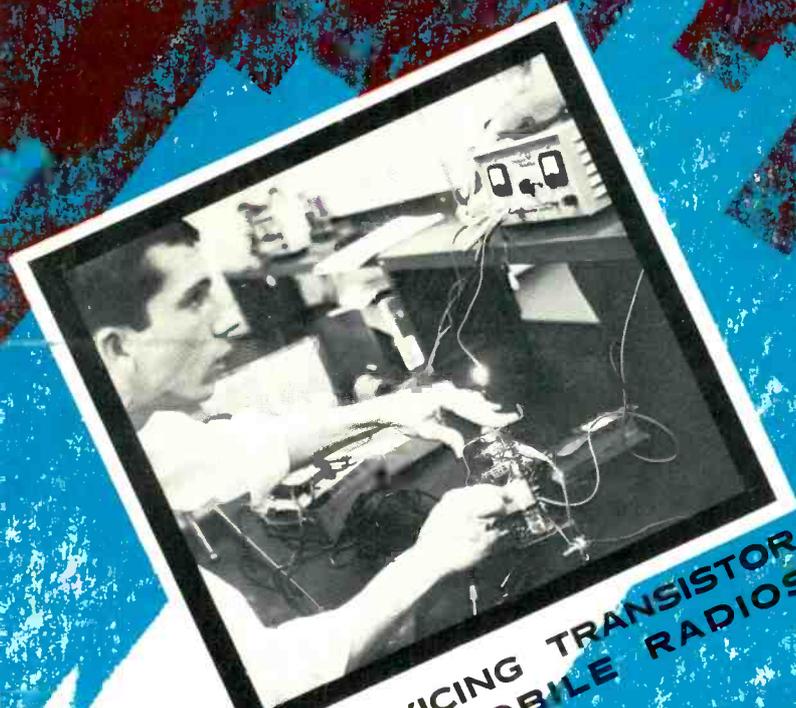
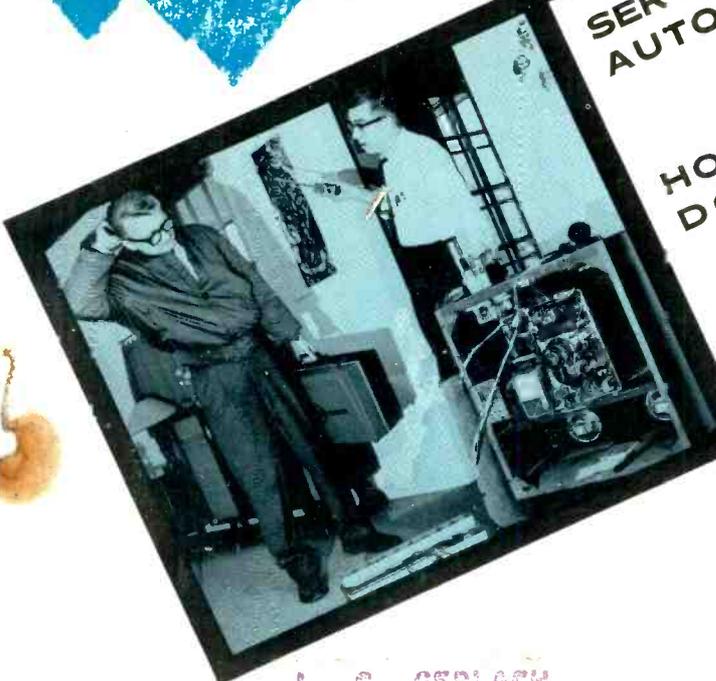


# ELECTRONIC TECHNICIAN

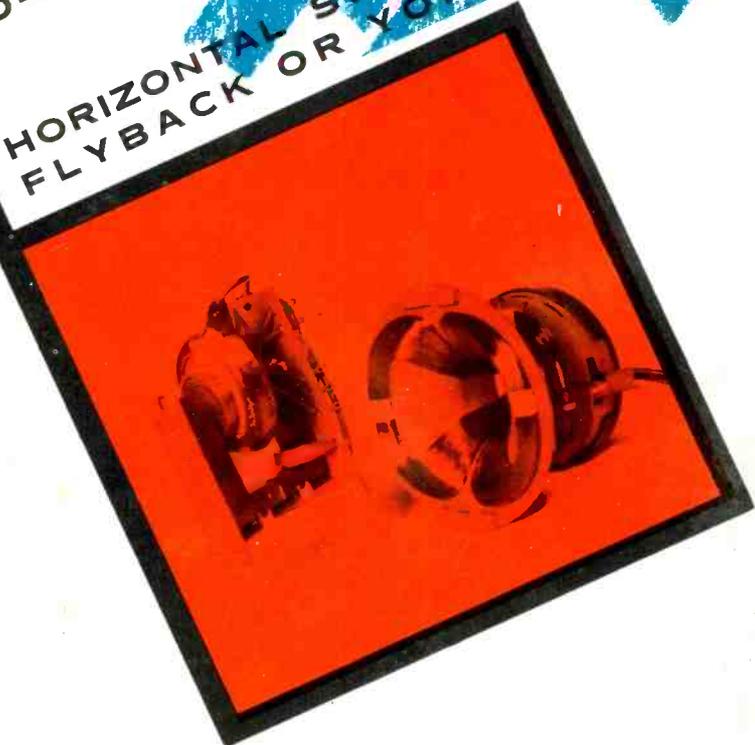


SERVICING TRANSISTOR  
AUTOMOBILE RADIOS



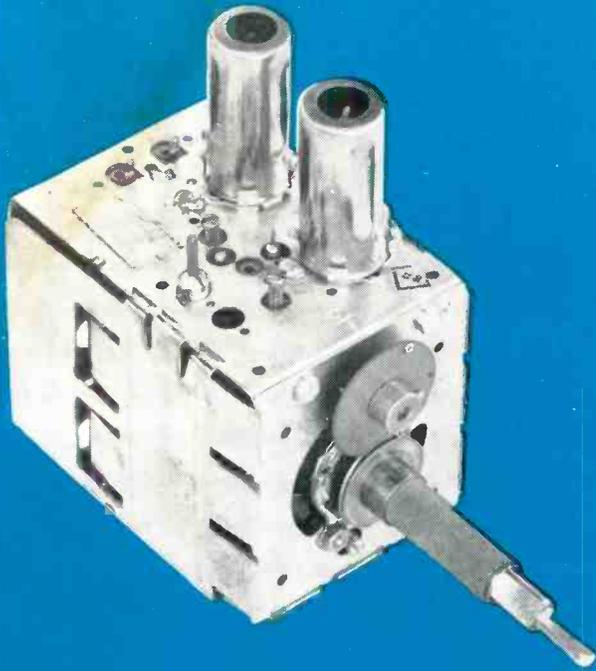
HOW TO HANDLE THE  
DO-IT-YOURSELFER

HORIZONTAL SWEEP:  
FLYBACK OR YOKE



L. C. GERLACH  
3709 W. 128TH WOODS  
DALES CORNERS, WIS.  
101-7104-2-128X9-1  
PI

# TUNER REPAIRS



# \$9.50

**FOR COMPLETE OVERHAUL**

**Includes ALL parts (except tubes)  
ALL labor on ALL makes**

**24-HOUR SERVICE with  
FULL YEAR WARRANTY**

Sarkes Tarzian, Inc., largest manufacturer of TV and FM tuners, maintains two completely-equipped Service Centers to serve YOU. Both centers are staffed by well-trained technicians in this specialized field and are assisted by engineering personnel to assure you of FAST, DEPENDABLE service.

Ⓢ Tarzian-made tuners—identified by this stamping—received one day will be repaired and shipped out the next. A little more time may be required on other makes. Every channel is checked and re-aligned per manufacturer's specifications, not just the channels which might exist in any given area.

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When inquiring about service on other than Tarzian-made tuners, always send TV make, chassis and Model number. Check with your local distributor for Sarkes Tarzian replacement tuners, parts, or repair service. Or, use the address nearest you for fast factory repair service.



**SARKES TARZIAN, INC.**

**TUNER SERVICE DIVISION**

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Bloomington, Indiana  
Tel: 332-6055

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North Hollywood, Calif.  
Tel: 769-2720

Manufacturers of Tuners . . . Semiconductors . . . Air Trimmers . . . FM Radios . . . AM-FM Radios . . . Audio Tape . . . Broadcast Equipment





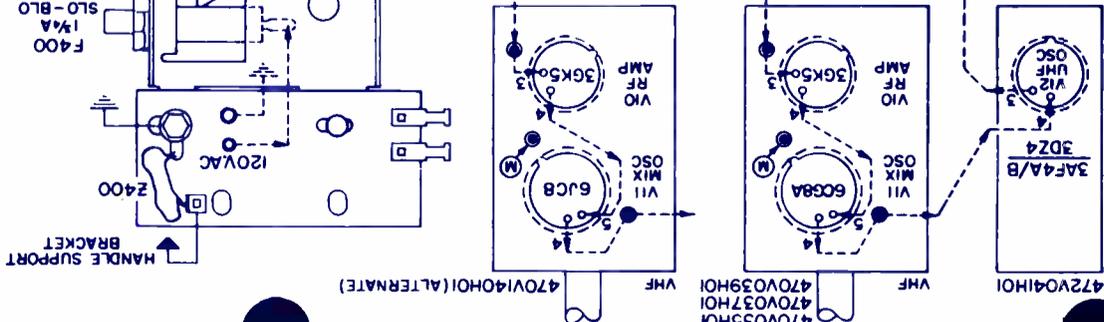




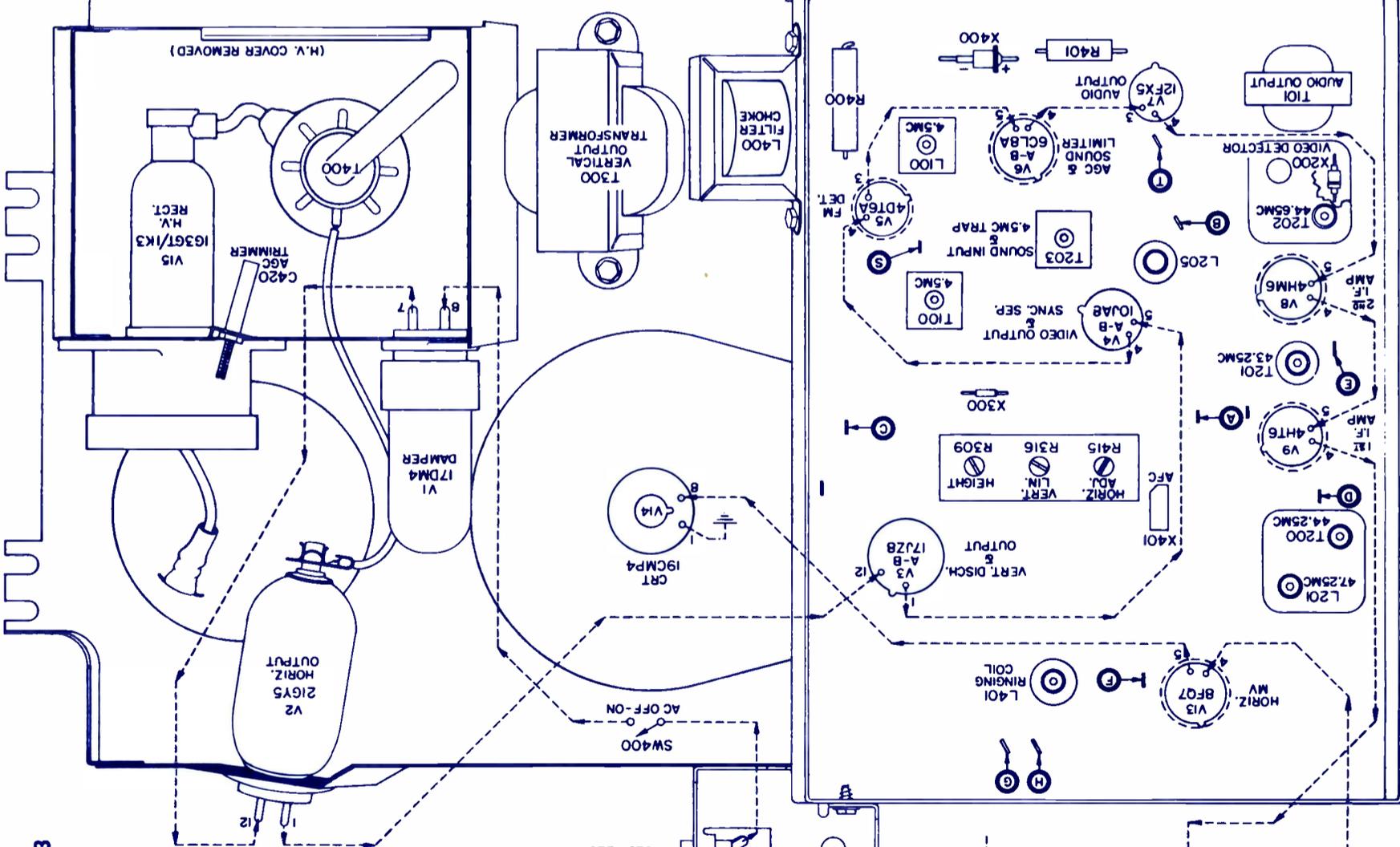
WESTINGHOUSE  
TV Chassis  
V-2446-1, -2, -3, -4

