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# Electronic Servicing



A HOWARD W. SAMS PUBLICATION



**MASTER SUBBER...exclusive test report**

Tape Recorder Workshop  
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# PTS ELECTRONICS

## Precision Tuner Service



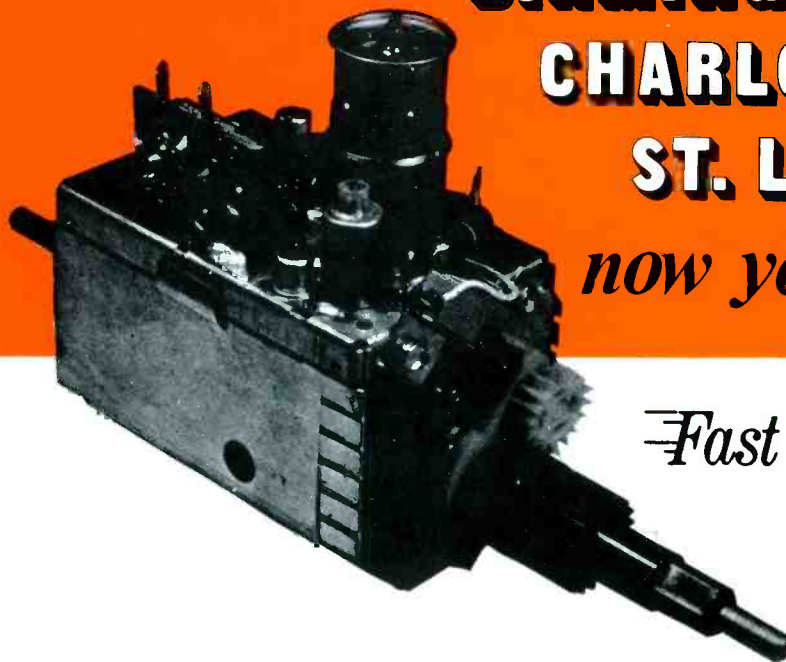
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For More Details Circle (3) on Reply Card

# electronic scanner

news of the industry

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**RCA has developed an electro-optic modulator** that permits a single laser beam to carry 20 TV programs simultaneously. It is said to be the first light modulator truly compatible with integrated circuits and capable of spatial switching, or aiming, the direction of a laser beam.

**Airport noise and congestion can be minimized** with a new Microwave Landing System now under test by the Federal Aviation Administration. Developed by scientists of International Telephone and Telegraph Corporation, the system provides landing guidance 80 degrees wide in the large pie-shaped approach sector, more than 13 times the 6 degrees of present-day systems. Aircraft can make landing approaches from over sparsely populated areas and will not have to go through a lengthy lining-up process.

**A miniature optical sensor** no bigger than an adult's thumbnail has been developed by General Electric for use in hand-held or sub-miniature TV camera systems. This should make possible a tubeless TV camera no larger than a pack of cigarettes. The tiny solid-state sensor and essential circuitry is called a Charge Injection Device (CID) module, and it converts optical images into electrical video signals.

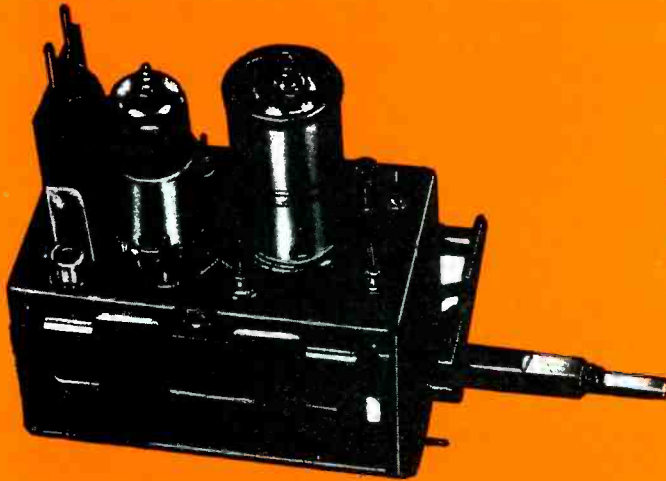
**Sufferers from a blinding disease may one day be helped to see** by an electronic light-amplifying device now under development by International Telephone and Telegraph Corporation. The device resembles a monocular or binocular opera glass and can electronically amplify dim light to levels useful to those handicapped by Retinitis Pigmentosa.

**At the NARDA convention in Miami**, officials Jim Renier and Jules Steinberg credited the drastic decline of single-unit appliance-TV stores to runaway operation costs, increasing costs of merchandise, big store competition and inability to move with the changing times. Renier declared that independent retailers should band together to form a gigantic holding company that would provide the host of management functions required in today's business climate, reports **Home Furnishings Daily**. Steinberg stated that maintaining and improving service operations is the key weapon in the independent store's fight against the continuing onrush of big store competition.

**The Entertainment Products Group of GTE Sylvania** is offering a home-study audio course to distributor and dealer sales personnel. The program includes an overview of the audio market, major audio components, features and parts, understanding specification sheets, and consumer selling.

**Teddyne Packard Bell** has announced that their entire 1975 line will feature 100 per cent solid-state electronics in both TV and audio products.

(Continued on page 6)



# \$9.95

ALL PARTS INCLUDED  
EXCEPT TUBES & TRANSISTORS

ONE YEAR GUARANTEE

# TUNER SERVICE CORPORATION

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

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Universal Replacement Tuner **\$12.95** (in Canada \$15.95)  
This price buys you a complete new tuner built specifically by **SARKES TARZIAN INC.** for this purpose.

All shafts have a maximum length of 10½" which can be cut to 1½".

Specify heater type parallel and series 450mA or 600mA.

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Customized tuners are available at a cost of only **\$15.95**; (with trade-in **\$13.95**) (in Canada \$17.95/\$15.95)

Send in your original tuner for comparison purposes.

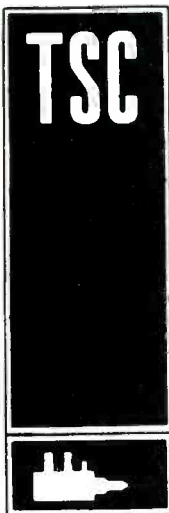
## REPAIR

VHF Or UHF Any Type **\$9.95.**  
UHF/VHF Combo **\$15.00.**

In this price all parts are included, tubes, transistors, diodes, and nuvistors are charged extra. This price does not cover mutilated tuners.

Fast efficient service at our conveniently located service centers.

All tuners ultrasonically cleaned, repaired, realigned and air tested.



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WATCH US GROW

FOR INFORMATION ON FRANCHISE, CONTACT HEADQUARTERS

For More Details Circle (4) on Reply Card

For several years, Dick Pavek of Tech Spray has been concerned about ecology and the shortages of raw materials. Therefore, Tech Spray is starting a reclamation program by refilling certain tuner-spray cans. Technicians are urged to turn in to their distributors empty cans (only those in good condition) that formerly contained Blue Shower, Color Rid Ox, or Minus 62 INSTANT CHILLER. The distributors will pay 5 cents for each can, which will be sent back to Tech Spray for refilling. It is interesting to note that this is not done to make a profit, but to conserve steel. According to Pavek, there is a small loss in the program because a special filling machine had to be built. That's because refilling must be done in a different way than it was during the original manufacturing.

Abraham and Strauss, a Brooklyn-based Federated department store, is charging customers for the delivery of white goods (\$5) and brown goods (from \$2). Other stores in the area have not instituted the new delivery fees; a number of them, however, charge customers for delivering merchandise that normally can be carried, such as portable TV sets and stereo equipment, as reported in **Home Furnishings Daily**.

A decline of color TV sales has some analysts worried that more manufacturers might leave the business, states the **Wall Street Journal**. Of the 20 American TV makers flourishing in 1968, eight have either eliminated color production or gone out of business, three others have been sold, or are scheduled to be sold, and several of the remaining dozen are in financial danger. Zenith with 24% and RCA with 20% shares of the market (approximately) dominate the market and account for nearly 100% of the profits.

Cable television companies have suffered severe problems in entering the urban markets. Many of the large companies have not only stopped seeking urban franchises, but even have given up some they had won at great expense, reports **Radio & Television Weekly**. One executive summed it up this way: "Cable TV bombed in the cities, and we will be a long time recovering from it. We not only oversold ourselves and made ridiculous promises, we underestimated the cost of wiring urban communities and the kinds of services the urban consumer would require."

How do you save a dying TV repair business? Open a TV retail store, as Dick Jones of Jones TV, Kingston, New York did and get more sets for service into homes. Jones added a sales business because he no longer was servicing enough sets. He now attaches two-year warranties to his used sets and says customers are drawn to him because of the availability of service, according to **Home Furnishings Daily**.

RCA has been granted a patent for its in-line color TV picture tube, introduced in 1973, reports the **Home Furnishings Daily**. The three electron guns are arranged in a single line, rather than the usual triangular formation. RCA says this helps eliminate convergence adjustments. □

# BLUE SHOWER

## DEGREASER

MUCH MORE THAN JUST A TUNER CLEANER . . .

BLUE SHOWER is the complete degreaser for all circuitry . . .

Cleans dusty flybacks . . . dirty chassis . . . and contaminated tuners

And it comes with our new OMNI-SPRA® extension

that cleans backs and sides of components as well as the front

Comes in two sizes . . . one for the bench and one more for the road



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YOU CAN HELP US CONSERVE STEEL

BLUE SHOWER cans are refillable when empty. Take them to any participating distributor — he will credit you 5 cents for each can and return them to TECH SPRAY for refilling.



From **TECH SPRAY** where we find solutions for your problems  
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# minus 62 INSTANT CHILLER

THE CHILLER THAT EXCEEDS THE STANDARD

For a long time -55°F was the standard for chilling sprays . . . because the colder the spray, the quicker intermittents are put into the failure mode

Now there's a new standard . . .

minus 62 INSTANT CHILLER chills to well below -62°F . . .

giving you better, faster servicing

The colder the better and minus 62 INSTANT CHILLER is the coldest



YOU CAN HELP US CONSERVE STEEL

MINUS 62 INSTANT CHILLER cans are refillable when empty. Take them to any participating distributor — he will credit you 5 cents for each can and return them to TECH SPRAY for refilling.



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# COLOR RID OX

## WITH LUBRI-SHINE®

THE ANSWER TO CLEANING AND PROTECTING IN-PLACE TUNERS

When you can't remove the tuner for servicing, COLOR RID OX cleans and protects safely

NO SILICONES . . .  
NO OILS . . .  
NO GREASES . . .

Contains only LUBRI-SHINE®

The new, dry film lubricant that makes contacts clean & shiny at the turn of the channel selector

One shot does it . . .

Without drift . . .

Without contamination . . .



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YOU CAN HELP US CONSERVE STEEL

COLOR RID OX cans are refillable when empty. Take them to any participating distributor — he will credit you 5 cents for each can and return them to TECH SPRAY for refilling.



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# BLUE STUFF

With Mini-Scrubbers

There are millions of mini-scrubbers in each can of BLUE STUFF. Not just a colored grease, BLUE STUFF'S millions of mini-scrubbers go to work instantly . . .

every time you rotate the channel selector . . .

cleaning and polishing . . .

for months and months.

Every can of BLUE STUFF is packed with 2 free BLUE PADS . . .

The polishing pads that you place in the bottom of the tuner cover on strip type tuners to help polish the contacts



Sorry . . . we can't refill BLUE STUFF cans. We worked out the technology for refilling BLUE SHOWER, MINUS 62 INSTANT CHILLER and COLOR RID OX but it won't work on BLUE STUFF cans. Maybe later, we're trying.

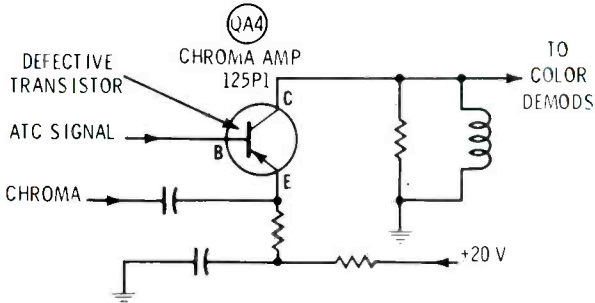
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For More Details Circle (5) on Reply Card

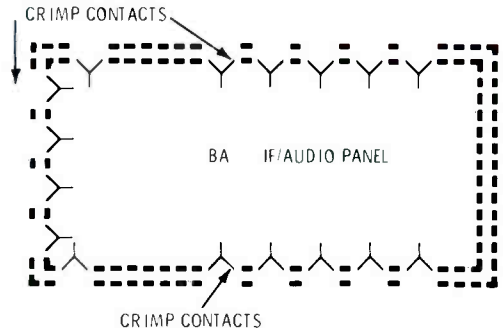
www.americanradiohistory.com

Chassis—Magnavox T940  
PHOTOFACT—1144-1



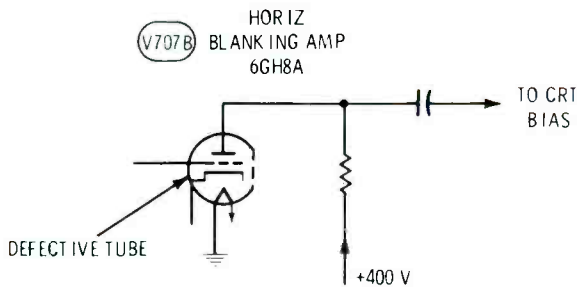
**Symptom**—Intermittent loss of color  
**Cure**—Check QA4 (in ATC box), and replace if it is defective

Chassis—Motorola 18TS929  
PHOTOFACT—1175-1



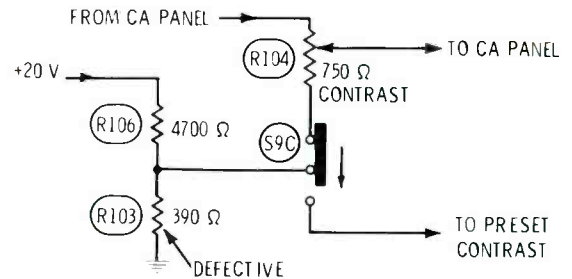
**Symptom**—Movement of the IF/audio panel causes brightness changes  
**Cure**—Remove BA panel, crimp contacts, and replace panel; don't use contact cleaner

Chassis—Magnavox T940  
PHOTOFACT—1144-1



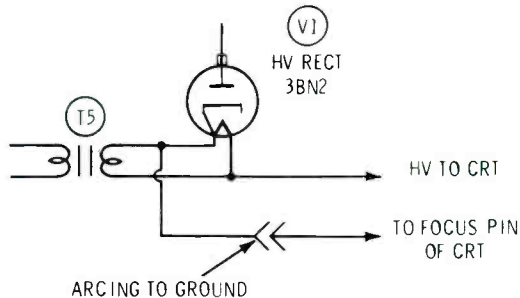
**Symptom**—Low brightness either at turn on, or after operation  
**Cure**—Replace V707B blanking amplifier tube as a test

Chassis—Motorola TS929 (late production)  
PHOTOFACT—1327-1



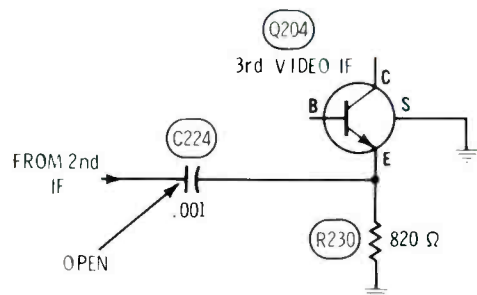
**Symptom**—No raster; HV okay  
**Cure**—Check R103, and replace if it is out of tolerance

Chassis—Motorola TS915 or TS919  
PHOTOFACT—953-1



**Symptom**—Arcing around focus plug on HV cage  
**Cure**—Install new focus plug, or remove plug and connect focus wire direct to the socket of the HV rectifier tube

Chassis—GTE Sylvania  
PHOTOFACT—1168-3



**Symptom**—No picture, or weak contrast  
**Cure**—Check C224, and replace if it is open

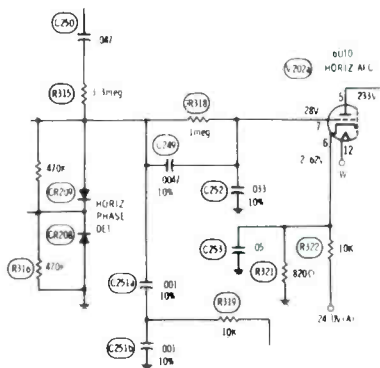


# servicebulletin

a digest of information from manufacturers

## Eliminating top hook Zenith 23DC14 color chassis (Photofact 1306-3)

Severe bending at the top of the picture might be caused by one or two things. First, check for correct mounting of the pincushion transformer (part number 95-3004) with respect to the horizontal oscillator coil. Interaction of the two magnetic fields might cause a hook at the picture top. Make sure the side of the pincushion transformer having the painted dot faces the front of the chassis.



If any top bend remains after the transformer is properly positioned, check the value of R315 (3.3 megohm). Purpose of the resistor is to neutralize any vertical signal reaching the horizontal phase detector. In a specific chassis the optimum might be infinite, or lower than the normal 3.3 megohm. Do not use a lower value than 1.5 megohm.

## No Instant-On RCA CTC62 color TV chassis (Photofact 1345-2)

Double symptoms of no Instant-On and slow warmup of the picture tube can be caused by an open fuse, F102.

In this chassis, the AC for the B+ is supplied through F102 **only** when the receiver is turned off. B+ is applied to the retrace section of the horizontal sweep at all times, and the standby voltage for the picture tube heaters is taken from T402.

(Continued on page 10)

DC to  
10 MHz,  
10 mV/cm  
sensitivity  
5" CRT

Simpson®

Model 455  
5" SCOPE  
\$310

- Direct input for vector display
- Sensitivity: vertical, 10 mV/cm to 5 V/cm; horizontal, 300 mV/cm.
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- 120 or 240 VAC operation, 50 or 60 Hz
- Fold-in support for incline viewing
- Size: 10<sup>3</sup>/<sub>8</sub>" H x 8" W x 16<sup>1</sup>/<sub>2</sub>" D
- Low-capacitance 10:1 probe available

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INSTRUMENTS THAT STAY ACCURATE

SIMPSON ELECTRIC CO.

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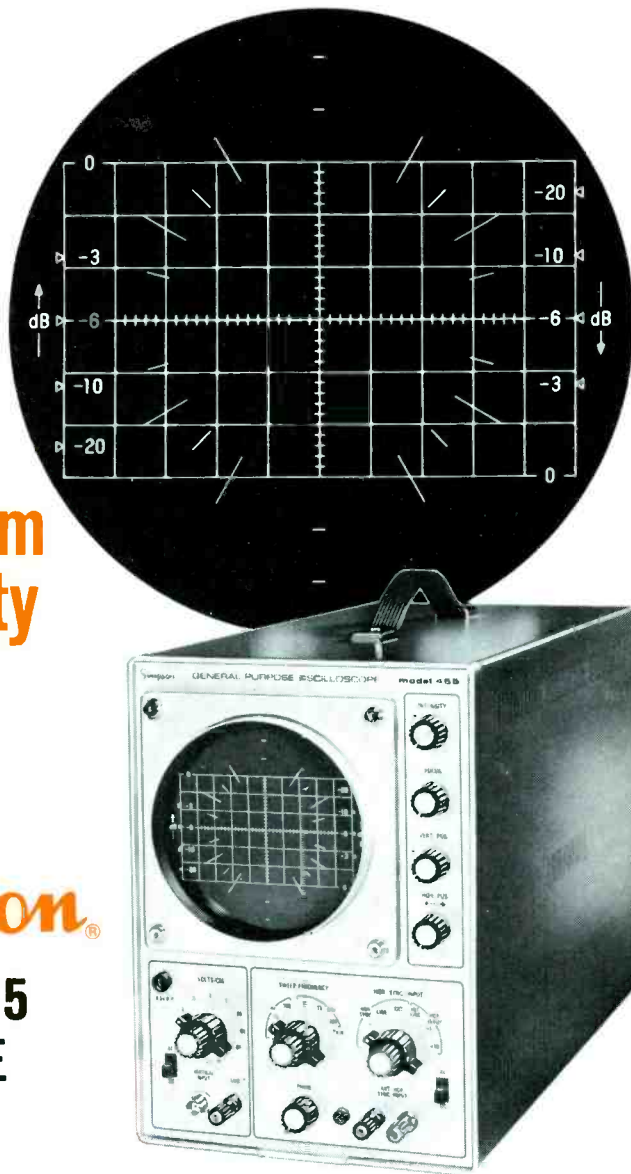
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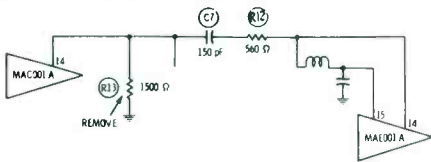
# servicebulletin

a digest of information from manufacturers

(Continued from previous page)

Therefore, an open fuse does not stop all operation, just eliminates the Instant-On feature. It's not recommended the receiver be operated without a good F102.

## Green In Lowlights RCA XL-100 Models (Photofact 1187-2)



If the complaint is "picture too green" or "tint control not centered", don't attempt to align module MAE, but clip out and discard R13 (or R352 RCA number). Then check the ACM color-level adjustment and the tint range.

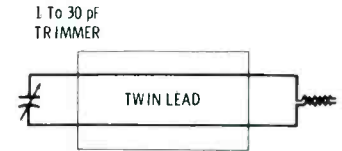
## Traps To Minimize Interference Philco Bulletin, But Applies To All Brands

External interference often requires a trap to reduce the intensity of the disturbance. An absorption-type trap easily can be made from a length of 300-ohm twin lead and a small trimmer capacitor, as shown in the diagram. Length of the twin lead and whether or not the wires at one end are connected together is determined by the frequency of the interference.

There are a few precautions. Tuning of the trap is very sharp. Therefore, it is easy to pass by the right spot. Tune slowly with a non-metallic tool and watch the picture for minimum interference.

Because the trap is an absorption type and is made of twin lead, it must be used with twin lead (either

before the set, or between the back of the set and the tuner) by taping it flat against the twin lead. For maximum attenuation, tape it tight at all points. Or add plastic tape as a spacer between trap and twin lead, if less attenuation is desired.



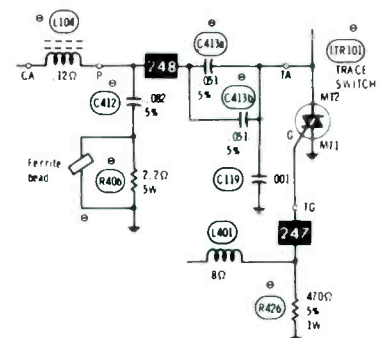
CH 2-6 6 To 8 INCHES  
FM 6 INCHES  
CH 7-13 3 INCHES  
UHF 5 INCHES (OPEN END)

One trap should remove all FM station interference. However, TV stations splatter over a wider bandwidth. So two traps, stagger tuned, might be required to eliminate interference from a strong TV station. Sometimes it is necessary to slide the trap to a different point of the down lead to obtain the maximum effect.

## Horizontal squeal RCA CTC62 color TV chassis (Photofact 1345-2)

The symptom can vary from chassis to chassis. It might be horizontal off frequency, loud squeal, or a "torn up" raster. The severity of symptoms might vary with the brightness control setting or with no-signal/signal conditions.

One possibility is that either C413A or C413B has opened. Except for early-production sets, each of the two .051 microfarad capacitors is made up of two .0255 capacitors packaged in parallel.



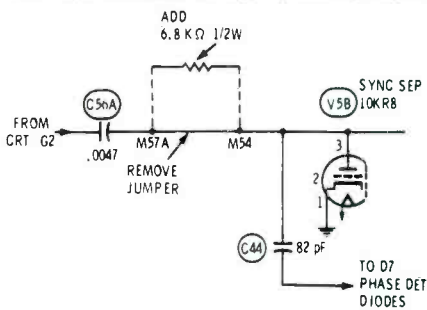
recommended you use only the correct RCA part number for replacements. Many ordinary capacitors run extremely hot in this service.

### Modification To Stop Failure Of Phase Diodes

Philco B-W TV's PR-4247 and PR-4268 (Photofact 1241 and 1395-2)

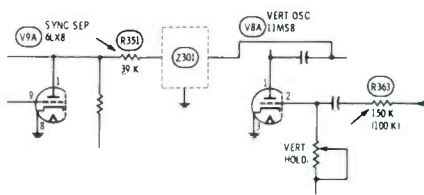
An arc path from the picture tube back through the vertical-blanking circuit at G2 might ruin the D7 horizontal phase diodes.

Add a 6.8K resistor, as shown in the diagram, between lugs M54 and M57A to minimize the possibility of future diode failures. Remove the



jumper lead from between those lugs, use insulating sleeves on the added resistor, and dress the resistor away from any wire ends on the panel.

### Improvement Of Vertical Hold Panasonic AN-96 and Other B-W TV (Photofact 1146-1)



To improve the vertical locking in fringe areas, change R351 from 39K to 22K, and change R363 from a 150K or 100K resistor to a 82K resistor and a 20K thermistor connected in series. The Panasonic part number for the thermistor is: ERTD3FHL203S. Panasonic is located at 10-16 44th Drive, Long Island City, New York 11101. □

give to the  
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# readers'exchange

Need a not-available schematic? Need an obsolete part? Have an unusual service problem and want help? Send information and full mailing address to ELECTRONIC SERVICING. Other ES readers should send replies with their offer of help direct to the writer. We reserve the right to edit and print all letters sent to this column. **Let us help one another.**

**Needed:** Schematic and tube tester guide book for model 157 accurate tube checker.

Texas TV  
2344 Bartlett Street  
Houston, Texas 77006

**Needed:** The adapter "Gidget" that enables you to play a four-track tape on an eight-track player, or information about where to buy one.

S. A. Elosh, Jr.  
231 Gladstone  
Campbell, Ohio 44405

**Needed:** Service diagram and parts list for Elegant stereo model 6390.

C. A. Headley  
P.O. Box 4096  
Montgomery, Alabama 36104

**Needed:** Information on the design and operation of scoreboard clocks.

Wilbur Elks  
Thomson TV Company  
121 West 3rd Street  
Wahington, North Carolina 27889

**Needed:** TV5DA genometer, made by Superior Instruments.

Ed Martin  
830 Stedwell Street  
London, Ontario N5Z 1L8

**Needed:** Schematic for a Philco-Transitone model CT2-CT5 car radio.

Stout Repair  
Route 6, Box 73  
Asheboro, North Carolina 27203

**Needed:** Power transformer for a GE stereo. The part number is EA88X26; the number on the transformer is 112B3944-2. Also need a power transformer for a Triplet model 3441-A scope, part number T-23B-91; or will sell the scope as is.

