chroma signal in relation to that of the reference subcarrier.

When tint control R22 is adjusted to the extreme CW position, which produces purple-tinted flesh tones, less forward bias is applied between the base and emitter of Q600, it conducts less, and the voltage at the "negative" end of the resistor in its emitter circuit becomes less positive. As a result of this action, the voltage applied to the collector of Q602 becomes sufficiently less positive to cut off conduction of this transistor.

Although none of the chroma signal applied to the base of Q602 is amplified when this transistor is biased off, some of the chroma sig-

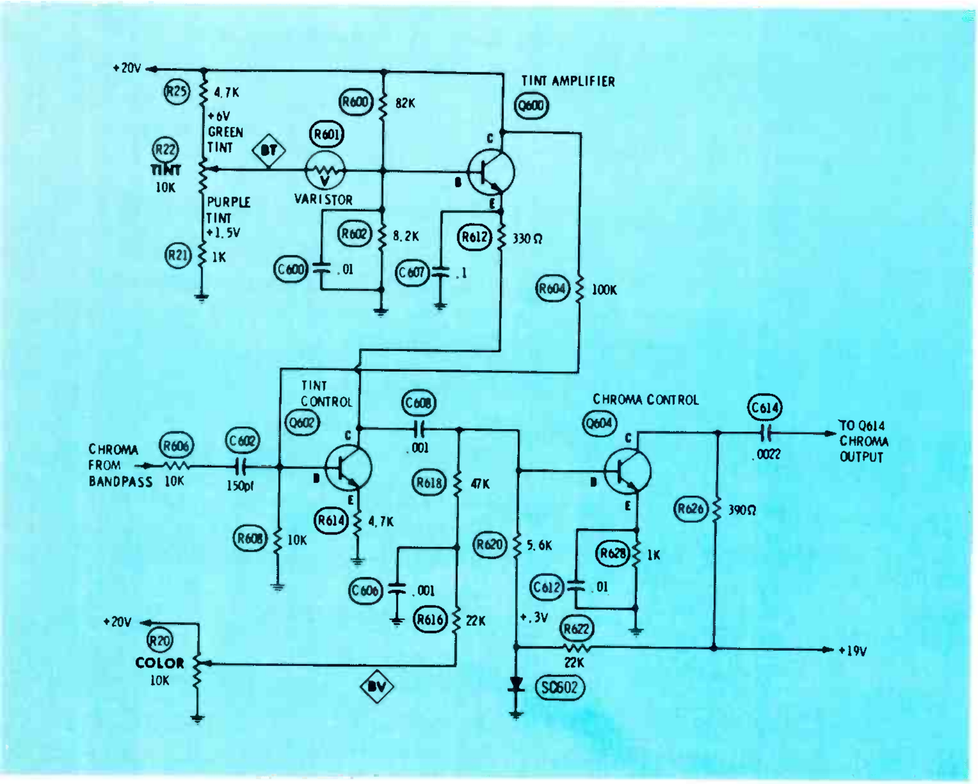


Fig. 1 Schematic diagram of the color and tint circuits in Sylvania's E01 color TV chassis. The internal capacitance of Q602 is the key to the operation of this tint-control system. Refer to the text for an explanation.

nal does feed through the capacitance between the base and collector of the transistor. However, unlike the 180-degree phase shift resulting from normal transfer of an amplified signal from base to collector, the chroma signal fed through the base-to-collector capacitance is **not** shifted in phase relative to the chroma reference subcarrier generated by the receiver.

Using this system, the phase of the chroma signal at the collector of Q602 can be varied over a range of almost 180 degrees relative to the phase of the chroma reference subcarrier, the exact phase shift depending on the vectorial addition of 1) the phase of the chroma signal transferred to the collector of Q602 by transistor amplification (180 degrees shift) and 2) the phase of the chroma signal transferred to the collector via the base-to-collector capacitance (no phase shift).

Color control action is by the more direct method of reducing the normal forward bias of Q604 to obtain less transistor gain. Diode SC602 provides a temperature-controlled minimum forward bias for better stability.

RCA

A differential amplifier is employed in the tint circuit of the new all-solid-state RCA CTC44 chassis, as shown in Fig. 2. Transistors Q711 and Q712 appear, at first glance, to be in parallel; the bases are separated by a coupling capacitor, but the signal input is of the same amplitude and phase at both bases. Both collectors are connected together. The difference between the two amplifiers is their frequency responses, which are determined by the components in their emitter circuits.

R603, in the emitter circuit of Q711, is paralleled by C749. This RC combination reduces the high frequencies from emitter to ground; consequently, amplifier Q711 increases the amplitude of high-frequency signals more than that of lower-frequency signals (opposite to the response of the degeneration or feedback). Such a stage is the equivalent of a high-pass filter, which causes a leading phase characteristic.

The frequency response of Q712 is just the opposite that of Q711; R610 in the emitter of Q712 is paralleled by an inductance instead of a capacitance. Because the emitter circuit thus attenuates the low frequencies, the amplifier produces increased gain at low frequencies. This is the equivalent of a low-pass circuit, which causes a lagging phase shift.

The combined output at the collectors will have the same phase as the input signal, if the phase shift in each amplifier is equal and opposite and both amplifiers have the same gain. The opposing phase shifts are cancelled by vectoral addition. This is the desired condition when the hue control is in the center of its range.

Any difference in the amplitude of the output signal from one amplifier compared to the output of the other causes a change in the phase of the signal at the paralleled collectors. The forward bias of Q-711 is fixed, while the forward bias of Q712 can be changed by adjustment of tint control R123.

Rotation of the tint control in the direction that increases the forward bias of Q712 also increases the gain of Q712. At the same time, the increased emitter current of Q712 raises (by way of the common cathode resistor, R606) the emitter voltage of Q711, thus decreasing the gain of Q711. At the collectors, the phase of Q712 is dominant; the output signal has a lagging phase. The exact phase is determined by the difference in the gain of the two amplifiers, at least until Q711 is biased to cutoff or Q712 reaches satura-

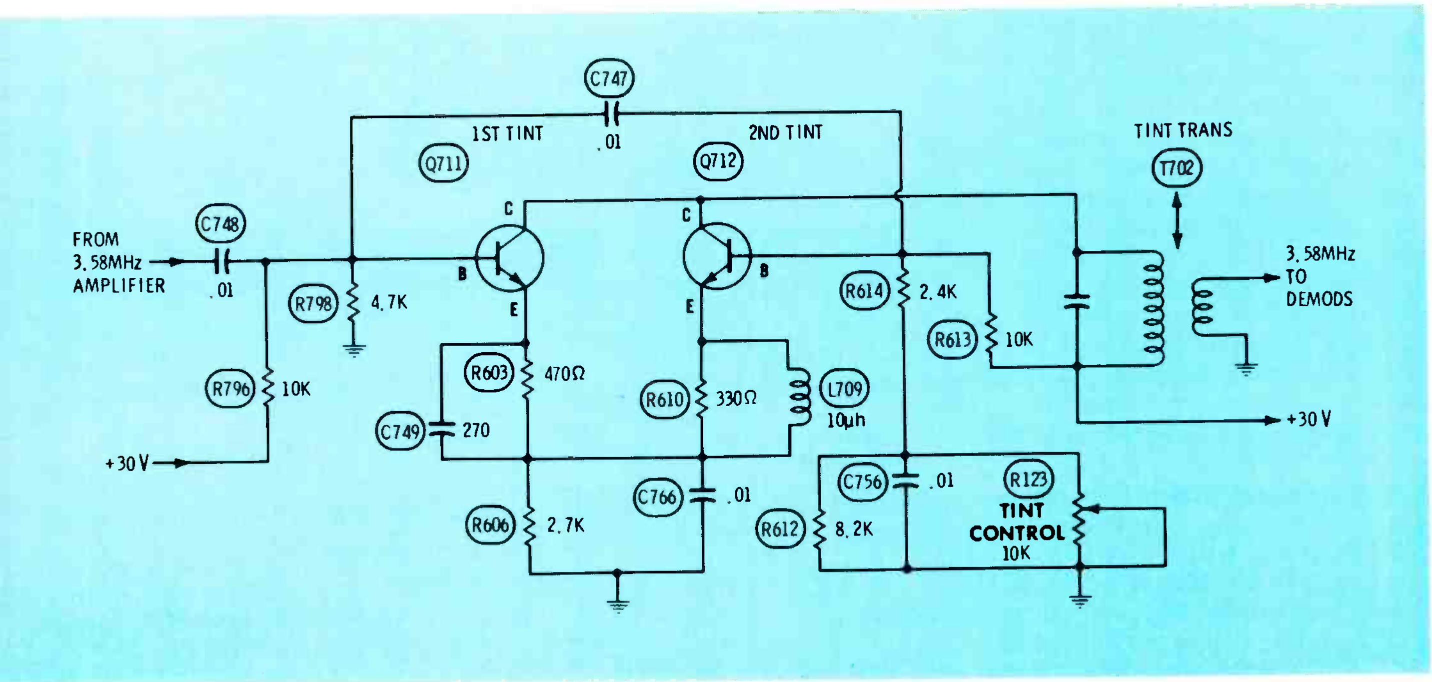


Fig. 2 The tint circuit of the RCA CTC44 chassis, shown here, is operated by voltage and, therefore, can be used in motorless remote-control applications.

tion, and this extremity is prevented by the resistor values in the base circuit of Q712.

Rotation of the tint control in the opposite direction reverses this action. The bias and gain of Q712 are reduced below that of Q711; thus, the output phase is leading.

Control of color saturation in the RCA CTC44 chassis is accomplished by a voltage-controlled variable voltage divider and by a change of bias which, in turn, changes the gain of the 3rd chroma IF amplifier transistor (see Fig. 3).

The arms of the voltage divider consist of R724 (1K ohms) and diode CR709, whose internal resistance decreases as its forward bias is increased. The resistance of CR-709 varies from 6.8K ohms at about .68 volt, to 750 ohms at about .75 volt, and to even lower values when supplied with higher forward bias voltages. The anode of CR709 is bypassed to ground. This enables the diode to function as the shunt leg of an AC voltage divider, in addition to being the source of a DC voltage that changes the emitter voltage (forward bias) of Q704 and, thus, its gain.

Transistor Q704 is operated as a grounded base type of amplifier, in which the input signal is applied to the emitter. When the color control is turned down (rotated CCW) maximum DC voltage is applied to the anode of CR709. The DC path from the cathode to ground is completed through R724 and L708; consequently, maximum voltage is dropped across CR709, and the internal resistance is at a minimum. This voltage divider action reduces the chroma signal (from C726/L708) before it is supplied to the emitter of Q704. Emitter DC voltage is at maximum because of the additional voltage entering through CR709; therefore, the forward bias and the gain of Q704 are both at minimum.

Clockwise rotation of the color control reduces the DC voltage applied to the anode of CR709, increasing the resistance of the diode (shunt arm of the voltage divider) and supplying more chroma signal to the emitter of Q704. Because the increase in the resistance of CR709 allows less DC voltage to reach the emitter of Q704, the emitter voltage decreases (forward bias is increased) and the transistor produces higher gain.