ELECTRONIC  
TECHNICIAN

TEKFAX  
825



More Data on Opposite Page



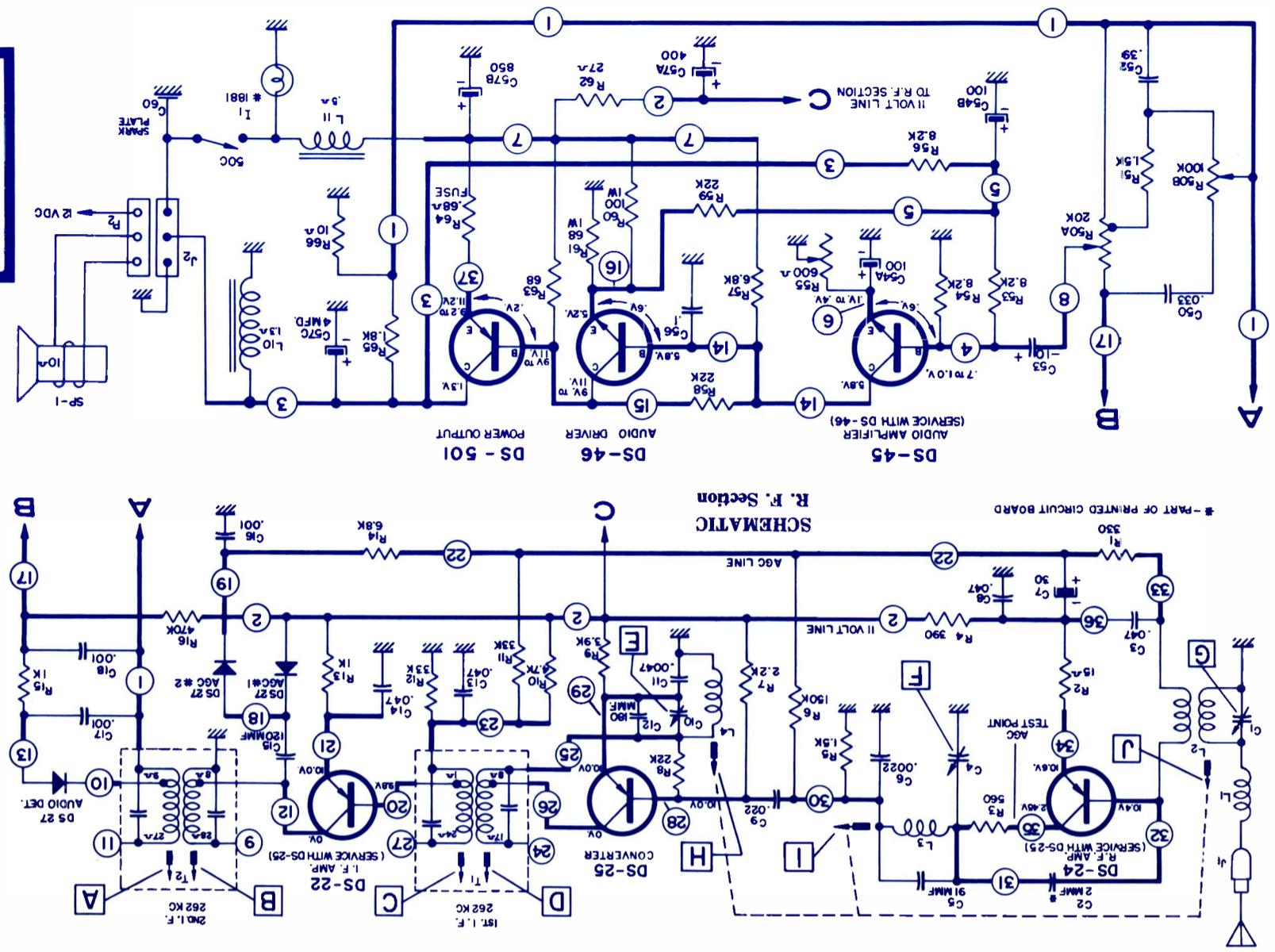
# ELECTRONIC TECHNICIAN TEKFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS  
AND TECHNICAL INFORMATION FOR SIX NEW SETS

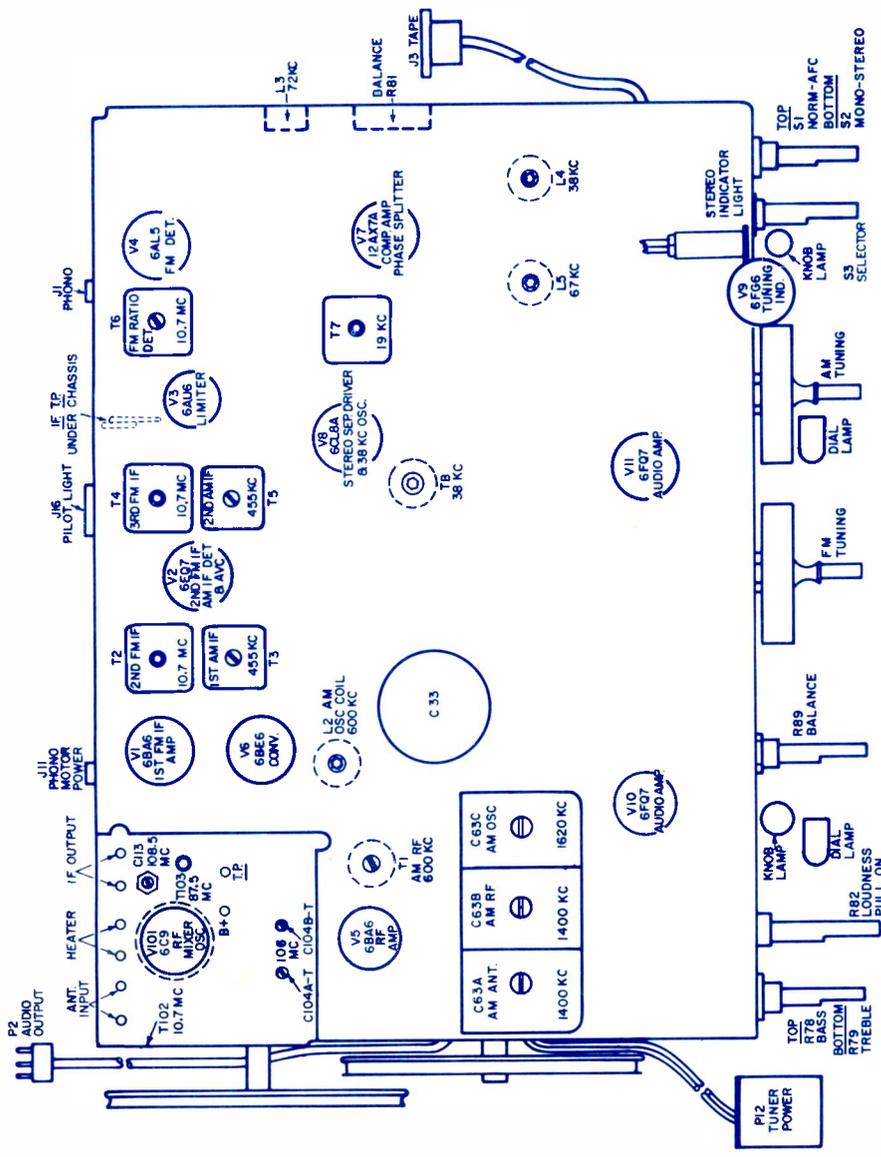
December • 1963

**DELCO**  
Buick Auto Radio  
Model 980655

# 826







**RCA**  
Stereo Hi Fi  
Models 4VF606 &  
4VF705

**ELECTRONIC  
TECHNICIAN**

**TEKFAK  
827**

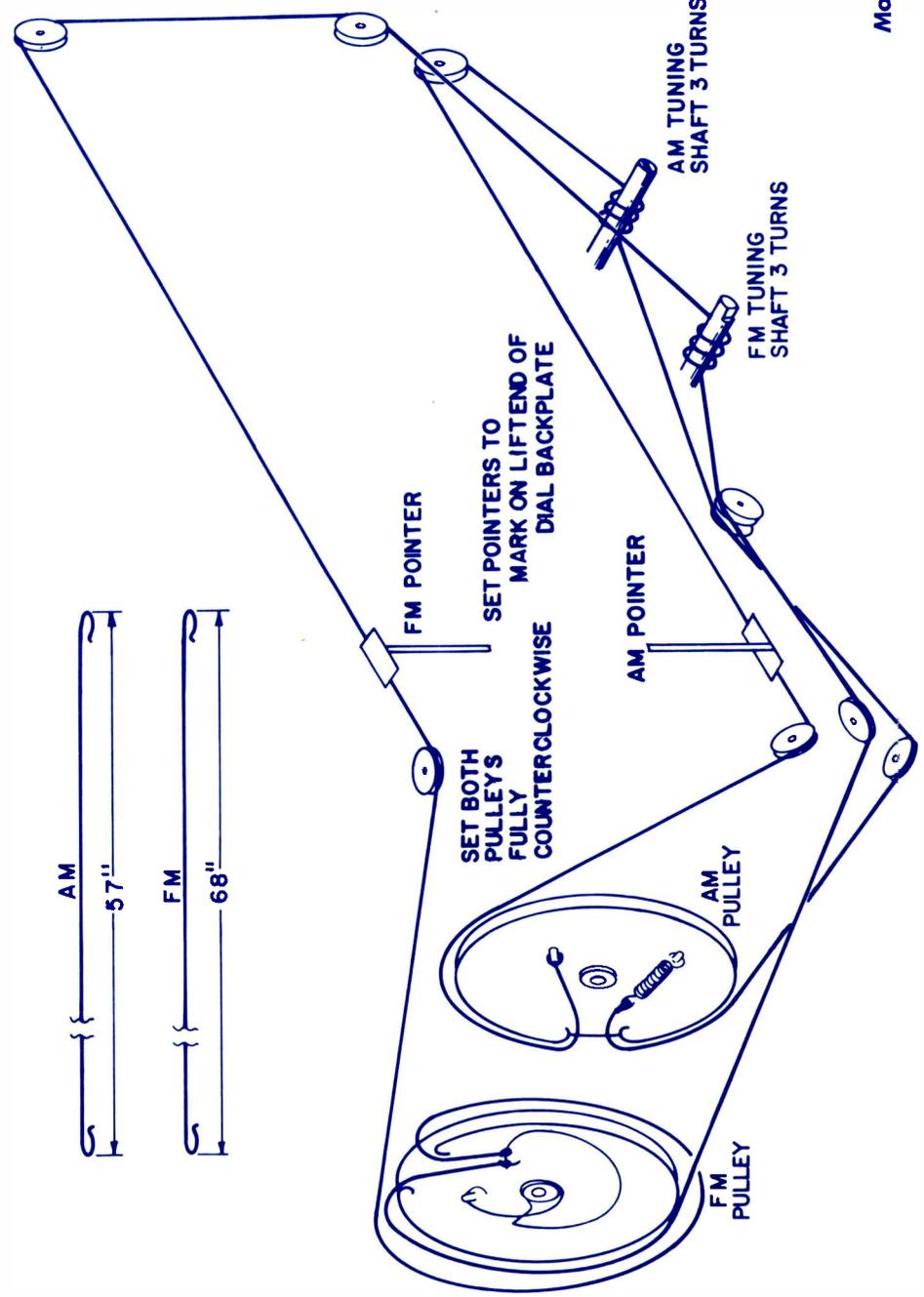
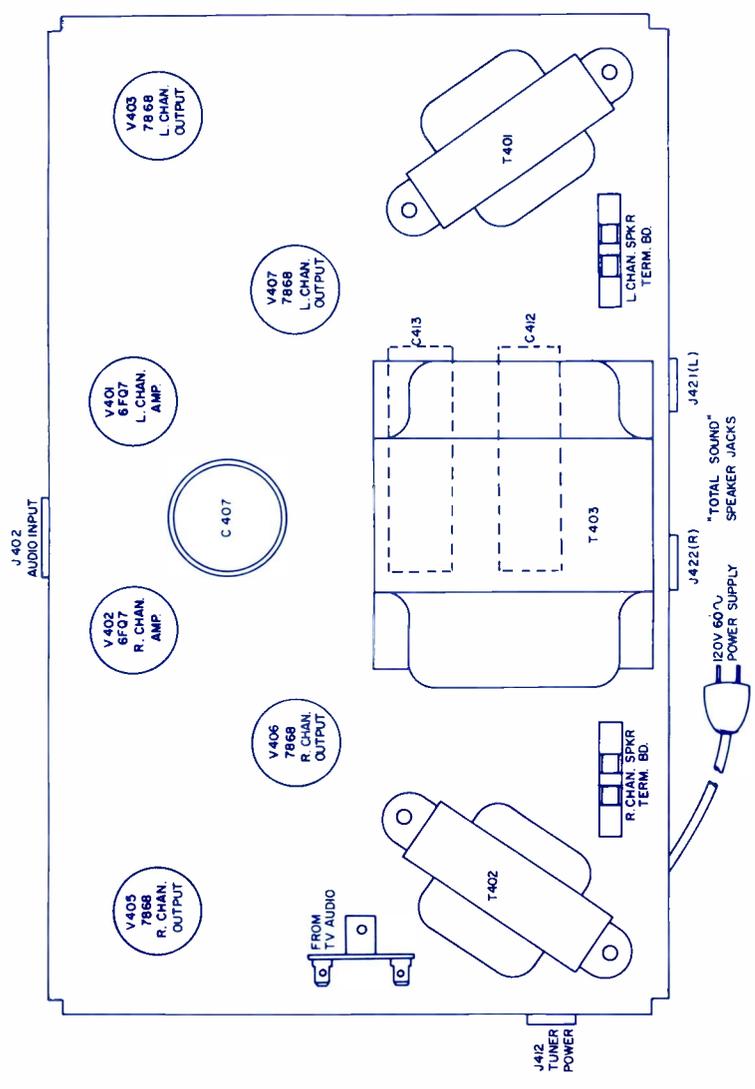
RESISTANCE VALUES ARE IN OHMS. K=1000  
CAPACITANCE VALUES LESS THAN 10 ARE IN P.F.  
VALUES 1 & ABOVE ARE IN μF. EXCEPTIONS NOTED  
TUBES ARE WITH NO SIGNAL; THEY ARE MEASURED  
TO CHASSIS GROUND WITH A "VOLTOHMIST" &  
SHOULD HOLD WITHIN ± 20% AT 120V POWER SOURCE.  
FM READINGS ARE TAKEN IN FM-STR  
POSITION. AM READINGS ARE TAKEN IN THE  
AM POSITION.