J. R. Garcia  
8026 Cinch Drive  
San Antonio, Texas 78227

**Needed:** 24.100 MHz crystal for an Olson Spotter CB radio.

Ed Kersul  
Box 43  
West Winfield, Pennsylvania 16062

**Needed:** Schematic for an Eico tracer PS-1.

S. Stanton  
428 West Roosevelt Blvd.  
Philadelphia, Pennsylvania 19120

**Needed:** Contact with shops that service police "Speed-timer" traffic radars.

Electronic Specialists, Inc.  
171 South Main Street  
Natick, Massachusetts 01760

**Needed:** FM stereo multiplex adapter, either Heath AC-11, Scott 335, or an equivalent.

Leland Wells  
545 Ridge Road  
Wethersfield, Connecticut 06109

**Needed:** Schematic and operating manual for a Jackson television sweep-marker signal generator model TVG-2.

Edwin H. Gackstatter  
P.O. Box 332  
Guymon, Oklahoma 73942

**Needed:** Schematics for two old radios, Philco model 42-1008 code 122, and General Electric model K-64.

ETC Dennis F. Saunders, Sr.  
Fleet Electronic Calibration Facility  
NavSuBase, Box 300  
Groton, Connecticut 06340

**Needed:** Schematic and operating instructions for an Eico signal tracer model 147A. Will buy or copy and return.

J. A. Pruett  
Route 4, Box 51E4  
Forrest City, Arkansas 72335

**Wanted:** New or used CB radios—Pearce-Simpson "Companion" I and II and Vocaline model ED27M.

Apache Communications  
Route 1, Box 378Q  
Lake Placid, Florida 33852

**Wanted:** Muntz tape players and recorders with the following model numbers: A-12, M-60, AR-500, and HW-512. State price and condition.

S. A. Elosh, Jr.  
231 Gladstone Street  
Campbell, Ohio 44405

**For Sale:** Triplet pocket VOM model 310, RCA sweep generator model 59C, and Simpson field strength meter model 488; all with operating instructions.

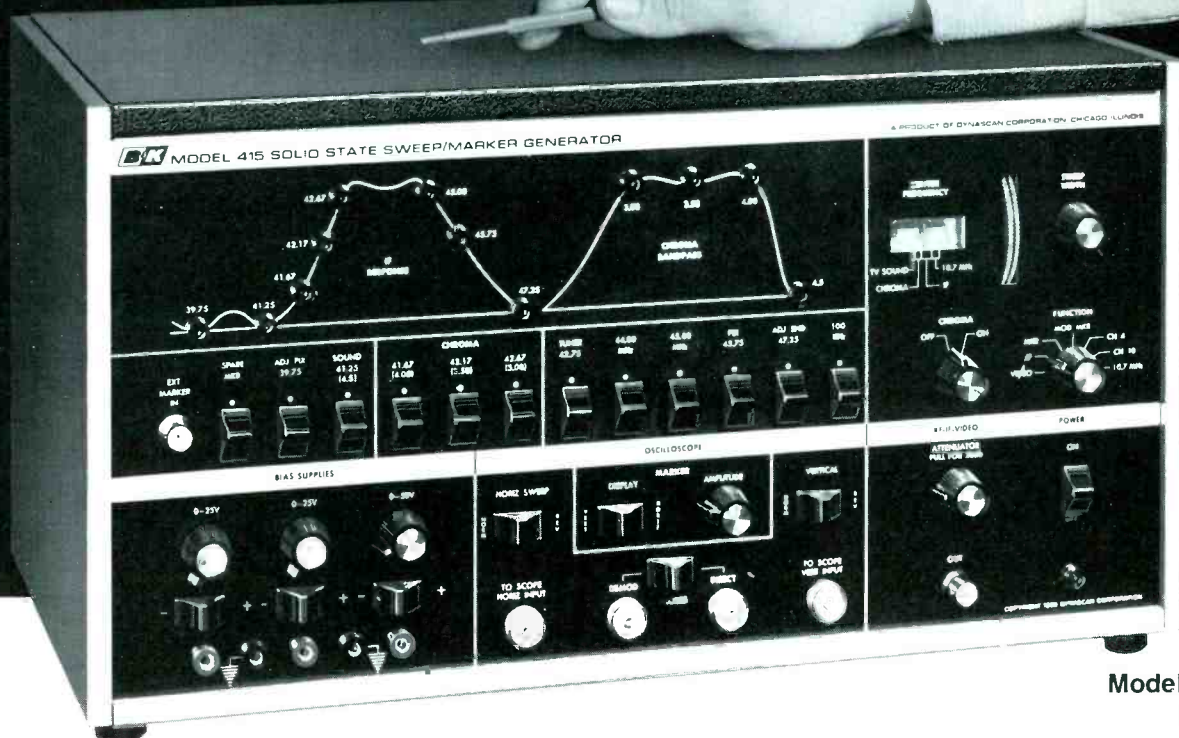
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Port Arthur, Texas 77640

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Troch's Television  
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□

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**Model 415  
\$440**

I used to hook up a separate sweep generator, marker generator, marker adder and bias supply, hope that everything was properly calibrated and adjusted, and pray that the alignment would hold after I disconnected the cables draped all over the bench.

I didn't do it very often.

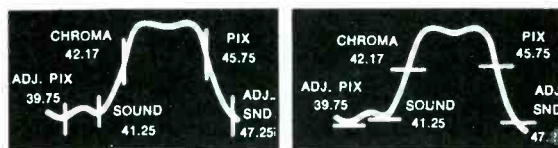
Now, in the time it used to take me just to set up, I can almost complete an alignment. And I'm confident the set will perform as well as it possibly can. My customers notice, too. That's the difference B&K's 415 Solid-State Sweep/Marker Generator made.

Setup is no problem. After I connect the 415's outputs to my scope (there's even low-frequency compensation to eliminate pattern errors), I connect its RF outputs (channel 4 or 10) to the antenna terminals or mixer test point, the direct probe to the video detector test point (or anywhere else after the video detector diode) and the demodulator probe to the bandpass amplifier output.

They're all clip-on connections, and the 415 comes with all the accessories I need. Once I've made the initial signal and bias hookups, there's nothing else to connect or reconnect. All interchanging changes and generator functions are controlled from the front panel. There's even a 15,750Hz filter to eliminate disabling

the set's horizontal output section.

Shaping the waveform is easy, because the 415 has 10 crystal-controlled IF markers, each of which lights up on the front-panel waveform diagram as it is used. Markers can be shown either vertically or horizontally on the scope trace. There's a 100kHz modulated marker that makes nulling the traps so easy it's almost automatic. And three low-impedance, reversible-polarity bias supplies—two, 0-25VDC; one, 0-50VDC.



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# How to shop for money

By Joseph Arkin, CPA

*The selling price of borrowed money can be high or low, depending on where you obtain it.*

Almost every electronic shop owner is forced at times to operate on credit, or loans. Since money is "tight" now and interest rates are very high, it's time for careful financial planning.

Money is a commodity, and you "buy" it as you do any other product. How much you pay depends on how good you are at shopping. The first step in obtaining a cheaper rate is to understand the **true** interest rate being charged.

The following information about various sources of loans contains pointers for reducing your interest costs.

## Bank Loans

Despite the furor over tight money, banks continue to make loans, and most solvent business firms can obtain them on the basis of their financial statement. However, the cost depends on the method of borrowing.

Most popular, from the bank's viewpoint, is the discount loan. For example, if you borrow \$1,000 at 6% for one year, the bank deducts \$60 and credits your account for \$940. Then you pay back \$83.33 each month for 12 months. This seems very straightforward, but the true interest is **not** 6%.

Because you did not receive the full amount (in effect, you made a payment the same day you obtained the loan), and you paid it back in monthly installments (rather than a lump sum at the end of the year), the true interest rate is approximately 12% per year. Also, in some cases, you might be required to pay for extra life insurance and filing fees.

Another method is the "add-on" type in which you repay the money plus the agreed-upon interest. Thus, \$1,000 at 6% per year is repaid at the rate of \$88.33 for 12 payments. That's slightly less than 12% effective interest.

The least-expensive form of bank loan is the straight business type where you borrow money to be repaid with interest in one lump sum. A \$1,000 6% loan for one year

would be repaid in full (\$1,060) at the end of the 12-month period. The effective interest rate in this example is 6%.

## Borrow on Possessions

You also can borrow on the collateral of your personally-owned or business-owned vehicles. If you're buying a new auto or truck, the interest rate will be low. But because payments are made monthly, the true interest rate is almost double the discount rate quoted.

Or, you can hypothecate securities owned by you or by your business. Most banks will loan up to 70% of the market value of listed securities, some over-the-counter stocks, and most mutual-fund shares. In most states, the usury laws limit the maximum rates that can be charged on loans. But some states allow higher rates for loans secured by the pledge of securities.

## Factoring

Pledging of a firm's accounts receivable is a relatively simple way to obtain money. But the method is costly, and only those firms with a

*(Continued on page 22)*

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Stable waveforms, displayed on an 8 x 10 cm crt, are easy to view, even under unfavorable ambient light conditions. Two identical input channels simplify generation of X-Y displays. This is particularly useful in analysis of vector patterns.

**Application versatility.**

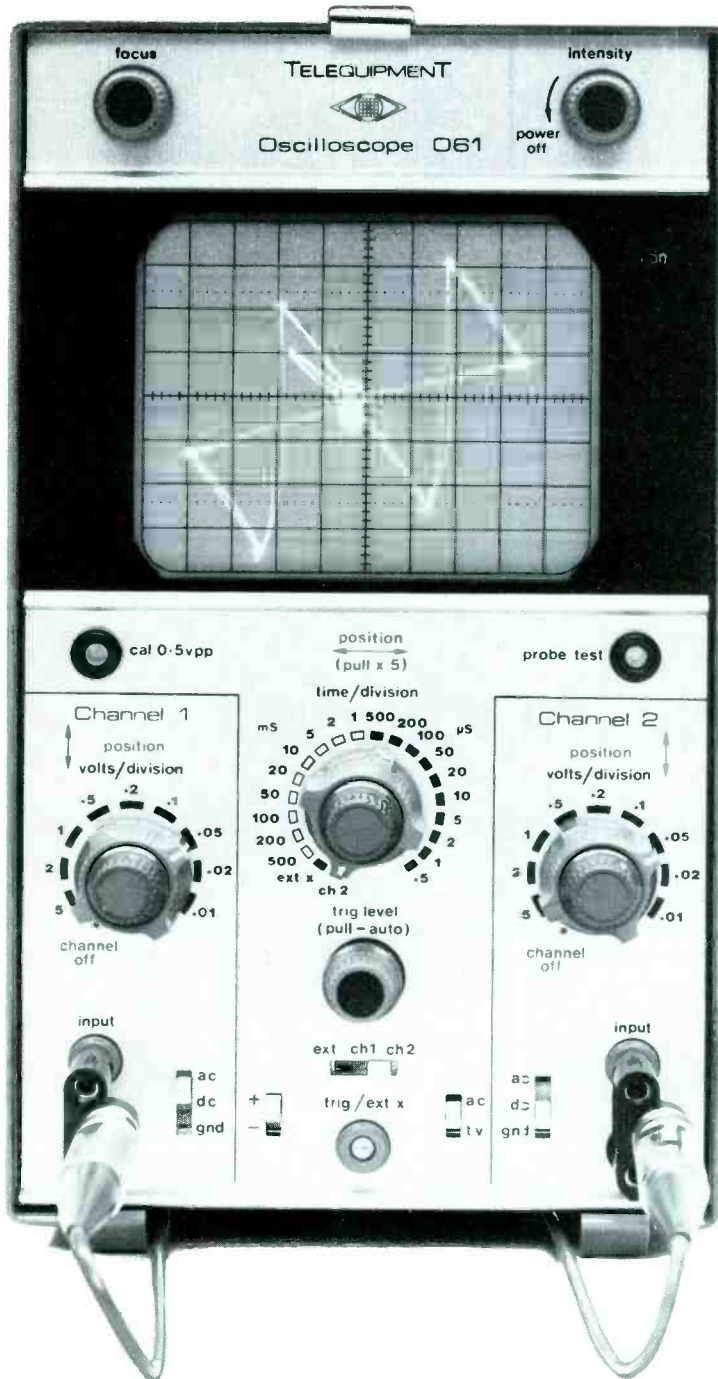
Because of its X-Y capability, the D61 simplifies alignment and troubleshooting of color television sets. Its performance equals or exceeds the requirements for servicing audio equipment, pocket calculators, public safety control, alarm, and communications systems, microwave ovens, digital clocks, and similar consumer electronic products.

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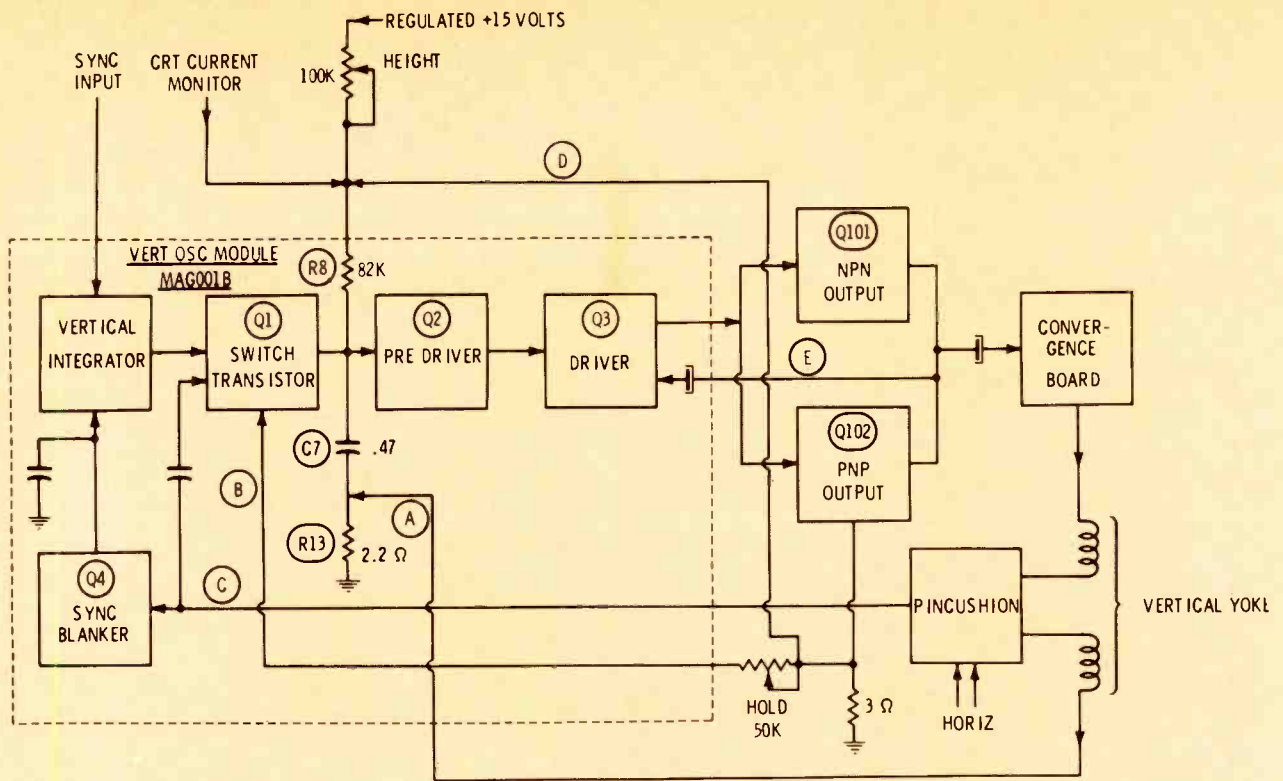


Fig. 1 Block diagram of the RCA CTC46 chassis (Photofact 1278-3) showing the stages and the feedback loops.

# Repair methods for RCA solid-state vertical

By Carl F. Moeller

*The distinctive differences between tube and solid-state circuitry are most noticeable in the deflection stages of television receivers. Also, in these areas are found more differences between brands and models than was true of tube circuits. Therefore, we are covering separately the various models. This month the subject is RCA XL-100 solid-state vertical sweep.*

Low-level parts of the vertical deflection circuit in chassis of the RCA XL-100 series of solid-state TV receivers are mounted on a module. But the output transistors, control circuits and the load are found at various points on the main chassis.

## Circuits On The Module Replacement of the MAG001B

module corrects any problems of the original unit. Therefore, the following description of the operation will be brief.

Vertical retrace is started when Q1 (Figure 1) is driven into conduction by either a sync pulse or a signal from feedback loop "B". This conduction discharges capacitor C7, removing the forward bias from Q2 and Q3 so they are cut off. The resulting maximum positive collector voltage of Q3 saturates the NPN output transistor, Q101, and cuts off the PNP output transistor, Q102. Notice that the two output transistors are connected in a complementary-symmetry circuit which is similar to many output stages in stereo amplifiers.

Electron flow is maximum through R13 on the module, through the yoke and pincushion

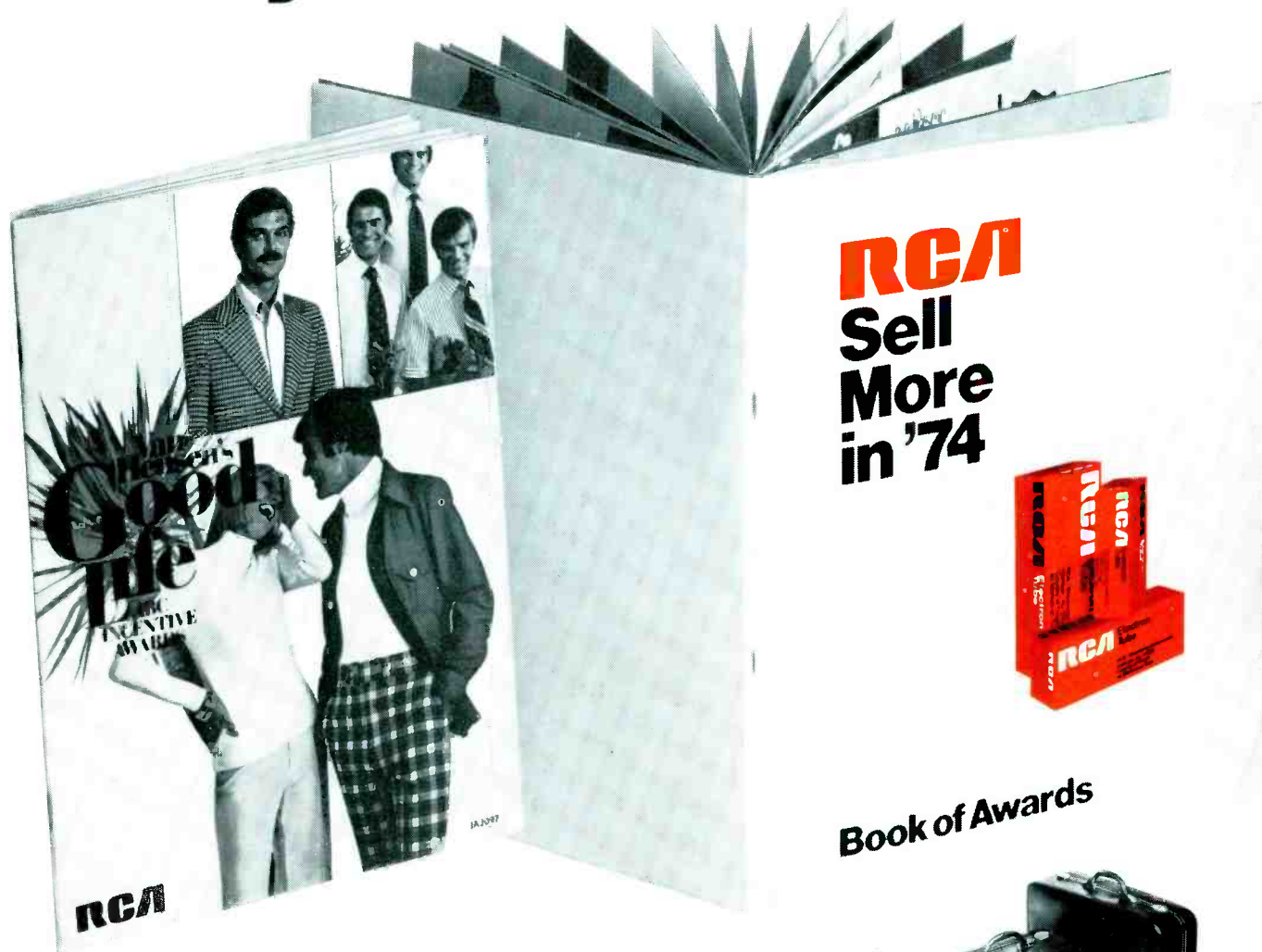
circuitry, and continues through the NPN output transistor to the B+ supply. This current drives the sweep from the center of the screen up to the top.

During the retrace interval just described, a positive-going retrace pulse is generated by the inductance of the yoke windings, and part of it is fed back to the module via feedback loop "C". The leading edge of the pulse drives Q1 hard into saturation (to decrease its turn-on time), and also saturates Q4 so its collector resistance grounds out the sync. Grounding the sync prevents "second triggering" from any noise which might be present with the sync. The trailing edge of the retrace pulse drives both Q1 and Q4 back into cutoff.

As soon as Q1 is cut off, C7 begins to charge through R8 and the height control towards B+ volt-



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## RCA

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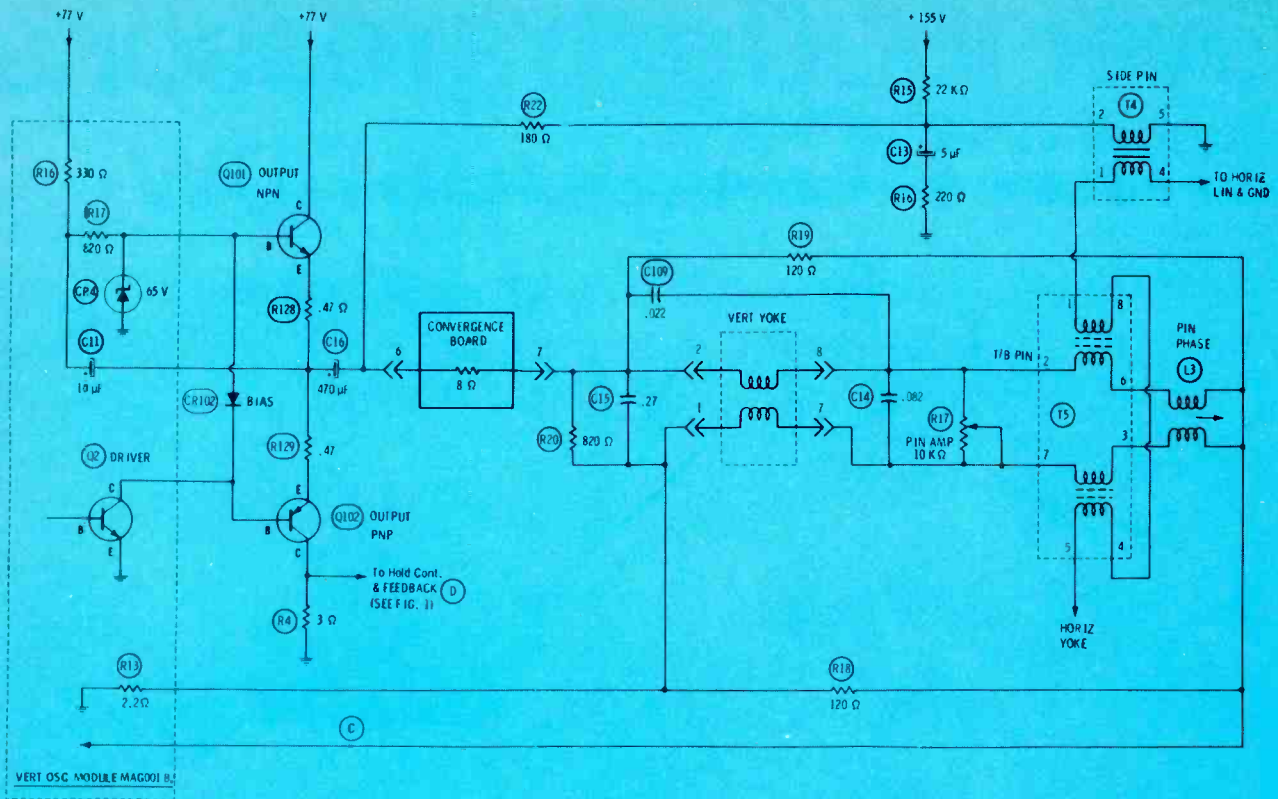


Fig. 2 Output transistors, yoke, and pincushion circuits of the RCA CTC46 chassis.

age. Q2 and Q3 begin to conduct, and the voltage at the collector of Q3 slowly begins to decrease. Because the time constant of C7 and R8 plus the height control is long for the amount of time involved, the voltage decrease is very linear.

Feedback loops "A" and "E" improve the linearity enough that a linearity control is not needed. A detailed explanation of the operation of the output transistors follows shortly, but first we will consider some additional facts about the actions in the module.

#### Operation with no sync

Of course, the oscillator must continue to operate even when there is no vertical sync. Therefore, a turn-on pulse for Q1 must be obtained from the yoke circuit. As sweep approaches the bottom of the raster, conduction of the PNP output transistor is increasing towards maximum, and voltage in feedback loop "B" also is rising. When it reaches a critical value, Q1 is turned on to begin the retrace. Thus, without sync pulses, the vertical sweep system operates as a free-running oscillator.

#### Function of the height control

The resistive value of the height control determines the amount of voltage charge C7 can accept in the time allotted. In pulse circuits, the amount of voltage determines the amplitude of the pulses. An increase of resistance reduces the voltage at C7 and reduces the height. A decrease increases height. (These actions are the reverse of what happens in class "A" amplifiers, where a higher load resistance increases the gain of the tube or transistor.)

For better stability, the B+ source for the height control is regulated. Purposes of the other two connections to the height control will be explained later.