To avoid bandwidth and phase changes, the load across tuned circuit C726/L708 needs to be relatively constant during color saturation adjustments. This is accomplished as a result of the fact that while the resistance of CR709 is minimum when the color control is turned down, the resistance of the path through R742 and the emitter-base junction of Q704 is maximum. These conditions are reversed when the color control is turned up; thus, a fairly constant load is applied to the tuned circuit regardless of color control variations.

Other New or Changed Chroma Circuitry

General Electric—Color and Tint Control

After analysis of the preceding relatively complicated circuits, the manually-operated color and tint circuits of the General Electric N-1 portable color receiver (Fig. 4) seem even more simple than they are.

The color control action is conventional. The tint control is turned

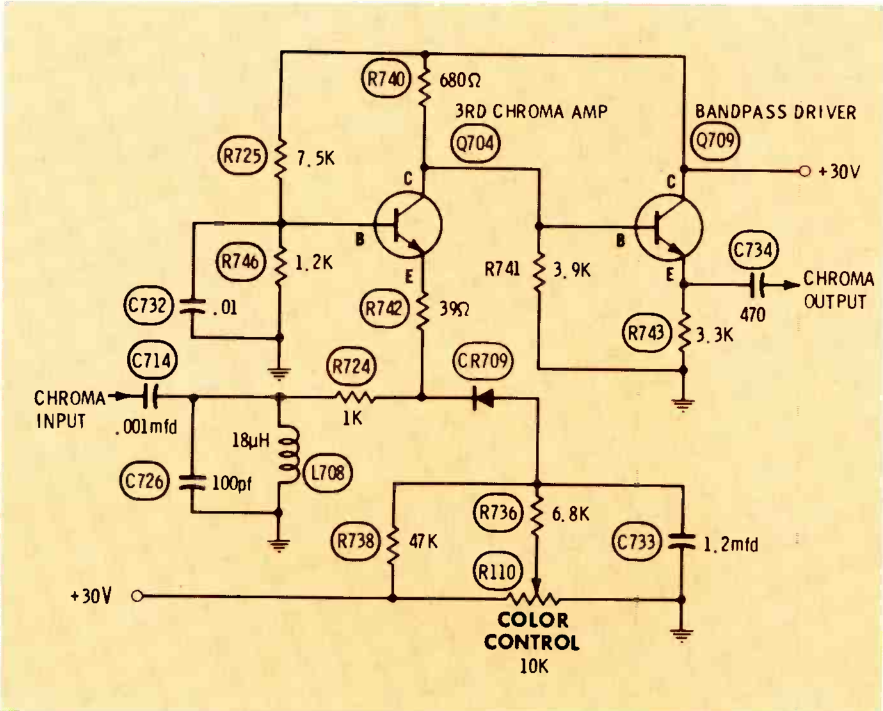


Fig. 3 The resistance of diode CR709 and the bias of Q704 are changed by one voltage to control color saturation in RCA's CTC44 solid-state color chassis.

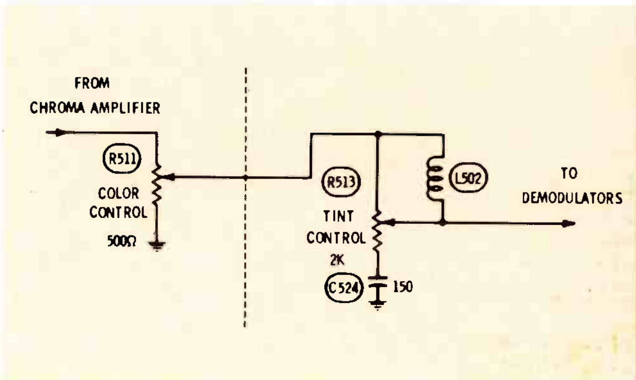


Fig. 4 Control of tint in GE's N-1 chassis is accomplished by phase shifting the chroma signal.

completely clockwise, L502 is shorted out and C524 has little effect because it is isolated by the 2K-ohm resistance of the control. Therefore, the phase of the chroma signal is unchanged.

Full CCW rotation of the tint control changes the circuit to a low-pass filter. The upper leg of the filter is L502 in parallel with R513, and the shunt leg is C524. This filter shifts the phase of the chroma signal by more than 100 degrees (lagging).

Sylvania—Chroma Sync Locking

A phase detector, DC amplifier and a varicap (varactor) diode are used in the Sylvania D16-2 color chassis to lock the 3.58-MHz crystal oscillator (Fig. 5).

The phase detector action is conventional except for the bias voltage for Q620, which is obtained **through** the phase detector.

Q620 actually consists of two cascaded emitter-follower transistors (Darlington pair) in one case. This type of operation provides very high input impedance. Error-correction voltage from the phase detector, plus forward bias, is applied to the base of Q620. Amplified error-correction voltage from the collector of Q602 is applied to the cathode of varicap diode SC608, whose anode is connected to a regulated voltage of about +7.6 volts, to establish reverse bias. The internal capacitance of SC608 changes when the voltage across it is changed. This capacitance, which is in series with the 3.58-MHz quartz crystal, changes the frequency of the color oscillator to accomplish and maintain chroma locking.

Electrohome—Pulse Clamping of CRT Grids

Pulse clamping of the DC voltages at the grids of the CRT in the Electrohome C7 chassis is provided by the circuit shown in Fig. 6. The two purposes of such a circuit are 1) to prevent variations in the plate voltages of the –Y amplifier tubes from changing the b-w screen color, and 2) to reset the DC voltage at each grid of the CRT during each horizontal cycle.

Both a negative-going pulse from the blanker tube and positive DC from the CRT bias control are present at the junction of R752, R755 and the cathode of D707. The CRT bias control supplies (through R755 and R752) a DC voltage of slightly more than the amount eventually needed at the grids of the CRT.

Capacitor C736 accepts and stores a charge because of the difference in DC voltages between the plate of the –Y amplifier and the grid of the CRT. Because the tip of the negative-going horizontal pulse at the cathode of diode D707 is less positive than the voltage at the anode (stored in C736), D707 conducts for the duration of the pulse and charges C736 to a new and lower voltage.

If a series of non-symmetrical chroma pulses at the grid of the CRT shifts the operating center to make the CRT grid more positive than it was during the previous blanker pulse, the next horizontal pulse will forward bias D707, whose conduction will lower the voltage on C736.

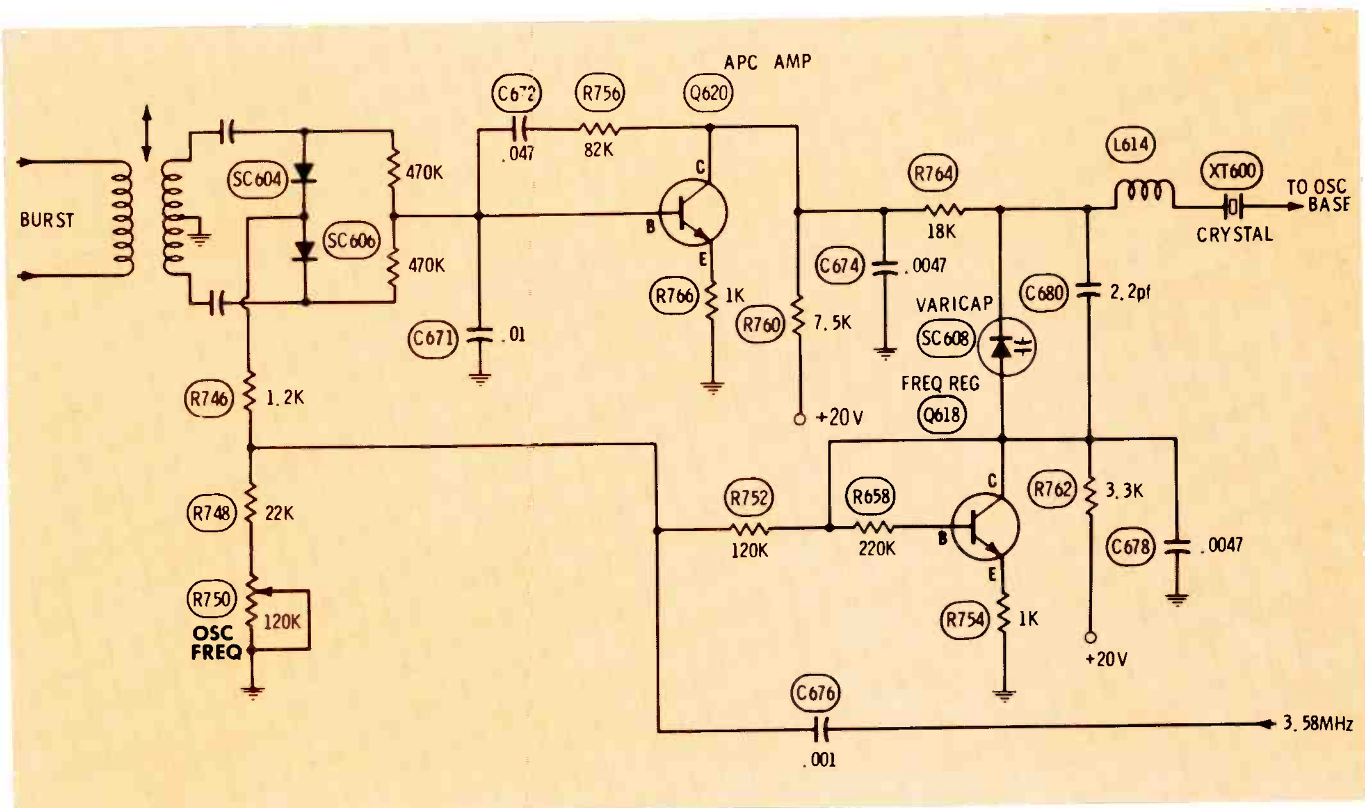


Fig. 5 Sylvania's D16-2 chassis uses a varicap diode to lock the color oscillator. A "Darlington pair" amplifier provides DC voltage gain between the phase detector and the varicap diode.

If the voltage at the grid of the CRT is not changed by the chroma signal, C736 is charged to a slightly higher voltage by the CRT bias voltage applied through R752. This slight increase is reduced by the next horizontal pulse.

Thus, undesirable changes in screen color are prevented by restoring the DC voltage on each grid of the CRT. As explained previously, this is accomplished during horizontal blanking, when no chroma information is present.

General Electric—Pulse Clamping of CRT Grids

A more elaborate system of pulse clamping the DC voltages at the grids of the CRT is employed in the General Electric KE-2 color chassis. Clipped and shaped sync pulses are used (Fig. 7) in place of pulses obtained from the horizontal sweep circuit.

About the same DC voltages are produced at the CRT grids when no station is received (no sync pulses) as are produced when station and sync pulses are present. Because the action is the same for all three grids of the CRT, only the effects on the blue grid will be explained here.

This pulse clamping action is easy to understand if two basic conditions are understood: 1) Transistor Q752 is an open circuit when there are no pulses present, and 2) the transistor is a near-short circuit when the sync pulse is present at the base.

When no signal is being received and, consequently, no sync pulses are present in the circuit, Q752 is open, and the grid voltage of the CRT is obtained through R762 from a +200-volt tap on the voltage divider comprised of R765, R766 and R767. With +325 volts applied to its cathode, diode CR752 is an open circuit, and the grid of the CRT floats at +200 volts because there is no chroma signal to cause it to drift. This action keeps the screen color and brightness stable.