**GENERAL ALIGNMENT CONDITIONS**

1. Connect low side of signal source and output indicator to chassis ground unless otherwise specified. Ground connection should be kept close to high side connection.
2. Signal input should be kept as low as possible to avoid AVC action. (Set output indicator to highest sensitivity.)
3. Markers should be accurate (crystal controlled or checked against a crystal calibrator). The 10.7 mc marker used in each section of the FM alignment should be the same (generator dial should not be changed).
4. Marker insertion and amplitude should not distort the oscilloscope trace.
5. Standard Modulation is 400 cycles at 30% amplitude.
6. Volume or loudness control should be turned to maximum and tone controls to mid-position when they are between signal source and output indicator. AFC switch OFF.
7. Place dial Escutcheon on chassis.
8. Set function switch to band being aligned.

December • 1963

More Data on Opposite Page



# ELECTRONIC TECHNICIAN

# TEKFAAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS  
AND TECHNICAL INFORMATION FOR SIX NEW SETS



| Model                                  | Manufacturer | Chassis                                      | Model | Manufacturer                            | Chassis |
|--|--------------|--|-------|---|---------|
| ADMIRAL 16A4D, -C, UA4D, -C, B4C, UB4C | 823          | PHILCO Transistor Radio, Portable            | 824   | RCA Stereo Hi Fi Models 4VF606 & 4VF705 | 825     |
| DELCO Buick Auto Radio Model 980655    | 826          | WESTINGHOUSE TV Chassis V-2446-1, -2, -3, -4 |       |   |         |
| GENERAL ELECTRIC TV Chassis QY         |              |  |       |   |         |

Schematic No.

# 828

GENERAL ELECTRIC TV Chassis QY

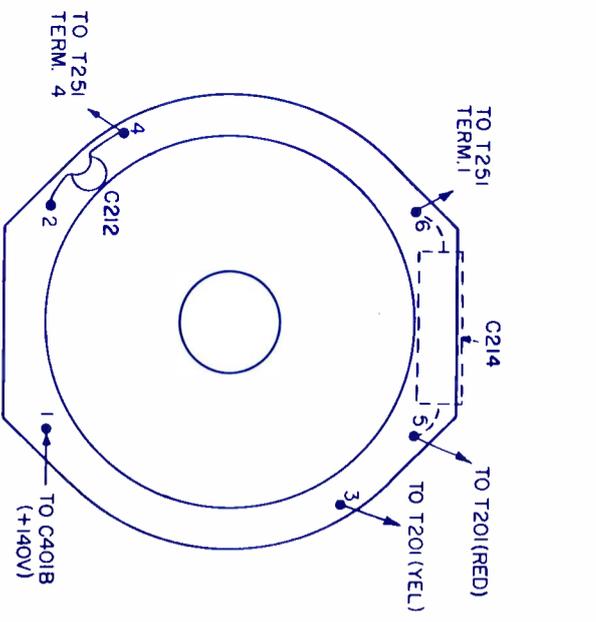
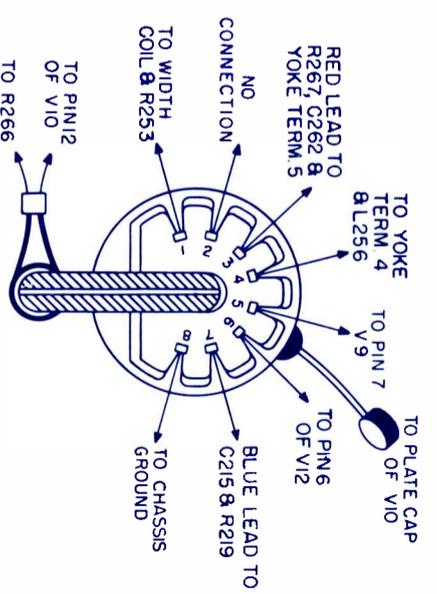
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS  
AND TECHNICAL INFORMATION FOR SIX NEW SETS

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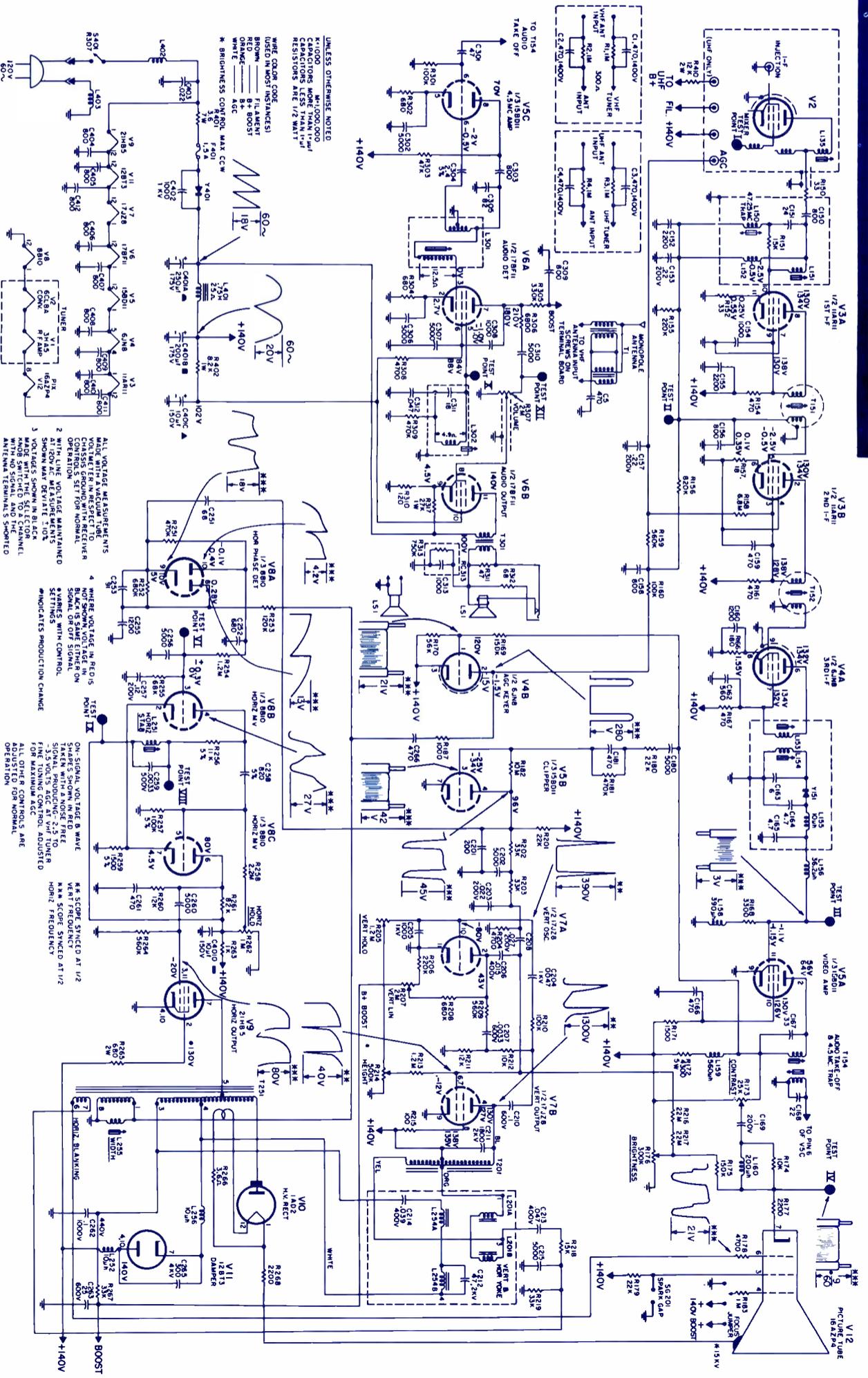
# TEKFAAX

December • 1963

HORIZONTAL OUTPUT TRANSFORMER T251



DEFLECTION YOKE



UNLESS OTHERWISE NOTED  
K=1,000  
M=1,000,000  
CAPACITORS MORE THAN 1 μF  
SHOWN WITH VALUE  
RESISTORS ARE 1/2 WATT

WIRE COLOR CODE  
USED IN MOST INSTANCES  
RED  
ORANGE  
WHITE  
\* BRIGHTNESS CONTROL MAX. CCW

ALL VOLTAGE MEASUREMENTS  
MADE WITH A VACUUM TUBE  
METER SET ON THE 100 Ω  
CHASSIS GROUND WITH RECEIVER  
CONTROLS SET FOR NORMAL  
OPERATION  
# INDICATES PRODUCTION CHANGE

WHERE VOLTAGE IN RED IS  
NOT SHOWN, VOLTAGE IN  
BLACK IS TO BE USED  
# INDICATES PRODUCTION CHANGE

ON-SIGNAL VOLTAGE WAVE  
FORMS TAKEN WITH A NOISE FREE  
SIGNATURE GENERATOR  
FINE TUNING CONTROL ADJUSTED  
FOR MAXIMUM AEC  
ALL OTHER CONTROLS ARE  
OPERATION

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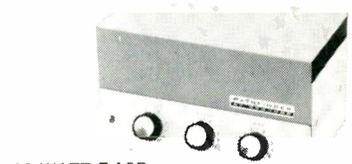
# NEW from **NEWCOMB**

## **PATHFINDER P.A.**



5-CHANNEL MIXER-PREAMPLIFIER, MODEL E-5P

### **ECONOMY LINE OF PUBLIC ADDRESS AMPLIFIERS**



10 WATT E-10B



20 WATT E-20



40 WATT E-40

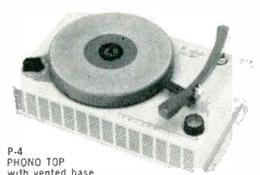


75 WATT E-75

The crisp new look, the warm colors, convenient controls and slanted panels of Newcomb's new Pathfinder P.A. equipment spell instant customer satisfaction. They provide a top quality look and excellent performance for tightly budgeted installations. Their reliability over long periods of time promises *lasting* satisfaction. They are built to meet today's requirements. The only thing old about Pathfinder amplifiers is their dependability. For over a quarter century Newcomb has put as much emphasis on dependability as on performance. Chassis are all hand wired for utmost reliability, quick tracing of readily interpreted circuits, and fast, straight-forward servicing. These features make them highly desirable for use as rental equipment. The Pathfinder line is very complete and includes a full selection of panels for rack mounting as well as two new rack mounting cabinets. The E-5P five-channel mixer-preamplifier is a gem. The 10 watt amplifier provides exceptional performance from so compact a package. The 20, 40, and 75 watt amplifiers have two microphone inputs, tape and phono inputs all with mixing and tone controls. There are outputs for tape and boosters. Each microphone channel is wired for Newcomb plug-in transformers for instant conversion for use with low impedance microphones. Each unit has a 25,000 hour pilot light. All are UL approved. A complete description of this exciting new line will be found in the new Pathfinder catalog. Write for your free copy. Franchises are available in some areas.



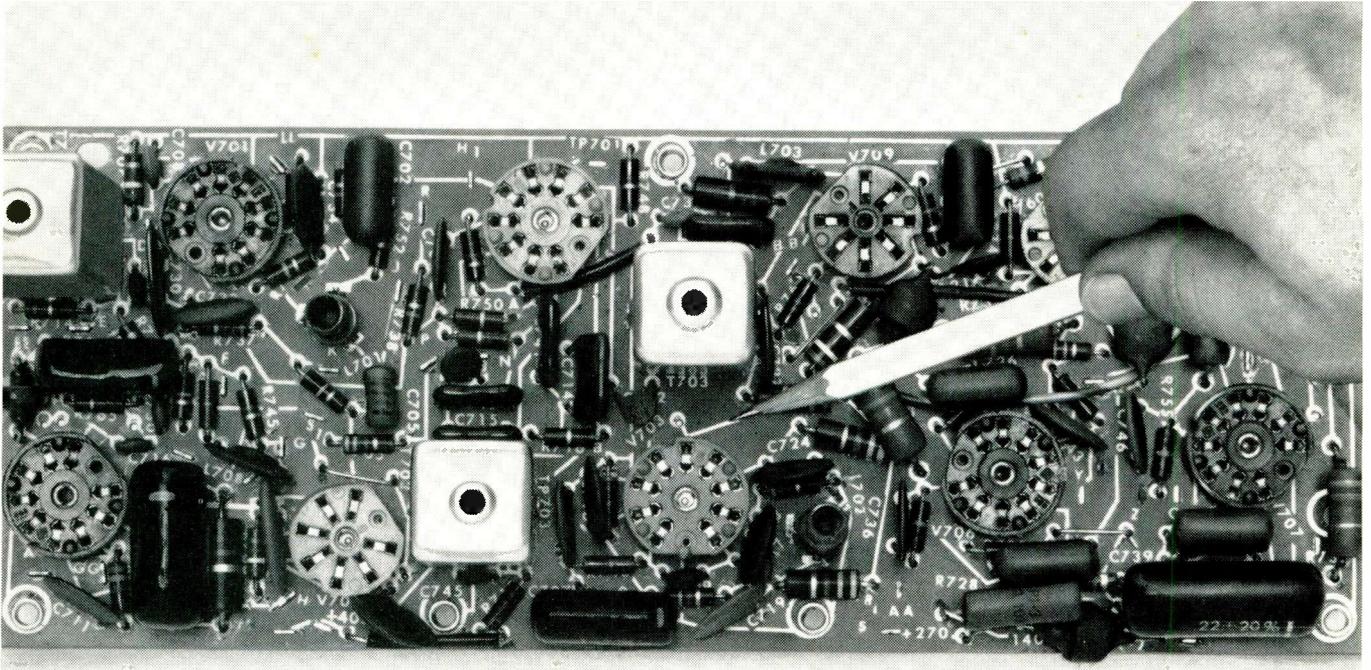
Control knobs have white, rotatable reference markers for quick return to pre-determined settings.



P-4 PHONO TOP with vented base fits top of E-20, E-40, E-75

**NEWCOMB AUDIO PRODUCTS CO., DEPT. ET-12 6824 LEXINGTON AVE., HOLLYWOOD 38, CALIFORNIA**

# From RCA Victor—another big advance in Space-Age Sealed Circuitry



RCA Victor Color TV Chroma Circuitry

You can see at a glance how new streamlined “road-mapping”  
makes servicing faster, easier, surer than ever before

Pictured above is the “new look” in RCA Space Age Sealed Circuitry . . . the new precision-crafted boards that you’ll see in *all* 1964 New Vista Color and in most RCA Victor black-and-white television sets for 1964.