#### Vertical Output And Load

Figure 2 shows the vertical output stage, and the yoke circuit of the RCA CTC46, the first modular console chassis. Later models have some changes, but the general operation is the same.

#### Output stage

Q101 and Q102 operate as a complementary-symmetry push-pull output stage. Their base drive is a

sawtooth waveform which is maximum positive at the end of retrace. Therefore, Q101 conducts during scan of the upper half of the raster, and Q102 conducts during the lower half of the scan. CR102 diode provides a voltage offset between the two bases to minimize crossover distortion that might occur during the center of the raster. Zener voltage regulator, CR4, on the module limits the maximum positive drive to the base of Q101. This limit of 65 volts prevents excessive current during retrace.

R128 and R129 limit to safe amounts the maximum emitter currents of the two transistors; similar resistors are used in audio amplifiers.

Two purposes are served by R4. In addition to acting as a fuse in the event the output transistors short, the resistor develops a pulse voltage which is fed through the feedback loop ("B" in Figure 1) to trigger oscillation of Q1, and also goes to the height control (loop "D") to improve linearity at the bottom of the raster.

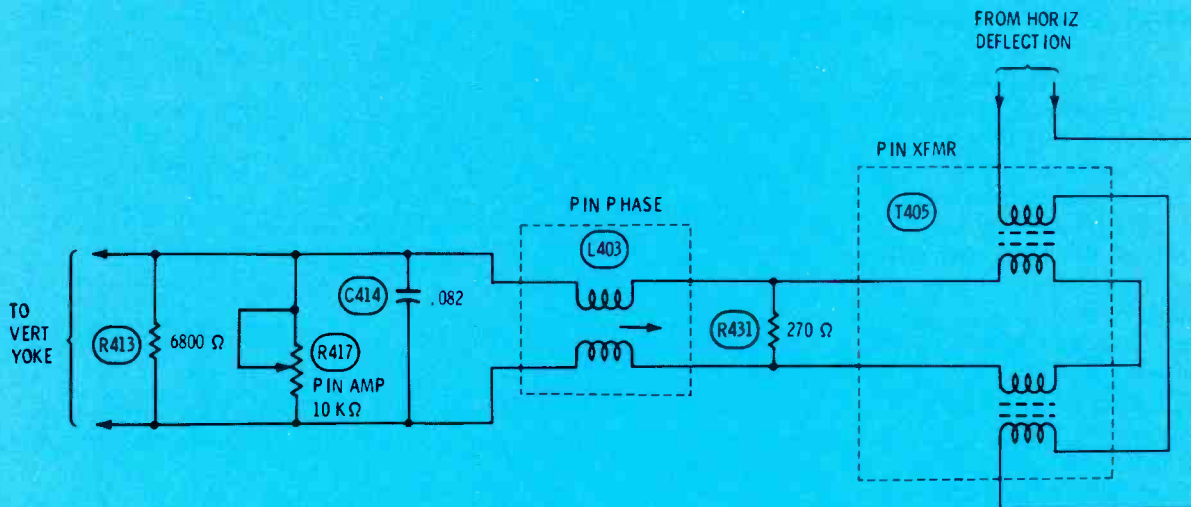


Fig. 3 The RCA CTC58 has one pincushion-correction transformer to accomplish both top-and-bottom and side correction (Photofact 1365-1).

#### Troubleshooting the output stage

The most-likely failure in the output stage is shorted transistors. If either shorts, it's likely the other transistor also will short because of the overload. This blows R4 (located on the PW-600 control board), which removes the short from the power supply. R4 is mounted in "plated-through" holes, and can be unsoldered without removing the chassis from the cabinet. (In the CTC60, R4 is identified as R221.) The output transistors are socket-mounted and secured by screws.

Because R604 is used as a fuse, it's important to use an exact replacement to prevent a future fire hazard. When installing the transistors, be sure the insulating spacers have not been ruptured. Also, use ample heat-sink compound (silicone grease) to prevent overheating and delayed failure.

Shorts in the output transistors can cause secondary failures on the oscillator module. For example, a base-collector short in Q101 applies 77 volts directly to CR4, the zener regulator, causing it to burn open. Then if new output transistors are

installed when CR4 is open, it is likely they will fail within the next few hours or weeks.

Always check CR4 for an open before replacing the output transistors, and always check the output transistors for shorts before installing another module. CR4 is connected to terminal 6 of the module, and it can be checked in the diode forward-conduction mode with an ohmmeter.

If both output transistors are shorted from collector-to-emitter, the driver transistor is likely to open. This will not damage the new replacement transistors, but it will eliminate the deflection. Use an ohmmeter to check Q3 for continuity. It's the only transistor on the module having a heat sink. Incidentally, check to make sure this heat sink is secure, and that sufficient compound is there to remove the heat.

CR102 occasionally might fail. If it opens, there will be no vertical deflection. If it shorts, a barely-discernible white horizontal bar about one-half inch tall will appear in the center of the raster. To test the diode, remove the module and

measure the resistance between terminals 4 and 6.

#### Convergence board

In this system, all of the vertical yoke current passes through the convergence circuits. Thus it's possible for an open in the convergence wiring to kill the deflection. Because several current paths go through the board, it's not likely that a component would stop all deflection. An open connection is far more probable. Pull out the convergence plug from the socket and measure the resistance between pins 6 and 7. About 8 ohms is normal. While you have the plug removed, check C16 with the ohmmeter by connecting it from convergence socket terminal 6 to module terminal 8 (remember terminal 1 is at the top). A normal 470-microfarad capacitance produces a very pronounced "kick" of the pointer.

#### Yoke and pincushion transformers

The complete path from the convergence board first is through one yoke winding (see Figure 2), through a winding of the top-

bottom pincushion transformer, T5, through both windings of the pincushion phasing coil, L3, next the second yoke winding, and finally to ground via R13. Total resistance of this path is about 20 ohms.

Top-and-bottom pincushion correction is accomplished by filtering some of the horizontal sweep signal and applying it to the vertical yoke coils so the height is increased at the center of the raster.

Correction of the side pincushion is the function of T4. Part of the vertical scan voltage is filtered and reduced in amplitude by R22, R16, and C13, and applied to the primary of T4. Bias current from R15 sets the operating point. The primary voltages and currents cause T4 to become higher in impedance at the top and bottom of the raster, thus decreasing the width there.

Each vertical yoke winding should read about 8 or 9 ohms, and the two windings should show identical resistances. If you suspect a short to ground, remove the module and again check the resistances to ground. There are several alternate paths to ground — through R18 and R19 (damping resistors), R20 and R22 — so pull the plug of the convergence board and the module. Resistance from terminal 7 of the convergence socket to ground should be several thousand ohms. A lower reading indicates a short or leakage.

If you suspect some defect of T5, L3 or T4 is bothering either the vertical or the horizontal sweep, you can eliminate all of them. Just connect a jumper wire across R17, the pin-amplitude control, and another from pin 5 of T5 to pin 4 of T4. Try one jumper at a time to determine which components are affected. Of course, the jumper across R17 eliminates top-and-bottom correction, and the other jumper eliminates both top-and-bottom and side pincushion correction.

#### Circuit variations

The CTC46, CTC54 and CTC60 have separate transformers for top-bottom and side pincushion correction. In the CTC48, CTC58, CTC64

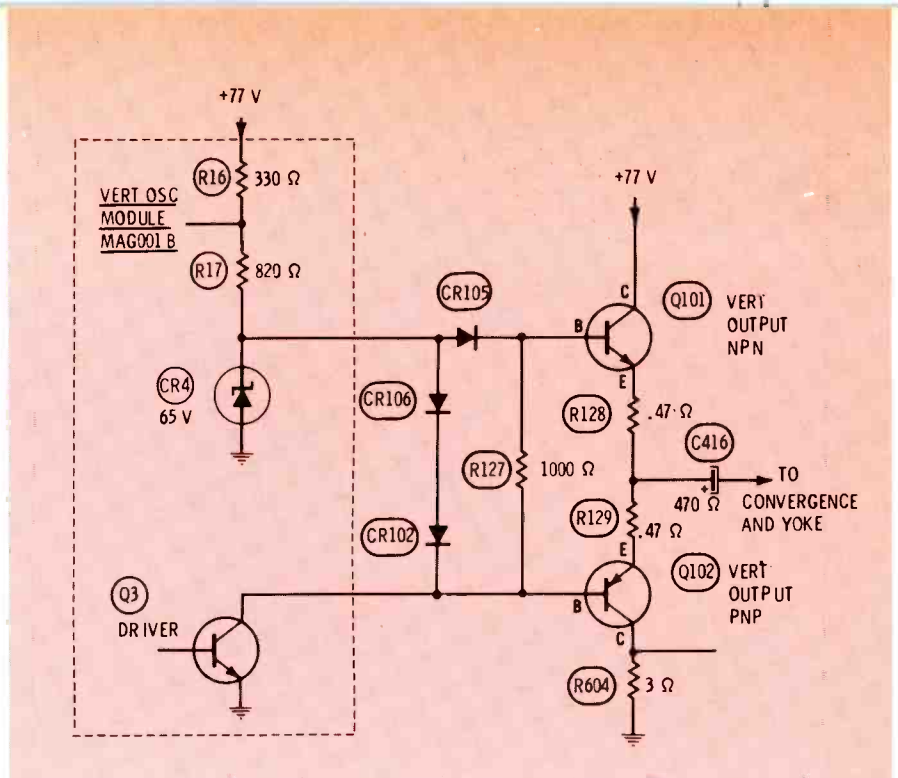


Fig. 4 Some models add two diodes and a resistor between the bases of the two output transistors.

and CTC68 chassis, one dual-function transformer and circuit does both (Figure 3). Vertical-sweep current changes the inductance of T405 to vary the width for side correction. At the same time, the horizontal-sweep current through T405 supplies horizontal pulses for correction of the top-bottom pincushion condition.

Additional protection for the output transistors is provided (Figure 4) by a circuit change in the CTC58, CTC64, CTC68 and CTC71 chassis. The single diode between the bases of the output transistors has been replaced by three diodes and a resistor. CR105, CR106, CR102 and R127. CR105 blocks B+ from the zener, CR4, in the event of shorted output transistors.

The other two diodes and the resistor more closely control the offset voltages between the two bases, and minimize "common-mode current". Common-mode current is any current flowing directly from one transistor to another without passing through the load circuit.

#### Height-Control Circuits

Figure 5 shows details of the height-control circuit of Figure 1, referred to before. Remember that any condition which makes the voltage at the collector of Q1 more positive increases the height.

**The height control itself is the first component to be tested if the height is insufficient. Next, be sure the 15-volt supply is correct.** This supply also feeds several other circuits, so an overload elsewhere might be pulling down the voltage.

Also, the regulated 15-volt supply, in turn, comes from the 30-volt main supply, which is regulated by a zener located on the signal-circuit board. Other loads on the 15-volt supply are the tuner, tuner AGC, brightness limiter, and the collector supply for the second video amplifier. Several of these are off the main chassis, so considerable wiring is involved. Also note that the junction of R9 and the height control leads to the service switch. In the service position, that point is grounded to collapse the vertical sweep. Leakage from switch to ground can reduce the height.

The feedback loop labeled "D" in Figure 1 consists of R5, R6, and C5. During the top half of the vertical scan, the voltage developed across R4 is zero. It's a positive-going sawtooth during the bottom half of the deflection. A fraction of this voltage is fed back to the height-control circuit to improve the linearity by stretching the lower half of the raster. Therefore, a shorted capacitor or open resistor can cause a slight compression at the bottom of the picture.



## Shop For Money

(Continued from page 14)

high gross margin of profit can ever consider it.

Most factoring is done on the basis of assigning sales invoices to the factor in exchange for an advance against future payments. Let's say your agreed-upon rate is 1½%. Then on \$1,000 of bills assigned, the factor will advance \$788. (That's \$1,000 less \$200 reserve equals \$800, and \$800 less 1½% equals \$788.) The 1½% charge is good for 30 to 45 days after which the uncollected account is charged back against the reserve account; or there is an additional charge of 1½%. On any unpaid balance there is an additional charge of ¼% to ½% per month.

Factoring can be obtained on a notification basis (customers pay directly to the factor) or non-notification basis where customers remit to you, and you in turn give the checks over to the factor who endorses them in code (with prior arrangement with the bank) and deposits to his account.

### Insurance Loans

Low-cost loans can be obtained by borrowing against the cash values of your insurance policies. Borrowing this way is easy, for there is no credit investigation, no financial statements to prepare, and very little paper work. And, you can practically dictate the terms of repayment. Rates vary, but usually you can borrow at 5% or 6% true interest rate. Veteran Administration loan rates usually are cheaper than those of private insurance companies.

If you want to make periodic repayments, the loan will be reduced and the interest charge lowered accordingly. Of course, the proceeds of the policy at death are reduced by the amount outstanding of the loan, but many companies will allow you to purchase term insurance on the amount of the loan, as added protection.

### Passbook Loans

Some people cannot understand why a person would borrow his own money from a savings bank and

pay interest for the privilege. People do this for the same reason that they open Christmas Club accounts which do not pay interest: They want and need a form of compulsion to save or repay themselves!

It is relatively simple to borrow on a savings passbook, leaving it in the custody of the bank during the term of the loan. Deposits can be made, and withdrawals, too, so long as the amount remaining is in excess of the balance of the loan. You pay a higher interest rate than the amount you receive as interest from the bank on your savings, but the cost is reduced because of the tax advantage. Suppose your savings account is earning 5¼% (taxable to you as income), and you borrow at 6¼% (tax-deductible to you as interest); your entire cost is only 1% less whatever you save on federal, state and local income taxes. Also, you don't break the continuity of your earning interest, if your need for money comes in the middle of an interest period. Therefore, the loan costs very little.

This type of loan is repayable periodically, or in a lump sum, at your option.

### Home-Mortgage Refinancing

Homes purchased years ago have a considerable amount of equity because of payments made, and also due to the inflationary trend that has boosted land and building values during the past several decades.

Although mortgage money is not plentiful, it shouldn't take too much shopping to locate a savings bank, savings and loan association, commercial bank, or insurance company which will refinance your existing first mortgage.

This method of obtaining cash is costly. The new mortgage will be at the present interest rates, probably higher than the original rate, and you'll be paying it not only on the new money obtained, but on the remainder of the old loan.

Also, you'll have to pay legal fees to the lender and to your own lawyer, and make payments for title policy, title closing, and mortgage filing fees. This could cost as much as \$1,000 plus the increased rate of interest. On the other hand, you would be spreading the additional cost factors over a long, long period

of time.

### Public Offering

The era when nearly everyone made a public offering of stock has been turned off by the poor performance of "new issues" and the recent sell off and steep decline of stock market prices. Purchasers are wary now, and it's becoming harder to market unseasoned securities.

### Loans From Credit Unions

You must be a member of the credit union to borrow, but usually it is easy to acquire membership. Interest rates are 12% or more per year, and they'll ask for co-signers. Also, most have maximum limits.

### Loans From Employees

You might be able to borrow from employees who know the solvency of your business. Offer debenture bonds or promissory notes. There is one inherent problem: after investing, the employee might consider himself a partner and want a voice in running the business.

### Small-Business Administration Loans

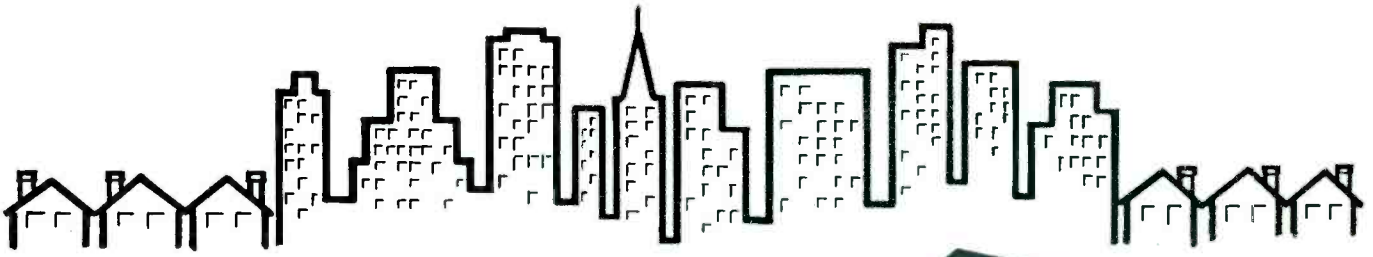
Three types of loans are available from the SBA. The first of these is the direct loan where the applicant first must have tried, without success, to obtain financing from banks or other lending institutions. The ceiling is \$100,000. Second is the guaranty loan, in which the SBA will guarantee up to 90% of the loan (ceiling \$350,000). The third kind is the participation loan where a conventional lending institution furnishes 25% or more of the amount, with the SBA supplying the balance.

There is considerable red tape involved in the procurement of loans through the SBA. For one thing, there's a detailed questionnaire requiring the profit-and-loss figures, balance sheets, and retained earnings for a five-year period.

In addition, the principals must submit personal statements of their assets and liabilities, with the requirement that they (and their wives) personally guarantee the loan and its repayment.

The SBA has helped many small

(Continued on page 57)



# Announcing the WINEGARD METRO-LINE TV-FM DISTRIBUTION AMPLIFIERS

...the first high input,  
high output, low-cost  
MATV system amplifiers  
for strong signal areas



Winegard's new Metro-Line amplifiers are specifically engineered to accommodate strong signals and eliminate overload economically and efficiently. Because they have the same commercial quality construction and circuitry as the DA-830, DA-825B and DA-815, they are ideal for home, hotel, apartment and office building systems.

Check these other important performance features:

- High output capability makes a Metro-Line your best db buy
- High input solves distortion and overload problems common in strong signal areas
- Lightning protection diode
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- Extended band pass (54 to 300MHz) includes mid and super band coverage making Metro-Line approved for CATV use
- Eliminates multiple outlet charge for extra sets or MATV systems on cable TV
- UL listed
- Easy for any competent TV service dealer to install
- Choose from 3 VHF-FM and 2 VHF-UHF-FM models; suggested list prices from \$30.85 to \$47.30

		DA-203	DA-205	DA-215	DA-803	DA-805
OUTPUT PER CHANNEL*	VHF	46dbmv	46dbmv	53dbmv	43dbmv	45dbmv
	UHF	NA	NA	NA	35dbmv	35dbmv
INPUT PER CHANNEL*	VHF	31dbmv	31dbmv	40dbmv	31dbmv	31dbmv
	UHF	NA	NA	NA	26dbmv	26dbmv
GAIN	VHF	15db	15db	13db	12db	14db
	UHF	NA	NA	NA	9db	9db
IMPEDANCE		300 ohm	75 ohm	75 ohm	300 ohm	75 ohm
Bandpass	VHF	54 to 300MHz	54 to 300MHz	54 to 300MHz	54 to 300MHz	54 to 300MHz
	UHF	NA	NA	NA	470 to 810MHz	470 to 810MHz
NOISE FIGURE	VHF	4.2db	3.3db	4.8db	4.3 db	3.3db
	UHF	NA	NA	NA	10.0db	7.3db
POWER REQUIREMENTS		117VAC, 60Hz, 2.3 watts	117VAC, 60Hz, 2.3 watts	117VAC, 60Hz, 2.3 watts	117VAC, 60Hz, 3.5 watts	117VAC, 60Hz, 3.5 watts

\*7 channels VHF, 5 channels UHF      0.5% Cross Modulation

For additional information and sample system layouts, request New Product Bulletin No. 24.



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Winegard Company / 3000 Kirkwood Street  
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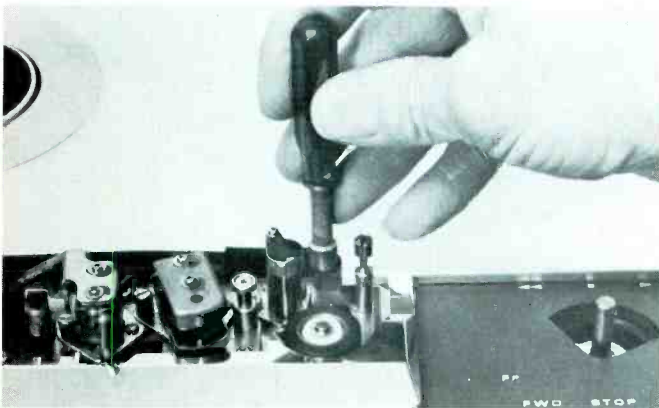
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Forest H. Belt's

# Workshop on Hi-Fi tape recorders

Part 1 By Dewey C. Couch

Your enthusiastic reception of Mr. Belt's Record Changer Workshop series indicated that more coverage by picture stories was needed. Here is the first installment of the new series about repairing open-reel hi-fi tape recorders.



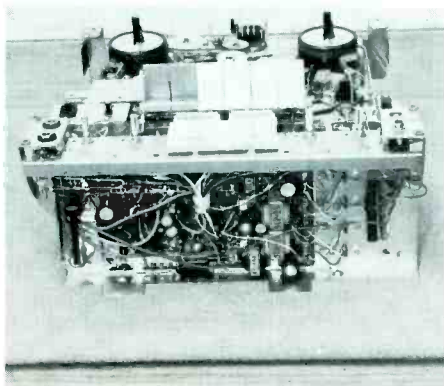
Troubleshooting and repairing hi-fi tape recorders can present real problems when you're not familiar with the mechanisms. It isn't easy to "see" how all those slides, levers, wheels, belts, and buttons work together to record or play a tape.

Yet, you can learn to do it; and you don't need special talents or a knack for mechanical troubleshooting. To finish a competent repair job on any open-reel tape recorder, you do need two things: a detailed knowledge of **what** all those mechanical gadgets are doing, and a fundamental **approach** to servicing (one that adapts to any mechanism). First, let's discuss the "approach".

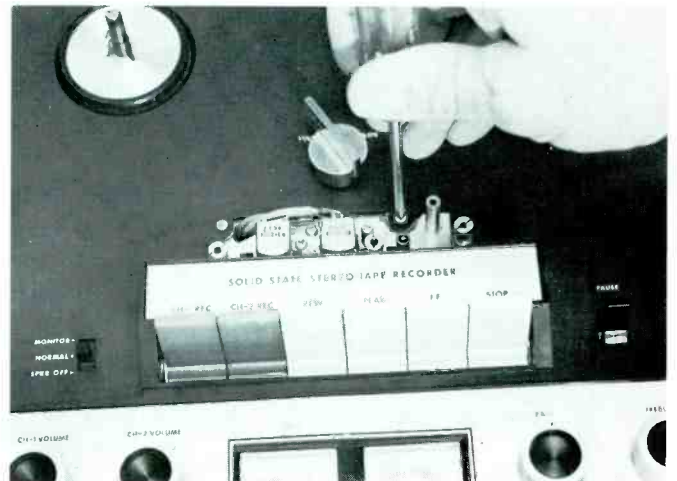
You can't do the whole servicing job in one step. Experienced technicians divide mechanical troubleshooting into five stages: cleaning, visual inspection, testing, adjustments, and diagnosis. In Part 1 of this new Workshop series, we'll cover the first two. You'll see what thorough cleaning involves. Lubrication goes along with cleanup, but don't overlubricate. Use oil or grease sparingly, but **don't** use graphite (it migrates). Some faults will clear up during the cleaning process; you don't even have to bother testing for them. Other faults might be uncovered by visual inspection, to be explained later.

Now, follow the various steps, and see—in sharp closeup photos—how you logically can approach tape-recorder servicing.

A soft foam-rubber service mat is handy for troubleshooting tape recorders. It guards the working surface of your bench. More important, it protects the mechanism. Best of all, it catches screws, washers, and other tiny parts you might drop.



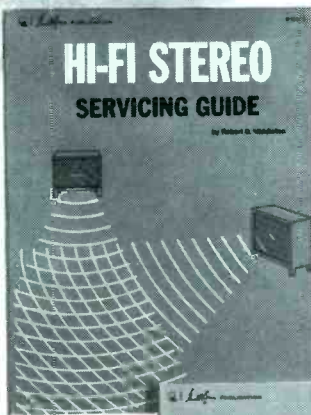
**Step 1.** All mechanical equipment collects dust, which imbedded in old hardened grease might bind certain moving parts. To get at the parts for cleaning, you'll have to expose the mechanism by removing it from the cabinet. As a first step, remove all control knobs and the head cover. Generally, knobs are push-on types. Grasp them firmly and pull straight up. Avoid tilting the head cover during removal, it's usually plastic, and the mounting posts could break easily.



**Step 2.** Remove the top or front panel. It's usually held by four corner screws. Watch out for screws hidden under the head cover or beneath certain knobs. Carefully work the front panel up and over any control shafts or other protruding parts. Don't try to force it. Most panels are thin metal and bend easily, or plastic that can chip or break.