When a signal is received, negative-going sync pulses are applied to C750, which is of sufficiently small capacitance to sharpen the pulses to a duration of 3.5 μs. The sharpened pulses then are applied to R759 and CR750, whose function is to clip the waveform so the amplitude does not exceed .8 volt PP. This shaped and clipped negative-going pulse at the base becomes, through normal transistor action, a larger positive-going pulse at the collector. Because the base-emitter junction of Q752 (NPN) has no forward bias, the transistor is an open circuit until the pulse from Q751 arrives through C752 and drives Q752 into complete saturation (a near-short circuit).

With Q752 a near-short circuit, the resistive values of the voltage divider are changed. R756, through Q752, is in parallel with R765 and R766, and the DC voltage at point 3 increases from the "no-pulse" voltage of +167 up to +190 volts. The same +190 volts also appears at point 1 (because Q752 is a near-short circuit). Between sync pulses, CR752 is biased off by the combination of +325 volts applied to its cathode and the +200 volts at its anode.

However, during the time the sync pulse is present the voltage on the cathode of CR752 drops to +190 volts, and the diode is biased on.

Normally, with CR752 conducting, the +200-volt charge on C740 would drop to about the +190-volt level present at the cathode of CR-752. However, a simultaneous 25-volt increase in the voltage applied to the anode of CR752 (via R762) attempts to increase the charge on C740. The result of these two opposing forces is an increase of the CRT grid voltage to about +200.06 volts.

When the pulse is gone, the CRT grid voltage slowly decreases to the original +200-volt level. The discharge of C740 from 200.06 volts to 200 volts is slowed by the combination of R762 and the storage action of C753.

If a chroma signal of non-symmetrical waveshape increases the average DC at the CRT grid above +200 volts, the pulse conduction path through CR752 and R769 is dominant over the charging path through R762, so the grid is restored by the next pulse back to the normal +200.06 volts. This action prevents any build-up of higher positive voltages on the grids of the CRT. Also the capacitive coupling prevents changes in the DC voltages at the plates of the –Y amplifiers from affecting the voltages on the grids of the CRT. Such changes are undesirable, because they would change the b-w screen color.

General Electric advises that any measurement of DC voltages on the grids of the CRT be made with a VTVM having an input resistance of no less than 100 megohms, because a lower input resistance interferes with clamp action. Similarly, a scope should not be connected to a grid of the CRT; instead, connect

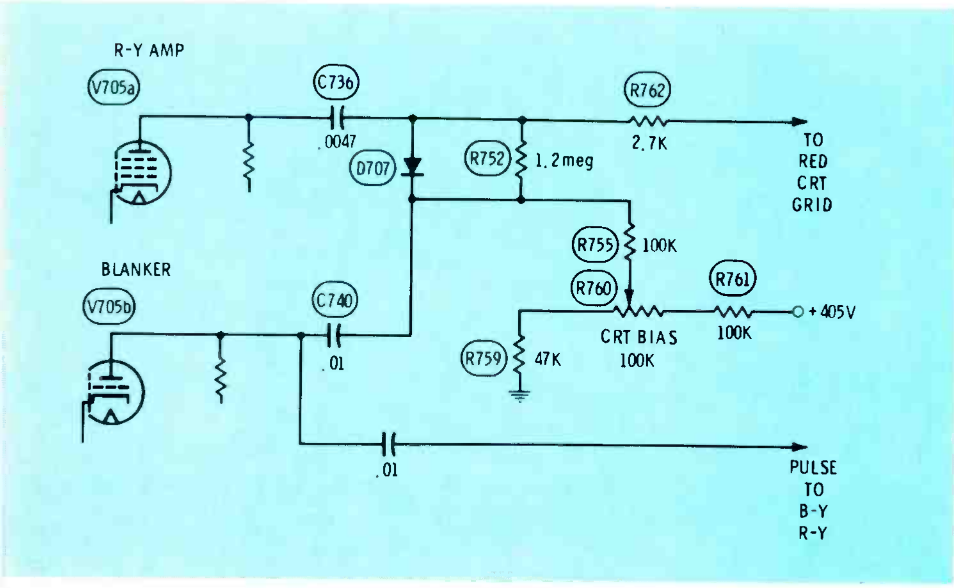


Fig. 6 Voltage clamping of the CRT grids in the Electrohome C7 chassis is by means of "pulsed diodes."

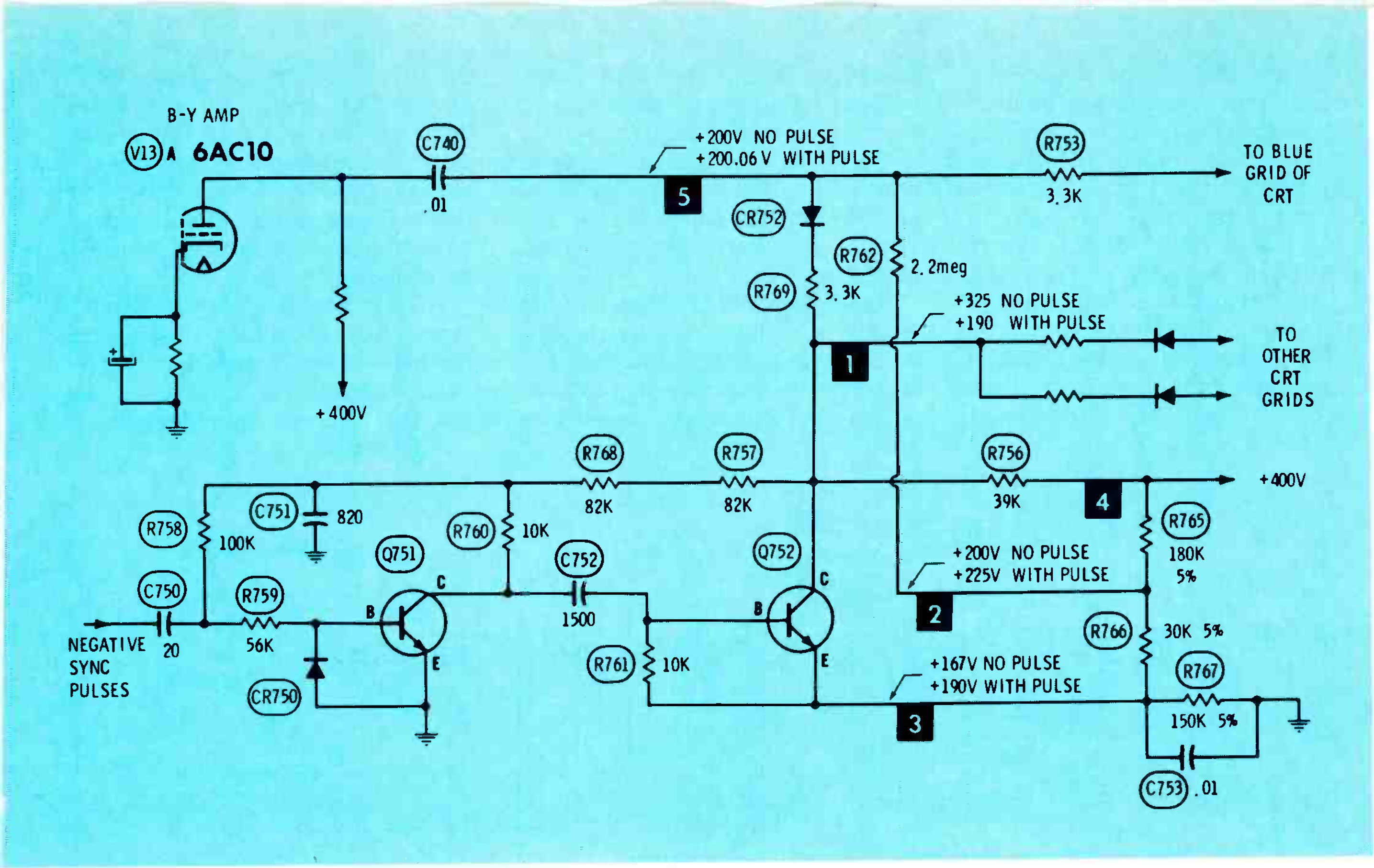


Fig. 7 The General Electric KE-2 chassis also clamps the DC voltages on the CRT grids by diodes controlled by pulses from the sync circuit.

it to the plate of the preceding –Y amplifier, where a small pulse should be found. It is advisable to observe the waveform both off channel and on a normal b-w program, to help you become familiar with the different waveforms thus obtained.

Remember, in any of these systems in which the grid circuits of the CRT are "pulsed", only a small percentage of the applied pulse ever reaches the grid of the CRT, or appears on a scope connected to the grid. The circuit action is identical to the peak-reading rectification of a pulse by a series rectifier circuit which has a large filter capacitor in parallel with the load. Only a small "ripple" remains. The capacitor connected from each –Y amplifier to the associated CRT grid performs the same function as the filter capacitor of the pulse rectifier.

A shorted clamp diode increases the DC voltage applied to its associated grid to about 275 volts, and increases the voltage to the other two grids to about 230 volts. The screen will be excessively bright over the area covered by the affected color, often to the point of blooming.

Panasonic—Auto-Color, Subcarrier Generation, and Pulse Clamping

Several new circuits found in Panasonic's CT98D color chassis are shown in the block diagram of Fig. 8.

When the Auto-Color circuit is switched on, pre-set color and tint controls are substituted for the conventional front-panel controls. In this chassis no provision is made for ATC by changing the demodulator phasing.

The "X" level control between the 2nd color amplifier and the diode-type "X" demodulator is provided to balance the red and blue chroma signals. The effect of a small amount of ATC is obtained if the "X" level control is adjusted to maximum.

"X" and "Z" transistor amplifier stages are used to increase the amplitude of these respective signals before matrixing and further amplification in the –Y amplifier tubes.

The 3.58-MHz subcarrier is generated by ringing the 3.58-MHz crystal with amplified burst. Loss of burst causes loss of the 3.58-MHz subcarrier, which, in turn, greatly weakens color "confetti" during b-w programs. However, because a color killer is used in this model to completely eliminate color snow when a color program is not being received, the absence of color confetti during a b-w program does not by itself indicate a loss of chroma subcarrier.

Pulse clamping of the DC voltages at the grids of the CRT by a method similar to that used by RCA and Electrohome is employed in the CT98D color chassis, with the exception that the resistor usually connected between the grid of the CRT and B+ in RCA and Electrohome chassis is connected between the grid of the CRT and the plate of the –Y amplifier in the Panasonic chassis.

RCA—Chroma Plug-In Modules

Pre-CRT matrixing of chroma and video signals, and pulse stabilization of b-w screen color temperature are functions of the MAD plug-in modules employed in RCA's CTC49 all-solid-state color chassis (Fig. 9). The early-production MAD module, which uses conventional components and a heat sink, and the newer encapsulated "computer card" MAD modules are shown in Fig. 10.

Three identical MAD modules are used, one each for red, blue and green drive to the cathodes of the CRT. As shown in Fig. 9, video is applied to the emitter circuit of Q1 through the paralleled paths of R7, R6, C2 (for increased high-frequency response) and R336 to R335 (video drive control). There is no phase inversion of the video, because Q1 is a grounded-base amplifier to this signal.

The chroma –Y signal is applied to the base of Q1. Matrixing of the video and chroma signals is accomplished inside Q1. The output at the collector of Q1 is a complete red, blue or green color signal.