This new schematic diagram “road-mapping” consists of *straight white lines* that run *directly* from *point-to-point*. No confusion, no difficult paths. And the extra space gained has been used

to make the label markings larger. You can see and trace the circuits at a glance.

Here again RCA Victor has made a vitally important contribution to easier, faster and more accurate servicing. It is part of our continuing research program to offer the utmost in reliability with Space Age Sealed Circuitry.

See Walt Disney’s “Wonderful World of Color,”  
Sundays, NBC-TV Network



The Most Trusted Name in Electronics

Tmk(s)®

**WORLD'S LARGEST  
ELECTRONIC TRADE  
CIRCULATION**

# ELECTRONIC TECHNICIAN

DECEMBER • 1963

VOL. 78 • No. 6

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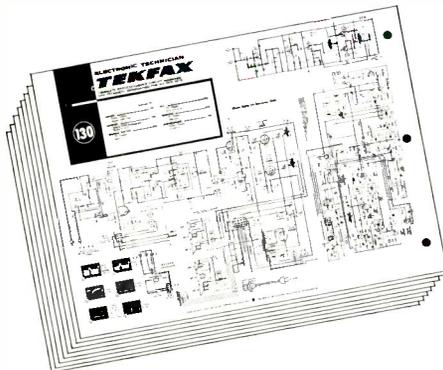
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## TEKFAX ..... 16 PAGES OF LATEST SCHEMATICS



ADMIRAL: TV Chassis 16A40, -C, UA40, -C, -B4C, UB4C

DELCO: Buick Auto Radio, Model 980655

GENERAL ELECTRIC: TV Chassis QY

PHILCO: Transistor Radio, Portable Model T-909

RCA: Stereo Hi Fi Models 4VF606 and 4VF705

WESTINGHOUSE: TV Chassis V-2446-1, -2, -3, -4



## How 6½ sq. ft. can speed up your picture-tube service:

10 versatile "Universal" picture-tube types from Sylvania's SILVER SCREEN 85 line may be all you need to fill 52% of your renewal needs! This fact, verified by a recent industry survey, stems from a remarkable streamlining of the Sylvania line—making fewer, more versatile types that can be used as replacements for many others. Already 54 types can replace 217.

Think what the versatility of these "Universal" tubes

can mean. An in-shop inventory of a few popular types can help you quickly take care of most of your renewal calls. Ordering is simplified...and distributor calls for special tubes can be cut way down.

Start profiting now from Sylvania's SILVER SCREEN 85 picture tubes. Call your Distributor and put an inventory in your own shop—where it can enhance your reputation for fast service and quality replacements.

**SILVER SCREEN 85 Picture Tubes** are made only from new parts and materials except for the envelopes which, prior to reuse, are inspected and tested to the same standards as new envelopes.



use it for **SILVER SCREEN 85<sup>®</sup>** tubes...  
 (10 "Universal" types meet half of all renewal needs)



The "Big 10" Tubes that fill  
 52% of all renewal needs:

|         |       |       |
|---------|-------|-------|
| 21CBP4A | } 24% | } 52% |
| 21ZP4B  |       |       |
| 21ACP4A | } 41% |       |
| 21YP4A  |       |       |
| 21EP4B  |       |       |
| 21FP4C  |       |       |
| 24AEP4  |       |       |
| 21DFP4  |       |       |
| 21AUP4A |       |       |
| 21DEP4A |       |       |

# SYLVANIA

SUBSIDIARY OF  
**GENERAL TELEPHONE & ELECTRONICS**



# make extra dollars with Eico scopes

An oscilloscope gives a visual picture of what is happening in a circuit, something no other test instrument can do. This very feature makes a good scope a money maker for your shop. It saves you time, analyzes those intermittent faults, and makes routine servicing easier than ever. Once you start using a scope regularly you'll never be without one.

You've pulled a set with a buzz in the sound. Is it 60-cycle hum or 60-cycle buzz? A quick look with the scope and you'll know. You'll either see a 60-cycle sinewave caused by heater-cathode leakage or there'll be a vertical deflection sawtooth probably resulting from a defective bypass capacitor.

I.f. alignment required? A scope is a must. Set it up along with your EICO post injection sweep generator, and you have only to adjust transformer and sound trap slugs to finish the job. Same thing for setting up the 4.5-mc sound takeoff network.

Losing the signal somewhere in the video circuits? Hook up the scope and see where it's going astray. There's a good chance you'll spot the bad component at the same time.

But when you go to buy a scope, what do you look for? Large screen, high sensitivity, frequency response, attenuators, synchronization, calibrator? All of these are important and are included in the design of any professional scope intended for the service technician.

**Large screen:** You can get by with 3 inches, but take the 5-inch screen of the EICO 460. Get a close look at what's happening. It's got an edge lit calibrated bezel too. **High sensitivity:** The 460's vertical amplifier delivers 25 mv per cm. All you'll ever need and more. **Frequency response:** EICO makes it flat from dc to 4.5 mc

in the 460. Ideal for color and black and white as well as industrial production and research, audio testing and experimenting. **Attenuators:** The vertical attenuator in the EICO 460 is a 4-step frequency compensated network. Can't beat this kind of design. **Sync:** Any signal reaching the screen is fully synced — automatically. And for special purposes you can inject your own external sync signal. **Calibration:** Accurate peak-to-peak voltage calibrator is built right into the 460.

All this adds up to the top scope for TV service. You can get it as a kit for \$89.95 or completely wired for \$129.50.

If you don't need so elaborate an instrument, take a careful look at the 427 dc to 1 mc scope or the new 3" General Purpose scope, the EICO 430 (kit, \$65.95; wired, \$99.95). The new 430 does everything bigger and more expensive scopes do. Vert amp/flat from 2 c to 500 kc, —6 db at 1mc. Sensitivity 25 mv/cm. Horiz amp. flat from 2 c to 300 kc. Sensitivity .25 V/cm. Flat face 3" tube; mu-metal shield eliminates effects of external fields.

There are plenty of accessories for EICO scopes too. An Electronic Switch to put two different signals on the scope screen at the same time (EICO 488; kit, \$23.95; wired, \$39.95). Voltage Calibrator for the less expensive 427 and 430 (EICO 495; kit, \$19.95; wired, \$24.95). Three accessory probes-demodulator, direct and low capacitance types.

Whether it's scopes, tube testers or VTVM's you get the best for less with EICO. Save money by building your instruments from kits, or buy them factory-wired at a substantial savings. See your distributor. Write for complete 28 page catalog. Dept. ET-12 *Add 5% in west*



EICO ELECTRONIC INSTRUMENT CO. INC., 131-01 39th Avenue, Flushing, New York 11352  
EXPORT: ROBURN AGENCIES INC., 431 GREENWICH ST., N. Y. 13, N. Y.

--- for more details circle 19 on post card

## LETTERS TO THE EDITOR

### Japanese Service Literature

We were most enthused with the "Japanese Transistor Radio Guide" published in the April 1963 issue of the ELECTRONIC TECHNICIAN. We removed this guide and filed it as one of our important sources of information for parts.

However, our enthusiasm has now "given away" to other feelings. We have used this Radio Guide on a number of occasions since its publication and we have yet to find a single importer or distributor who is able to supply parts or schematics or who can even inform us where parts can be obtained for these Japanese transistor radios.

We feel it is a sad situation when the American public purchases a product which cannot be serviced for lack of parts. It appears that the importers and distributors are interested only in selling a product and are not interested in keeping the product in working order after it is sold. Perhaps when enough of the American public has purchased a foreign product which cannot be repaired because parts are not available, they will then realize that the purchase was not such a bargain after all and will stick with the good old reliable "Made in U.S.A." product.

However, we commend you for the effort in supplying such information; it was a good try!

Merril E. Breeze

Little Rock, Ark.

### Ohms Law

Your editorial "Ohms Law Fine-But" brings forth following comments:

I agree with your opening paragraph; you and your magazine are doing a noble job in support and defense of the technician, but unfortunately you have assigned yourself a virtually insurmountable task.

Back in the 1920's when radio first came in, the radioman had a considerable degree of prestige and it was believed this field would expand and develop into a profession. Not so, however. It now appears to be about one of the least

For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 65 Marshall St., North Adams, Mass., to cover handling and mailing costs.



## Is "do-it-yourself" TV Service as dangerous as they say?

When a TV set starts "acting up," a tube is often involved. At least, that's where the trouble appears to be.

Some people will pull the back off the set, remove the tubes, and take them to the "do-it-yourself" tube tester at the neighborhood store. The test instrument shows which tubes are faulty (but not always—some faults do not show up on these testers). Replacements are purchased, then inserted into the set. Reception improves, and the trouble has been caught and corrected.

### BUT HAS IT?

The self-service test instrument checks *tubes*. It can't test the *more than 500 other parts* in

your set! It can't show you the *source* of the trouble that probably blew the tube. Neither can it show the damage often suffered by other parts due to the faulty tube.

Mere tube replacements do not always cure these trouble spots. Weak links continue to exist, *setting up chain reactions of damage, trouble, and expense!*

The total failure of many a good TV set can be traced directly to "do-it-yourself" tinkering.

Your TV set is the most complicated device you own—far more complex than even your automobile. When you need TV service, call an expert technician—your fully trained and experienced Independent Service Dealer.

**AFTER ALL, YOU WOULDN'T ENTRUST YOUR JOB TO AN AMATEUR, WOULD YOU?**

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,  
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS FOR . . .

**YOUR INDEPENDENT TV-RADIO SERVICE DEALER**

# Heavy Duty... Dual Heat

## LETTERS TO THE EDITOR

attractive fields from a financial standpoint that one can get into. And rather than the situation improving, it is constantly getting worse. (It must be pointed out—we refer only to the consumer field; not industrial). There is practically no incentive other than the peculiar fascination of this thing called electronics.

As you point out in your article the qualifications for success would really call for a sort of super-man. He would be an expert experienced technician, a sort of financial genius, a top flight salesman and a diplomat. What are the incentives? In all probability the party would be better off driving a bus—with a weekly salary.

While there are few exceptions most manufacturers care not a whoop about the technician. In most cases the apparent attention that is given to the technician is merely pretense. The manufacturer is concerned with only one thing—keep production lines humming.

If you will review the advertising and brochures put out by most manufacturers (there are few exceptions) the technicians are given no recognition; they are deliberately ignored. Writeups, photos, all kinds of publicity is given to executives, sales managers, merchandising experts, expeditors, accountants, clerks etc., but not the technically trained. As a specific example of what I mean I refer you to a folio sent out by a company to their distributors. The inside front page of this masterpiece has numerous pictures of the staff, but engineering is not represented.

There is no practical solution—it is perhaps a trend of the times, which will have to be accepted. The prime deterrent to making servicing reasonably profitable is that the initial cost of a new unit is too low and units are not built to be serviced but junked. Sales is the thing—service is a necessary evil which a smart manager will recognize and divert into sales profit.

(Name Withheld)  
Colonial Heights, Va.

*Continued on page 63*

ELECTRONIC TECHNICIAN

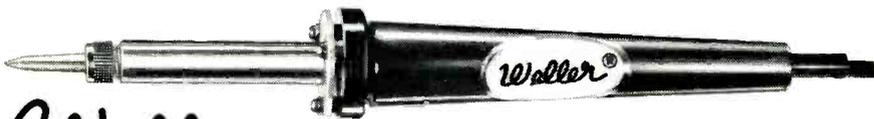


## Weller® SOLDERING KIT

with 240/325  
watt gun

Professional, heavy-duty gun has two trigger positions—lets you switch instantly to the heat best suited for the job. Use of low heat prevents damage when soldering near heat-sensitive components and prolongs tip life. Heat comes on instantly when trigger is pulled—goes off when trigger is released. Spotlight illuminates work. Kit also includes break-proof metal-tone plastic utility case—smoothing tip—cutting tip—tip-changing wrench—and solder. MODEL D550PK.

# Light...Efficient...Rugged



## Weller® "Pencil" SOLDERING IRON

A low cost 25 watt, 115 volt iron that's ideal for miniature-type soldering. Use it as easily as a pencil. High efficiency and rapid recovery enable this Weller model to do the work of irons with much higher wattage ratings. Rugged heating element for extra durability and long service. Lightweight design reduces user fatigue, provides more accurate control. Complete with tip and cord set. Screwdriver-shaped tips available in three sizes. MODEL W-P.

Buy Weller Soldering Tools at your Electronic Parts Distributor  
WELLER ELECTRIC CORP., 601 Stone's Crossing Rd., Easton, Pa.

- - - for more details circle 41 on post card

# LOOK! ALL PROFIT AND NO WORK!



Transistor-Powered Apollo, model 3721



Transistor-Powered FM/Stereo, model 3731

A new TV indoor antenna guaranteed to work up to 45 miles clear out!

Bet you thought the "15-to-60 mile" reception area was the private preserve of outdoor antennas only; that nobody, but nobody, had yet conceived an indoor antenna powerful enough to break the suburban picture-and-sound barrier!

Well, Channel Master has! And it creates a brand-new market. We've combined the world's most advanced indoor TV antenna and a super-effective built-in hidden amplifier. Result? The Apollo!—a transistor-powered indoor antenna that, for sheer TV pull-in power, surpasses every other indoor antenna ever created. What other indoor antenna guarantees to bring in a picture clear, sharp, and ghost-free—from 15 to 50 miles out.

And talk about adaptability: the Apollo's "Miraclick" Switch gives the viewer exactly the right amount of power his area requires. The "Miraclick" electronically adjusts the antenna to weak or strong signal areas. And a built-in FM Trap cuts out FM overloading in strong signal areas. **Fair-traded at \$29.95.**

A new FM/stereo indoor antenna guaranteed to work up to 60 miles clear out!

Channel Master's transistor-powered FM/Stereo indoor antenna alone does for FM what the Apollo does for TV. Works from 15 to 60 miles out. (And offsets signal loss inherent in the multiplex circuit). **Fair-traded at \$19.95.**

**You're in a new business!** Both these powerhouse antennas are smart, modern showpieces. Eye-catchingly packaged for easy selling, too. Together, they push the indoor antenna market back to a brand-new frontier. Even if you don't know the first thing about antennas (of any kind)—and have never before cared to become involved with them—the high sales possibilities of these two should be enough to change your mind.