# The more specialized your field, the more you'll need these books

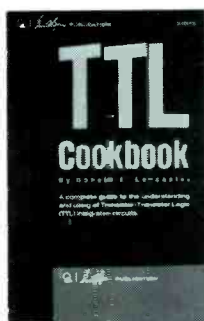


## HI-FI STEREO SERVICING GUIDE— 2nd Edition

by Robert G. Middleton

Anyone servicing a-m tuners, fm tuners, stereo-multiplex units, and audio amplifiers can gain valuable service direction and assistance from this guide. It also covers hi-fi speaker installations, system evaluation, troubleshooting, and methods of verifying test equipment performance. 104 pages, softbound. No. 21075 \$4.50

cuited logic electronics. This practical book helps him over that hurdle. It opens with a necessary explanation of the binary number system and Boolean algebra and progresses logically to the practical problems and limitations involved in preparing to work in this new field. A glossary of digital terms is included. 160 pages, softbound. No. 21081 \$4.50



## TTL COOKBOOK

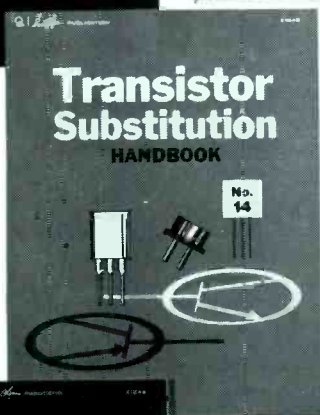
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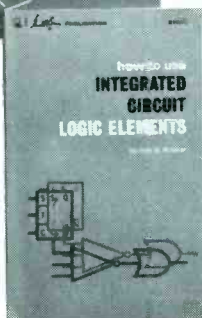
by The Howard W. Sams  
Engineering Staff

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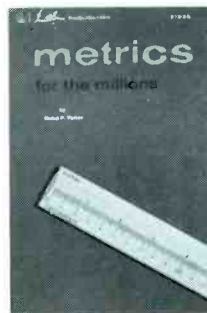
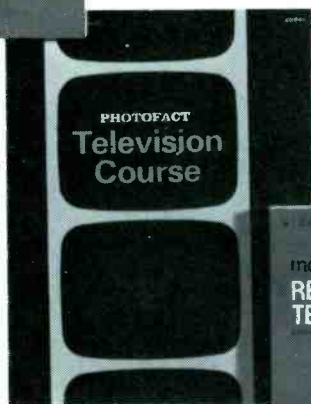
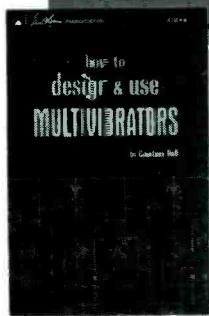
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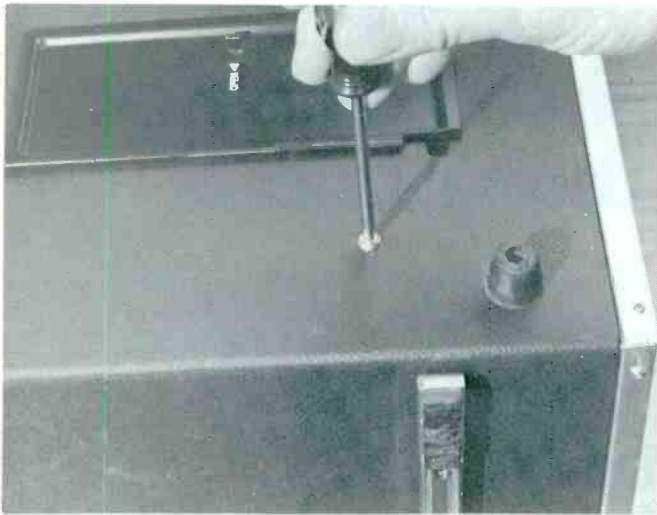
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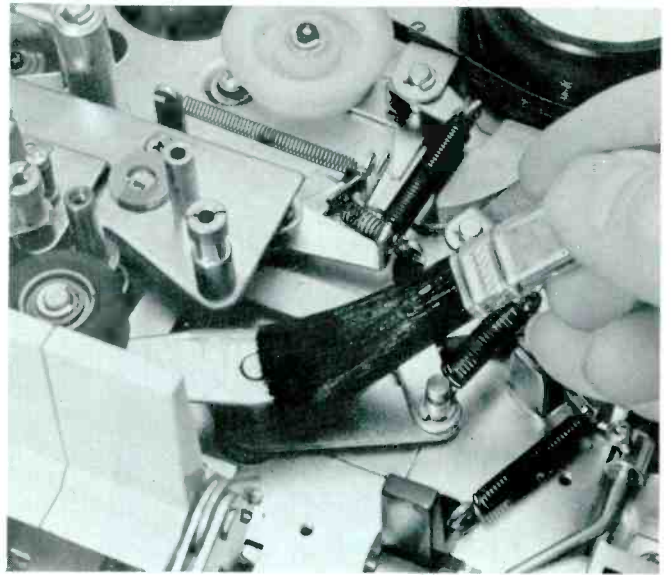
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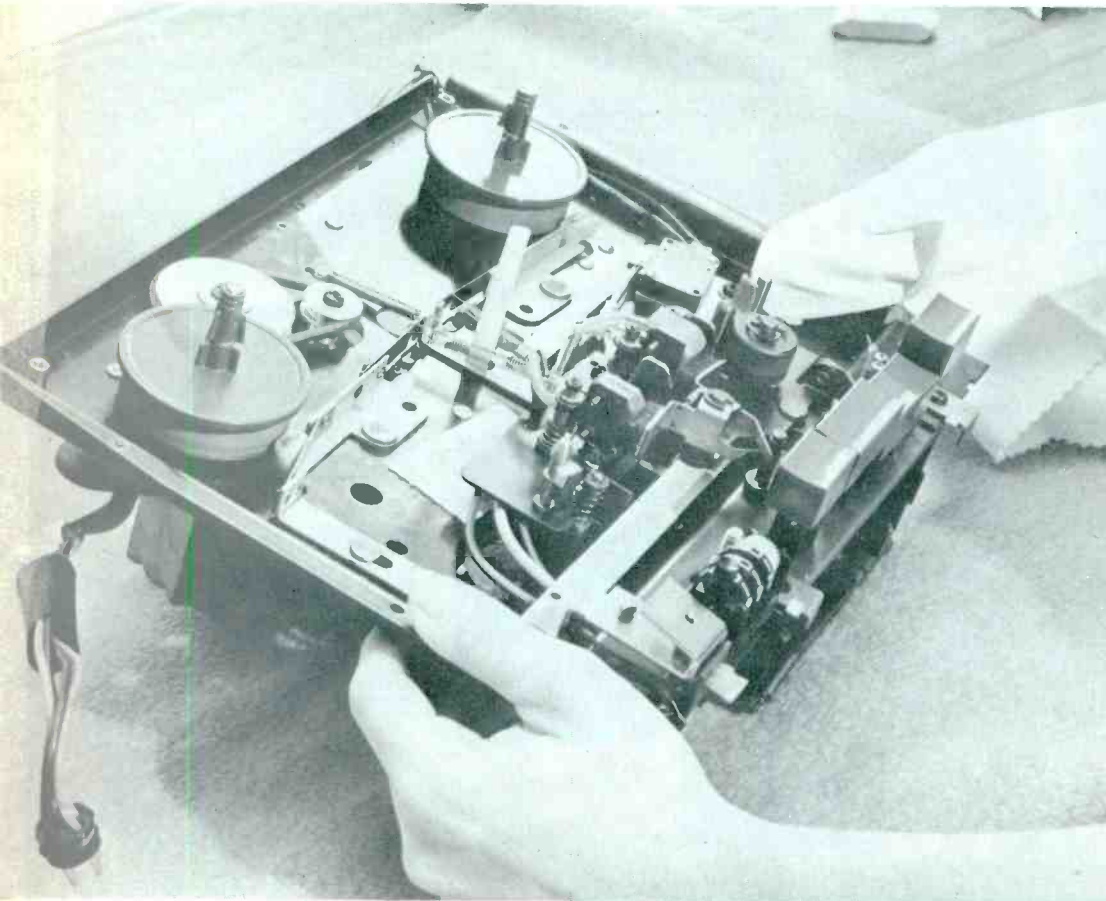
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**Step 3.** Mechanisms are held in the recorder case by screws at the top corners, through the bottom, or at the ends of the cabinet. The handles of portable models generally have to be removed. When you have extracted all mounting screws, carefully turn the machine face down on the soft mat and lift the cabinet off.



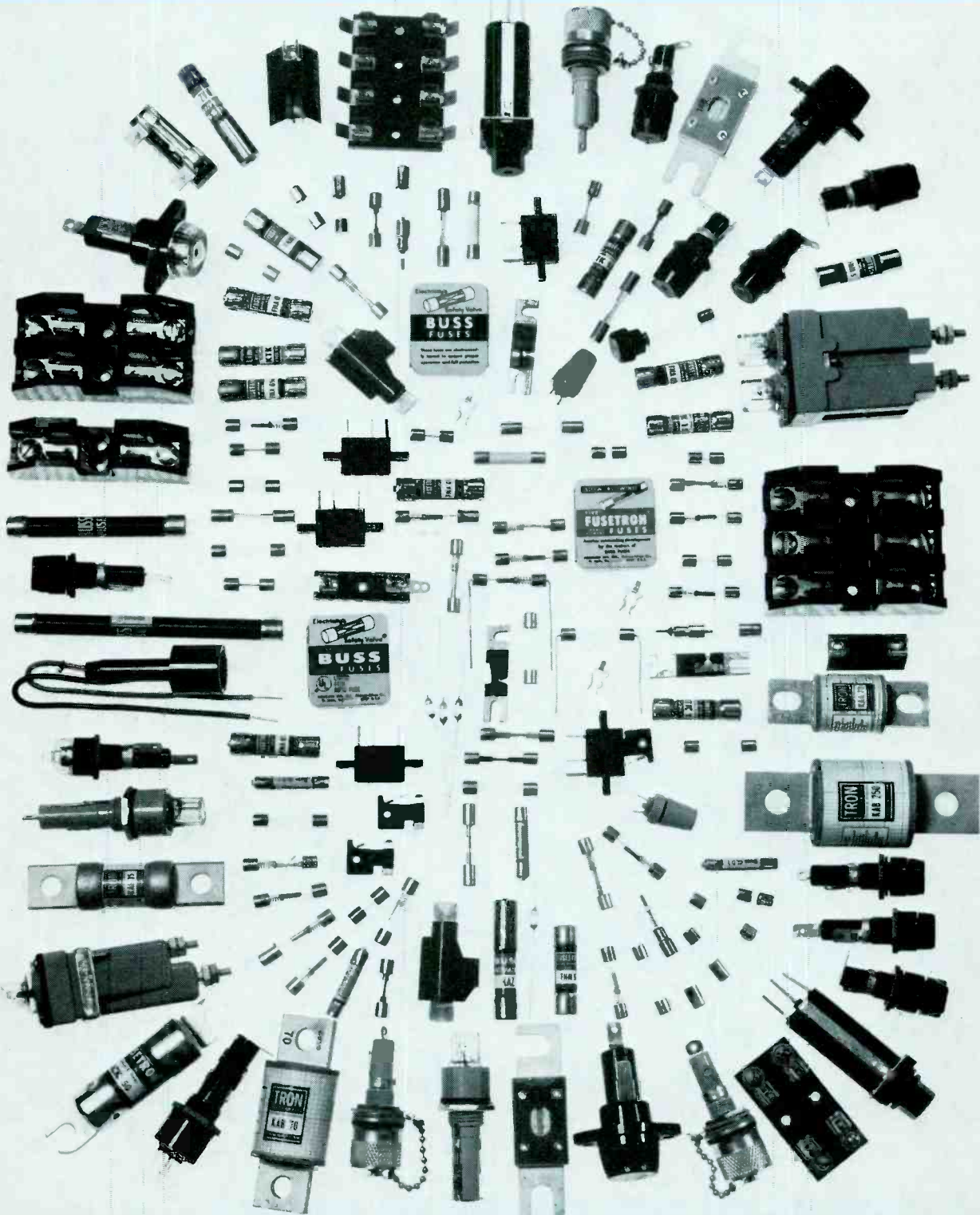
**Step 4.** Cleaning comes first. Use a soft-bristle brush to whisk away any lint clinging to the surfaces of the mechanism. Take care not to break any wires or knock loose any springs.



**Step 5.** Wipe any accumulated grime from the chassis and moving parts, both above and below the base plate. You'll often find it caked; evaporating lubricants mix with dust to form a scum. Alcohol helps cut the layer. **DO NOT** use carbon tetrachloride. Give special effort to slides and levers, and use caution so you don't bend them. A small brush dipped in alcohol can help you reach hard-to-get-at parts. Especially, clean surfaces of cams and levers where they contact other parts. A layer of caked dust on rubbing surfaces spells trouble. **Don't** do any lubricating at this stage of your procedure.

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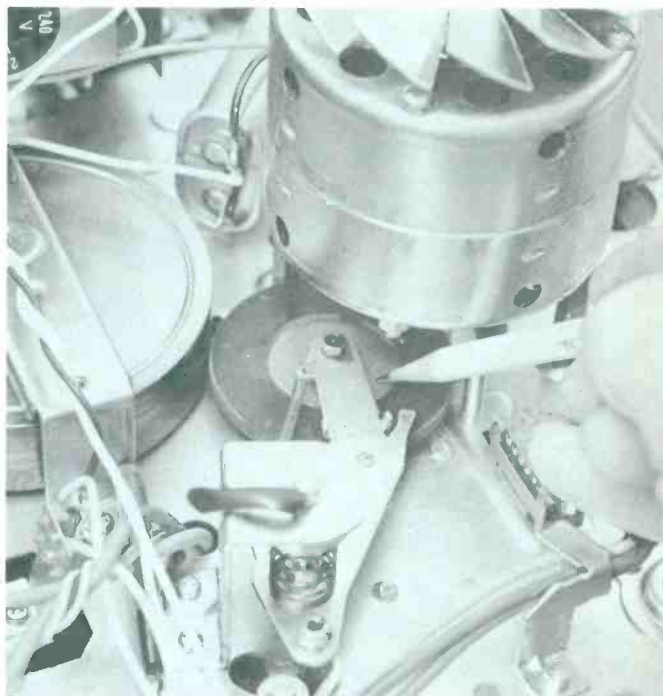
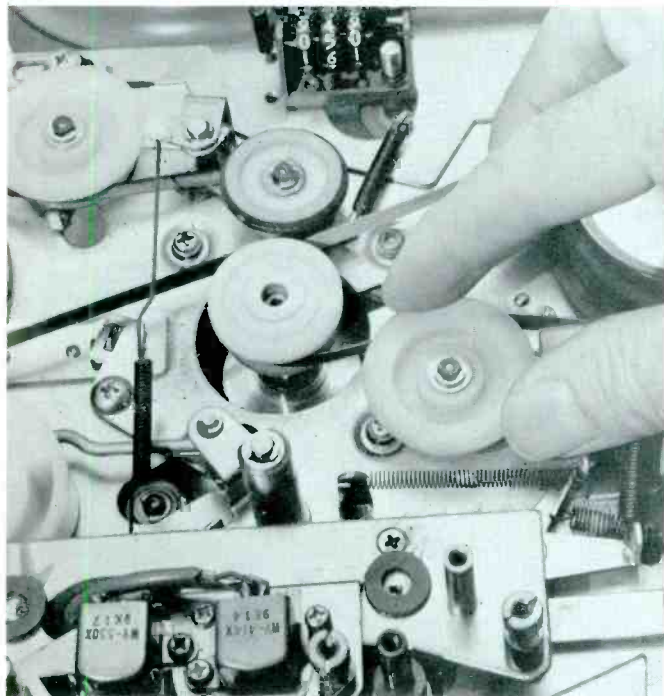
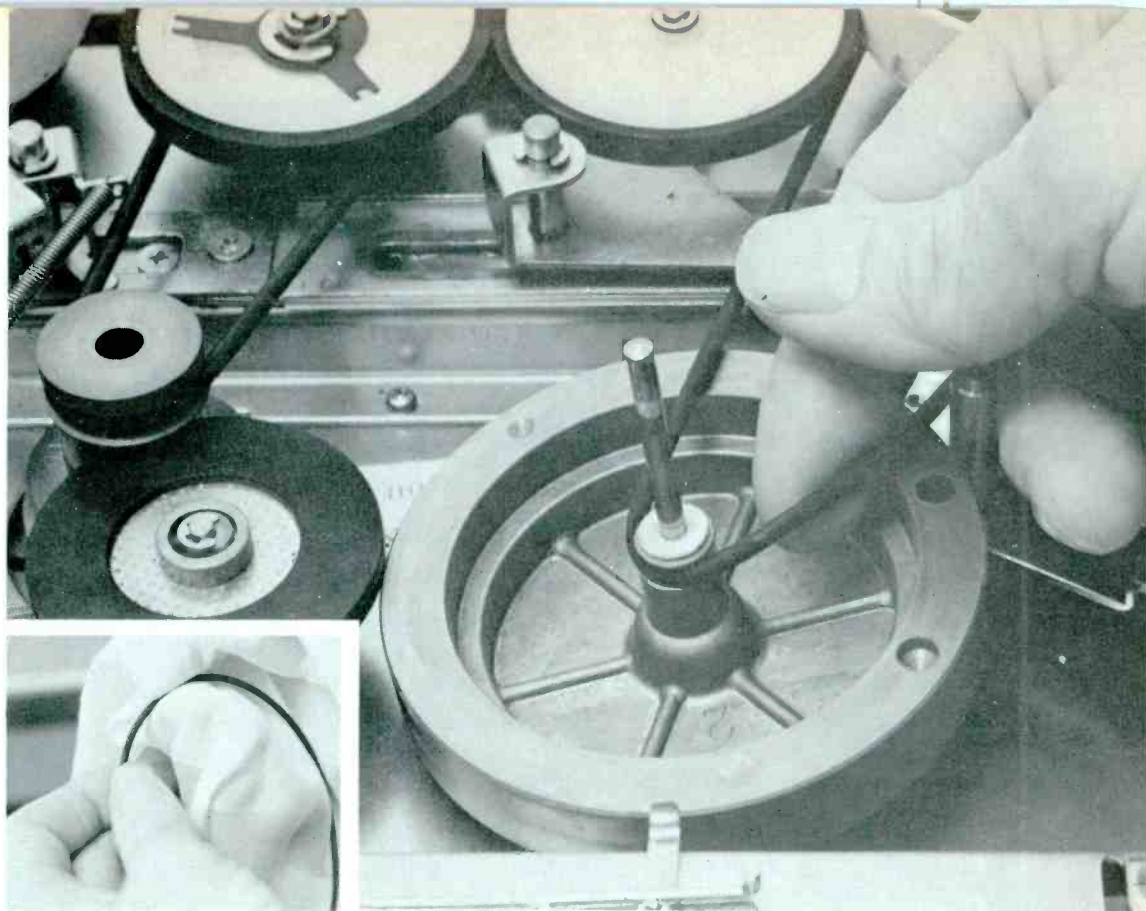
the complete line of fuses, holders, blocks and clips to protect all electronic and electrical circuits and devices.



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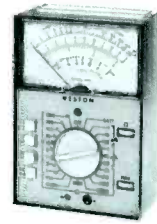
**Step 6.** Residue of any kind on rubber or metal driving surfaces easily can cause slippage, resulting in the kind of erratic operation known as "wow". Alcohol does an excellent job of removing even invisible substances, such as the oil from your fingertips. Remove all belts and clean them thoroughly. Check them for minute cracks and worn or slick areas. Check their tension, too; they may have stretched slightly. Any sign of a fault in a drive belt means you should replace it. The cost is small, and not worth chancing a call-back. After cleaning metal or rubber surfaces, keep fingertips away.



**Step 7.** Remove all the idlers and give them a good cleaning, especially their rubber rims and their spindle holes. A Q-Tip or other cotton swab is best for the holes. Check the rubber rims for tiny cracks, or spots that are slick or flat. Replace the idler (or the rim, if it's removable) if you can see any defects.

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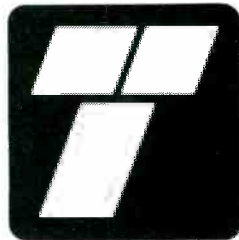
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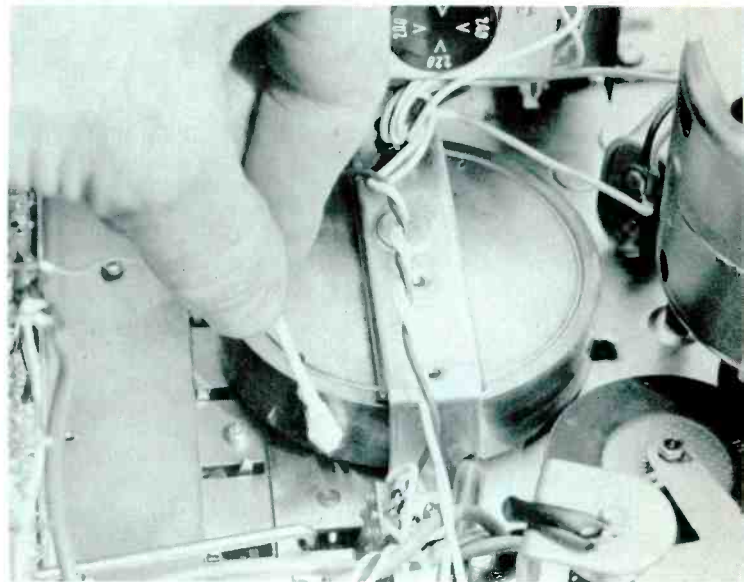
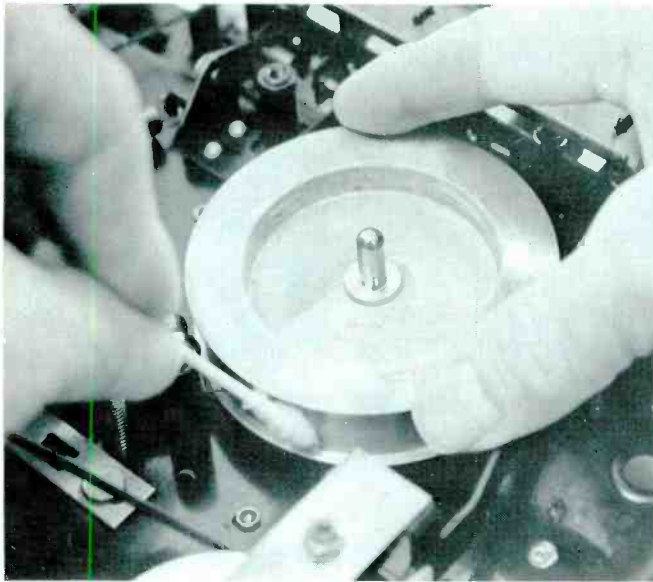
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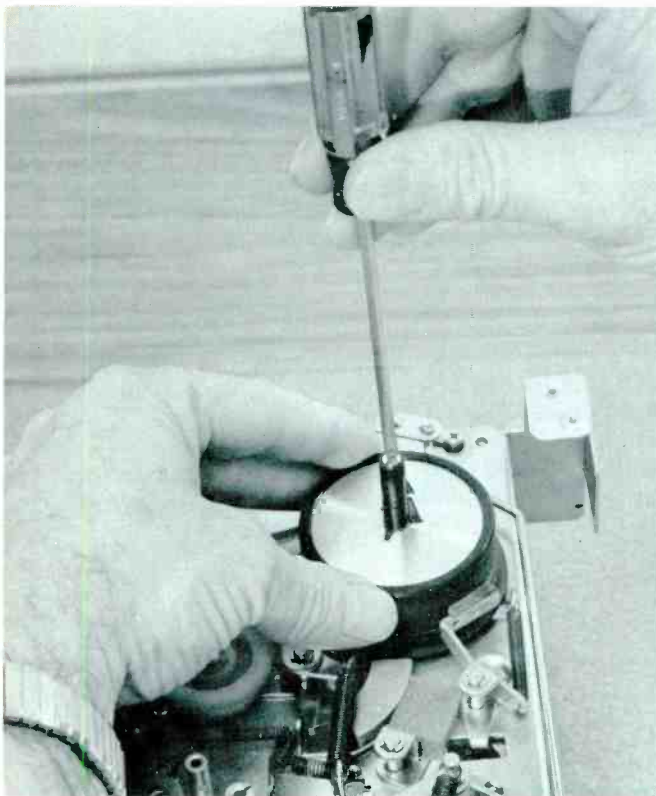
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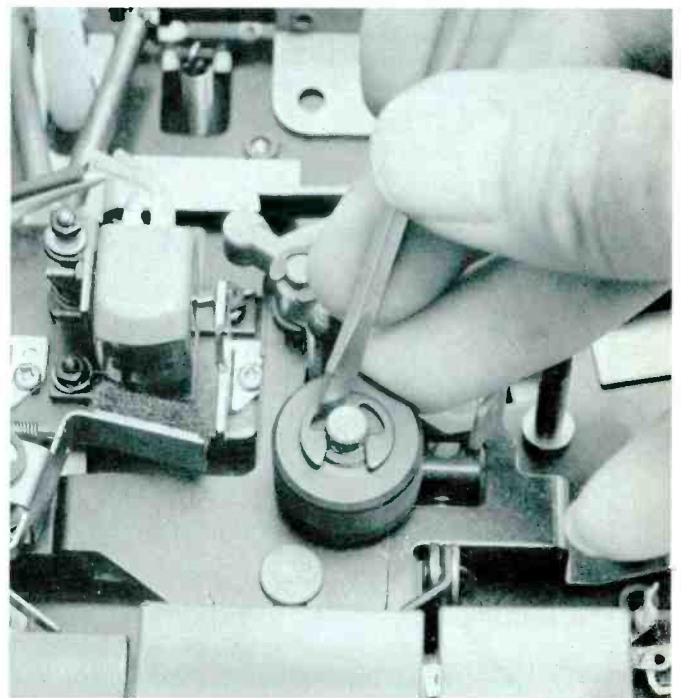
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**Step 8.** The flywheel in most recorders also requires frequent swabbing off. Its drive surface collects grime and evaporated-oil residue. Clean the outer rim and the shaft with alcohol. Repeat the swabbing several times until a clean cloth or Q-Tip shows no trace of dirt.