No signal is applied to the three grids of the CRT; only a DC voltage, which can be varied by the "kine bias" control, is present on the grids.

The collector of Q1 in each MAD module is coupled directly through a 3.3K-ohm resistor (inside the CRT socket) to the corresponding cathode of the CRT; therefore, stability of the DC voltages on the collectors of all three Q1 transistors will determine whether or not the b-w screen color remains unchanged. Stabilization of these collector voltages is accomplished by a pulse clamping circuit, which also supplies horizontal blanking.

A large positive-going horizontal pulse obtained from a winding on the high-voltage transformer is applied through C309; R340, R341 and R331 reduce the amplitude of

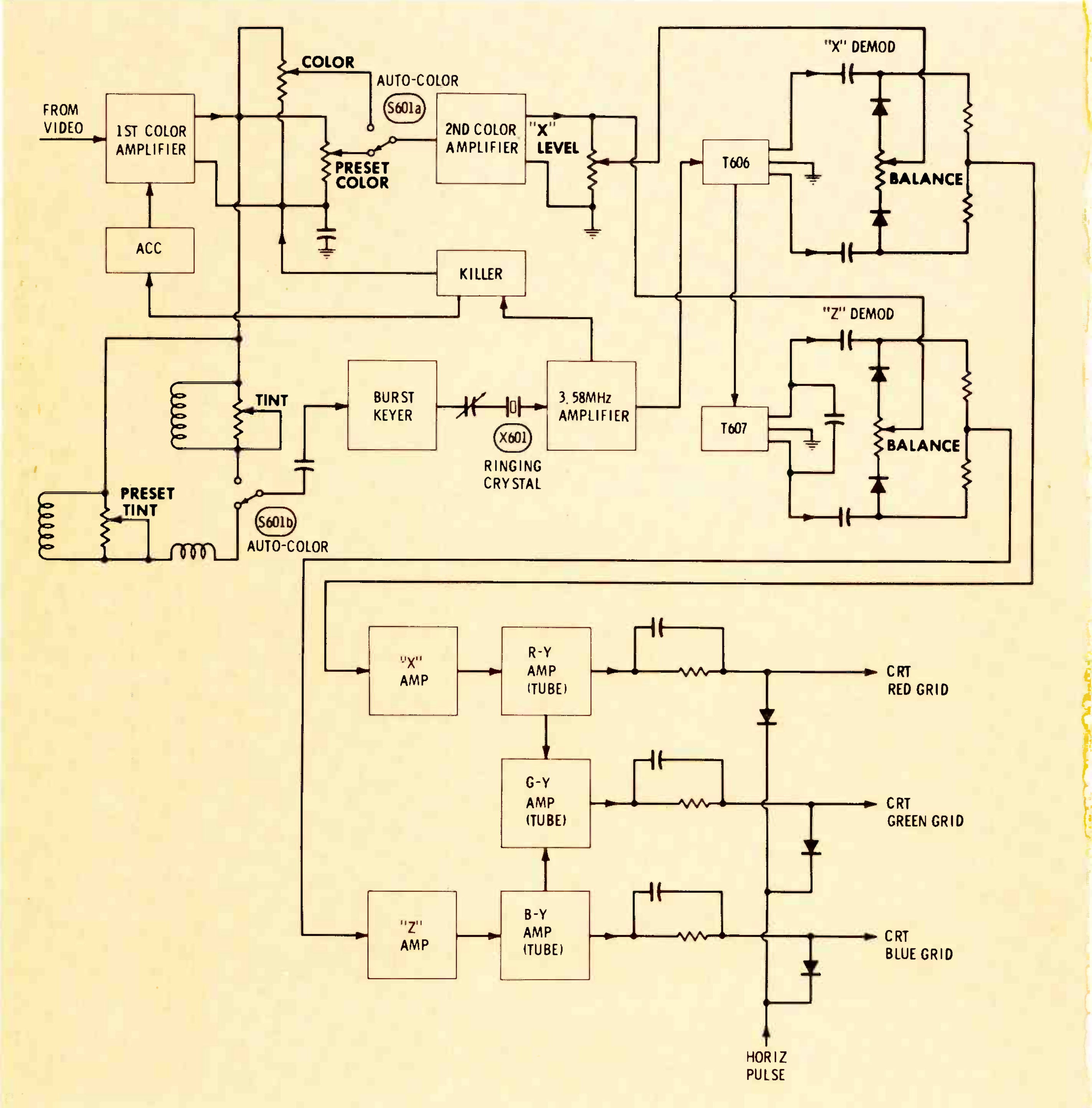


Fig. 8 A block diagram of the Panasonic CT98D chroma circuit shows pre-set color and tint controls, "X" balance control and a variation of the CRT grid clamp circuit.

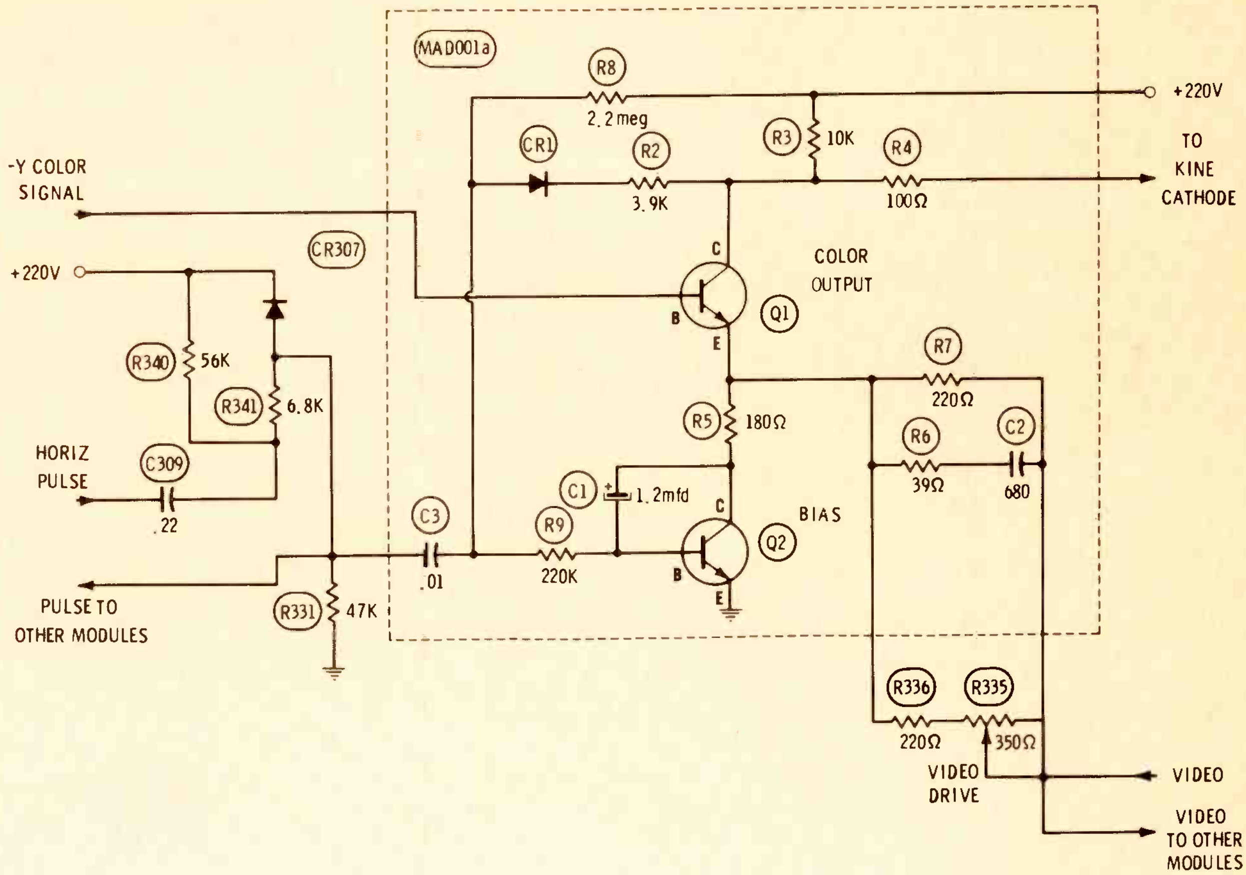


Fig. 9 Plug-in MAD module of RCA's CTC49 all-solid-state color portable receiver incorporates pre-CRT matrixing of video and chroma signals, plus pulse stabilization of the DC voltages applied to the CRT.

the pulse and provide DC return paths. Diode CR307 "compares" the pulse to the +220-volt supply and clips off any portion of the pulse which exceeds 220 volts peak. The 220-volts (peak) pulse passes through C3 and diode CR1 (by forward biasing it into conduction), and, after attenuation to 160 volts peak by the voltage divider action of R2 and the C-E resistance of Q1, continues on to the cathode of the CRT and blanks off the associated gun. This blanking action is in addition to the horizontal blanking applied to a video amplifier.

Regulation of the DC voltage on the collector of Q1 is not quite as simple as the blanking function. During retrace time, when no color signal is present on the collector, the DC voltage at the collector of Q1 is compared to the blanking pulse. An error-correcting voltage developed by this comparison action is used as the variable forward bias for Q2. The variable voltage drop across the C-E junction of Q2 changes the forward bias of Q1; as

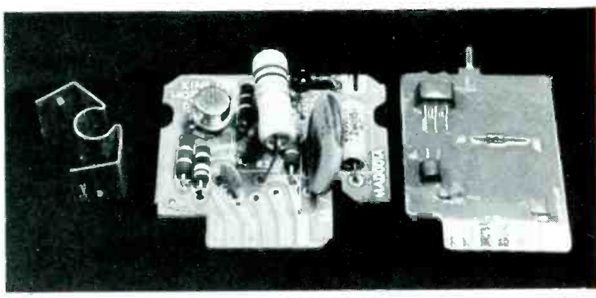


Fig. 10 An early production MAD module with heat sink is shown on the left, and the newer encapsulated version on the right.

a result, the DC voltage on the collector is maintained at the desired level. These complex actions are easier to understand if the explanation is divided into three segments.

First, imagine that R8 and C3 are removed, and that R2 and diode CR1 are removed and replaced by a resistor of the correct value to provide bias for Q2. If the ambient temperature increases, Q1 draws more current, the collector voltage decreases (less positive), less forward bias through the added resistor is applied to the base of Q2, and the collector voltage of Q2 increases, as does the emitter voltage of Q1. An increase in emitter voltage represents a decrease in forward bias; consequently, the transistor draws less current and the collector voltage is increased to the same voltage that was present there before the temperature change.

C1 slows the correction action to prevent overshoot or hunting.

It is obvious that a circuit which increases the forward bias of Q2 when the collector voltage of Q1 is increased also will stabilize that collector voltage at a level determined by the tolerance of the parts in the circuit. However, a standard is needed so that the collector voltage is stabilized at the desired voltage, and so that the DC voltages at the collectors of all three Q1 transistors will be nearly identical. This standard is furnished by the blanking pulse.

For the second segment, imagine that C3, diode CR1 and R2 are reinstalled according to the original wiring, but R3 is removed and the collector of Q1 is grounded. On the anode of diode CR1 will be found a non-varying negative voltage which is the result of shunt-type rectification of the horizontal blanking pulse by diode CR1.