Think of it! All profit (very high) and no work (no rooftop installation). You're really in business! Matter of fact, it's no trade secret that each antenna in Channel Master's complete indoor antenna line is the best in its category at its price.

Call your Channel Master distributor for full details on our indoor antenna free premium promotion!

— for more details circle 18 on post card

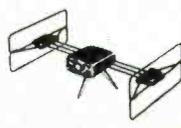
Also available! Top quality non-amplified indoor antennas.



Model 3720.



Model 3730.



Model 3900, Model 3901.



Model 3718.

... Only from

# CHANNEL MASTER

ELLENVILLE, N. Y.



# EDITOR'S MEMO

## Don't Cheat Yourself

Selling seems to be the most difficult job many technicians encounter; tougher than the toughest dogs. Letters which come across my desk indicate to some degree why this is true: Most technicians don't understand the principles or logic behind a sale. For example, some technicians won't sell color TV sets because they don't like color or color programming. This can be likened to the car dealer who won't sell this year's model because his mechanics don't like it as well as last year's. Or because his mechanic says it won't go any faster and uses about the same design as last year's model.

Generally speaking, the same thing is true of TV sets: from year to year very few major changes are made. No one will argue, of course, that a 1963 set isn't a great improvement over a 1953 set. For the most part, just the trim is different. But the car dealer doesn't say "you don't need a new car" simply because yours is still running or because there isn't enough improvement to merit another. That's your decision. A decision is usually based more on "trim" than on the actual "workings." Similarly, it's up

to your customer when you tell him about the new TV receivers.

It's time you get it through your head that you're not cheating someone when you sell him a product that is not significantly different than the one he already has. His interests are primarily in the "trim."

Often a set owner needs only a nudge to buy a new set. When his set is two years old and has had two or three calls, the fact that the repair is only \$15 is immaterial—for him it may be the last straw.

Perhaps it's the lady of the house that will play the key role. If she has just purchased new living room furniture, a sleek new TV set might be all the room needs to top it off.

But you say you don't sell sets? Then I suggest you start. No one is in a better position to sell TVs than the technician. You are invited into the home (the hardest trick for a door-to-door salesman) and your word is respected. While you're looking at the set, you can give the owner literature on new sets, a net antenna, a booster, a UHF converter, set surge protectors, wired commercial silencers, Hi Fi, and a host of other items you should be selling.

And it's your opportunity to tell your customer how much "better" color is today than it has been and about how much he can expect to spend on his present set for service in the next year.

I know, you think you can make more money servicing his old set than selling

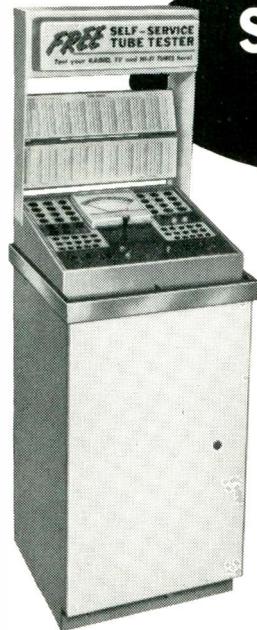
him a new one. Stop and think: you won't be servicing his set. Because if you don't "sell" him, someone else will!

All this doesn't mean that you have to be a high pressure salesman or that you have to try to sell a new TV to every customer you call on. There are a lot of things you can sell, however, and you should be alert to every possible set sale and the host of little items you can sell on almost every house call.



**Mercury**

## SELF-SERVICE TUBE TESTERS are BIG INCOME PRODUCERS



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(Lo-Boy Floor Model)  
Dealer Net **\$18450**

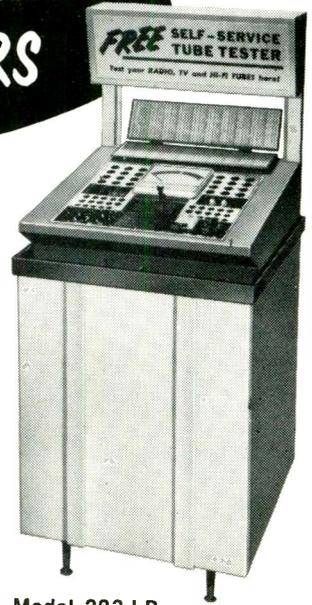
**Model 202-C**  
(Counter Model)  
Dealer Net **\$12995**

### NEW MODERN EYE-STOPPING TESTERS... TOPS in PERFORMANCE... QUALITY... and VALUE

Here is everything you want in self-service tube testers at down-to-earth prices. **MORE VERSATILITY**—Tests emission, shorts and gas of over 1200 tube types including the very latest NUVIDSTORS, NOVARS, COMPACTRONS, etc.... Also tests fuses, pilot lights, 6 and 12 volt auto radio vibrators, all type batteries under load. **SMARTER LOOKING**—Modern cabinet design finished in a rich green and white color combination with gold trim... Eye-stoppers in any location—will attract do-it-yourself customers as never before and sell tubes in a big way. **MORE QUALITY FEATURES**—Completely self-service... Only two easy-to-use controls are required to test any tube... Easy-to-read quick flip tube charts list over 1200 tube types... Engineered to accommodate new tube types as they are introduced... Etched aluminum panel always retains its handsome appearance... 63 phosphor-bronze beryllium tube sockets assure positive contacts and long life.

Replace old self-service tube testers with Mercury testers and spark-up your present locations... place them in new locations and be assured of the greatest profit results.

*Slightly higher in the West*



**Model 203-LB**  
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**Model 203-C**  
(Deluxe Counter Model)  
Dealer Net **\$16695**

**MERCURY ELECTRONICS CORPORATION, 111 ROOSEVELT AVENUE, MINEOLA, NEW YORK**

--- for more details circle 25 on post card  
ELECTRONIC TECHNICIAN

On target? Sure! But more than that—

**This rotator alone has the power to turn the heaviest antenna array easily ... and the ruggedness to keep it "on course" in foulest weather.**



Most any good rotator can hit the target in fair weather!

(Channel Master Tenn-A-Liner Rotators offer a degree of pinpoint accuracy pretty close to perfect).

But in installing a rotator, ask yourself this: How will it do in foul weather? Stand up -- or act up? Will it turn a heavy antenna load without trouble? And keep the antenna on the beam?

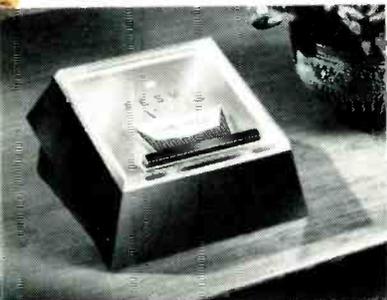
THE FACTS are as follows: Channel Master rotators (manual or automatic) have the greatest turning power of any TV-FM rotator in existence. Thanks to their built-in, friction-free, ball thrust bearing (nobody else has it), these rotators alone have the power to easily turn the heaviest fringe-area antennas. They've proved they can even "crack through" an ice-loaded antenna installation weighing over 329 pounds. Also, because higher voltage is delivered to the motor, you can use longer leads. And still maintain peak torque.

CHANNEL MASTER rotators, furthermore, are made to operate under a 70 mile gale wind. And to back up all this rugged, foolproof performance, only Channel Master Tenn-A-Liner Rotators give your customers a 90 day "Instant Replacement" Warranty. (After 90 days, parts or the complete unit can be replaced at extremely low pro-rated prices).

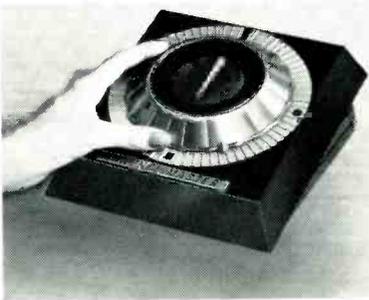
Priced to let you meet competition head-on, too. And to give you top profit as well. Do yourself, and your customers, a good turn. Install Channel Master Rotators next time.

# CHANNEL MASTER Rotators

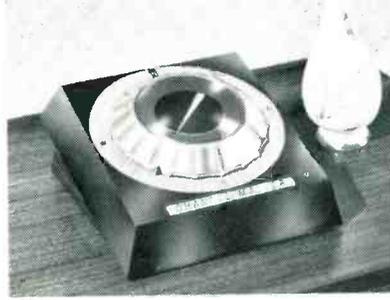
"More accurate by design ... more distinctive in design"



**COMPASS TENN-A-LINER (Model 9520).** Non-automatic. Fingertip control. Accurate repeatability. Continuous instant direction indication. Pushbutton Switch ends reception interference caused by wind vibration.



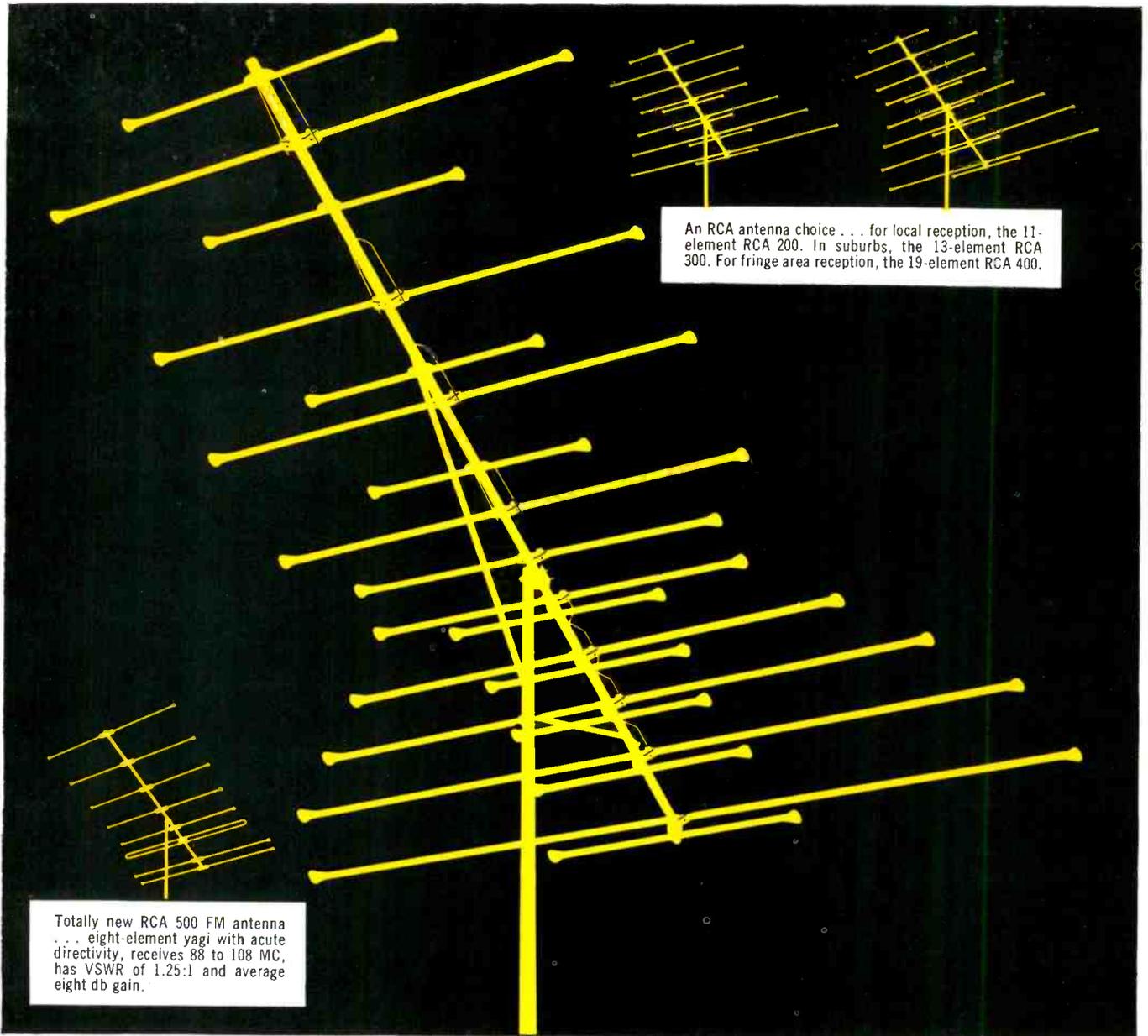
**AUTOMATIC TENN-A-LINER (Model 9524).** Most accurate in the world. Aims antenna within one degree of precise transmitter location. Increments are not limited to 10 to 15 degree segments.



**NEW! GEMINI (Model 9527).** World's first all-in-one Automatic Rotator with built-in amplifier. Combines Tenn-A-Liner with famous Telstar transistorized booster-coupler. Fast, profitable, 2-in-1 installation. Only 1 unit on mast -- 1 housing on set -- 1 transmission line. Built-in "FM Trap".



**ROTATOR ALIGNMENT BEARING (Model 9523).** Provides added rough-weather protection by stabilizing antenna on giant fringe-area antenna arrays.



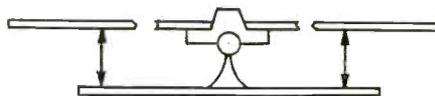
An RCA antenna choice . . . for local reception, the 11-element RCA 200. In suburbs, the 13-element RCA 300. For fringe area reception, the 19-element RCA 400.

Totally new RCA 500 FM antenna . . . eight-element yagi with acute directivity, receives 88 to 108 MC, has VSWR of 1.25:1 and average eight db gain.

## RCA . . . Pioneer and developer of Color TV . . . Announces a new concept in outdoor antennas

Now the most trusted name in color TV brings you and your customers a whole new outdoor antenna line packed with top-value features. RCA puts together in a single line the best of all-channel yagi and multiple cross-driven element antenna types. You'll satisfy every customer's demand for sharpest color or black-and-white TV reception with this new RCA Series 200, 300 and 400 antennas.

RCA's electro-lens director system absorbs maximum incoming signal power, gives extremely high gain across



### CAPACITIVELY COUPLED

the VHF band, offers excellent forward gain on the front end.

In addition to phasing low and high band directors for best high band performance, RCA and only RCA positions high band driven elements *directly below* low band driven elements.

Through capacitance thus existing, RCA antennas feed energy *directly* into the transmission line from high band driven elements. An RCA exclusive!