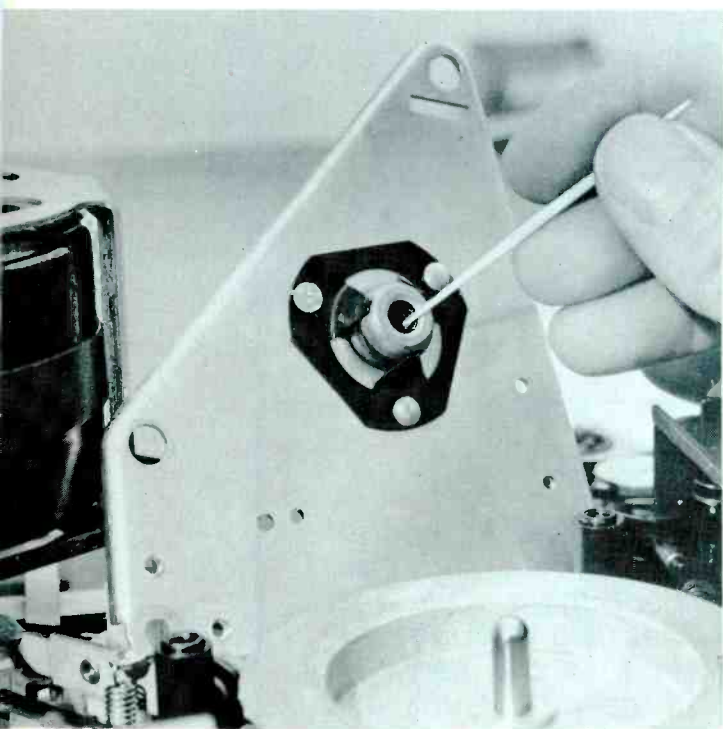
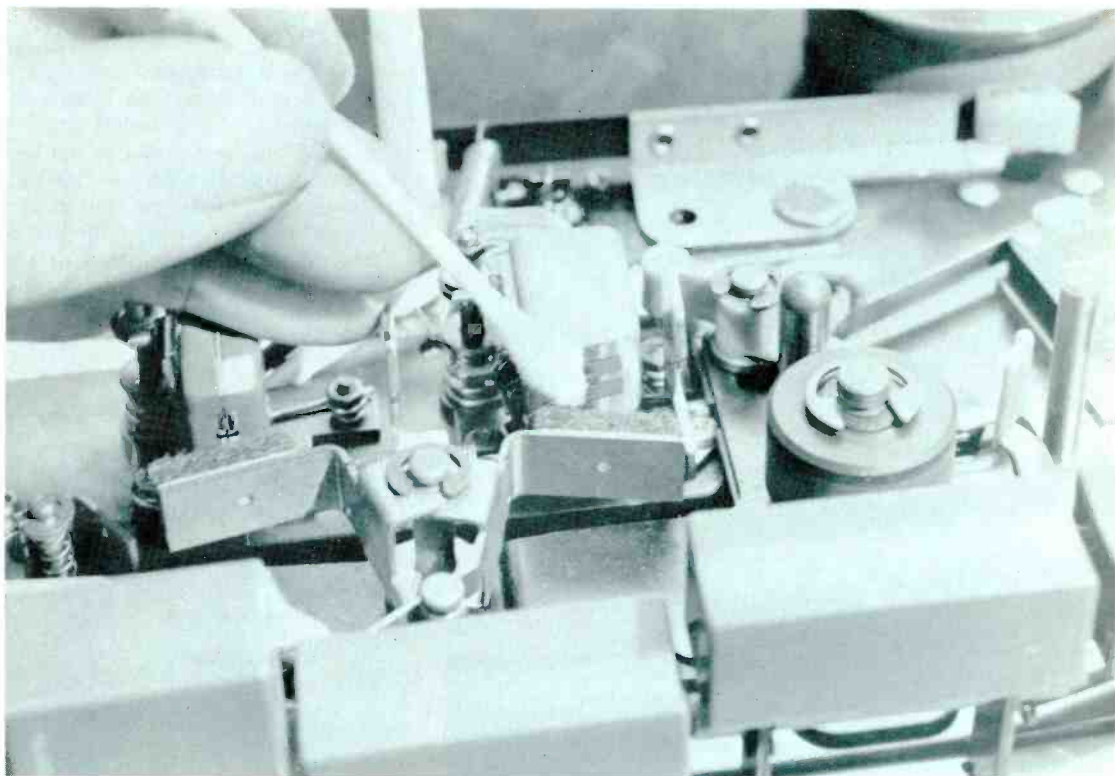


**Step 9.** Remove the supply and takeup spindles or turntables, which hold the tape reels, and clean the top, sides, and bottom. A Q-Tip is handy for cleaning the center holes here, too. Many spindles have a felt clutch underneath. You can clean it with a stiff brush or, in some instances, by wringing it out in alcohol and then allowing it to dry. Check the felt for wear. If it looks slick and/or matted, replace it. The clutch has a drive pulley beneath the felt. Take it out and clean it and its shaft.

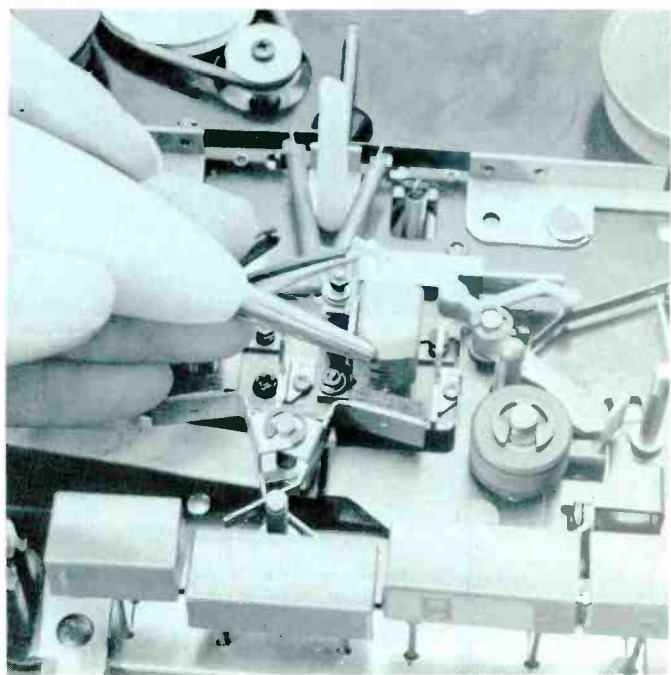


**Step 10.** Oxide deposits from the tape often build up on the pressure roller. They have a reddish, rusty appearance. They can cause tape slippage, giving playbacks that characteristic "wow" sound—sometimes so slight it's only noticeable on sustained music notes. Clean the oxides off with a Q-Tip, or soak the roller for several minutes in alcohol. Then wipe it dry with a clean cloth. Check it for wear or cracks. Even a minute roughness of the surface might cause wow. Clean the roller mounting shaft, too. Binding here, due to grime buildup, can prevent the tape being pulled through smoothly. As with all drive surfaces, meticulously keep your fingers off after cleaning; body oil causes slippage.

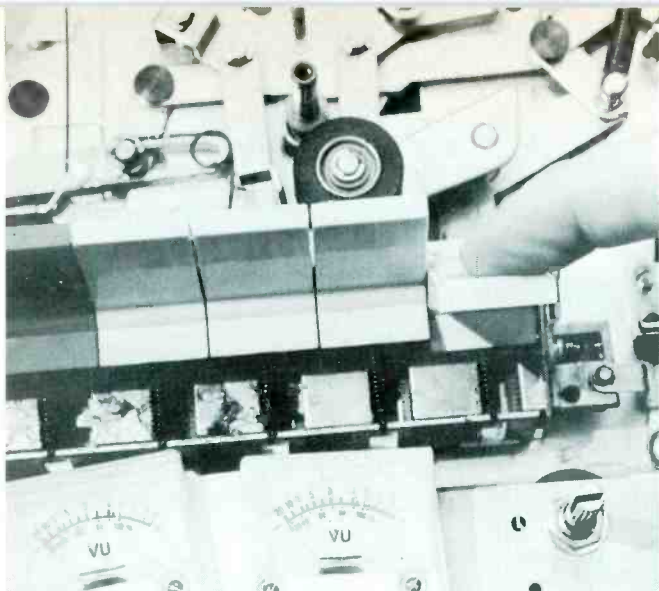
**Step 11.** Tape heads notoriously collect oxide deposits, which create multiple difficulties. Such deposits prevent tapes from seating properly at the magnetic gaps on the head face, reducing high-frequency tones. They bring on squeaks. They increase head wear. They contaminate other tapes. Alcohol will dissolve and remove any oxide layer. Use a cotton swab; cloth is likely to damage the heads.



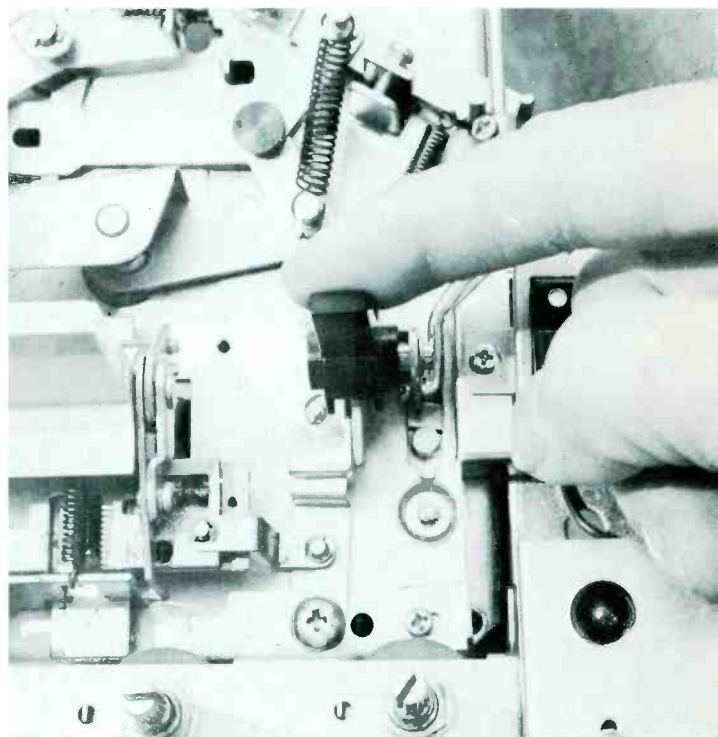
**Step 12.** After you've cleaned them, lightly lubricate all idler shafts at their bearings. Use a fine silicone grease; oil won't do. Don't overlubricate. Apply a tiny bit of lube to the lower flywheel bearing, too. A toothpick works well for this. Don't use anything metal to apply lubricant. It may score the surface, no matter how slightly, and cause the bearing to wear unduly.



**Step 13.** After you've assembled all parts, demagnetize the record/playback head. It may have picked up some magnetism from tools you've moved nearby. Or, it may be holding residual magnetism from long use. Magnetism reduces the high-frequency response, and adds "hiss". Make this an unailing part of your service procedure. Move a degaussing tool round and round near the head. Never let it touch the front, lest it scar the delicate face and cause excessive tape wear. When you finish, move the tool at least 2 feet away before turning it off.



**Step 14.** Make several preliminary inspections before you begin testing the mechanism's operation. Observe that no loose wiring interferes with any lever or slide. Check movement of controls and pushbuttons. Look above and below the base plate; hunt for linkages or springs that may have slipped off. Usually, front-panel controls consist of a speed-change knob, pushbuttons, or a function knob, and a pause handle or knob. In your first operational tryout of the machine, see if each does what it's supposed to.



### **Next Month**

*In this session, you've been exposed to most of the drive parts in a tape mechanism, and have seen how to clean and inspect them. Our next Workshop session covers testing and adjustments. You'll proceed further into the servicing procedure, and learn to check specific faults and how to adjust assemblies for correct operation. The third and final session takes you through two basic hi-fi open-reel tape mechanisms, revealing how to diagnose faults in each.* □



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<p>Q101 1ST IF IF MODULE 150-190P</p> <p><b>POLARITY</b> NPN</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 100<math>\mu</math>A</p>	
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<p>Q106 1ST VIDEO AMP IF MODULE 150-190P</p> <p><b>POLARITY</b> PNP</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 50<math>\mu</math>A</p>	
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<p>Q102 2ND IF IF MODULE 150-190P</p> <p><b>POLARITY</b> NPN</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 100<math>\mu</math>A</p>	
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<p>Q201 24V REG</p> <p><b>POLARITY</b> NPN</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 50<math>\mu</math>A</p>	
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<p>Q103 3RD IF IF MODULE 150-190P</p> <p><b>POLARITY</b> NPN</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 200<math>\mu</math>A</p>	
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<p>Q202 HORIZ OUTPUT</p> <p><b>POLARITY</b> NPN</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b></p>	REMOVE TO TEST
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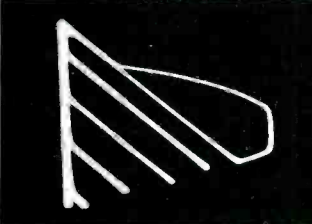
<p>Q104 VIDEO FOLL IF MODULE 150-190P</p> <p><b>POLARITY</b> NPN</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 100<math>\mu</math>A</p>	
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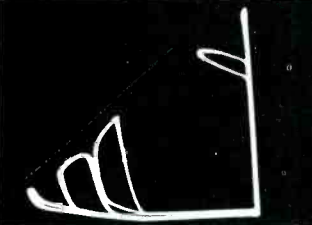
<p>Q701 PNP OSC VERT MODULE 9-92</p> <p><b>POLARITY</b> PNP</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 20<math>\mu</math>A</p>	
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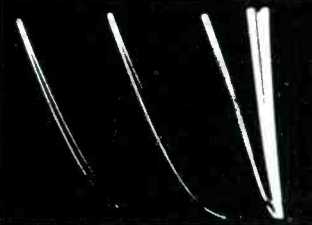
<p>Q105 AFC IF MODULE 150-190P</p> <p><b>POLARITY</b> NPN</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 100<math>\mu</math>A</p>	
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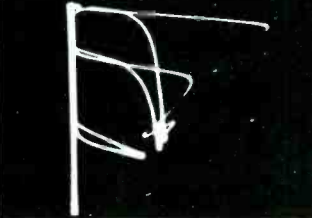
<p>Q702 NPN OSC VERT MODULE 9-92</p> <p><b>POLARITY</b> NPN</p> <p><b>SWEEP VOLTAGE</b> 30V</p> <p><b>BASE CURRENT</b> 20<math>\mu</math>A</p>	
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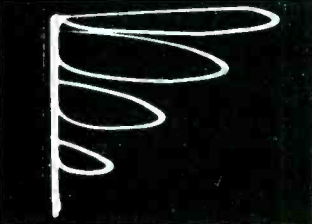
MANUFACTURER	MODEL OR CHASSIS
ZENITH	17EC45/19EC45

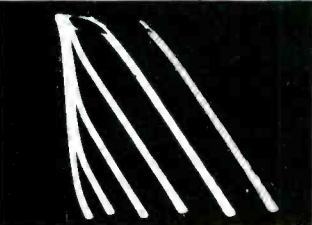
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q705 DEFLECT AMP VERT MODULE 9-92 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 10 $\mu$ A	

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q706 DRIVER VERT MODULE 9-92 <b>POLARITY</b> PNP <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 200 $\mu$ A	

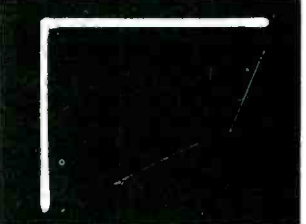
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q707 PNP OUTPUT VERT MODULE 9-92 <b>POLARITY</b> PNP <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 200 $\mu$ A	

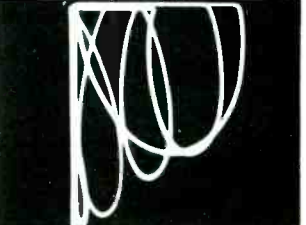
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
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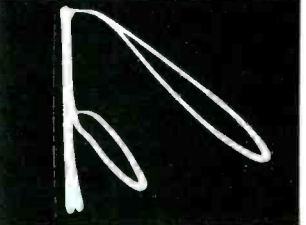
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q801 HORIZ AFC HORIZ MODULE 9-90 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 20 $\mu$ A	

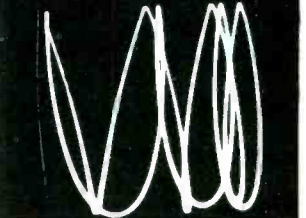
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q802 HORIZ OSC HORIZ MODULE 9-90 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 20 $\mu$ A	

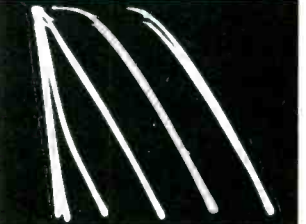
MANUFACTURER	MODEL OR CHASSIS
ZENITH	17EC45/19EC45

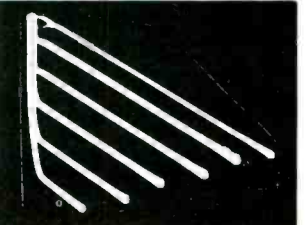
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q803 HORIZ DRIVER HORIZ MODULE 9-90 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 1000 $\mu$ A	

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q804 SAWTOOTH SHAPER HORIZ MODULE 9-90 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 20 $\mu$ A	

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q901 VERT BLANKING LUM MODULE 9-88 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 10 $\mu$ A	

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q902 BRITE LIMITER LUM MODULE 9-88 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 20 $\mu$ A	

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q903 BLANK DRIVER LUM MODULE 9-88 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 50 $\mu$ A	

TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS
Q904 2ND VIDEO LUM MODULE 9-88 <b>POLARITY</b> NPN <b>SWEEP VOLTAGE</b> 30V <b>BASE CURRENT</b> 10 $\mu$ A	

MANUFACTURER	MODEL OR CHASSIS
TRANSISTOR IDENTIFICATION & CURVE TRACER SETTINGS	SIGNATURE PATTERNS

Q905 VIDEO BLANKER LUM MODULE 9-88	
<b>POLARITY</b> PNP	
<b>SWEEP VOLTAGE</b> 30V	
<b>BASE CURRENT</b> 50 $\mu$ A	

Q1204 VIDEO DRIVER COLOR MODULE 9-89	
<b>POLARITY</b> PNP	
<b>SWEEP VOLTAGE</b> 30V	
<b>BASE CURRENT</b> 20 $\mu$ A	

Q1205 BLUE VIDEO OUT COLOR MODULE 9-89	
<b>POLARITY</b> NPN	
<b>SWEEP VOLTAGE</b> 30V	
<b>BASE CURRENT</b> 20 $\mu$ A	

Q1206 RED VIDEO OUT COLOR MODULE 9-89	
<b>POLARITY</b> NPN	
<b>SWEEP VOLTAGE</b> 30V	
<b>BASE CURRENT</b> 20 $\mu$ A	

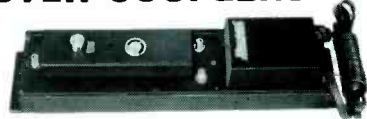
Q1207 GREEN VIDEO OUT COLOR MODULE 9-89	
<b>POLARITY</b> NPN	
<b>SWEEP VOLTAGE</b> 30V	
<b>BASE CURRENT</b> 20 $\mu$ A	

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# Reports from the test lab

By Carl Babcoke

*These monthly reports about electronic test equipment are based on actual examination and operation in the ELECTRONIC SERVICING laboratory. Observations about the performance, and details of new and useful features are spotlighted, along with tips about how to use the instruments for best results.*

Advertisements for the Master Subber Mark V appeared in two issues of **Electronic Servicing** before the first unit came off the assembly line (manufacturers have parts shortages, too!). The concept of additional signals for test substitution was an interesting one, and I waited impatiently for the unit to arrive. It was worth the delay.

## Description

A picture without other objects to provide a size comparison might make the Master Subber appear to be rather large (Figure 1). It's not. In fact, it's only an inch or so larger in each dimension than the Tuner Subber Mark IV, which is used to substitute for tuners or IF stages only. The attractive gray-and-red cabinet with many silver-trimmed controls gives an illusion of larger size. It is small and light enough to be easily moved wherever needed, even on service calls.

There are several brands of tuner-substitution test devices now on the market. They all check tuners by supplying the 40-MHz output of an internal solid-state tuner to the defective set. If the reception is better than with the original tuner, the set's tuner undoubtedly is bad. These devices are very handy for proving your diagnosis.

The Master Subber Mark V, manufactured by Castle TV Tuner Service, provides the proper signals for injection into video stages, sound IF's, and audio stages, in addition to the usual 40-MHz IF signal.



Fig. 1 Front panel layout of the Master Subber Mark V manufactured by Castle TV Tuner Service.

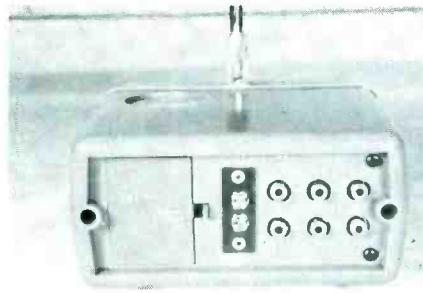


Fig. 2 In this rear view, the battery compartment is at the left, terminals for external antenna are in the center, and 6 phono sockets for the various signals are at the right.

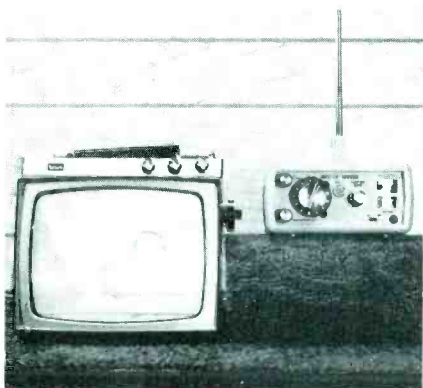


Fig. 3 A normal picture was obtained when the IF signal from the Master Subber was injected at the first IF of this b-w solid-state TV receiver.

## TV without a picture

Imagine a miniature television receiver without vertical, horizontal or high-voltage circuits. That describes the Master Subber.

One interesting function is that you can listen to the audio of any TV station within range, and without connecting any cables. There are several advantages to this. First, you can be certain the Subber actually is emitting a signal, and approximately the quality of the signal. Second, adjustments of the Master Gain and Color Bandspread controls are fairly critical in obtaining best results during some tests, and the sound from the internal loudspeaker helps locate the best settings.

## Tuner substitute

A collapsible monopole antenna is built into the carrying handle, and when extended it is adequate for reception of strong signals. Also, terminals are provided on the back for rabbit-ear or outside-antenna connections. Collapse the monopole when you use the 300-ohm terminals.

The channel-selector knob has the usual 2-to-13 numbers plus UHF, but there is no concentric fine-tuning knob. Instead, a knob and control located at the lower-left corner of the front panel adjust the oscillator frequency and also change the bandpass of the 40-MHz IF amplifier. Although the knob is marked "Color Bandspread", it affects both the picture quality, and the noise in the audio.

Gains of both the RF FET and the IF stages are controlled by the "Master Gain Control". More than 60 dB attenuation is claimed, and I have no reason to doubt that specification.

Two meters are located along the right edge of the front panel. The bottom one shows battery voltage, and the one at the top is an uncalibrated signal-strength meter, called "Video Carrier Level". Incidentally, the adjustments of Color Bandspread and Master Gain which

give the **highest** meter reading are not necessarily those providing the best picture sharpness and freedom from overload.

Several shielded cables are provided. One has an RCA/phono type pin connector at one end, and two insulated clips at the other. To inject the tuner IF signal into the receiver IF's, plug this cable into the socket labelled "40-MHz V IF", which is located on the back (see Figure 2). Attach the two clips to almost any desired point in the video-IF stages and to ground. An internal blocking capacitor prevents damage to the Subber or to the TV receiver.

Turn on the Master Subber (an LED located near the Castle symbol lights in red to show current drain). Select the channel you want, and turn down the Master Gain to the lowest point giving a usable picture. Adjust the Color Bandsread counterclockwise until sound bars can be seen, then clockwise just enough to eliminate the sound disturbance.

Increase or reduce the gain as needed when you inject a signal into any IF stages of both solid-state and tube receivers. The high gain of the Subber usually produces overload at excessive settings.

Output of the IF signal is through a circuit the manufacturer calls "Master-match-coupler", and it does match most receiver IF circuits very well considering the variety found in the many models. Of course, perfect match giving ideal alignment is not necessary in

a test device. If you can obtain a reasonably-sharp picture and some color, that is sufficient to prove where the defect originates.

#### Test results

When connected to various points in the IF of a solid-state portable, good contrast could be obtained up to the base of the last IF transistor (Figure 3). An old color receiver showed a good picture and fair color when the Subber was attached to the input of the IF's, and decreasing contrast when the injection point was moved along the IF's. At the grid of the third-IF tube, the contrast was low, and there was no color. These results seem to indicate the Subber is very adequate for the job.

#### Testing AGC

There is a way of testing the AGC. It's done by injecting the Subber IF signal into the first IF stage that is not controlled by AGC. Adjust the Master Gain for a normal picture, then measure the voltage at various points in the AGC circuit. If the readings are too high or too low, an AGC defect is indicated.

#### Testing The Video Detector

If no picture can be obtained by injection in the video IF's, then a video signal of the proper polarity should be injected at the output of the video detector. Appearance of a picture proves the defect is between the IF's and the video stages (probably in the video detector). No

picture suggests the problem is located in a following video stage.

#### Video Tracing

Two sockets on the Subber's rear panel provide a choice of positive- or negative-going video from the internal video circuit (waveforms in Figure 4A). Amplitude can be adjusted by the Master Gain control. Specifications call for 7 volts p-p, but my sample measured between 4 and 5 volts p-p. Of course, that's sufficient, for most video detectors have between 2 and 4 volts p-p, depending on model and AGC adjustment.

Injecting a negative-going video signal at the grid of the first video tube provided a picture of normal contrast. Connection to the grid of the video output tube produced a low-contrast picture (out of lock because the injection was beyond the sync takeoff point).

#### Video Hum

A transformer built in combination with the wall plug provides power when the Master Subber is to be used for long periods of time. The cable is plugged into a jack on the front panel, and the higher DC voltage reverse biases two diodes which disconnect the two internal batteries. Incidentally, use only 9-volt Alkaline batteries, because current drain is between 60 and 70 milliamperes.

AC operation introduces hum into the video waveforms (Figure 4B). Filter capacitors to minimize

*(Continued on page 57)*

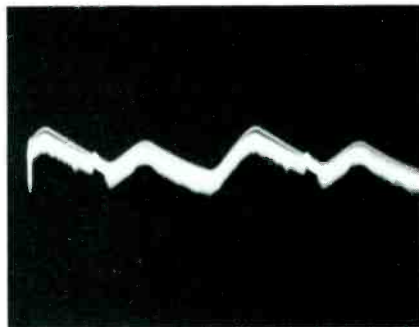
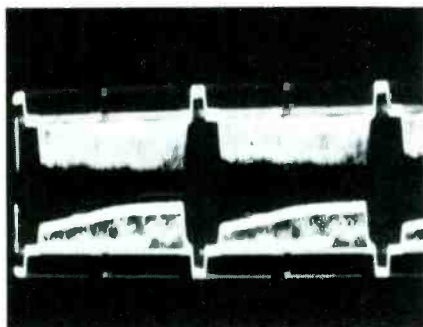


Fig. 4 These video waveforms are typical. (Left) Positive-going video is shown in the top waveform, and negative-going video below. Both can be used simultaneously, if desired. (Right) Operation with the AC power cable and transformer caused 120 Hz hum in the video waveforms. The hum had little effect on the other functions.

Fig. 5 There is no excess space inside the Master Subber. Most of the components not in the tuner are inside two small modules.