Next, imagine that R2 is disconnected from the collector of Q2 and attached to a variable, positive DC supply. As the positive supply voltage is increased, the negative voltage at the anode of diode CR1 decreases. The reason for this action is simple, but important: Any positive voltage on the cathode of diode CR1 subtracts from the rectified (negative) voltage, because before rectification can occur more pulse is required to exceed the cathode voltage. Or to state this another way: Any positive voltage on the cathode of diode CR1 causes the same effect on the rectified voltage as would a reduction in the pulse amplitude.

The last analytical step assumes that the circuit is complete, as shown in Fig. 9. Resistor R8 supplies an unvarying positive voltage at a slightly higher level than the negative voltage from the anode of CR1, which changes when correction of the collector voltage of Q1 is required. This resultant voltage is the bias supply for Q2, and is supplied to the base of this transistor through R9. C1 filters out the horizontal pulses so that only DC voltages are applied to Q2. In addition, C1 retards the speed of any correction of the voltage at the collector of Q1.

Now the stabilizing loop is complete from the collector of Q1, through the pulse circuit, bias voltage of Q2, bias voltage of Q1 and back again to the collector of Q1.

Next Month

New degaussing circuits, pincushion correction circuits, miscellaneous circuits and serviceability features will be the subjects of the final installment in this series of articles about new and changed circuitry in 1971 color TV chassis ▲

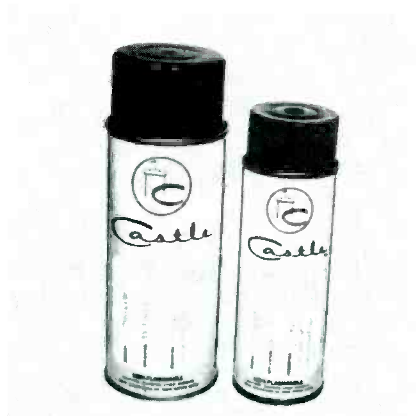
product report

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

"Contact Overhaul" Kit

A new kit for cleaning and lubricating switch contacts for color and black-and-white television tuners has been introduced by Castle Television Tuner Service, Inc.

Included in the kit are an aerosol spray can of degreaser/cleaner for removal of "muck" from contact surfaces and an aerosol spray of lubricant for use on TV tuner contacts.



Co-ordinated density and pressure reportedly gives the user adequate control of the spray pattern to ensure pinpoint application on the contact surface.

The "Contact overhaul" kit sells for $5.50 complete with instructions.

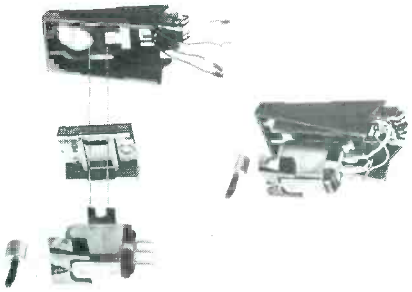
Circle 59 on literature card

Snap-In Cartridges

A snap-in cartridge mounting system that reportedly does away with time-consuming installation has been announced by Pickering and Company, Inc.

Installation is said to be easy: Lugs molded on the adapter fit into the usual mounting holes; the color-coded connecting wires are slipped onto their respective pins and the whole assembly is snapped into the tone arm shell.

The mounting assembly shown here fits Garrard turntables; others in the kit include configurations for



other turntable brands. Prices start at $29.95.

Circle 60 on literature card

Tuner Cleaner/Lubricant

A new aerosol which polishes as well as cleans and lubricates TV tuner contacts has been introduced by Chemtronics, Inc.

TUN-O-BRITE reportedly uses hollow-centered polishing particles that are crushed by the first wiping action of the tuner. These particles cut through corrosion and dirt and then disintegrate, according to the manufacturer.

The lubricant in TUN-O-BRITE reportedly provides a protective film over tuner contacts and causes almost no tuner drift.

TUN-O-BRITE is available in two sizes, an 8-oz. can for $2.39 and a 16-oz. can for $3.49.

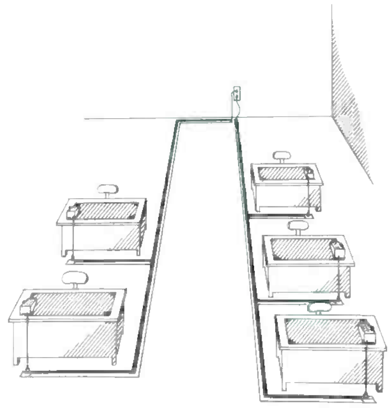
Circle 61 on literature card

Floor-Hugging Extension Cord

A stumble-free, over-the-floor extension cord has been introduced by Ideas, Inc.

Electriduct, a flat rubber duct that hugs the floor, reportedly does away with expensive installation costs of permanent wiring, does not hamper traffic or cleaning and can be easily relocated without damage to floors.

UL-approved Electriduct is available in 4-, 5-, 6- and 10-foot standard lengths, in 2- or 3-wire units. Pre-wired custom systems with outlets where needed can be fabricated to suit individual room layouts and



special arrangements. Also available are various sizes of rubber duct, plus components and fittings, for the protection and enlargement of existing wiring systems.

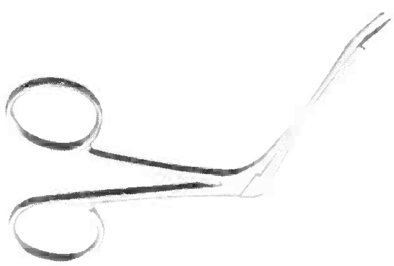
Prices range from $13.20 for the 2-wire, 4-foot length to $27.70 for the 3-wire, 10-foot length.

Circle 62 on literature card

Long-Reach Gripper

Techni-Tool, Inc. announces their #300 Long Reach Gripper.

Constructed of surgical stainless steel, the gripper has a 4-inch angled head which reportedly is designed to fit in small, tightly packed component groupings. The jaws are set oblique to the handles for increased visibility.



The price is $13.25. ▲

Circle 63 on literature card

advertisers' index

Zenith's Hybrid Color

by Wayne Lemons

A look at the most-changed circuitry in this manufacturer's tube/transistor color TV chasis.

The new Zenith 12B14C50 color TV chassis employs more transistors than any previous Zenith color chassis. It is equipped with 14 transistors and 12 tubes, and a fully transistorized "Y" channel.

The color and the "Y" signal are pre-mixed and applied to the cathodes of the CRT, permitting the CRT control grids to be returned to a fixed DC source.

As in an earlier color chassis, the 2nd color amplifier and the color demodulator integrated circuitry is contained in a plug-in module which can be removed and replaced from the top of the chassis.

Zenith uses a ganged contrast and color control, which they call a "color commander." To maintain the correct black level with a change in contrast, a special "black tracking" circuit increases or decreases the brightness slightly as the Contrast/Color control is rotated.

The chassis also is equipped with a simplified automatic degausser circuit, a new high-level noise clipper, a simplified focus circuit, a pincushion circuit using a saturable reactor, and an "automatic" tint control circuit.

The Video (Y) Amplifiers

The "Y" channel in the 12B14-C50 chassis is all transistorized, as shown in Fig. 1. There is an emitter-follower 1st video amplifier, a common-emitter 2nd video amplifier, and an emitter-follower 3rd video amplifier. The 3rd video amplifier also serves as an impedance matcher and "modulator" to the emitters of the red, green, and blue output transistors.

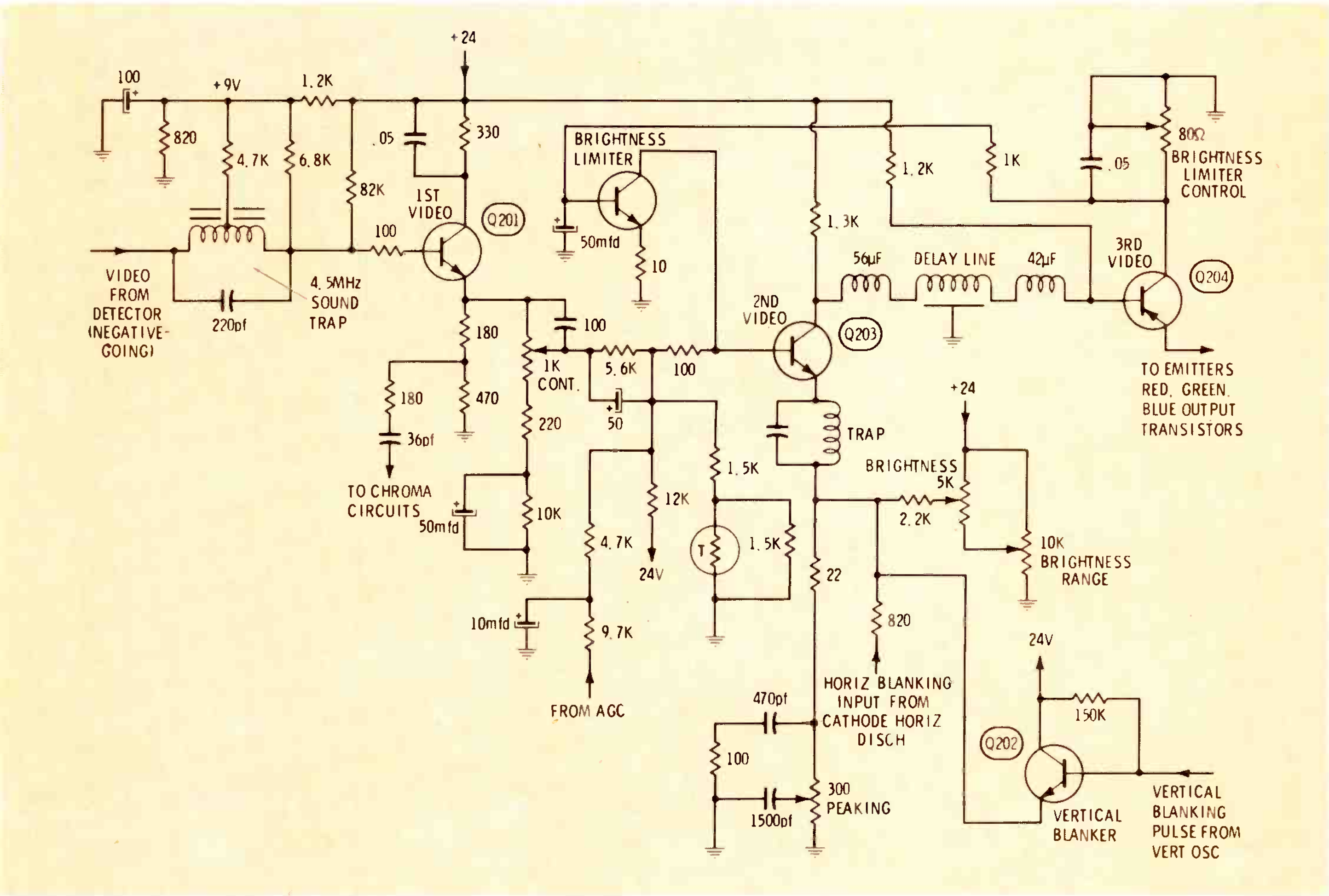


Fig. 1 Transistorized "Y" channel with brightness limiter and vertical blanking transistors is used in new Zenith chassis.