A permanent gold *anodized* finish defends every RCA antenna's glossy finish from weather corrosion. Wrap-around mast clamp aligns antenna on mast, prevents boom crushing.

Just call your RCA Victor distributor. He'll tell you and show you all about new RCA 200, 300, 400 antennas and that's *plenty!* Call now—sell soon!

RCA PARTS AND ACCESSORIES, CAMDEN, N. J.



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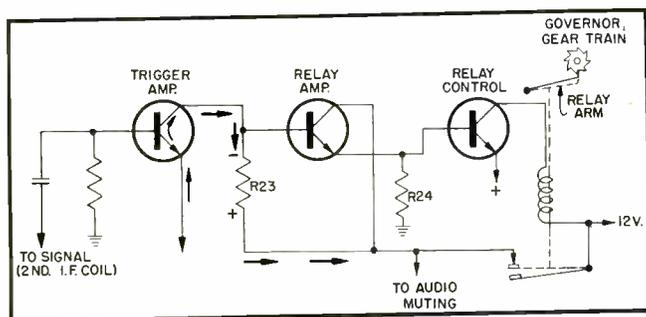
# TECHNICAL DIGEST

## DELCO

### Cadillac Model 7286315 Auto Radio—Wonder Bar Troubleshooting Procedure

Various controls of the Wonder Bar radio can be helpful in troubleshooting. Basic rules are:

1. If radio is dead during manual tuning and



A signal from the 2nd IF coil causes trigger amplifier to conduct (see arrows) causing voltage across R23. This cuts off the relay amplifier, causing voltage across R24 to disappear, cutting off the relay control stage. Relay current thus stops and the relay arm stops the turner.

doesn't stop on stations (keeps searching), check RF, converter or IF sections.

2. If radio is dead during manual tuning but stops on stations automatically (no sound heard after stop), check audio section.

3. If radio sounds good on manual tuning but fails to stop on stations (keeps searching), check trigger section. *Caution:* Be sure sensitivity control is in "more stations" position.

4. If radio works normally but stops as soon as the Wonder Bar is released (between stations), check trigger section.

## GENERAL ELECTRIC

### Color Chassis CW, CX and CY—Adjusting Horizontal Efficiency Coil

The horizontal efficiency coil is adjusted to obtain a specific horizontal amplifier cathode current. The cathode current is specified in the service manual and is measured on a milliammeter inserted in series with the cathode to ground connection.

Some service technicians are substituting a pilot lamp as an indicating device—placing it between the plate cap and connector on top of the horizontal amplifier tube. They adjust the horizontal efficiency coil for minimum lamp brilliance to indicate minimum plate current.

The lamp method is not recommended for the following reasons:

1. Minimum plate current does not necessarily mean maximum output from a screen grid tube. Maximum horizontal amplifier tube output can be obtained only by adjusting the horizontal efficiency coil for the horizontal amplifier cathode current specified in the service manual. Of course, maximum output should be produced to obtain maximum efficiency from the horizontal system (boost, brightness, focus, sweep).

2. The eye cannot see small changes in a pilot lamp's brightness which represent current variations of a few milliamperes. Therefore critical adjustments which can be observed on a milliammeter cannot be seen with a pilot lamp.

3. If the pilot lamp represents significant capacity, it could result in flyback transformer detuning when removed from the circuit.

## MOTOROLA

### Color TV Models 23CK37, 38, 39, 40, 42, 44 & 46—General Convergence Procedure

The following eight steps outline, in general, the complete step-by-step convergence procedure detailed in the service manual:

1. Demagnetize shadow mask with degaussing coil.
2. Adjust purity ring for center screen area red, adjust yoke position for outer area red.
3. Set black and white brightness tracking.
4. Properly center and size picture.
5. Converge all three colors in center area of screen.
6. Dynamically converge all three.
7. Recheck steps #2 and #5.
8. Repeat step #3.

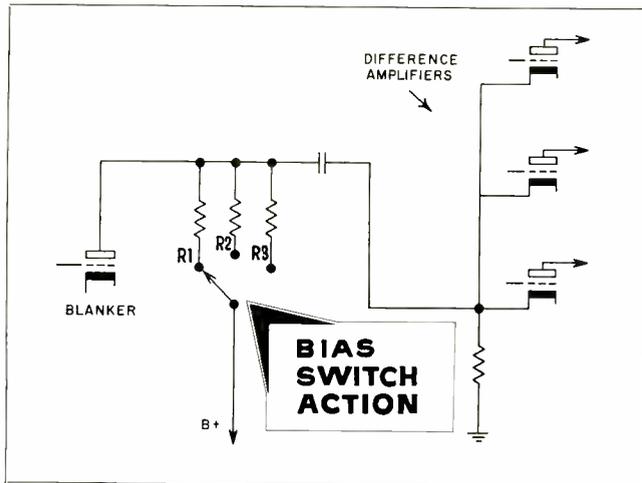
Complete details of each step appear in manual 68P65110A79.

## RCA

### CTC15 Color Chassis — CRT Bias Switch

The CRT bias switch has been relocated in the circuitry and now affects the picture tube grids instead of the cathodes as in the previous CTC12. This maintains a more constant load to the third video amplifier at any setting of the CRT bias switch.

A three-position slide switch effectively selects three

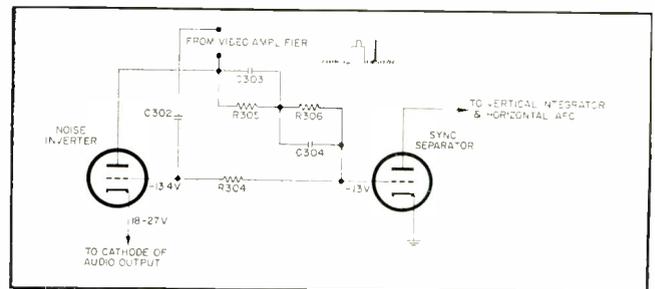


CRT bias switch on RCA CTC15 color chassis.

different plate load resistor values for the blanking amplifier when the CRT bias switch is operated. This changes the blanking pulse amplitude which is fed to the common cathodes of the R-Y, B-Y, and G-Y amplifiers. As a result, the average bias on these tubes will change with each position of the switch. A change in bias results in a plate voltage change, and since the CRT control grids are dc coupled this change appears at the CRT. With the three settings provided on the bias switch, it is possible to make adjustment for any variations in CRT characteristics.

Bias level depends on the incoming signal strength. A low frequency filter (R306/C304) prevents sync instability caused by low frequency signal variations—including airplane flutter. One-half of the double triode serves as a noise inverter to provide stable sync if noise pulses get to the sync circuits. The composite video signal is coupled through C302 to the noise inverter grid. It is biased by a negative voltage from the sync separator grid (dependent on signal strength) and by a positive voltage applied to the cathode from the audio output tube cathode. The tube is biased so that noise pulse amplitudes greater than sync pulses will cause the tube to conduct. When the tube conducts a negative-going noise pulse appears at the plate. The pulse mixes with the composite video signal at the junction of R305/C303 cancelling the noise pulse.

Trouble in this section usually takes the form of complete loss of sync, loss of either vertical or horizontal sync, or instability. After substituting the tube, the next thing to do is use a scope. A scope is the only effective instrument to use to check the condition of video or sync signals. If the composite video signal from the video amplifier has the proper amplitude, follow the signal through the coupling capacitor into the sync separator grid circuit. There may be enough video signal on the grid, but the bias circuit of C303/R305 may not be producing correct bias because of an off-



Westinghouse chassis V-2435 sync circuit.

## WESTINGHOUSE

### TV Chassis V-2435 — Sync Operation and Troubleshooting

The positive going composite video signal at this circuit's input causes the tube to draw grid current and charge C303. When the sync pulse drops to the video level, C303 discharges through R305 to the B+ line. Discharging the capacitor to the B+ line instead of ground produces a steeper discharge curve to prevent noise pulses getting through the sync separator. A negative voltage is produced which biases the tube.

value component. The amount of bias is also dependent on the incoming video signal's peak value. In a situation where the bias and the video signal are normal but no sync pulses appear, check the plate voltage. If it is low, or missing, look for off-value resistors, shorted or leaky capacitors.

Of course, sync failure can be caused by faults outside the sync circuitry. For example, if sync pulse amplitude is low, look for trouble in IF-detector-video amplifier sections.

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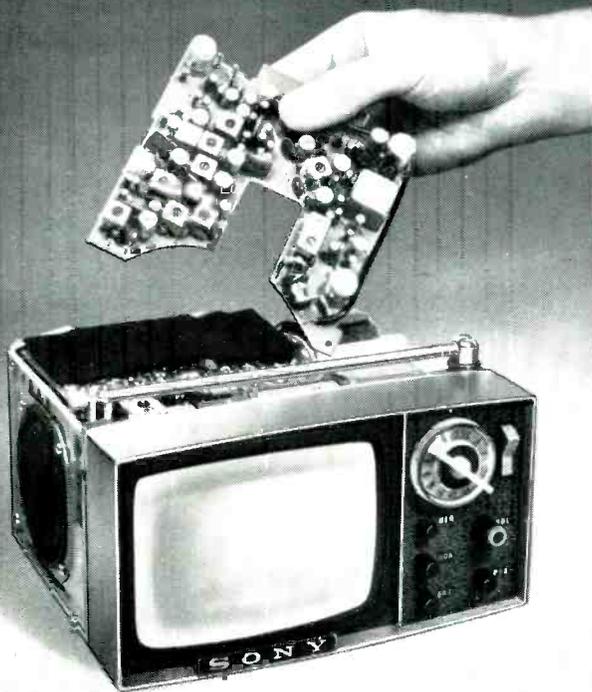
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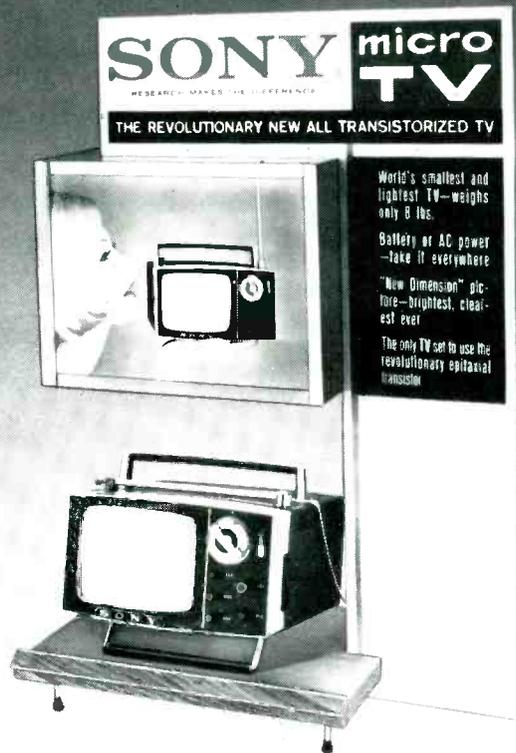
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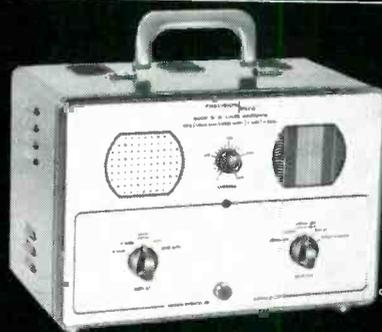
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### Precision's G-36 Color Bar White Dot Generator

The *easiest-operating* generator of its kind!  
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Completely capable of testing and adjusting  
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G-36K (Kit): \$119.95; G-36W (Factory Wired): \$179.95

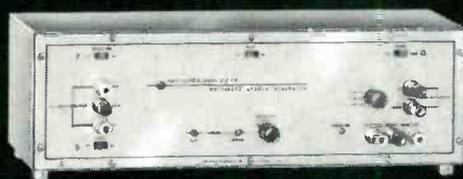


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### Precision's E-490 Multiplex Signal Generator

Specifically designed to fill the technician's need  
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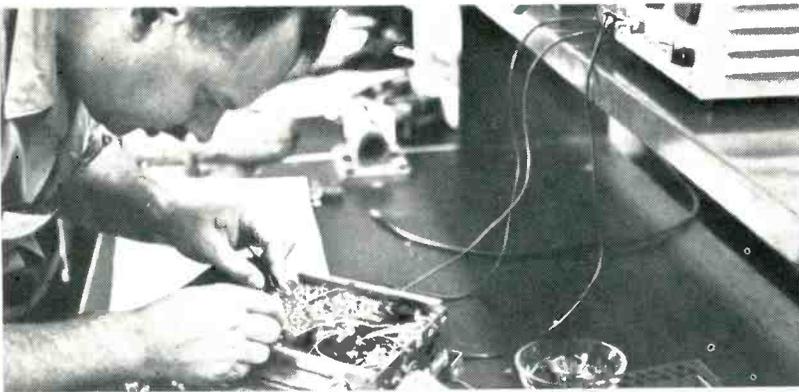
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# SERVICING TRANSISTORIZED AM/FM Auto Radios



by  
*Don Henderson*

*Many technicians are finding  
new car radios easier to repair  
than conventional tube  
or hybrid sets*

■ Service-dealers and technicians who repair AM/FM car radios are finding more money in the "till" at year's end. If you are not prepared to handle AM/FM car radios, there's no better time to begin than now. Of course, you will need to know something about AM and FM radio in general and a little more than average about transistors if you are going to do a highly successful job.

#### **Transistor Operation**

If you already know everything about transistors, how they work—upside down and inside out—you can skip this part and go to the

information on troubleshooting. But few technicians are sufficiently knowledgeable about transistors to skip anything concerning them.

A practical working knowledge of transistor operation is not as difficult to come by as some people have indicated. One good way to begin is by learning what a semiconductor diode is and how it works. And for our purposes we can safely skip the chemistry and physics of semiconductors—valence bonds, boundaries and how positive carriers (“holes”) arise, etc.

In a simplified sense, as shown in Fig. 1, a slice of germanium, for example, forms a semiconductor diode. Opposite sides of the germanium wafer are called “P” and “N” areas respectively. The “P” area may be doped with a small amount of indium and the “N” area with antimony. The “N” area contains extra (free) electrons and the “P” area has positive charged carriers or “holes.” These holes attract electrons.