# DELCO AM/FM/Stereo Radios— Circuits and Servicing

By Joseph J. Carr, CET

*Summer time is car-radio repair time. This article covers unique circuitry, alignment, troubleshooting, and the solution to a mean kind of intermittent in the 1971-73 Delco AM/FM/Stereo car radios.*

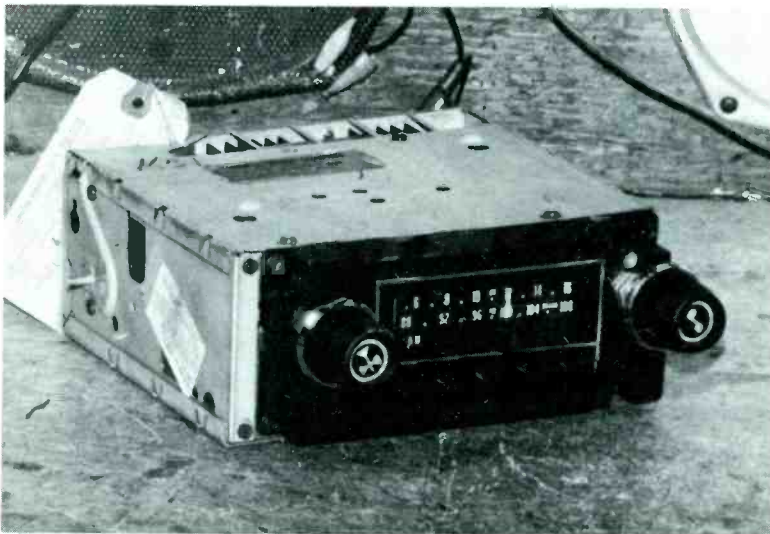


Fig. 1 A typical model of the 1971/1972 Delco AM/FM/Stereo auto radio. Remove the panel on the left for access to the audio/multiplex circuit board.

These newer Delco car radios in General Motors cars are a far cry from the traditional ones. They incorporate some of the latest solid-state technology, and use some of the components and techniques of expensive home-stereo receivers. Consequently, more than a set of hand tools and a battery eliminator are required for profitable servicing of these radios. A typical model is shown in Figure 1.

## FM Circuits

Two transistors (one FM RF amplifier and an FM local oscillator) are included as part of the RF deck. The mixer transistor, as is customary with Delco, is located on the FM IF/detector circuit board (PCB), and is connected to the RF deck via coaxial cable. Tuning is by movement of the coil cores (permeability tuned).

The coil board and the RF-circuitry board are formed into two sub-assemblies that are attached at right angles to each other on the Permeability Tuning Mechanism (PTM). Then the entire FM IF and detector circuitry is on a separate PCB located behind the bottom chassis cover.

Most Delco FM car radios have a quadra-tuned IF filter (Figure 2) between the mixer and the first-IF transistor. This type of circuit provides a flat-topped curve with good

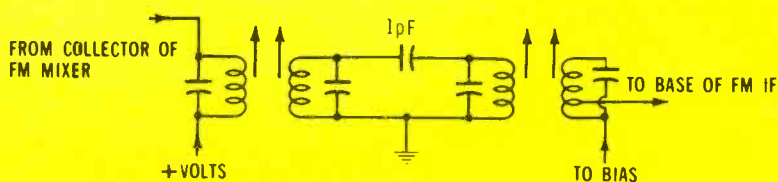


Fig. 2 This quadra-tuned IF circuit provides a curve with flat top and steep side skirts.

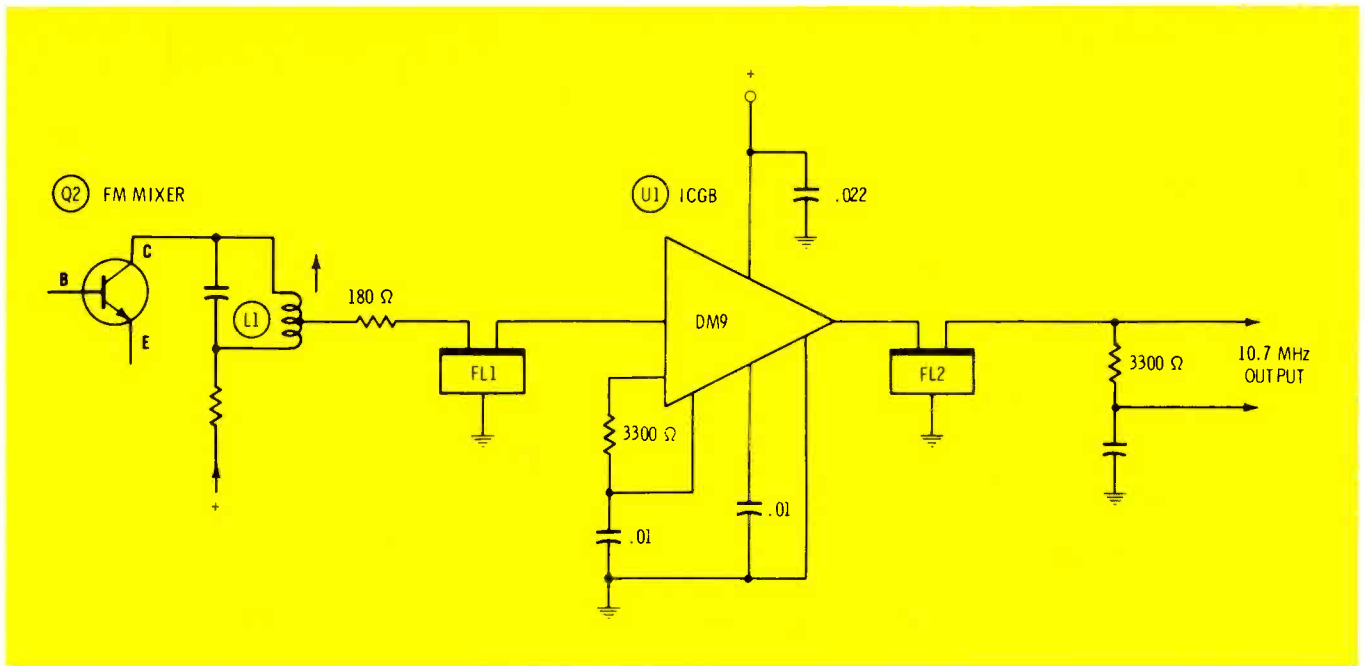


Fig. 3 An IC Gain Block (ICGB) includes two ceramic filters and one IC.

rejection of adjacent channels.

A newer kind of IF circuit is the IC Gain Block (ICGB in Figure 3) which includes two ceramic filters and one IC. The Integrated Circuit provides more than enough gain to overcome the loss inherent with ceramic filters and still drive the detector to full limiting.

Ceramic-crystal filters (Figure 4) can give selectivity much superior to that obtained from tuned circuits. These filters are high-quality ones manufactured by Murata of Japan, and should not be confused with some of the less-effective ones sometimes found in low-priced FM portable radios. The ceramic element at the input of the filter changes electricity into mechanical motion. This motion is transferred through the high-Q tuned action of the "horseshoe" and is applied to the output ceramic element where the motion is changed to voltage.

Because of manufacturing tolerances, the precise center frequency of these filters might not be 10.700 MHz, although the resonant frequency is very stable. Therefore, Delco has tested the filters and designates them by color-coded marks according to the exact frequency. Filters showing the same color are compatible; therefore, you should always use another of the same color as a replacement. No alignment is possible, and none is

ever needed for ceramic filters.

#### FM detector

The FM detector is a special quadrature type (circuit shown in Figure 5) using the Delco DM-11 IC and the straight-pin version of the DM-11 called the DM-31.

In the IC, the first stages are three wideband limiting amplifiers providing high gain. Output from the last limiter is a square wave of the 10.7-MHz IF signal which is split into two channels we shall call the F-1 and F-2 signals. Signal F-1 is not modified, but it is fed directly to the gated synchronous detector. The F-2 signal goes through a RCL network that shifts the phase by exactly  $90^\circ$  before it also is applied to the gated detector. In the detector, the two quad signals are combined to produce an output signal of pulses whose width changes according to the frequency. Integration of this signal provides the recovered audio.

#### Multiplex decoder

Most Delco FM/stereo receivers incorporate the DM-24 multiplex decoder. A few radios, however, use the DM-36 detector which has a Phase-Locked Loop (PLL) circuit. In Figure 6 is shown the DM-36 schematic, while the block diagram showing the functions is in Figure 7.

A voltage-controlled oscillator operating at 76 kHz is the heart of the PLL's circuitry. The oscillator is designed to change frequency according to the control voltage from a phase comparison circuit.

Output of the 76 kHz oscillator drives two cascaded flip-flops giving 38 kHz and 19 kHz signals. The 19 kHz one is compared in phase with the 19 kHz pilot and a DC error voltage developed, which locks the 76 kHz oscillator to the correct frequency and phase. The stereo lamp also is turned on by phase comparison of the 19 kHz signals.

The 38 kHz signal from the flip-flop supplies gating to the decoder section so right- and left-channel audio signals are derived.

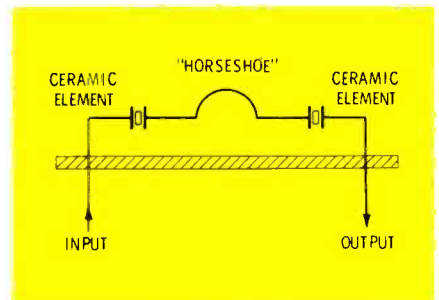


Fig. 4 Ceramic-crystal filters change the 10.7 MHz signal to mechanical motion and then back again to a 10.7 MHz voltage. They give superior curves and don't require tuning in the field.

One of the advantages of the PLL decoder is the relative ease of alignment. Usually it is sufficient to adjust to an approximately-correct frequency and let the locking do the rest.

But it is important to determine whether or not the free-running frequency is close enough to lock reliably with different carrier

strengths of stations. Do this by tuning through several stations while you observe the stereo lamp for correct operation. For this test, as well as for other checks of stereo operation, it's best to choose a station that's only moderately strong.

Of course, the official Delco method of aligning the PLL de-

coder (using Lissajous figures on a scope) works extremely well. In practice, however, a bit of manipulation with the coarse and fine controls to obtain a dependable stereo lamp action generally is sufficient.

The two potentiometers for coarse and fine frequency adjustment are located on the audio/multiplex board, which is attached to the volume control, and standing vertically on the left side of the chassis. For most service on the PCB, it's necessary to remove the top cover, bottom cover, and the side plate (see Figure 1). However, if adjustment only is needed, a "hex" tool will reach the pots easily, as shown in Figure 8.

#### Audio modules

Over the years, Delco has incorporated many of the white plastic-cased DM-8 and DM-28 audio modules. These modules include two transistors and most other parts for complete audio-driver systems for class "A" outputs. Later sets used the DM-29 modules.

Power to drive the speaker comes from a TO-3 PNP power transistor, such as the DS-501 or DS-515 (Figure 9). Failures of the output transistors have been minimal because of the large multi-fin heat sinks favored by Delco. But do use plenty of silicone heat-transfer grease, if you replace any outputs.

Here is a helpful list of typical DC voltages found at the terminals of three IC's:

Pin	DM-11 (U1)	DM-36 (U3)	DM-28 (U4)
1	4.3 V	3.0 V	0 V
2	3.4 V	5.0 V	0 V
3	—	5.1 V	1.5 V
4	1.4 V	5.0 V	1.3 V
5	1.4 V	—	0 V
6	1.4 V	5.8 V	.9 V
7	0 V	13.4 V	12.6 V
		(1.4 12 on)	
8	0 V	—	13.2 V
9	.15 V	2.4 V	.9 V
10	1.4 V	2.4 V	—
11	—	1.7 V	.5 V
12	3.4 V	2.4 V	—
13	8 V	2.4 V	—
14	4.6 V	2.4 V	—
15	—	3.2 V	—
16	—	13.4 V	—

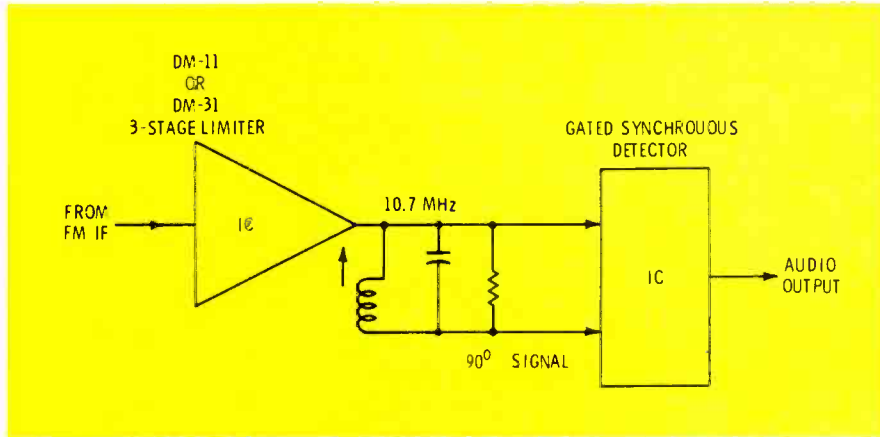


Fig. 5 Output of the IC with the 3 stages of limiting goes through two paths to the detector: one signal goes direct, and the other is phase shifted by 90°. Detection action produces variable-width pulses which are integrated to recover the audio.

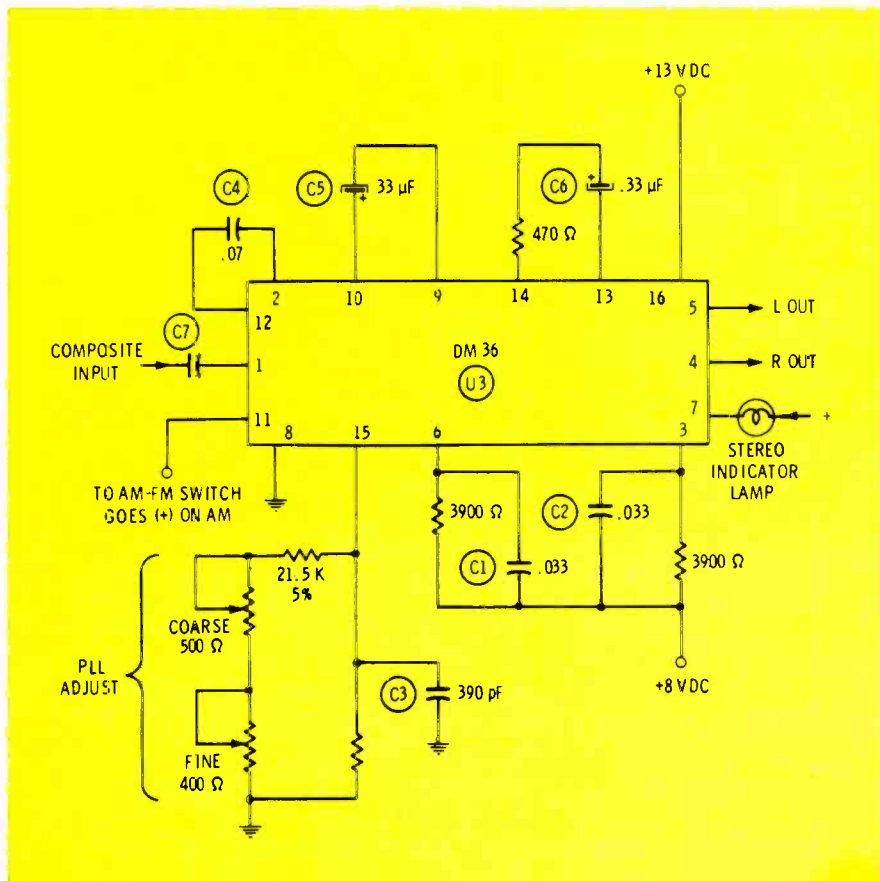


Fig. 6 Schematic of the Phase-Locked Loop (PLL) shows that most of the circuitry is inside the IC.

#### Intermittent Problems

One related group of intermittent



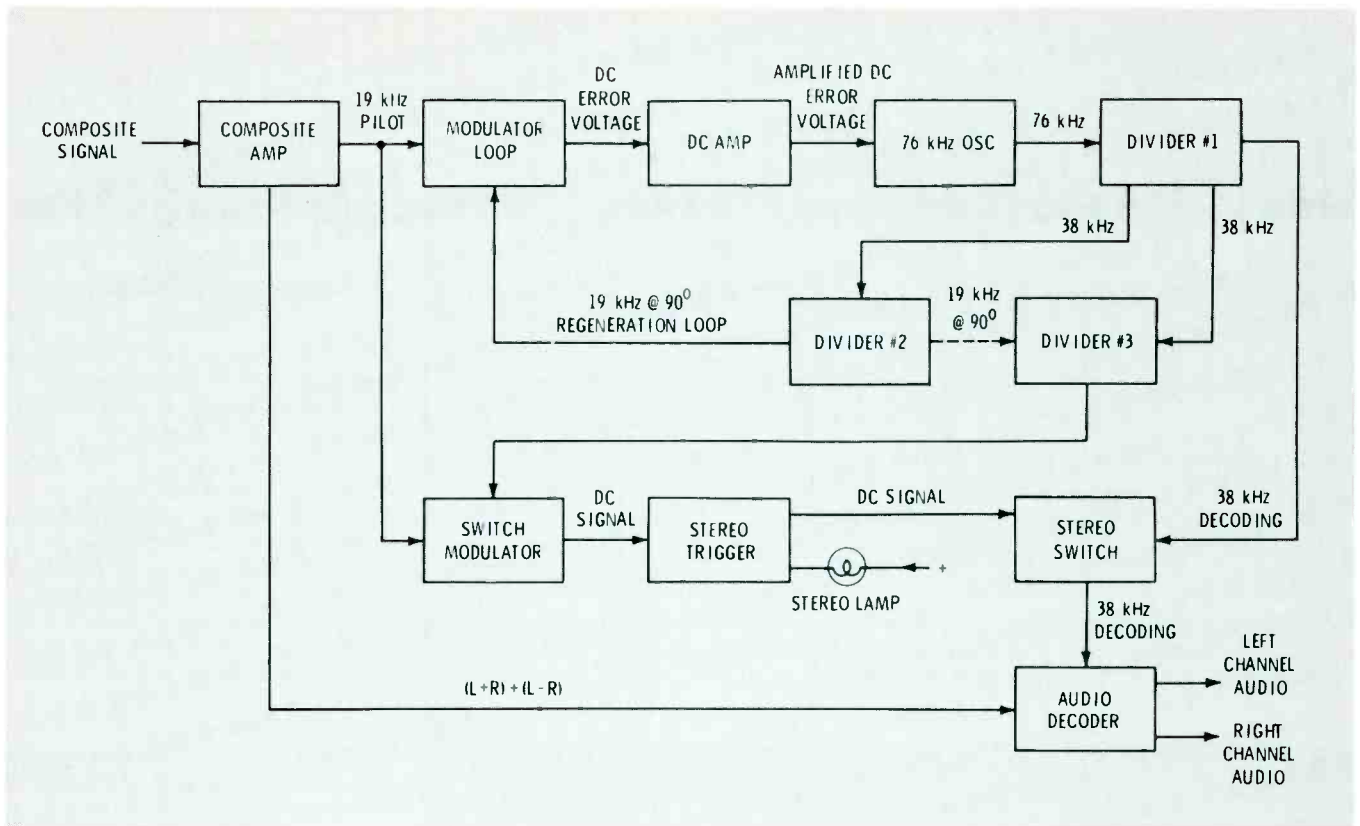


Fig. 7 Block diagram of the PLL gives the many functions performed by one IC.

problems has plagued the 1971 and early 1972 Delco FM radios (model numbers beginning with either a 1 or a 2).

The problem has to do with open circuits in the conductors connecting to the through-board connectors called "griplets". A griplet has a cylindrical body with the ends flared out, one on the top side, and one on the bottom side of the circuit board. The flared portion resembles a star, and each is soldered to the copper foil to connect together the tracks of foil on top and bottom.

Locating any such intermittent contact is very difficult. For one thing, most of the breaks seem to occur on the component side where it is nearly impossible to see.

Symptoms vary somewhat, depending on where the open occurs. Intermittent or dead oscillator, either or both channels of audio dead, and either or both fuse resistors open are some typical symptoms.

The simple cure for griplet failure is to jumper them with lengths of #24 wire. To make this even easier, Delco offers pre-cut wire harnesses under part number

1223460 for FM monaural and 1223450 for stereo radios.

It's much faster to obtain and install the wiring harness than it is to find the individual open circuits. After some practice, you should be able to install a harness in about 15 minutes. I recommend that you modify every one of this affected group to prevent callbacks.

### Dial Lamp Replacement

In most of the AM-only radios and the "griplet" models, Delco included a welcome feature: a removable dial scale that permits dial lamp replacement while the radio is in the car. Just raise the dial scale, and then pull it toward you. This will expose the double-ended pilot lamp.

### Alignment

Specific instructions about alignment should be obtained from the manufacturer or from the Sam's AR series of auto radio manuals. As a sample of alignment, refer to Table 1 which is a rewording of the Delco instructions. Figure 10 shows the locations of transformers and islands.

Alternate methods of alignment

are to use dual FM sweep or Total Harmonic Distortion (THD). By the THD method, you do the IF alignment correctly, and approximately set the discriminator (or phasing) adjustment. Then without sweep, FM modulate the generator with an audio tone, connect the THD meter

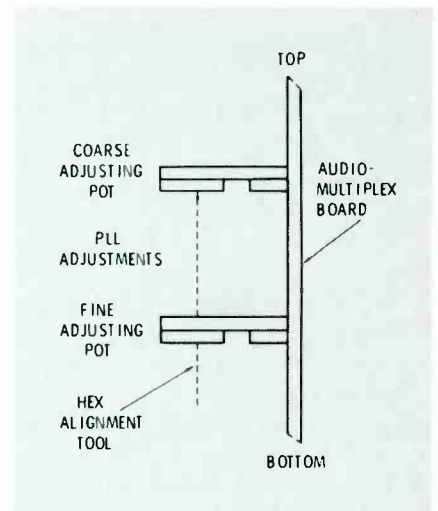


Fig. 8 Adjustment of the 76-kHz oscillator free-running frequency is made easily by using a hex head alignment tool inserted through both pots from the bottom of the set.

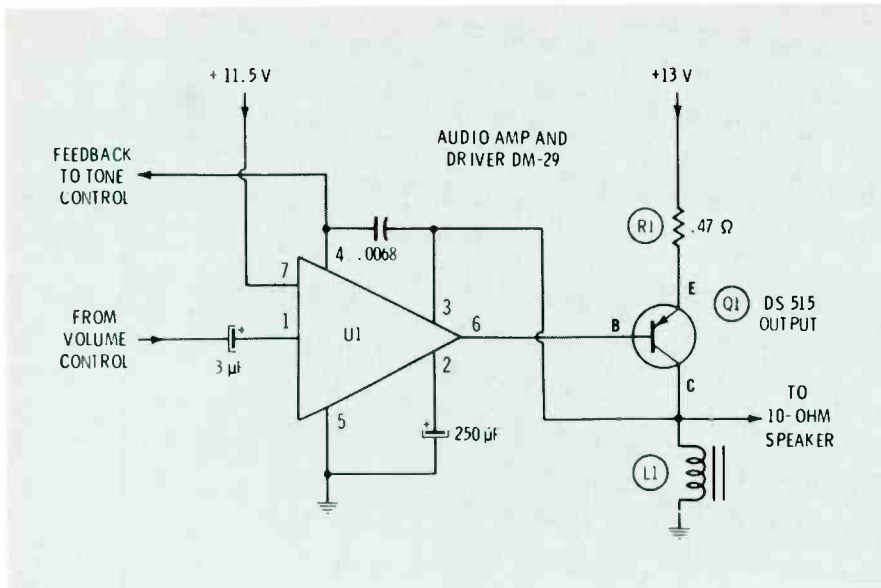


Fig. 9 The audio circuit includes a DM-8 or DM-28 audio module (containing two transistors and other parts) and a power output transistor. An audio choke (L1) removes most of the DC current from the speaker.

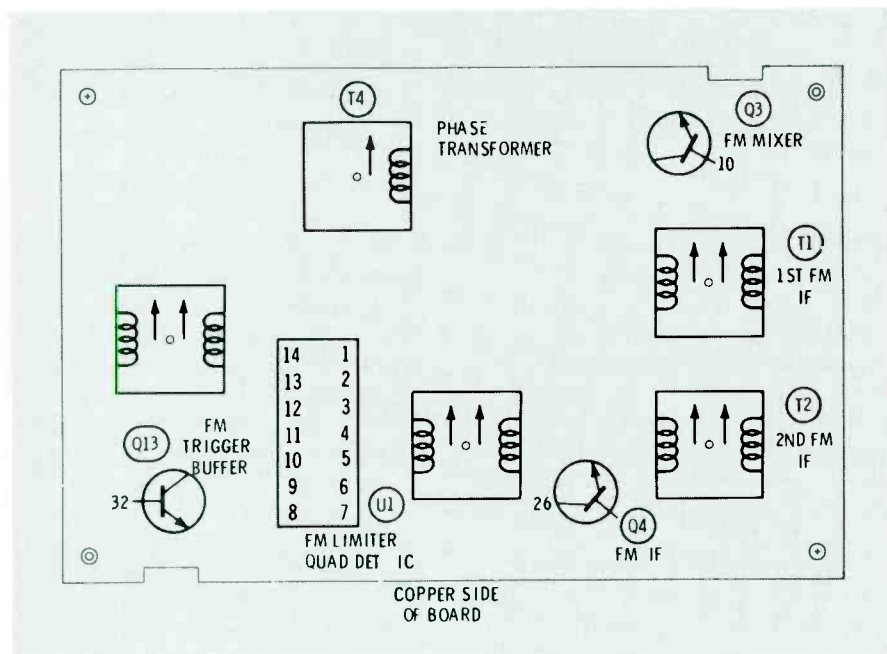


Fig. 10 Locations of transformers and connection points for alignment of a typical Delco car radio.

to the audio stage following the detector and adjust the phasing or discriminator core for minimum harmonic distortion.

Another way is to adjust all controls to produce a null at the audio-modulating frequency of the FM signal generator, and adjust the phase or discriminator transformer so the null deepens.

Most sophisticated of all is to use the Sound Technology dual-sweep FM-1000 generator. Operation of

this generator was covered in the April, 1973 issue of *ELECTRONIC SERVICING*. I found the easiest way of connecting radio and generator for the audio sample was from the speaker leads through a potentiometer (Figure 11) to the generator. The pot serves to adjust the level so it does not overload the generator input. A capacitor is needed because most Delco radios have a small amount of DC at the speaker. □

Table 1

## Alignment by generator of the DM-11 and DM-31 FM IF and quad detector

Note: set dial of radio to the high-end stop, and the generator frequency for 10.7 MHz unmodulated for all steps.