The contrast control is in the emitter circuit of the 1st video; the chroma take-off also is in this circuit. The brightness and brightness range controls are in the emitter circuit of the 2nd video. Vertical and horizontal blanking also is inserted at the 2nd video emitter.

Stabilization from three sources is applied at the base of the 2nd video transistor, Q203.

1st Video Stage

The video signal from the detector diode is fed through peaking coils and a sound trap to the base of the 1st video, Q201. At first glance, the resistors in the base circuit of Q201 appear to comprise a rather complex DC biasing network. The reason for this many resistors, according to Zenith, is to provide a better AC match between the medium-high output impedance of the diode detector and the medium-low input impedance of the 1st video transistor. As far as the DC bias is concerned, the resistors are in parallel. The 4.7K-ohm resistor helps sharpen the tuning of the trap.

The contrast control circuit parallels the 180- and 470-ohm emitter resistors and varies the AC video signal level fed to the base of the 2nd video amplifier, Q203.

The "black-tracking" circuit operates because of the different AC and DC impedances of the contrast control circuit. For video (AC), the circuit offers an impedance of 1220 ohms (the 1k contrast control and the 220-ohm resistor in series with it, disregarding the 180- and 470-ohm parallel resistors) because AC is bypassed around the 10k resistor by a 50-mfd capacitor. For DC, however, the 50-mfd capacitor has no effect, so the circuit impedance is 11,220 ohms. Consequently, with the contrast control arm at the low end, the signal level is reduced about 5½ times, but the DC bias level (affecting the brightness) is reduced only about 1/11. In other words, lowering the contrast also slightly lowers the brightness, while increasing the contrast slightly increases the brightness, both actions keeping the CRT black level relatively constant.

The 2nd Video

With direct-coupling between video stages, which is used in most color sets, a change in bias in any stage causes a corresponding change in picture tube brightness. This is why brightness problems in color sets often occur in the video amplifiers, and why the brightness control and brightness range can be inserted at almost any convenient spot in the circuit following the chroma takeoff and contrast control.

But there are some disadvantages to the direct-coupled circuit. If, during warmup, the current flow through one or more of the transistors changes, the brightness also will change. To compensate for warmup change in this circuit, a negative-temperature-coefficient (decreases in resistance with increase in heat) thermistor is placed in the

Setting the Brightness Range and Brightness Limiter

To get full effectiveness from the Brightness Limiter circuit it must be adjusted in conjunction with the Brightness Range control as follows:

1. Turn the Brightness Limiter control fully clockwise.
2. Turn Brightness control fully clockwise.
3. Adjust Brightness Range until picture blooms 1 inch.
4. Adjust Brightness Limiter counterclockwise until picture blooms only ¼ inch.

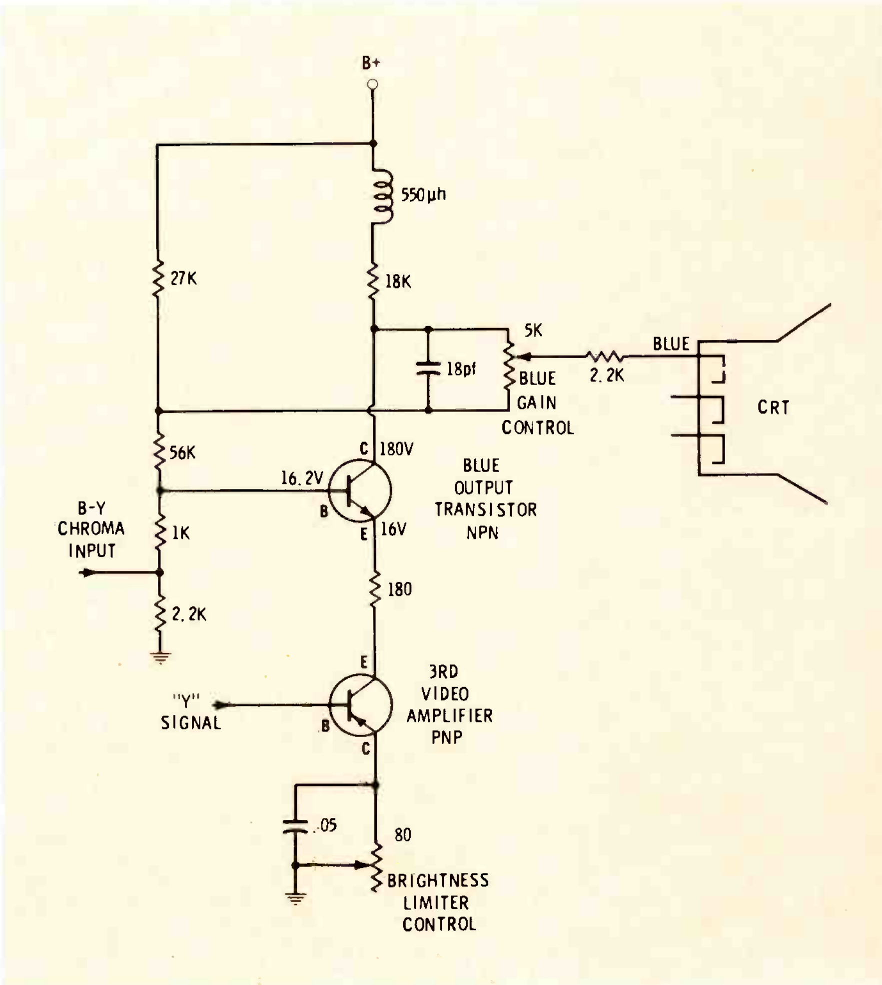


Fig. 2 Simplified schematic of pre-CRT mixing of chroma and "Y" signals.

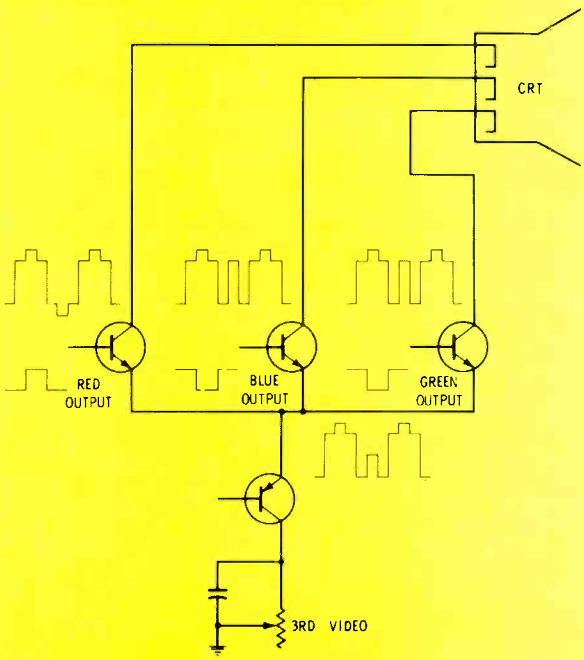


Fig. 3 Simplified circuit showing matrixing of chroma signals with the "Y" signal when a red color bar is being received.

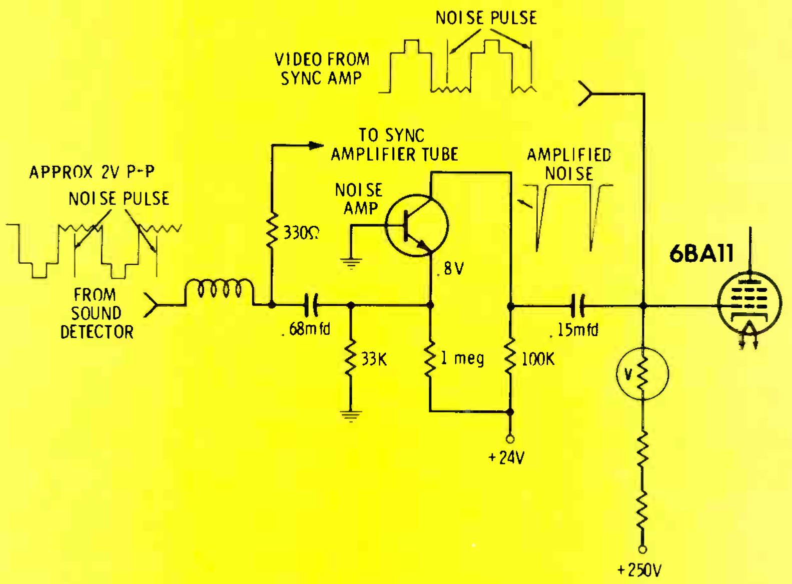


Fig. 4 Common-base, high-level noise amplifier used in new Zenith chassis. During normal reception, video input signals are not strong enough to override the bias of the noise amplifier transistor; however, a strong noise pulse will cause it to conduct and apply a strong negative pulse to the 6BA11 grid.

base bias circuit of the 2nd video stage. As the transistor heats it tends to draw more current, but the thermistor compensates by reducing the DC bias to the base, which, in turn, reduces the conduction of the transistor circuit.

Another problem in direct-coupled circuits is that when weak signals are received the detector output drops below the normal level maintained by the AGC on stronger signals. This means that the brightness would increase on weak signals. To prevent this, the base of the 2nd video amplifier is tied through an RC network to the AGC line. Because the AGC line goes more negative when a weak signal is received, more negative voltage is applied to the base of the 2nd video, preventing a drastic change of brightness.

A third stabilizing signal is introduced at the base of the 2nd video by the brightness limiter transistor; this application will be discussed in detail later in this article.

Located in the emitter circuit of the 2nd video amplifier are another trap, a peaking control circuit, input for vertical and horizontal blanking signals, and the brightness and brightness range controls.

The peaking control functions by varying the frequency response of the video amplifier. When the arm of the peaking control is at the "hot" end, the higher video frequencies are bypassed around the major portion of the emitter resistance, producing maximum high-frequency gain and pictures with sharp outlines but more apparent noise and snow, especially in weak signal areas. With the peaking control arm at the "ground" end, the high-frequency gain is reduced and the outlines in the picture tend to smear, but noise and snow are less apparent. The peaking control is a "customer preference" control and operates on the same principle as a tone control in an audio circuit. "Normal" operation is with the control at about midrange.

The brightness and brightness range controls vary the emitter bias of the 2nd video and, in turn, this change in bias is projected through the remainder of the video stages to the cathodes of the CRT. Brightness is minimum when the arm of the brightness control is at the +24-volt side. For this reason, the brightness control can always vary the brightness to zero regardless of the setting of the brightness range control. The brightness range varies the amount of positive voltage on the "low" side of brightness control and sets the maximum level to which the customer can increase the brightness.

Horizontal blanking also is inserted at the emitter of Q203, through an 820-ohm resistor which is tied to the cathode of the horizontal discharge tube.

Vertical blanking is applied at the same point, but the vertical pulses, taken off the vertical oscillator-amplifier, are first fed to a vertical blanker transistor to reduce the loading and provide a better impedance match.

3rd Video Stage

The output of the 2nd video amplifier is fed through the delay line to the base of the 3rd video. There is an 80-ohm adjustable resistor in series between the 3rd video collector and ground. This is the brightness limiter control. The positive voltage developed across this control is filtered to remove video, and the resultant DC then is fed to the base of the NPN brightness limiter transistor. This positive voltage causes the transistor to conduct and supply a negative voltage to the base of the 2nd video amplifier.