If we connect the negative side of a battery to the “P” diode terminal and the positive side of the battery to the “N” diode terminal, no current will flow in the milliammeter, as shown in Fig. 1A. The diode is “reverse” biased. Positive carriers are attracted to one edge of the “P”-doped area by the negative battery charge and the electrons are attracted to one edge of

the “N”-doped germanium. Since the center section of the diode has neither positive carriers nor electrons, it acts as an insulator—a very high resistance—and only a small insignificant amount of current can flow.

When the battery is reversed (Fig. 1B) positive carriers and electrons appear at the diode junction and current flows. The diode is now “forward” biased.

The NPN transistor is essentially a PN diode with an additional “N”-doped area added. One “N” area is the collector, the other “N” area is the emitter, and the center “P” germanium area is the base. A PNP type transistor, of course, is designed in reverse, with an “N”-doped area between two “P”-doped areas.

Transistor operation is easier to understand if we visualize a transistor as two diodes, as shown in Fig. 2, with both sides of the “P” (base) area forming junctions; the collector diode junction on one end and the emitter diode junction on the other end. From this viewpoint we can demonstrate how easy it is to troubleshoot malfunctioning transistor circuitry.

If we connect a normal voltage across an NPN transistor—positive battery to the collector and negative battery to the emitter—no current will flow through it. The emitter diode is forward biased and the

collector diode is reverse biased. The reverse biased collector diode is high resistance, preventing current flow. To make the transistor conduct we have to place a larger forward bias across the emitter-base diode section. Germanium transistors will conduct with about 0.2 v bias (Fig. 3). The battery polarities, of course, must be reversed on a PNP transistor.

When properly biased, and with a high positive voltage on the collector, electron velocity increases and about 95 percent of these electrons pass through the base area into the collector. Only about 5 percent circulate through the emitter-base diode and bias circuit.

As we already know, when a small ac signal is applied to the transistor input (base), it varies the 0.2 v bias, and a small change in this bias produces a much larger change in the collector current. This effect, as in an electron tube, results in transistor gain.

In practice, the bias battery is replaced by a voltage divider. A simplified drawing of NPN and PNP transistor amplifier bias circuits are shown in Fig. 4. And it should be noted here that bias is measured with a VTVM, and its probes are placed across the transistor base and emitter.

### Troubleshooting

Most troubleshooting tests on

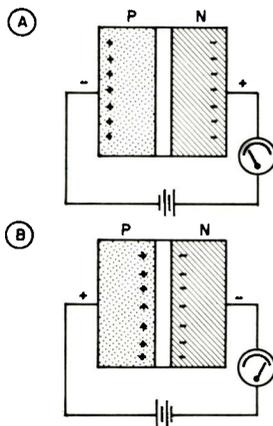


Fig. 1 (A)—No current flows through semiconductor diode with positive battery to the “N” terminal and negative battery to the “P” terminal. (B) — With battery reversed positive carriers and electrons are drawn to diode junction and current flows.

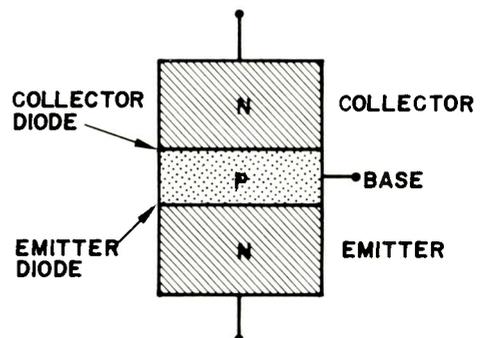


Fig. 2—Simplified drawing of NPN germanium transistor which consists of two semiconductor diodes.

AM/FM car radios can be done with the switch set on the "AM" position.

About the only convenient test "tool" you will need, in addition to test equipment you already have, is a 1 kc square-wave "noise" generator. An inexpensive "pencil" type generator is usually adequate. The noise generator won't work on FM circuitry, however.

You will get dead radios, weak and distorted radios and radios with intermittent difficulties. And chances are good that you will have less trouble with them than conventional tube types or hybrids.

When a customer drives up with an AM/FM auto radio, he will probably mention one or more of these faults. This is a time to ask questions and listen carefully. Medical doctors do this in preliminary diagnosis of human ills. The radio can't tell how it "feels" and where it "hurts" but its owner can do the next best thing—tell you how the radio *sounds*. This is an effective preliminary troubleshooting technique. At this point too you should already have a manufacturer's schematic on hand. Drawings of area-numbered PC boards are also necessary if you want to do a reasonably quick and successful job. Most manufacturers furnish complete schematic and PC board drawings for the asking, or at a nominal cost.

### Weak Set

Suppose your customer complains that his radio is "weak," for example. You then turn the radio on and a "thump" comes from the speaker; but you find the customer is right—all stations are weak. You then check the battery to make sure it is up to par. You also check the antenna trimmer to determine if it is peaked. You find everything normal here and then you remove the radio to the bench and connect it to your dc voltage supply, set the switch on "AM" and prepare to isolate the defective stage.

The block diagram of a typical transistorized AM/FM auto radio is shown in Fig. 5. As previously mentioned, most stages can be checked with the switch set on "AM." The audio driver and output stages are common to both AM and FM. A number of other stages are also common.

You already know by the "thump" that the speaker is working. You can also feel certain that the output transistor is conducting too. If in doubt, measure the voltage on its collector. If the voltage is normal, then the transistor is conducting. But we now have to determine if the stage has gain. A weak signal from the noise generator is injected into the output transistor—with the radio's volume control turned up full. Observe the

noise-signal level. Move the noise generator output lead to the transistor's base. Note if the speaker-signal level is now the same or has increased substantially. If the signal is much stronger, then move on to the next stage (driver, audio detector, last IF, etc.) until the defective stage is located. If no increase in volume, then you know the trouble is in the output stage.

Perhaps a customer complains that stations are weak and "garbled." You suspect the output stage and switch the set "on." But this time you do not get a thump in the speaker. You measure the collector voltage with a VTVM and find it zero instead of normal (1.6 v in some sets). You know three things can cause this condition: defective transistor, defective bias supply or a grounded collector. You check the bias carefully with the VTVM and find it normal. After referring to the schematic, you see two possibilities left: output transformer shorted directly to ground or a shorted electrolytic. You lift both from ground—and still no voltage appears on the collector. "Tough Dog?" Not exactly; a mica washer insulates the collector from chassis ground and a small burr on the transistor collector has pushed through the mica—shorting the collector to ground.

Another customer comes in carrying an AM/FM transistorized

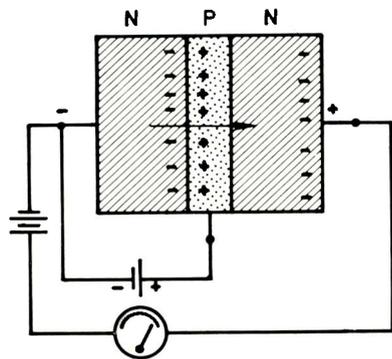


Fig. 3—Forward bias across emitter-base diode of transistor drives electrons through into collector area.

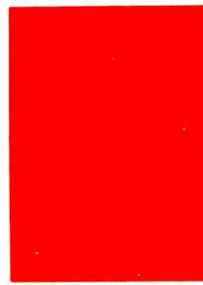
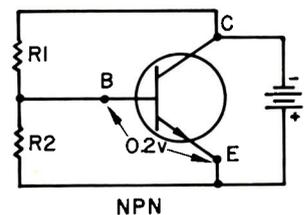
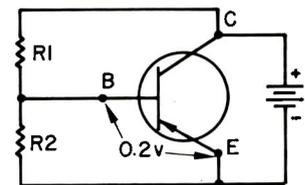


Fig. 4 — Simplified schematic of transistor amplifier bias circuits for NPN and PNP transistors.



NPN



PNP

auto radio which he says is "dead." You know that a common defect in a transistorized output stage is an open fuse-resistor. You visualize a quick job. But no, a few minutes with the "pencil buzzer" shows that everything is very much alive—except the converter stage. And you find yourself absorbed in checking out another transistor stage.

You remember to check for transistor conduction first. Here we determine this by checking emitter resistor voltage drop. Instead of a normal 1-v drop, for example, your meter reads 10.8 v across a 4K resistor. You now suspect a shorted transistor (emitter-to-collector) or a grounded emitter. An ohmmeter reading from emitter to ground shows zero ohms. The schematic is glanced at and you see that the meter would still read 8Ω through the IF transformer primary plus 6Ω in the oscillator coil—or 14Ω—even if the transistor is shorted. You look at the diagram again and notice a 0.0047 μf capacitor connected from the emitter to ground. You clip off one lead of the capacitor, check it with the VTVM and find it shorted. A new capacitor puts the radio back in business.

Let's look at one more radio that a customer brings in. The owner complains that he can "barely" hear it. You hook it up, switch it on and place your ear close to the speaker. A local station comes in faintly. Since you heard a good "thump" when you turned the

radio on, you check the gain of one stage after another until you find an IF stage that shows a *loss* instead of a gain. You determine this by switching the generator output probe alternately from base to collector. Then you find the emitter bypass capacitor checks good—its bypass action normal—because the noise generator signal level from the speaker is lower when the signal is injected at the emitter than when injected at the base. Now you use the VTVM on a low ohms scale to check the transistor's collector diode.

We recall that a transistor is composed of two diodes—collector-diode and emitter-diode. These are tested separately. And use only the RX100Ω scale on your VOM or VTVM to make forward and reverse resistance checks on small transistors. This is done simply by reversing the meter probes for each measurement at a diode. The reading on the emitter-diode should be near 1 MΩ. The other reading should be between 200 and 300Ω. Although the low-ohms reading will change very little with the transistor in or out of the circuit, the high-ohms reading will be different when out of the circuit because of circuit shunts. The high reading will vary from about 1K to 100KΩ in-circuit—depending on circuit shunt resistance. In the circuit diode ratios will run from 5 to 1 or a little more.

Now you try this test on your IF transistor that shows a level "loss," after you have checked dc con-

duction and find it zero under a high-bias condition. An in-circuit collector-diode check shows two readings, one at 200Ω and the other at 1000Ω. This is a 5 to 1 ratio. The two readings on the emitter-diode are 1400 and 1900Ω. This is a poor ratio, less than 5 to 1, and the lower reading is not under 500Ω, which it should normally be. You feel certain this transistor is defective.

Although there is some slight danger that a good transistor would be damaged by placing it in the circuit without further investigation, there is little possibility in this circuit. We jump the leads of a known-to-be-good similar transistor across the E, B, C PC terminals on the back of the board. And the set's gain jumps up to normal. The old transistor is removed from the board and the new one installed.

Low gain can be caused by any number of transistor circuit defects, including leaking bypass capacitors and malfunctioning IF coils.

#### Troubleshooting Routine

If you establish a regular-routine-procedure for troubleshooting AM/FM transistor auto radios, you will find that they can be repaired with little waste of time. After you repair a few, you will probably find that certain types of failures will occur more often than others and some will appear very rarely. Some technicians keep a card file on these for future reference.

A logical system to follow for reducing troubleshooting time to a minimum may seem obvious to you. It goes like this:

1. Depending on symptom, check the car's battery and the antenna trimmer capacitor.
2. Isolate the defective stage with noise generator or signal generator (in FM circuitry). And check emitter bypass (except in converter stage).
3. If no conduction in a transistor, check the emitter-base forward bias.
4. Check reverse and forward resistance of both transistor diodes.
5. Check ac bypass circuits.
6. Check tuned circuits.

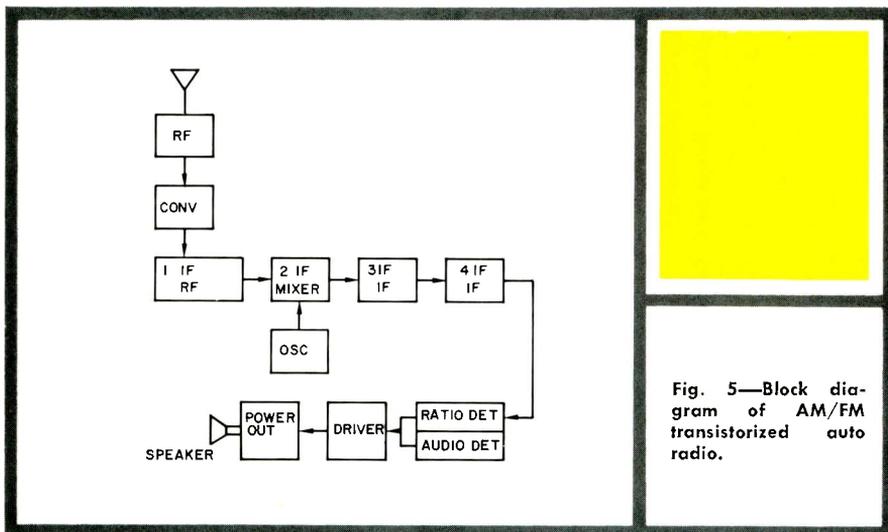


Fig. 5—Block diagram of AM/FM transistorized auto radio.

*Continued on page 78*

■ TV technicians *can* become more interesting individuals and in the process, make more money doing it. How? By learning how to live more — and how to be different!

When Henry Thoreau was eight years old, someone asked him what he was going to be when he grew up. "Why," said the boy, "I will be *I!*" He was, too — and that's what we remember the famous American essayist for today.

Here are five ways that you can show your individuality, be more interesting and enjoy life more.

# INTERESTING INDIVIDUALS ARE MORE SUCCESSFUL

**1. Get out of that one-track rut.** Most service-dealers and technicians who can think or talk about nothing but their business are in a personality rut. They scare away a lot of business contacts. They could be charming, useful, interesting and more successful citizens if they allowed themselves to express more varied interests.

How to develop other interests? Take adult-education courses in subjects you know nothing about. Join a social organization. Go out more to concerts, plays, museums, discussion groups. Participate in the activities of your neighborhood organizations.

**2. Be different, but not superior.** At any social get-together, the liveliest and most interesting person is the one whose observations are stimulating because they are different. The art of being different lies in not antagonizing others unnecessarily. People generally don't object to "differentness" but only to the attitude of superiority that so often goes with it. If we all granted to one another the right simply to be ourselves, we would be different enough.