### Step 1

Adjust generator for maximum output through a .0047 capacitor to island #10. Connect VTVM on -DC scale through RF-detector probe to island #26. Adjust top and bottom cores of T1 and T2 for maximum meter reading.

### Step 2

Connect generator to the antenna socket, and the RF-detector probe to island #32. Notice meter reading only; do not adjust.

### Step 3

Reduce generator output for about 2/3 the previous meter reading. Adjust top and bottom cores of T3 for maximum meter reading; reduce generator output as needed to maintain the 2/3 reading.

### Step 4

Remove RF-detector probe, change VTVM to AC and connect across speaker terminals. Reduce output of generator until noise begins to overcome the quieting. Adjust T4 for minimum meter reading between two noise peaks.

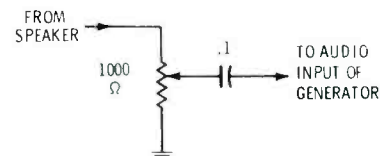


Fig. 11 When aligning with the Sound Technology generator, use a loss circuit like this one to prevent generator overload when obtaining the sample of audio.

# Pricing and selling MATV systems

By Lon Cantor

*The MATV market is growing rapidly. It's a profitable field for you to enter. However, before you can install a MATV system, you have to sell it. And before you sell it, you must know what to charge for it. This article gives guidelines for pricing and selling MATV systems.*

The selling price of a MATV system is the sum of these three things:

- net cost of the materials used;
- cost of the labor to install the system; and
- your desired profit.

## Methods Of Estimating

Estimate the job too high, and you are likely to lose the sale. Estimate too low, and you might lose your shirt. Obviously, it's vital for any estimates you make to be accurate.

## Before the estimate

Here are seven steps to be done before you submit any estimate:

**Visit the job site;** never make an estimate without it. Notice if there are hills or tall buildings to block the signals or cause ghosts. Use a test antenna on a mast, and a field-strength meter to record the levels of sound and picture carriers of all stations. Check the picture quality on a portable color TV receiver.

**Find out which channels the owner wants to receive.** This is very important. If you assume the owner expects only the three local VHF TV stations, but he actually wants also the UHF channel and two distant VHF stations, you're in big trouble.

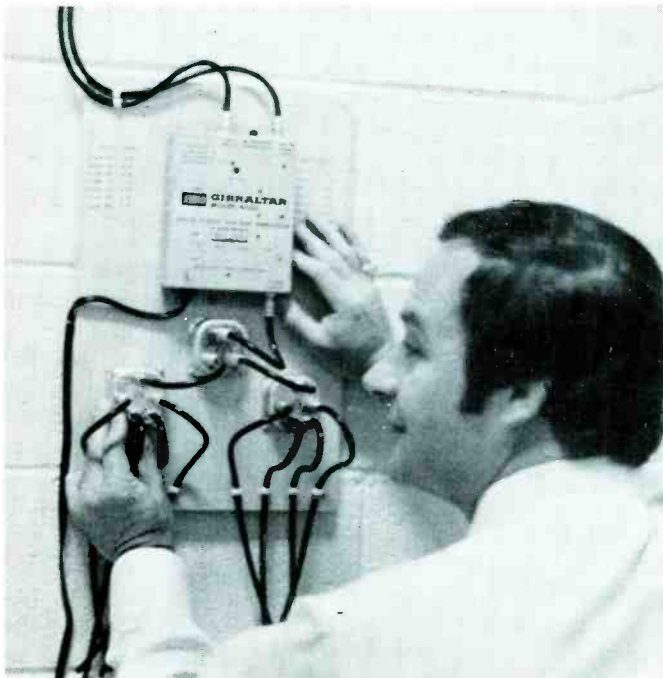
**Discuss how the cable will be run.** If you intend to run the cable outdoors, but the owner wants it indoors and hidden, your estimate might be far too low. After you agree, put it in writing, as part of the estimate.

**Design the system, or choose a packaged system which meets the requirements.** For example, suppose it is a 10-story apartment house with four apartments per floor. Figure 1 shows one type of packaged system for those specifications.

**Write out a bill of materials.** Be sure to include the antenna, amplifier, splitters, tap-offs, terminators and cable. Plus hardware, such as mast and mounts.

**Estimate the amount of labor required.** This is not always easy, but you can do it after a little practice. Multiply your hourly rate of labor by the number of hours required.

**Add your gross profit, the amount you expect to make on the job.** This percentage of gross profit should be based on your overhead, operating expenses and other costs. Your accountant should be able to tell you what percentage you make on your other work. However, it's not unusual for the profit to be



Even small MATV systems should be installed in neat and serviceable layouts.

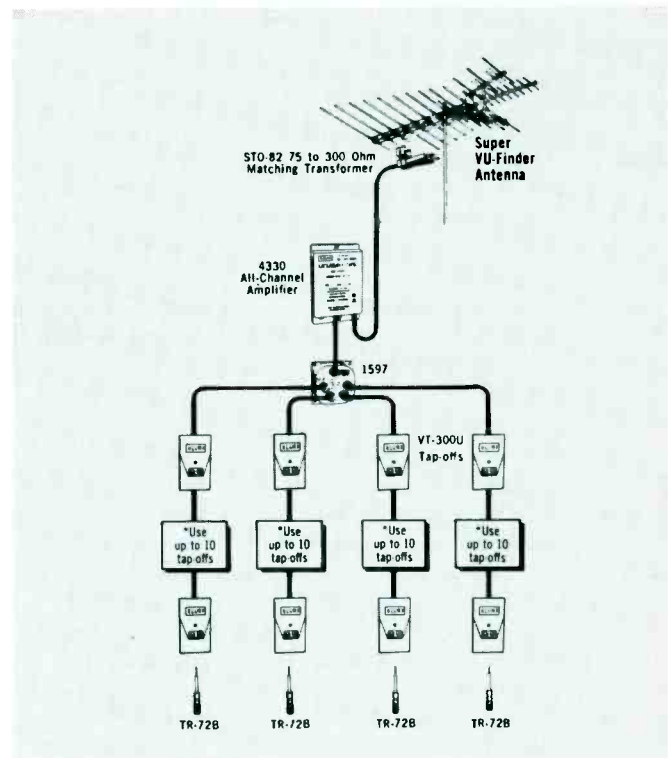


Fig. 1 One example of a "packaged" MATV system. This one handles up to 40 TV receivers.

better in the MATV field.

#### Use a formula

Some installers simplify estimates by using a formula. They merely multiply the net cost of the materials by some factor. For uncomplicated jobs, this method works well.

Take the system of Figure 1, for example. The bill of materials might look something like this:

1 antenna	37.77
1 matching transformer	1.98
1 all-channel amplifier	77.71
1 4-way hybrid splitter	7.27
40 tap-offs (at 2.70)	108.00
4 75-ohm terminators	4.12
1000' low-loss coax cable	95.05
miscellaneous hardware	20.00
<b>Total</b>	<b>\$351.90</b>

If the bill-of-materials cost were multiplied by a factor of three, the installer would charge about \$1060 for the system. This figures to less than \$27 per outlet, which is not expensive.

Under normal conditions, one installer and a helper should be able to install the job in about three days. That's 6 working days. Figuring labor at \$50 per day (as an example, not a suggestion), the labor estimate would be \$300.

Thus, the total net cost of the system is \$352 plus \$300, or \$652. Gross profit is \$1060 minus \$652, or \$408. (Gross profit normally includes a one-year warranty on the system.)

As you can see, the multiply-material cost-by-three method is a good rule of thumb. However, it assumes average labor costs, which do not exceed the cost of materials.

#### Estimating Labor

Many installers prefer to estimate labor more accurately before offering a price. They point out that labor costs can skyrocket on difficult or complex jobs.

To compute labor costs, you should use an estimate guide based on how long it takes your crew to install **each** piece of equipment. The following figures will give you a "ball park" guesstimate to help until you can develop your own

figures from experience:

- install antenna, mast, hardware, and transformer 3 hours;
- install amplifier (including balancing) 1 hour;
- install each splitter .5 hour;
- install each tap-off .3 hour;
- install matching transformer .2 hour;
- install head-end housing (if required) .2 hour;
- install filter, attenuator or trap (each) .2 hour;
- install each terminator .1 hour.

These estimates are reasonably accurate, but they do not include the time to install the cable. And that's the most difficult of all jobs to estimate.

In the first place, running the cable is not always the responsibility of the MATV installer. On many jobs, the electrical contractor already has included this in his estimate. Of course, your costs will decrease greatly in that event.

On other jobs, the electrical contractor installs the conduit, but the MATV installer is responsible for pulling the cable, a job that is not very difficult or time-consuming. But beware of one trap: some local laws or building codes **require** you to hire a union electrician to pull the cable. Union electricians not only have a high per-hour scale, but you can't be sure they will work as fast as you or your men. If union electricians are involved, estimate high. **Before you submit a bid, make sure you know exactly who is responsible for what.** If an electrical contractor is to pull the cable or install conduit, get a written contract from him.

In new construction, either with or without conduit, running cable is not very difficult. You can figure about 50 feet of cable per hour.

Estimating cable time for old buildings is more difficult. When you visit the job site, look over the building and decide the easiest way to run the cable. Often, the most economical way is to run the cables outdoors and bring them in through the window frames. This method permits about 50 feet of cable per hour. However, the owner

of the building might object. Point out the difference in price between indoor and outdoor wiring and let him make the decision.

If you must run the cable indoors in older buildings, try to find air shafts, electrical-access shafts, or plumbing shafts. If the shaft is broken by wooden floors, figure about 25 feet an hour. But, if you have to go through reinforced concrete, expect only 5 feet per hour.

If the cable can go floor-to-floor through closets, figure about 20 feet per hour, provided you have easy access to all apartments.

**Make sure the owner knows exactly how you intend to run cable from floor-to-floor, along hallways and inside rooms so no misunderstandings can occur.**

Let's go back to the example of Figure 1 and estimate it using normal figures for labor. We'll assume that it is an old building, where cable can be run at about 25 feet per hour.

1 antenna	3 hours
1 amplifier	1 hour
1 splitter	.5 hour
40 tap-offs at .3 hour	12 hours
4 terminators at .2 hour	1 hour
1000' cable at 25'/hour	40 hours

Total labor 57.5 hours

Add 10% for checking out the system and making adjustments, and the total is about 64 hours of labor.

The first time around, we guessed this job for about 3 days work for two men, or a total of 48 manhours. While it is possible for two good men to finish it in three days, the 64-hour estimate probably is more realistic. Unless the cable can be installed faster than 25 feet per hour, figure about four days of work for you and your helper.

Labor rates vary all over the country, of course. But suppose we assume a rate of \$6 per hour. Six dollars times 64 hours equals \$384 for labor. Add to this the materials cost of \$351.90 for a total of \$735.90. That's the total cost of the system. Notice that the labor and materials costs are about the same. This is typical. That's why the rough method of estimating by

multiplying the material costs by three usually works.

Now, suppose your accountant tells you that you should make 33% on sales of MATV systems. Simply multiply your total cost by 3/2 for a total selling price of \$1103.85. Notice that the total is \$44 more than when calculated by the first estimating method.

The main advantage of figuring labor time instead of estimating it is that you can be much more comfortable with your estimate. Suppose the actual installation required 12 working days, rather than six, it would certainly be a non-profitable job!

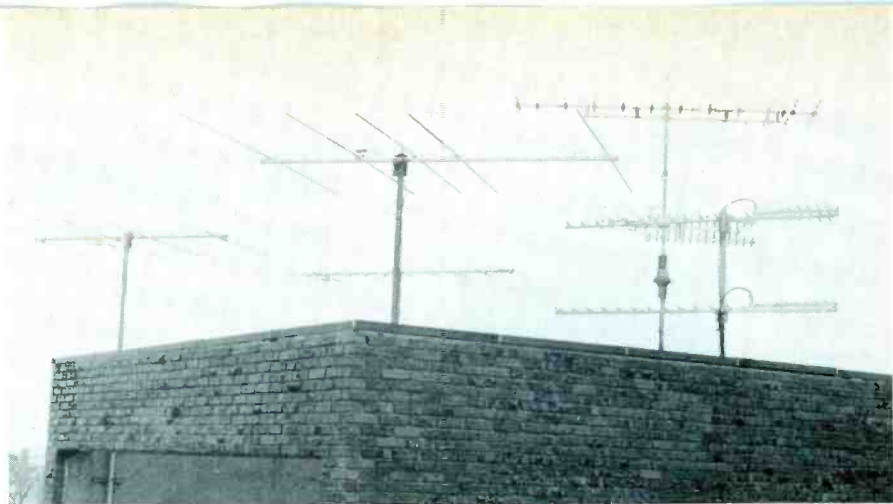
One last point about estimates. Most MATV jobs include a warranty for the first year. Because the manufacturer's warranty covers the equipment, you won't have to be concerned about replacements. However, you should provide for about two service calls the first year. Add about 5% to your estimate to cover the warranty.

**A good profitable idea is to sell a service contract for after the first year.** A charge per year of about 10% of the original sale price of the system will be fair to both of you. Modern MATV systems are solid state, requiring very little electronic service if they are properly installed.

### Selling MATV Systems

The best place to start selling MATV systems is in your customer's homes. Every time you service a TV set or install a one-set antenna, suggest a complete home system. In such small jobs, you might charge what you normally would for the antenna, plus \$25 to \$40 per outlet extra, depending on how hard it is to run the cable.

**Owners of homes under construction are particularly good prospects.** Find out for whom the house is being built. Contact the owner and explain how much cheaper and better it is to have a system installed before the walls are closed in. Point out the advantages of being able to move portable TV's from room to room or out onto the patio. If you confine your approach to the higher-priced homes, you should make a sale almost every



Six antennas, many of them single-channel yagis, were used for one typical MATV installation in a large apartment building.

time.

**Your next best bet is a small motel.** Every time you see one under construction, contact the owner. He'll probably be delighted to get a quote on a MATV system, because every modern motel needs one.

The same thing applies to small apartment houses. Find the owner or manager and ask to bid on the installation.

Almost all new public schools will include a master antenna system. Contact the school board and ask to submit a bid.

Although all hospitals include MATV systems, they are seldom easy to sell. Many hospital systems are sold as a package deal, along with the TV receivers and the maintenance, although there is a possibility you might get to act as a sub-contractor for the MATV installation.

**Retail stores selling TV sets are excellent prospects for MATV systems.** It's the only way to operate a bank of TV sets without flop-over and ghosts. Whenever you see a new shopping center under construction, contact the construction superintendent to obtain the name of the owner or manager of the center. Then from the manager, find out the owners of any TV/appliance stores scheduled for the center.

Mobile-home parks usually require underground wiring, and such systems can be sold directly to the park owner. But it is important to contact him before construction of the park begins.

### Selling Large MATV Systems

Large MATV systems seldom are

sold directly to an owner. If, after getting some experience on small MATV systems, you want to expand into larger systems, you should subscribe to the Dodge reports. They tell you about all new construction in your area.

Selling large systems is somewhat complex. First, you should work with the electrical engineer of the architectural firm. It is his job to write a specification for the MATV system. If you provide him with a system layout and thus get him to specify the equipment you recommend, you will have an inside track for the contract.

Next, you must work with the electrical contractor, who is a sub-contractor for the general contractor. Although responsible for all electrical wiring, the electrical contractor usually sub-contracts the MATV system. You should submit a bid to the electrical contractor, based on the specifications provided by the architectural firm. If your bid is reasonably low, and you convince the electrical contractor that you are competent, you probably will get the job.

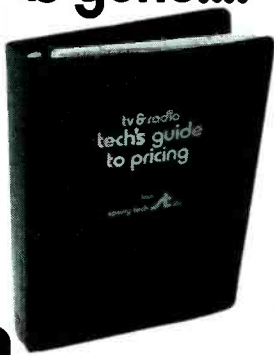
To sell large MATV systems, you must be aggressive and able to inspire confidence in your professionalism. The rewards, however, are tremendous. One job usually leads to another.

### Conclusion

Large amounts of money can be made in MATV installations, if you have the ambition and drive to gain experience in small jobs, and then expand to larger installations, including commercial jobs. But that's possible only after you begin. Go to it! □

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## test equipment report

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### Audio Sweep Generator

MITS, Inc. announces the availability of the SG1900 audio sweep generator.

The SG1900 offers the capabilities of both a fixed-frequency (CW) and a sweep generator, and has fully adjustable logarithmic and linear sweep modes from 10 ms to 100 seconds. The generator eliminates the time-consuming task of hand-plotting the response data points by providing an instantaneous oscilloscope display of the unit under test.

Specifications include a range of 1 Hz to 100,000 Hz, response of  $\pm 0.1\%$  to 20 KHz and  $\pm 0.15\%$  to 100,000 Hz. The unit features fixed-output attenuation of 0, 20, and 40 dB, as



well as continuously variable attenuation.

The SG1900 audio sweep generator sells for \$119.95 in kit form, and \$149.95 assembled.

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### Color Bar Generator



Hickok Electrical Instrument Company announces the Model 239 pocket-size color bar generator.

Model 239 is a hand-held, self-contained instrument with nine stable patterns, including gated rainbow for testing and adjusting color-TV circuits. The generator features MOS LSI solid-state circuitry, low battery drain, stability from  $-50^{\circ}$  to  $150^{\circ}$ F, and digital timing.

Simplified controls include two matrix slide switches for pattern selection, chroma level adjustment from 0 to 150%, and RF adjustment for Channels 2 through 4. Two standard 9-volt batteries are self-contained in the case; the generator measures 5-3/4 X 3-3/8 X 1-7/8 inches and weighs 12 ounces.

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### Outlet Tester

Model OT-5 from Bio-Design, Inc. is a hand-held, battery-operated outlet tester that determines a variety of possible faults or hazardous conditions on electrical wiring.

The compact Model OT-5 consists of a voltmeter, ground tester, rotary selector switch, indicator lights, and adapter cables. This tester can be used with any 2-, 3-, or 4-wire outlets, single or three-phase, with voltages ranging from 0 to 500 volts, and 50 to 400 Hz; the voltmeter measures line-to-line and line-to-ground voltages. The ground-tester checks outlet ground resistances from 0 to 50 ohms. By using the rotary selector switch, the tester will detect electrical

hazards and faulty wiring, including open phase, grounded phase, unwired terminal, or reversed polarity.

Model OT-5 measures 5-7/8 X 3-1/8 X 2-1/4 inches and weighs 18 ounces.

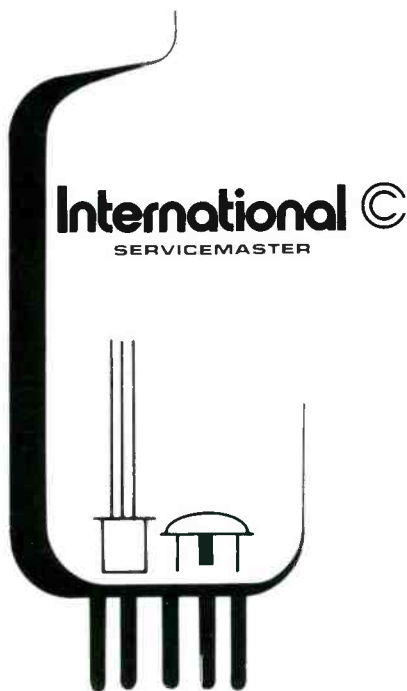
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### Receptacle Circuit Tester

Circle F Industries announces the availability of a receptacle-polarity circuit testing device.

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## productreport

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Specifications include input voltage of 12V DC, power output of 250 VA maximum, and voltage regulations of 15% maximum no load to full load. Size of the inverter is 4-1/2 X 10 X 7-1/2 inches.

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### Display Racks

Four new sizes of display racks are available from Kole Enterprises, Inc. Designed for use with Kole bins, the display/pick racks feature tilted shelves to display contents for quick and easy access.

The 3-shelf bench top, 8-shelf standing, double 8-shelf standing, and mobile 8-shelf double standing, including the dolly, are offered in complete kits, with or without bins. Made of heavy-duty steel, the display/pick racks have a rust resistant gray enamel finish.

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(Continued on page 50)

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|--|--|
| <input type="checkbox"/> SK3006.....5 for \$2.35 | <input type="checkbox"/> SK3035.....5 for \$9.15 |
| <input type="checkbox"/> SK3009.....5 for \$3.90 | <input type="checkbox"/> SK3036.....5 for \$9.75 |
| <input type="checkbox"/> SK3018.....5 for \$2.25 | <input type="checkbox"/> SK3040.....5 for \$3.75 |
| <input type="checkbox"/> SK3020.....5 for \$2.20 | <input type="checkbox"/> SK3041.....5 for \$4.20 |
| <input type="checkbox"/> SK3024.....5 for \$3.15 | <input type="checkbox"/> SK3042.....5 for \$6.20 |
| <input type="checkbox"/> SK3025.....5 for \$4.50 | <input type="checkbox"/> SK3054.....5 for \$4.50 |
| <input type="checkbox"/> SK3026.....5 for \$3.00 | <input type="checkbox"/> SK3114.....5 for \$2.40 |

### GENERAL

- |   |
|---|
| <input type="checkbox"/> 3.58 crystal osc.....6 for \$3.00                                |
| <input type="checkbox"/> 6500 PIV ITT Focus Rect.....10 for \$4.00                        |
| <input type="checkbox"/> Zen. Voltage Tripler 212-136<br>ea. \$3.95.....3 for \$10.00     |
| <input type="checkbox"/> Blue Lateral Magnets incl. P.R.....2 for \$2.50                  |
| <input type="checkbox"/> 2.5 amp 1000 PIV IR170.....20 for \$3.00                         |
| <input type="checkbox"/> Color Burst Boost Rectifier.....7 for \$2.00                     |
| <input type="checkbox"/> 66 meg res—53 meg res.....10 for \$3.00                          |
| <input type="checkbox"/> 19" & 25" Color Boosters<br>21" Color Boosters.....3 for \$11.95 |
| <input type="checkbox"/> 47mfd / 160v r.l.....5 for \$1.00                                |
| <input type="checkbox"/> 60 min. Irish Cassette Tapes.....6 for \$2.50                    |
| <input type="checkbox"/> GE Parallel tuner inc. 6LJ8-6GK5.....\$3.95                      |
| <input type="checkbox"/> CM Series Tuner incl. 6CG8-6GK5.....\$3.95                       |
| <input type="checkbox"/> Jap Phono arm incl. cartridge and<br>needle.....\$1.00           |
| <input type="checkbox"/> Xcelite Service Master Kit.....\$24.95                           |

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- |  |
|--|
| <input type="checkbox"/> D Size.....35c list—24 for \$3.60       |
| <input type="checkbox"/> C Size.....35c list—24 for \$3.60       |
| <input type="checkbox"/> Penlite.....4/\$1.00 list—24 for \$2.40 |
| <input type="checkbox"/> 9 Volt.....list 69c—10 for \$2.50       |

### ANTENNA SUPPLIES

- |   |
|---|
| <input type="checkbox"/> Finco MATV Mod. G922 300 ohm input<br>4-300 ohm output.....\$29.95 |
| <input type="checkbox"/> Finco #3020 2 Way Signal Splitter UHF VHF.....\$1.75               |
| <input type="checkbox"/> JFD Signal Splitter 82 Channel SS21.....\$1.50                     |
| <input type="checkbox"/> JFD BC2 Two Set Coupler.....\$1.50                                 |
| <input type="checkbox"/> 72 ohm to 300 ohm matching transformer.....\$1.25                  |
| <input type="checkbox"/> 2 set 72 ohm coupler.....\$2.95                                    |
| <input type="checkbox"/> 4 set 72 ohm coupler.....\$3.95                                    |
| <input type="checkbox"/> 1000 ft. foam wire Columbia #22.....\$23.95                        |
| <input type="checkbox"/> 500 ft. Coax White 72 ohm.....\$16.95                              |
| <input type="checkbox"/> Finco CA 9 Color Antenna.....\$6.90                                |
| <input type="checkbox"/> Finco CA 13 Color Antenna.....\$9.90                               |

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For More Details Circle (16) on Reply Card

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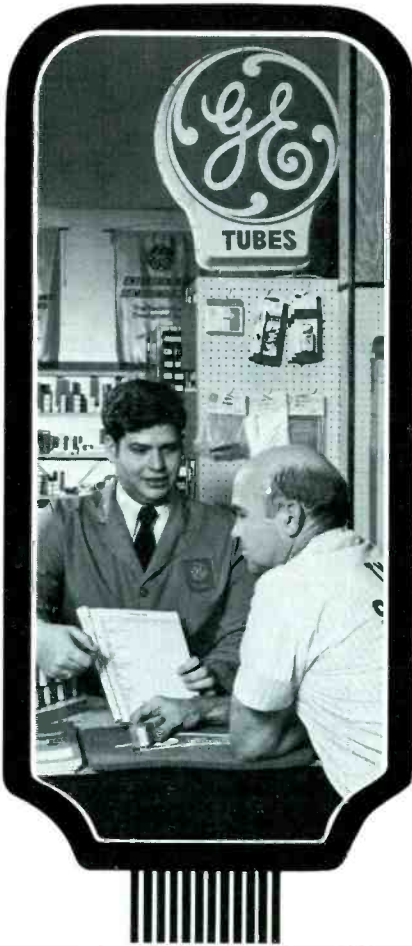
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GENERAL  ELECTRIC



(Continued from previous page)

With a melting point of 445° F, Alu-Sol for soldering to aluminum contains four cores of flux and eliminates the need for pre-cleaning. It leaves a relatively non-corrosive, non-conductive flux residue that generally does not require removal.

Arax is designed for work with iron and steel and is useful for plumbing, automotive, or non-electrical work where the highest tensile strength is required. It has four cores of acid-based flux.

For More Details Circle (41) on Reply Card

### Brighteners and HV Repair Kit

Three Model CR-250 90-degree color picture tube brighteners and a high voltage repair kit, Model HVK-630, are available in a promotional package from Telematic.



The repair kit, featuring HV repair parts, anode wire, filament wire, HV spaghetti, and styrene anode caps, is offered free with the three color brighteners. Promotional package VP-180 contains \$23 worth of merchandise and sells for \$18.

For More Details Circle (42) on Reply Card

### Self-Adjusting Multi-Wrench

This ingenious tool from Brookstone Company takes the place of a set of wrenches. It handles all nuts and bolts 3/8" X 7/8" across flats, including metric, and automatically adjusts itself.