The operation of this two-stage compensating circuit is as follows: If the current through the 3rd video transistor increases for any reason, there will be additional positive voltage applied to the base of the brightness limiter, which will increase the negative bias on the 2nd video, which, in turn, will reduce the bias on the 3rd video, almost completely cancelling an increase of current in the 3rd video.

The opposite condition occurs if the 3rd video transistor current should drop for any reason. In other words, this is an amplified stabilizing circuit that limits extreme changes in bias, thereby limiting undesirable brightness changes.

Pre-CRT Matrixing

Before increased use of transistors, almost all manufacturers mixed (matrixed) the video and chroma signals in the picture tube by applying the video to the CRT cathodes and the color to the CRT grids. This had the disadvantages of requiring high-level color amplifiers and the possibility of tracking problems in either or both the video and color amplifier circuits.

By pre-mixing the video (Y) and the color, the final video amplifiers can amplify both the video and the color, and the CRT grids can be returned to a fixed DC source, reducing the possibilities of tracking errors.

Fig. 2 shows how the video and one color signal are mixed in this chassis. The "Y" signal is fed into the 3rd video amplifier, which is in series with the emitter of the B-Y (blue) output transistor. This, in effect, mixes the two signals so that a composite of the two appears at the collector of the blue output transistor, where it is coupled through the blue gain control to the blue cathode of the CRT.

Fig. 3 shows, in simplified form, how this pre-CRT mixing occurs. Suppose a red bar is being transmitted. The bar will appear gray on a black-and-white set because the video signal is about "half way to black", as can be seen by the waveform at the emitter of the 3rd video amplifier. With no color input to any of the output transistors, there will be an exact replica of this signal (except amplified) at all three output collectors. (Remember,

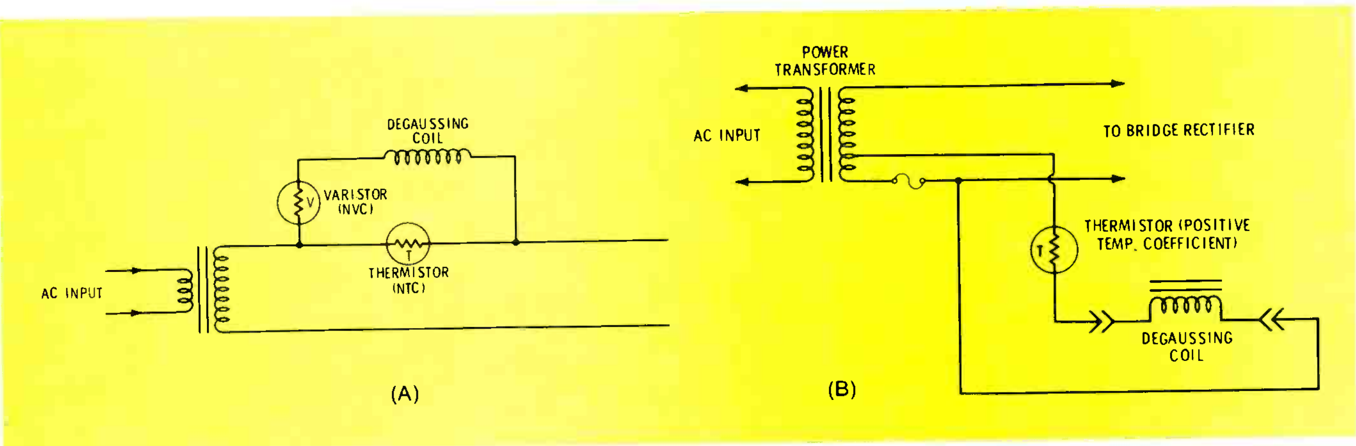


Fig. 5 (A) More conventional degaussing circuits have imployed at least two voltage and/or temperature sensitive resistors. Zenith automatic degaussing circuit **(B)** uses only one thermistor, and it has a positive temperature coefficient.

there is no phase inversion because the input is to the emitters.) But, with a red signal coming from the color demodulator, there is a positive pulse at the base of the red output transistor. This positive pulse causes the collector to go negative (phase **is** inverted between base and collector), making the red CRT cathode also go negative, which, in turn, increases the brightness of the red gun. At the same time the positive pulse is arriving at the red output transistor, the color demodulator is supplying negative pulses to the basis of the green and blue output transistors, which produces positive-going signals on their collectors and on the blue and green CRT cathodes, decreasing to zero the brightness of these two colors.

The same process occurs if a blue or green bar were transmitted, except that the corresponding output transistor would receive the "turn on" signal and the other two the "turn off" signal from the chroma demodulator.

The Noise Clipper

A new high-level noise canceller is used in this chassis. As shown in Fig. 4, the transistor is in a common-base circuit designed to feed high-level negative noise pulses to the 1st grid of the 6BA11 sync tube. During normal operation the video input to the noise amplifier transistor is insufficient to overcome the reverse bias between its base and emitter, and, consequently, there is no transistor output to the grid of the 6BA11. However, when a strong noise pulse occurs, it overrides the transistor reverse bias and appears as an amplified negative pulse at the grid of the sync tube. (There is no phase change between input and output of a common-base amplifier.) This amplified negative pulse cancels the effect of the positive-polarity noise pulse, which also is fed through normal channels to the other input grid of the 6BA11. This prevents the noise pulse from falsely triggering either sweep circuit.

The Automatic Degaussing Circuit

Most automatic degaussing circuits employed previously use at least two self-variable resistors, either varistors or thermistors or a combination of the two, such as the design shown in Fig. 5A. In this circuit both control units have negative coefficients.

When power is first applied to the set and the thermistor is "cold", its resistance is relatively high, about 120 ohms. Consequently, maximum voltage is developed across it. At the same time, the resistance of the varistor is at minimum, which permits maximum current flow through the degaussing coil.

As the set warms up, the resistance of the thermistor decreases, finally reaching about 2 or 3 ohms. The voltage drop across it also decreases, which, in turn, causes the resistance of the varistor to increase to maximum, cutting off almost all current flow through the degaussing coil.

The automatic degaussing circuit in Zenith's new chassis uses a low-voltage, high-current degausser and a single thermistor with a positive temperature coefficient. When the set first is turned on, the thermistor is cold, its resistance is at minimum, and about 6 amps of current flow through the degaussing coil. During the first few seconds of operation, the resistance of the thermistor increases to maximum and current through the degaussing coil decreases to about 30ma, which is low enough not to affect the picture tube, yet sufficiently high to keep the thermistor warm enough to maintain a high resistance.

The Focus Circuit

The focus circuit in the new Zenith chassis, shown in Fig. 6, is simply a voltage divider network connected directly to the 25KV high-voltage source for the CRT. By placing the control in the "tail", or "cold", end of the circuit, the voltage on the control is kept at a reasonable level, and the danger of arc-over or shock is minimized.

Pincushion Correction

Another change in the new Zenith chassis is the deletion of the pincushion amplifier tube. A saturable reactor is used instead—not a new idea, but one that Zenith has not used before.

The saturable reactor uses two separate windings on a special core material. One of the windings is in toroidal form (Fig. 7A), which has no air gap and, because it keeps all the lines of force within the core itself, needs no shielding—it does not radiate nor does it accept electromagnetic signals not directly induced into the core by another toroidal winding on the same core. However, because the core has no air gap, it does saturate rather easily with medium current. With low current in the coil, the coil has a high inductance and reactance. But as the coil current increases, the inductance and the reactance decrease, and once the core has saturated there is little reactance to current variations in the coil.

The second winding of this pincushion unit is wound in normal fashion on the same core as the first winding (Fig. 7B). Because the two windings are at a 90-degree angle to one another, there is no transfer

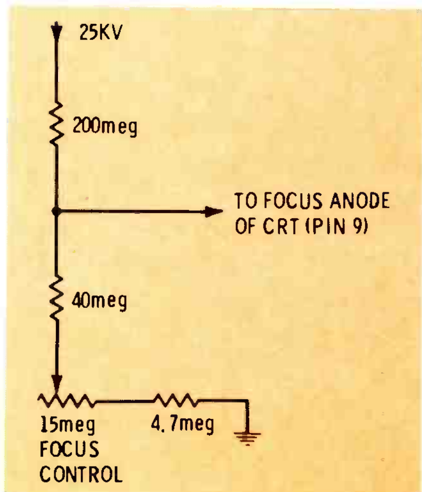


Fig. 6 Resistive-divider focus circuit eliminates the need for a focus rectifier.

of voltage between the two; however, because the core is common to both windings, the second winding can vary the reactance of the first winding by causing core saturation.

Utilizing this effect, the signal applied to the toroidal coil can be modulated by the signal applied to the second winding, but the second winding will not be modulated by the signal in the toroidal winding.

For correction of pincushion at the top and bottom of the screen, the vertical signal is applied to the toroidal coil, and the horizontal signal is applied to the normal coil. The vertical signal then is modulated by the horizontal signal, but the vertical signal does not affect the horizontal because, as far as the normally wound coil is concerned, its core has a large air gap and never saturates.

In this particular reactor it requires current flow in both the vertical and horizontal circuits to saturate the core.

Here's how it works: At the beginning of the vertical sweep (top of raster), the sawtooth of current is at its highest amplitude, and this current, plus the current of the top horizontal line, produces maximum saturation of the reactor, which produces minimum reactance and maximum vertical current flow. Because the current is maximum at the beginning and end of each horizontal line, there would be maximum vertical deflection at the ends of the lines—which is just opposite the effect needed. To correct for this, a secondary winding tunable around 15,750 Hz is provided. By adjusting the winding, the phase can be shifted to produce maximum vertical deflection at the center of the screen, instead of at the ends of the lines.

As the beam sweeps downward across the CRT, the vertical yoke current decreases at a linear rate, decreasing the saturation and increasing the reactance of the coil, so that no correction occurs at the center of the screen. As the current increases again to sweep the beam on down to the bottom, the saturation again occurs, producing maximum vertical sweep at the center of the raster.

"Automatic" Tint Control

By pulling out the tint control knob on this Zenith chassis the customer can have "automatic" tint. The control functions by shifting the demodulation angle from the normal 105 degrees to 132 degrees. This shifts the R-Y (red) more toward orange, and there is less apparent flesh tone change as the set is switched from channel to channel.