Operating like a ratchet wrench, it doesn't require removal and re-gripping with each stroke. The wrench grips at least three surfaces without rounding or damaging corners, and the grip increases as turning gets tougher. Thus, it is useful for removing or tightening damaged or rusted bolts that ordinary socket wrenches won't fit.

Made of high-quality chrome-vanadium tool-steel polished heads, the wrench is entirely chrome plated. It measures 8-1/2 inches long and sells for \$9.10 postpaid. □

For More Details Circle (43) on Reply Card

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For More Details Circle (17) on Reply Card



# SPRAY AWAY THE RACKET.



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COMPANY

Spartanburg, South Carolina

For More Details Circle (18) on Reply Card

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EV/GAME	SOUNDESIGN
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MARDEN	WORKMAN
	ZENITH

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6LQ6 TUBE \$3.21 EACH  
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OPEN ACCOUNTS WELCOMED

For More Details Circle (19) on Reply Card

## audio systems report

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

### Needle Kits

Six Caddi-Kits, each containing an assortment of 12 diamond needles to cover major brand names, are offered by EV-Game.

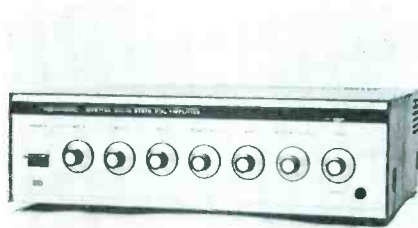
The kits are designed to replace the diamond needles used by GE, RCA, EV, Magnavox, Zenith, BSR, Astatic, and Varco. Also included is a universal kit that contains one each of the 12 fastest selling needles. The Caddi-Kits are available individually or by a sampler kit, Model SNK-6, which is one each of the six kits packaged.

Each assortment is packed in a clear plastic 2-1/2 inch cube, and the color-coded label provides self-inventory and cross-reference.

For More Details Circle (44) on Reply Card

### Public-Address System Amplifier

Radio Shack has introduced the Realistic MPA-50, a 50-watt public-address system amplifier featuring a priority switch that overrides any of its inputs for paging.



The Realistic MPA-50 has four microphone inputs, an auxiliary input for tape or tuner, and a rear panel switch for either ceramic or magnetic phono cartridge input. Other features include a master volume and tone control, level controls for each of the five inputs, output protection circuitry with an overload light and reset button, and pushbutton control.

The amplifier is rated at 50 watts RMS with response given as 100-10,000 Hz at full power. It has 4-, 8-, and 16-ohm speaker outputs and 25- and 70-volt line outputs; it measures 4-1/4 X 13-3/4 X 11 inches.

Realistic MPA-50 amplifier sells for \$129.95.

For More Details Circle (45) on Reply Card

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C.R.T. BRIGHTENER



CR-115

REPLACEMENT SOCKET



CR-90-110

TUBE TEST ADAPTOR



CR-110-90

CHASSIS SERVICE ADAPTOR



CR-110

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## TeleMatic

Brooklyn, N.Y. 11207

For More Details Circle (20) on Reply Card

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with



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Distributor



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- All components are functionally arranged in drawers by value, type, etc.
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- All kits are completely set up, ready to use.

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# antenna systems report

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

## Balanced Matching Transformer

A 75 to 300-ohm matching transformer that rejects noise and direct pickup is available from **Jerrold Electronics** for use in MATV, cable TV, and home TV antenna systems.

Capable of handling UHF, VHF and FM frequencies, the T-4000 matching transformer is balanced (40 dB) to reject direct pick-up. An important mechanical feature of the T-4000 is that it provides a connector which mates with standard F fittings as well as the patent-pending snap-fit SF-9 connector.

The transformer is available in peg-board display as well as bulk. List price of the display-packed T-4000 is \$1.75.

For More Details Circle (46) on Reply Card

## Color Antennas

**JFD Electronics** has introduced a new series of VHF/UHF/FM antennas. The LPV-UC Color Best antennas combine log periodic design with a new ultra-sensitive corner reflector and UHF driver for improved reception in color or black-and-white on all channels.

Other features include capacitor-coupled dipoles and electronically-integrated high-gain corner reflector. A staggered multi-element phased driver minimizes ghosts and snow on VHF and UHF bands. Triple square crossarm construction maintains solid rigidity and improves signal transfer.

For More Details Circle (47) on Reply Card

## TV Signal Selector

Model CTS-2 Cablemate TV signal selector is available from **Winegard Company**.

The signal selector switch connects either cable TV signals or antenna signals to the TV set via coaxial cable and a VHF-UHF band separator built right into the switch. In addition to a 75-ohm cable TV input connector, the CTS-2 offers a choice of 300- or 75-ohm antenna input. The switch mounts on the back of the TV set out of sight with just the switch showing; the cable TV subscriber can switch from antenna to cable at a flip of the switch. □

For More Details Circle (48) on Reply Card

# Super Values

**RAYTHEON TUBES**

- 5-6BA11 — \$4.75
- 5-12GE5 — \$4.75
- 5-3EH7 — \$2.55
- 5-4BU8 — \$5.00
- 5-6GH8—\$3.55
- 5-3HQ5—\$6.35
- 5-3KT6 — \$4.25
- 5-35EH5—\$3.85
- 100-6GH8—\$65.00

**CARTRIDGES (BULK)**

- SONOTONE 8-T — \$1.25 Ea.
- BSR-TC8S — \$1.25 Ea.
- VARCO-CN-72 — \$1.25 Ea.

**YOKES-B/W**

- Y-130-Zenith 95-2874 — \$7.95 Ea.
- Y-105-MANY CHASSIS — \$7.95 Ea.
- Motorola 24D66926AO4D — \$2.00 Ea.
- Motorola 24D66926AO7 — \$2.00 Ea.

**DIODES—TRANSISTORS**

- 25-IR-2.5 Amp.-1000 PIV—\$4.95
- 100-IR-2.5 Amp.-1000 PIV — \$16.95
- 6500 Focus Rect. — 4 for \$2.00
- 13.5 KV Focus Rect.—5 for \$3.00
- 25-IN34A Crystal Diodes — \$2.00
- 5-Color Boost Rect. — \$2.00

**COLOR FLYBACKS**

- RCA-137545 — \$7.95 Ea.
- RCA—136640 — \$7.95 Ea.
- EMERSON-738229A — \$3.95
- PHILCO-32-10132-1—\$3.95

- 10 Ass't'd Align. Tools — \$1.98
- TUNER CLEANER SPRAY 8 Oz. — \$1.00
- 50 Ass't'd W.W. Resistors — \$2.79
- 20 Ass't'd MALLORY CONTROLS — \$2.00
- SLIDE SWITCHES ASS'T'D — 10 for \$1.00
- DELAY LINES — 2 for \$1.19
- 25 Ass't'd Terminal Strips — \$1.00
- 20 Ass't'd Tube Sockets — \$1.00
- CRT Harness-COLOR — 5 for \$2.00
- CRT Harness-B/W — 3 for \$1.00
- 7 & 9 Pin Tube Sockets (P.C.) 20 for \$1.00
- R. F. Cables Tinned Ends — 6 for \$1.00
- Shunt Reg. Hoods — 2 for \$1.00
- 50 Ass't'd IF Xfmrs-Rad.-TV-FM — \$2.49
- 100 Ass't'd MICA COND. — \$1.19

**CONDENSERS CANS**

- 300 Mfd.-200 Volts — 4 for \$2.29
- 400 Mfd.-200 Volts — 4 for \$2.59.9
- 30-20-10 Mfd.-350 V/1" Can — 4 for \$1.00
- 40-20 Mfd. - 150 Volts - P.C. — 5 for \$1.00
- 200 Mfd.-80 Mfd.-350 V. — 3 for \$1.69
- 25 Ass't'd. Filters — \$3.95
- 1500 Mfd. - 50 Volts — 3 for \$1.59

**CONDENSERS-AXIAL LEADS**

- 100 Mfd.-150 Volts — 10 for \$1.98
- 500 Mfd.-25 Volts (P.C.) — 5 for \$1.00
- 150 Mfd.-150V-50Mfd.-50 V. — 3 for \$1.00
- 100 Mfd.-50 Volts — 4 for \$1.00
- 5 Mfd. - 250 Volts 5 for \$1.00
- 16 Mfd. - 450 V. — 4 for \$1.39
- 30 Mfd. - 450 Volts — 3 for \$1.19
- 10 Mfd. - 600 Volts — 3 for \$1.00
- 25 Ass't'd Axial Leads — \$3.95
- 25-Axial-Pc-Trans. Work — \$3.95

- COLOR CRT BOOSTER-70% — \$4.29
- COLOR CRT BOOSTER-90% — \$4.59
- 70% Conv. Assembly — \$1.79

**TUNERS**

- SYLV. TRANS.-54-29331-3 — \$6.95
- SYLV. TRANS. 54-35055-2 — \$6.95
- GEN. ELECT. TRANS. 86X15 — \$6.95
- G. I. PARALLEL-6GS7-6HA5 — \$3.95
- SYLV. SER. 54-27887-1-5GJ7-3HA5 — \$5.95
- PHILCO SERIES-76-13579-6 — \$4.95
- G.E. Series-5GJ7-3HA5 — \$5.95
- G.E. Par. ET38X318 — \$6.95

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## TV TECH SPECIALS

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# catalogs literature

Circle appropriate  
number on Reader  
Service Card.

**105. General Electric**—has announced availability of a 28-page catalog of service, advertising, and sales-promotion materials for use by independent electronic technicians.

**106. H. K. Simon**—offers details of actual business increases gained by shop owners who applied the principles given in the business-promotion package which includes "How To Double Your Business" and "Television Sales and TV Service Promotion" supplement.

**107. Mountain West Alarm Supply Co.**—makes available three books, "Design For Security", "Silent Sentinels" and "Practical Ways To Prevent Burglary and Illegal Entry", which discuss security planning, management, locks, alarms, and electronics. A folder with detailed summaries of these books and how to buy them may be obtained by writing to Mountain West.

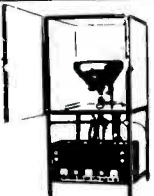
**108. Nortronics Company**—has introduced the fifth edition of their Recorder-Care Manual. The two-color, 32-page manual discusses magnetic heads, principles of magnetic recording, and recorder maintenance, and contains a catalog section which illustrates and describes recorder-care products by Nortronics.

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For More Details Circle (23) on Reply Card

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For More Details Circle (24) on Reply Card

June, 1974

**109. PLC Electronics**—announces the availability of a detailed 32-page catalog which lists 17 professional security systems designed for installation by electronic service technicians.

**110. Howard W. Sams & Co.**—offers the new Audel Book Catalog, a colorful 48-page catalog describing 98 books which were written for the do-it-yourselfer, homeowner, craftsman, or student. Some of the books included in the catalog are "Electrical Library", "Practical Electricity", "Radio and Television Library", and "New Electric Science Library".

**111. Simpson Electric**—has published a 40-page catalog which describes the complete line of Simpson test and measurement devices available from distributors. Catalog 4200 lists over 1500 types, styles, sizes, and ranges of panel meters, more than 100 meter relays, and a variety of general and special purpose test equipment.

**112. Triplett Corp.**—has introduced an eight-page, four-color brochure on its new line of sound measuring, monitoring, and recording equipment. "A Better Way To See Sound" illustrates Triplett's sound level meters, dosimeter, integrator, calibrators, and accessories. It provides detailed physical and electronic specifications, including dimensions, weights, decibel ranges, performance parameters, operating characteristics, and environmental considerations, and has tables showing typical sound pressure levels generated by various industrial and other operations.

**113. Tucker Electronics Co.**—has announced the availability of a 160-page instrument catalog. Over 5000 test instruments are listed by nearly 600 manufacturer names. Many re-conditioned, new and used sets are available, and a variety of rental and purchase finance plans are offered. The catalog features 18 sections divided by products category, and backed by an inventory of over 15,000 instruments. □

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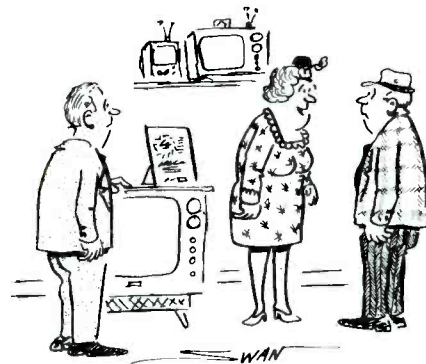
For More Details Circle (25) on Reply Card

# photofact<sup>TM</sup>bulletin

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

<b>CORONADO</b>	
TV25-1062A/B .....	1402-2
<b>DUMONT</b>	
21DT40W, 25DC40W/41M/42S (Ch. 30K19, 31K19) .....	1404-1
<b>EMERSON</b>	
Chassis 31K2001-4 .....	1398-1
<b>GENERAL ELECTRIC</b>	
Chassis 10QA .....	1399-2
<b>GENERAL ELECTRIC</b>	
Chassis 25MB, 25MH .....	1400-3
Remote Control Receiver EP62X38, Transmitter EP62X50 .....	1400-3-A
<b>GENERAL ELECTRIC</b>	
CQA6205WD, QA6218WD (Ch. 16QA) .....	1405-1
<b>J. C. PENNEY</b>	
2332A, 2355 .....	1405-2
<b>MIDLAND</b>	
15-259 .....	1405-3
<b>MOTOROLA</b>	
Chassis FA18TS-929, FB16TS-929, GA18TS-929, YFA16TS-929, YFA18TS-929, YFB18TS-929 .....	1398-2
<b>MOTOROLA</b>	
Chassis 12TS-/C12TS-476T .....	1401-3
<b>PANASONIC</b>	
CT-252, CT-253, CT-254, CT-256 .....	1399-3
<b>RCA</b>	
Chassis KCS189B/C/D .....	1404-2
<b>SEARS</b>	
528.41670300 thru 528.41670313 .....	1391-1
<b>SEARS</b>	
528.43800300/301/302, 528.43801300, 528.43806300, 528.43810300/301/302, 528.43811300, 528.43816300, 528.43820300/301/302, 528.43821300, 528.43826300 .....	1402-3
Remote Control .....	1402-3-A
<b>SEARS</b>	
564.41990300/1300/1301 .....	1403-1
<b>SHARP</b>	
2K-31A .....	1403-2
<b>SONY</b>	
KV-1730R .....	1395-3
Remote Control Used With Model KV-1730R .....	1395-3-A
<b>SYLVANIA</b>	
Chassis B10-14 thru B10-18 .....	1393-3
<b>SYLVANIA</b>	
Chassis D19-9 .....	1387-2

## cartoon corner



"LET'S BUY THE SET HERE IN DENVER; THE STATIONS ARE BETTER THAN THOSE AT HOME."



"WE'VE LOST CONTACT WITH OUR HOME PLANET."

## reader chuckles

### TV Technician's Lament

*They said their color turned bright green,  
But you found no light on the screen.  
You fixed that problem only to find,  
All you see is one horizontal line.  
A couple of tubes make that all right,  
And then the color is bent in a stripe.  
The horizontal's got the shakes,  
And channel seven comes in on eight.  
So you decide you've got a bummer,  
Why didn't you listen to Mom,  
And instead become a plumber?*

By Ken Lendt

Submitted by Richard Bowser, CET  
Riteway TV  
Omaha, Nebraska

Editor's Note: We can all appreciate Technician Lendt's feelings enough to forgive him some forced rhymes.

# bookreview

## Introduction to Biomedical Electronics (No. 21005)

**Author:** Edward J. Bukstein

**Publisher:** Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis, Indiana 46268

**Size:** 5-1/2 X 8-1/2 inches, 208 pages

**Price:** \$5.50 softbound

Electronic instrumentation is a vital part of medical practice today; consequently, it is crucial that the bioelectronics specialist be prepared to service hospital equipment with the fastest and most exact methods possible. This book offers the electronic technician an opportunity to become acquainted with various equipment used in hospitals today. The first chapter covers the medical terminology needed for clear communication with people in the medical community. Other chapters discuss biomedical recording systems, systems applications, circuit details and valuable troubleshooting information. Also, special attention is given to shock hazards involving both the patient and hospital personnel. Other topics explained from the technician's standpoint include electrophysiology of the heart, electrocardiography, monitor oscilloscopes, heart rate monitors, fetal monitoring, pacemakers, and telemetry.

## FM Stereo/Quad Receiver Servicing Manual (No. 660)

**Author:** Joseph J. Carr

**Publisher:** Tab Books, Blue Ridge Summit, Pennsylvania 17214

**Size:** 5-1/2 X 8-1/2 inches, 192 pages

**Price:** \$7.95 hardbound, \$4.95 softbound

This book provides the technician with the latest information on multichannel FM receivers, from servicing and adjustment to information on the digital tuner. The audio section is covered first, beginning with a review of the basic circuits, plus the bias, feedback, and protection methods used in modern stereo receivers. Included also are function controls, preamplifiers, audio IC op-amps, tone control techniques, and equalization. Coverage of two- and four-channel systems consists of signal splitter and preamplifier circuits, subcarrier regeneration, decoder circuits, IC stereo decoders, and four-channel stereo systems, including matrix quad. Later chapters discuss in detail a number of receiver performance measurements; among them are power output, frequency response, input sensitivity, harmonic distortion, channel separation, and signal-to-noise ratio. To assist the technician in setting up an FM receiver servicing facility, the author suggests a full complement of equipment; each unit is evaluated for its importance in the servicing function versus its cost.

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# SERVICE ASSOCIATIONS

## NATESA News

NATESA has scheduled its 1974 Convention for August 16 to 18 at the Chicago Sheraton Hotel. Features include sponsored meals, seminars on business and electronic developments, plus fellowship and fun.

NATESA publications the "Joys Of Electronic Living" and "So You Want To Be An Electronic Technician" are in their 10th printing. Contact NATESA to find out how you can obtain quantities of these booklets. The "TV Service Contract Cookbook" also is off the presses.

Write to NATESA at: National Alliance of Television & Electronic Service Associations, 5908 South Troy, Chicago, Illinois 60629.

## NESDA News

More than 700 participants have attended the NESDA Business Management schools presented in Louisiana, New York, Missouri, Kansas, Kentucky, Indiana, Oregon, Washington, Ohio and Iowa.

From the Newsletter of the Wisconsin Electronic

Service Association comes a suggestion for a useful (and cheap) tool. Tom Flegler of Kenwood TV in Milwaukee, Wisconsin says to make a long-reach screw holder just solder an alligator clip to the end of a monopole telescoping antenna.

Evaluation of service data is being added to NESDA's Serviceability Project. Manufacturer's service data is judged on: indexing and filing, accuracy, completeness, readability, updating of production changes, availability of data, and the quality of photographs and mechanical drawings.



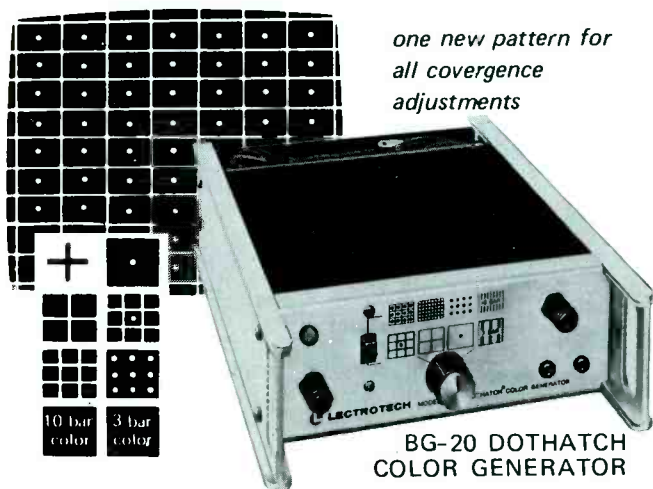
Those attending the February 21 meeting of the NESDA/ISCET Serviceability are (left to right): Robert Hannum, Supervisor of Training & Technical Publications for General Electric; Dick Raub; Buzz Padgett; Claude Desmeules; Jim Candler; Dick Glass, Executive VP of NESDA; and Dean Mock. All but Mr. Hannum are members of the NESDA Serviceability Committee.

An editorial in the Arkansas Anode questions why there is no separate charge for delivery and installation of a chassis or TV set, although the service call and shop labor are itemized separately. Some shops include it with the bench labor, although there are occasions when this might result in a loss. It was suggested the deliver-and-install charge should be about 70% of the service-call price.

This year, the NESDA National Convention is to be held in Kauai, Hawaii, August 6 to 17. Two of the speakers are Miles Sterling and John Sperry, both experts in business management and pricing. Write to NESDA, 1715 Expo Lane, Indianapolis, Indiana 46224 for a free brochure about the convention. □

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## Shop For Money

(Continued from page 22)

businesses to obtain needed capital, despite the tightening money market.

### Loans From Finance Companies

If you can't borrow from your bank or other similar source, you'll find most finance companies eager to lend you money on the equity of your fixtures or equipment. However, loans from finance companies carry the **highest** rate of interest, and should be considered only as a last resort.

### State and Municipal Loans

Many states have agencies for the sole purpose of making loans to business firms desiring to enlarge their facilities, if it would increase employment and payrolls in the area. Some cities also encourage businesses in this way. Contact your state Department of Commerce and local authorities for specific information.

### Other Sources of Help

Disaster loans can be obtained by businessmen whose establishments have been damaged or destroyed by floods or other disasters. These carry very attractive interest rates.

Also, loans through the Area Development Administration can be obtained to help business expansion in rural areas in order to increase employment.

The federal government has a program called Service Corps of Retired Executives (SCORE) where more than 2,000 talented and trained retirees are available to help small businesses solve problems of pricing, advertising and purchasing. There is no charge for the first 90 days of SCORE counseling.

Booklets about various phases of operating a business can be obtained from the Small-Business Administration for prices ranging from free to three or four dollars per book.

### Summary

Cash to expand your business or tide you over a temporary time of insufficient profit can be obtained from many different sources. Most

of the popular ones have been listed, along with an estimate of the cost.

Watch your cash flow, and plan ahead as far as possible. There are times when it's wise to borrow the money you need rather than suffer the paralysis of just barely getting by.

Then, if it's advisable to borrow, remember you can combine several of the ideas given here. Just keep the payments within your power to repay. □

### Test Lab Report

(Continued from page 37)

the hum would have made necessary a larger case size; and the hum does not interfere with most of the tests. If you want to check the performance without the hum, just unplug the power cable.

DC voltage for both battery and AC operation is monitored by the "Battery" meter. Any reading in the black area of the scale indicates normal voltage. The scale is not linear, but the zero is suppressed, and this stretches the scale around the correct voltage reading. When the instrument is off, the pointer rests against the stop at the right.

### Audio Subbing

Our publishing deadline did not allow time enough for tests of all the sound-IF functions. But we did inject a signal from the "Audio" jack to the volume control of a tube-powered receiver. The volume was enough for a satisfactory test. Amplitude of the audio test signal is about .5 volt p-p, which is more than enough for full volume from transistorized receivers.

The "Internal speaker" control on the front panel does not change the amplitude of the test signal at the audio jack. Use the receiver volume control to set the level during tests.

### Testing UHF Tuners

UHF tuners can be tested by connecting their output signals to the jack marked "UHF tuner test", and turning the Subber channel selector to UHF. The Subber functions as a 40-MHz IF amplifier. Connect it in the usual way to the

IF input point on a TV chassis.

### Modular Construction


Some of the components in the Master Subber are attached to the front panel, some are wired to the rear jacks, the tuner has the normal components, and the remainder are inside two modules (Figure 5). Probably IC's are used. If so, they are inside the modules. The layout shows evidence of careful design.

### Summary

In all the tests we performed, the Master Subber operated very satisfactorily. We believe it will prove to be quite valuable as a diagnostic aid in locating the stage of a TV receiver where the signal is eliminated by a defect. □

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## The MARKETPLACE

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

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

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

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**UNUSUAL SURPLUS AND PARTS** Catalog. \$1. ETCO Electronics Dept. E.S., Box 741, Montreal "A" H3C 2V2 12-73-12t

**REPLACEMENT TRANSISTORS:** Up to 60% below dealer net! Send for details. Kenneth E. Hull C.E.T., 835 Halesworth Dr., Cincinnati, Ohio 45240. 4-74-3t

**FOR SALE** — RCA stereo FM simulator, \$150.00. Photofacts, service manuals, new tubes, 50 to 70 percent off. Clifford Shaw, 321 Dawn Court, Ridgecrest, California 93555. 6-74-1t

**FOR SALE: G.E. ALIGNMENT EQUIPMENT:** Oscilloscope ST-2A, marker Generator ST-5A, sweep generator ST-4A; all manuals and probes, excellent condition, paid \$2,000.00 make an offer. Paul TV 7548 Belmont Ave., Chicago, Illinois 60634. Phone 312-889-1245. 6-74-1t

**TRANSISTOR-TESTER.** Build in 10 minutes for pennies. Will test transistors, diodes, fuses, tubefilaments, shorts, broken-circuits, and many other parts. How to build and use instructions. \$1. TIPS, Box 188, Bruce, Miss. 38915. 6-74-1t

**B&K Model 415 Generator (New).** Best offer over \$250; Write-Herbert, Box 188, Minersville, Pa. 17954. 6-74-1t

## EDUCATION-INSTRUCTION

**REPAIR TV TUNERS**—High Earnings; Complete Course Details, 12 Repair Tricks, Many Plans, Two Lessons, all for \$2. Refundable. Frank Boeck, Box 3236 Enterprise, Redding, Calif. 96001. 6-74-6t

## SERVICES

**OSCILLOSCOPE REPAIRS.** Send unit or write for details. ONG ELECTRONICS, INC., Box 209, Corning, New York 14830. 6-74-3t

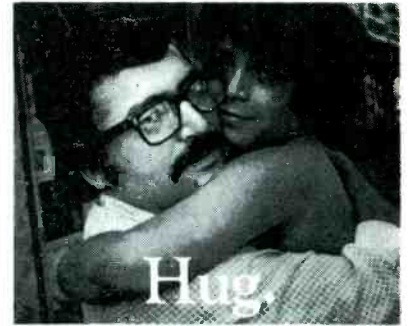
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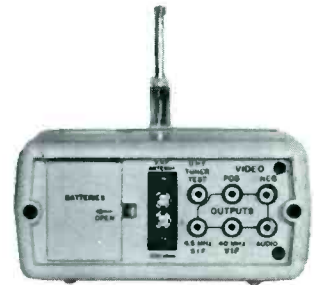
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