Fig. 8 shows how the automatic tint control circuit functions. The phase of the 3.58 oscillator injection to the color demodulator is changed by switching in a simple phase-shifting network so that the demodulation angle is changed by about 27 degrees. ▲

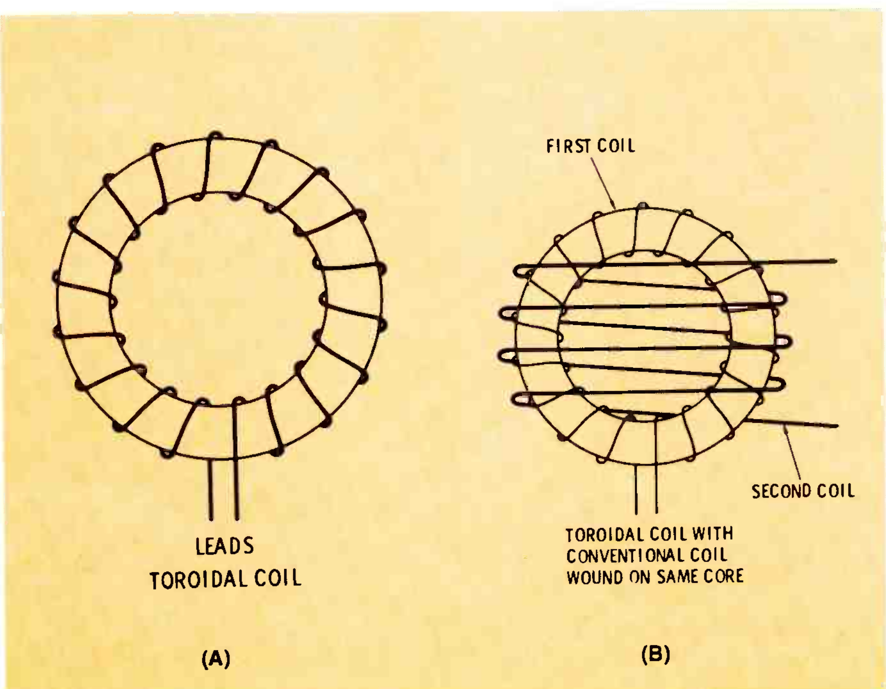


Fig. 7 (A) Toroidal coil. **(B)** Toroidal coil with a conventional coil wound on same core. There is no electromagnetic transfer of energy between the two coils, but current in the conventional coil can cause core saturation and a reduction in reactance of the toroidal coil.

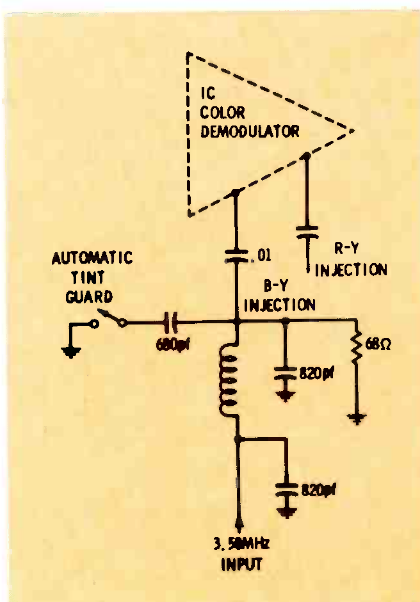


Fig. 8 Changing the 3.58 oscillator injection phase angle at the input of the color demodulator by about 27 degrees shifts the R-Y (red) signal toward orange, so there is less apparent flesh tone change when the set is switched from channel to channel.

catalogs literature

ANTENNAS

100. *Jerrold Electronics Corp.*—has released a 56-page full line general distributor catalog which includes a guide to MATV systems and nearly 300 Jerrold products. The catalog cost is $1.00.

101. *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.

AUDIO

102. *Altec Lansing*—introduces a 12-page brochure for information on sound systems in the sports and entertainment field, stadiums, automobile speedways, hotels, restaurants and other public entertainment facilities.

103. *Darome, Inc.*—has released an 8-page brochure showing how a complete background music, local public address, and constant level paging system can be installed without using relays or complicated wiring.

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

105. *Shure Brother, Inc.*—has published a 4-page brochure, "Professional Sound Systems in High Schools, Colleges, and Universities," No. AL398, describing the company's Vocal Master Sound system and how it helps solve public address problems.

COMMUNICATIONS

106. *The Hallicrafters Co.*—has published a 4-page, two color brochure which provides the complete mechanical and general specifications of the Porta Command PC-230 FM 2-way radio, including the full line of accessories which expand the new radio's versatility.

107. *Sonar Radio Corp.*—Catalog titled "Sonar Business Radio, FM Monitor Receivers and CB Equipment," lists specifications and prices of this manufacturer's line of transceivers, receivers and communications accessories.

COMPONENTS

108. *General Electric Tube Department*—has released a new 52-page Entertainment Semiconductor Almanac, No. ETRM-4311F. The almanac contains approximately 20,000 cross references from JEDEC, or OEM part numbers to GE parts numbers for universal replacement semiconductors, selenium rectifiers for color TV, dual diodes, and quartz crystals.

109. *The Hallicrafters Co.*—is offering a 4-page, two color brochure that features the complete line of CRX "Portamon" special frequency monitor radios, lightweight pocket portable and table model radios.

110. *Loral Distributor Products*—has made available a 24 page electrolytic capacitor replacement guide. The catalog features replacement products by the original manufacturers part number.

111. *Motorola, Inc.*—has made available a HEP cross reference guide catalog No. HMA07 which lists replacements for over 27,000 different semiconductor device type numbers available through authorized HEP suppliers.

112. *RCA Distributor Products*—is offering an 8-page illustrated pamphlet entitled "When, Where and Why It Pays To Switch To RCA Alkaline Rechargeable Batteries," No. 1P1385.*

113. *Semitronics Corp.*—has a new, revised, "Transistor, Rectifier, and Diode Interchangibility Guide" containing a list of over 100 basic types of semiconductors that can be used as substitutes for over 12,000 types. Include 25 cents to cover handling and postage.

114. *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.

115. *Sylvania Electronic Products, Inc.*—a 73-page guide which provides replacement considerations, specifications and drawings of Sylvania components plus a listing of over 35,000 JEDEC types and manufacturers' parts numbers. Copies are $1.00.*

116. *General Electric* — a 12-page, 4-color, illustrated "Picture Tube Guidebook", brochure No. ETRO-5372, provides a reference source for information about GE color picture tube replacements and tube interchangeability.*

117. *Workman Electronic Products, Inc.*—has released a 32-page, pocket size cross reference listing for color

TV controls. 105 Workman part numbers are in numerical order with specifications and illustrations of the part.*

TV ACCESSORIES

118. *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 Adaptors and convergence loads.

TECHNICAL PUBLICATIONS

119. *Howard W. Sams & Co., Inc.*—literature describes popular and informative publications on radio and television servicing, communications, audio, hi-fi and industrial electronics, including their 1970 catalog of technical books on every phase of electronics.*
120. *Sylvania Electric Products, Inc., Sylvania Electronic Components Div.*—has published the 14th edition of its technical manual, which includes mechanical and electrical ratings for receiving tubes, television picture tubes and solid-state devices. The price of this manual is $1.90.*

TEST EQUIPMENT

121. *B & K Mfg. Div., Dynascan Corp.*—is making available an illustrated, 24-page 2-color Catalog BK-71, featuring B&K test equipment, with charts, patterns and full descriptive details and specifications included.*
122. *Eico*—has released a 32-page, 1970 catalog which features 12 new products in their test equipment line, plus a 7-page listing of authorized Eico dealers.*
123. *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.
124. *Sencore, Inc.*—has issued its 12-page 1970 catalog, Form No. 517, which describes the company's complete line of test instruments, and features 5 new instruments, with performance data and prices included.*
125. *Triplett Corp.*—Bulletin No. 51570, a 2-page technical bulletin which provides the specifications and price of Triplett's new Model 602 VOM.

TOOLS

126. *General Electric*—has issued a 2-page brochure No. GEA-8927, describing the features of GE's new soldering iron.
127. *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.
128. *Xcelite, Inc.*—has published a 2-page illustrated Bulletin N670, which introduces two new reversible ratcheting handles for use with more than 60 of the company's available Series "99" nutdriver, screwdriver, and special purpose blades.
129. *Xcelite, Inc.*—Bulletin N770 describes this company's three new socket wrench and ratchet screwdriver sets.

***Check "Index to Advertisers" for additional information.**

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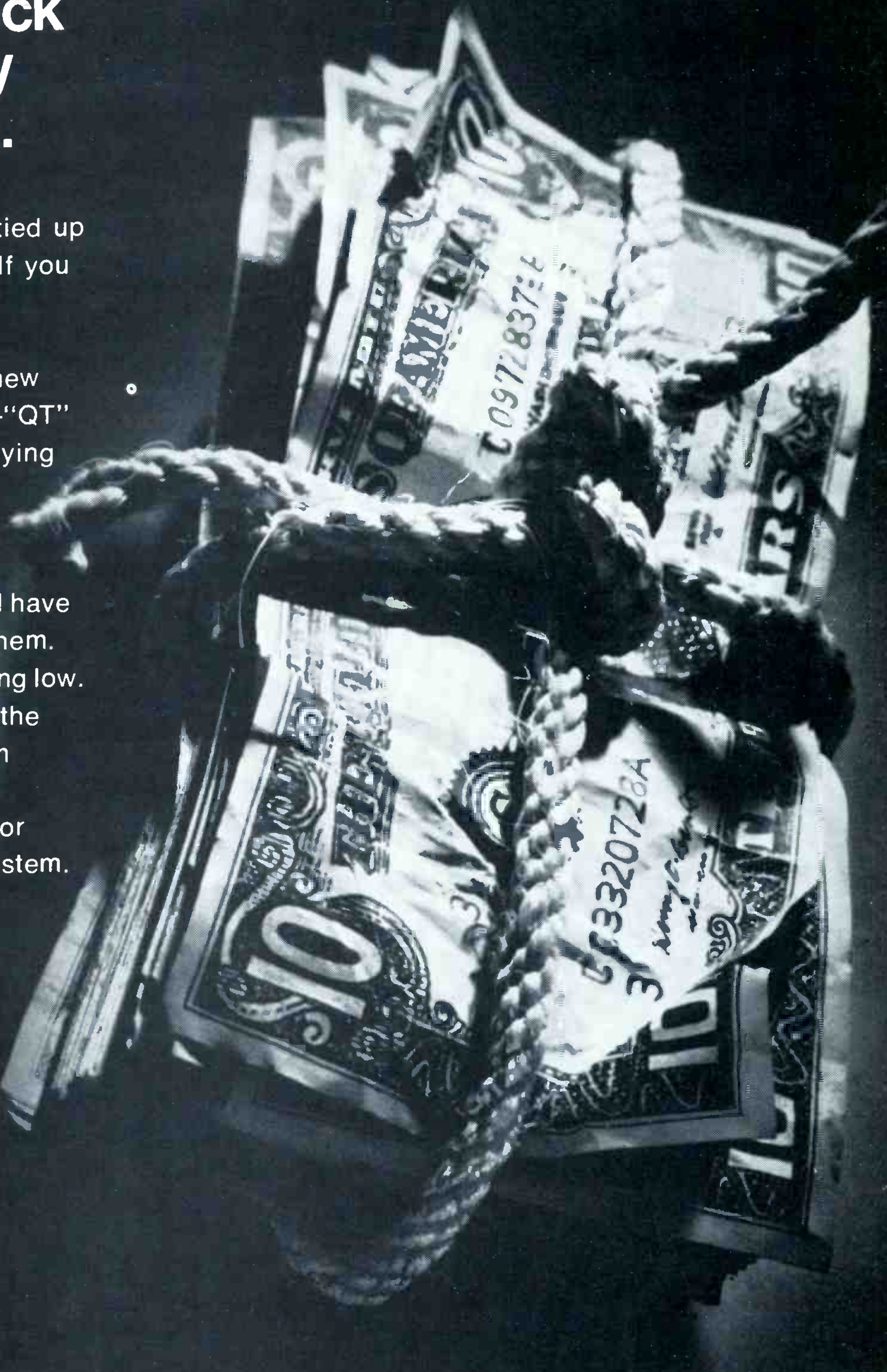

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