**3. Be prepared to talk.** If conversation is not your forte, arm yourself with ammunition beforehand. Read a magazine, the day's newspaper or an up-to-date article in your home encyclopedia, so you'll have something to talk about. Try to cultivate a little general knowledge of a lot of things

so you'll be able to discuss them intelligently.

If there's a pause in a conversation, try to fill it. Listen to what's said; take an interest in it; ask questions. You're not being fair if you excuse reticence on the ground that you "don't know anything about new cars." Instead, introduce a subject you *do* know about.

**4. Make others feel important.** You'll be surprised how much more interesting you'll become in the eyes of others if you simply make *them* feel important. You can achieve this goal by remembering people's names, their likes and dislikes, by asking their advice, and by proposing new ideas as if you were reminding them of something they already know. Everyone likes to know that their opinions are worth something. Don't be afraid to ask for them. But once you do, then don't make the mistake of failing to listen.

**5. When conversing, be natural, cheerful and truthful — but exercise tact.** Hide our cares and worries. No one wants to hear about them. To a casual "How are you?", no one expects a complete recitation of ills and aches and pains. Think back to the last time Mrs. X told you the history of her ailing gall bladder; chances are you didn't consider the dear woman to be particularly interesting. Develop a cheerful, positive approach to conversation. A sourpuss is a bore.

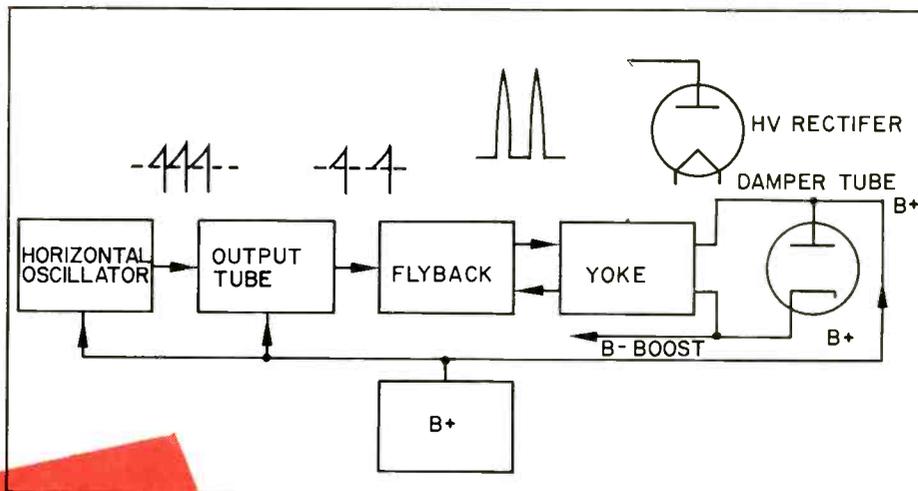
Avoid affected manners of speech; they can ruin your personality. Learn to control any nervous mannerisms; they can detract from everything else that's good about you.

Don't think that you'll be more interesting by "telling a tale or two." The world's greatest liar is "they say." As Mark Twain once observed, if you tell the truth every time, you will never have to remember anything you said. But combine honesty and sincerity with tact — the ability to do and say the right thing at the right time in the right way. Tact — the crowning quality of a truly interesting individual — is remembering another person's birthday, but forgetting which one it is. ■



All you need to be more interesting are diversified experiences, a little knowledge of a lot of things, a sense of humor, unusual opinions, the ability to converse easily.

Fig. 1—No matter what it looks like on the schematic, these are all the basic parts in a horizontal sweep circuit.



# FLYBACK OR YOKE?

... A logical procedure to help you quickly locate most horizontal troubles, including the most frustrating

*by Jack Darr*

■ The most important thing we need for horizontal output and HV stage servicing is a thorough knowledge of how they work. Certainly they're complicated; as my old instructor said long ago, "Current flows in only one direction at a time in any circuit — except in ham transmitters." But the TV horizontal output circuit is worse than that. Of course, the current isn't actually flowing in two or three directions at a time; it just looks like it! Here's the whole process, as briefly as possible.

### Sweep Theory

A voltage pulse from the horizontal oscillator is fed to the output tube where it's amplified and fed to the flyback transformer. The flyback, in turn, feeds the yoke, having stepped it down to match the yoke's lower impedance. The yoke catches the pulse, uses it to sweep the beam across the screen, and throws it back to the flyback. (Being an inductor, it's a privileged character and can do this.) The flyback takes it back, steps it up and makes very high voltage out of it. The HV rectifier takes this and makes dc out of it. Since the damper tube is always connected directly across the yoke, it calms down the oscillations that result from 'firing' a fast burst of energy into a high-Q circuit. And having some dc voltage left over, it adds

TABLE I  
Typical peak and average currents for horizontal output tubes.

| TUBE      | AVERAGE | PEAK |
|-----------|---------|------|
| -AU5, AV5 | 95-100  | 110  |
| -BG6      | 90-100  | 110  |
| -BQ6      | 80-95   | 110  |
| -DQ6      | 110-130 | 140  |
| -CD6      | 110-150 | 200  |
| -DN6      | 120-140 | 200  |

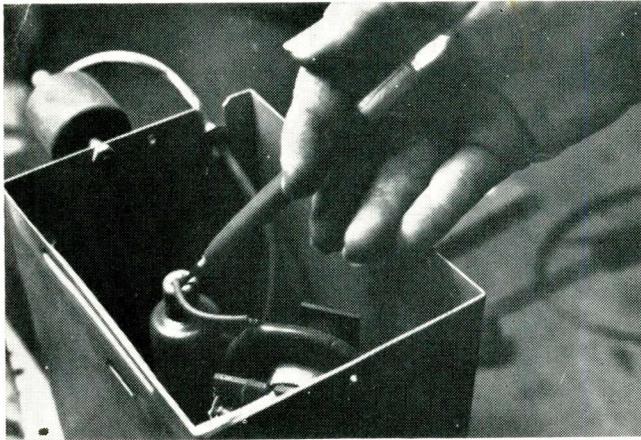


Fig. 2—A little neon tester helps check for RF. It will also check for presence of HV by touching the probe to the HV (ultor) connection.



Fig. 3—A test adapter breaks cathode of horizontal output tube for current measurements. If you can't buy one in your area, make up one for each type of tube; this one is for 6BQ6 types. (Label from old set of RCA shelf-stickers!)

it to the top of the B+ and we've got boost voltage. That's all there is to it. Fig. 1 shows it in block form.

No matter what the circuit looks like on the schematic, it has these same parts in it. As we just said, all of these actions don't take place at the same time — it just looks like it! Actually, a few  $\mu$ sec separate the different actions, but that's enough. Now, with everything in place 'interlocked' like this — every action depending upon some other action — can we check it 'all at once?' Gosh, no! To get any results at all, we must take it apart and check each piece individually. Now, I don't mean unsolder anything. Not yet, anyhow. With the right methods and equipment, we can dissect this thing and check each part by checking 'actions and reactions.' Since each action affects others, we can often check some part of the circuit by 'reading' the effect on another, never going near the part we're actually working on! *We must develop a logical series of tests;* without this, we're just 'poking around.' And each test must count by making each one tell you something about what the circuit's doing.

#### Systematic Testing

Probably the easiest place to start is checking for RF on the plate of the HV rectifier. A little

neon tester simplifies this: No glow, no RF (Fig. 2). Look back through the flyback and output tube. You can also tape a tiny neon lamp to the HV rectifier plate lead; if there's RF there, it will glow. Weak glow, low HV, change all tubes including the damper. Even in the older sets that didn't use boost voltage for other circuits, it's always used on the plate of the horizontal output tube.

If changing tubes doesn't cure the trouble, check the plate current of the output tube. You don't have to pull the chassis for this. Use a test adapter like the one shown in Fig. 3. This is a tube base and socket with the cathode lead broken and brought out to a pair of test points. Use the 0-500 dc ma scale on your VOM to measure the current between these points.

If you'll put a terminal on the side of this adapter, to the grid connection of the tube, you can measure either P-P drive voltage on a scope, as in Fig. 4, or the grid bias, with the VTVM. Get an adapter like this for the damper tube too. With the cathode pin and plate pin brought out, you can check boost voltage from the top of the chassis.

Now, check the current. This will tell you a lot about what is wrong. The average and peak currents for some typical output tube types are shown in Table I. For

the best tube life, keep it down around the average. Even 5-10 ma above peak will ruin a new tube in a week or two.

A close check on horizontal output tube current in the best "call back eliminator" you ever saw. Make it a habit to check the current everytime you replace a horizontal output tube. You'll catch the ones that "go" just before the warranty runs out everytime!

#### Interpreting Data

Now, let's interpret the current readings you get. Low current — weak tube, low B+, low boost or low screen-grid voltage. Too high current — not enough drive, overload (short in flyback, yoke, damper circuit, etc.). Now, here's the big question. Is it a short in the flyback itself? This is the one that bothers more men than any other! But the answer's easy. Just take the load off and see!

Disconnect the horizontal yoke winding. If the current falls to less than half normal, the flyback will still draw heavy current even with the load removed (the load being the yoke, of course). An easy way to check this is shown in Fig. 6. A pilot light bulb in a socket, with clips so that it can be hooked in series with output tube plate is a good current "meter."

Choose a lamp with a current rating about the same as the tube.

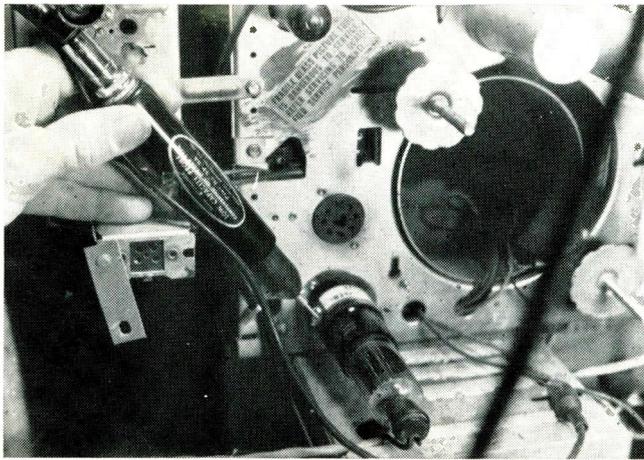


Fig. 4—Terminal on side of test adapter lets you check P-P drive voltage, with scope (note low-capacity probe) or grid voltage.

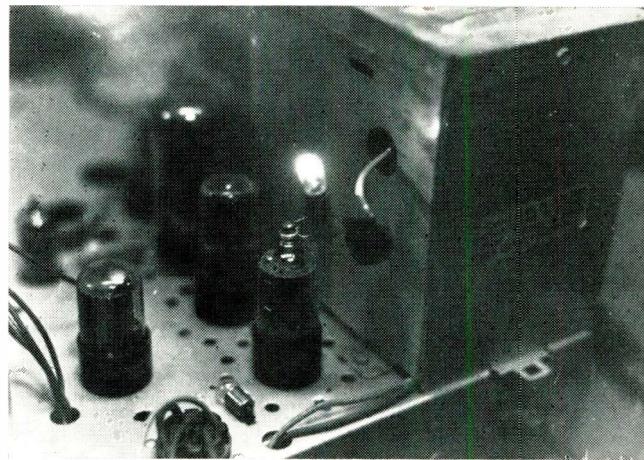


Fig. 5—The 'Dime Milliammeter'! Pilot light socket wired with clips so it can be hooked in the horizontal output tube's plate circuit.

For instance, old faithful #47 is a 150-ma type. If you're checking for an overload in a stage that's drawing about 140 ma current, the lamp will light to full brightness on normal current, and 'flare' up on an overload. When a load is disconnected, it's easy to see the lamp fall to a yellow glow. (Practice by trying this out on a set that is working. Use the milliammeter and the pilot light at the same time. A dime's worth of pilot light is a lot cheaper than a VOM if you have a sudden short!) It is not meant to substitute for a meter, however, where an accurate measurement is needed.

#### 'Sub' Testing

We're still not too sure that the flyback is OK, are we? We know it isn't shorted, but will it actually 'put out' the right amount of 'stuff?' Let's try to find out. If you have a 'substitution' type tester, that gives you substitute drive signals, grid, plate, etc., use it. This is the best method by far. In a pinch a working TV chassis is also a good source of test signals. (Even a junked chassis!)

Lift the plate cap of the output tube on the bad set, and hook it, with a clip-lead, to the plate of the substitute set. Connect the two chassis together. (*Don't use an ac/dc chassis for substitution*

*checks!* But if you have to, be *sure* that there's no ac between the two chassis by measuring between them and reversing the plugs until both chassis are at ground potential.) Now, turn both sets on. If the flyback is OK, the output tube of the test set will drive it, generating HV and, usually, a raster.

If it does, OK. If it doesn't don't give up yet; there may be something else! Disconnect the yoke and try again; see if the HV comes up. (If a shorted yoke is disconnected, you'll usually get about half normal HV.) Also, you can put the plate cap back on and try feeding the grid-drive from the test set into the one being repaired. Pull the output tube in the test set (although you don't really have to — the average oscillator will easily drive two sets at once. Remember, this is a *voltage* requirement and low current is involved.)

Next, check the boost voltage. If the voltage on plate and cathode of the damper is the same (B+), you don't have any boost! Check the yoke; this is the 'source' of the boost voltage, and the pulse that the yoke throws back to the flyback during flyback time *is* the boost voltage after the damper gets through with it. For a quick check, disconnect the horizontal winding and substitute another horizontal yoke winding. You don't have to

put it on the tube; leave it on the bench, but look out for open wires: they bite!

Now if the boost voltage comes back, or even rises to about half its normal value, suspect the original yoke. You might check to see just *what* has happened. A lot of yoke troubles are just a short in wiring and are easily repaired.

You do *not* need an exact duplicate for this test; almost any yoke will do. Most horizontal yokes used today are low-impedance anyhow. Even a mismatched yoke will give you enough 'reaction' to tell whether or not the original yoke is bad.

A final suggestion: try out these tests on sets that are working. In this way you'll be able to recognize a 'normal reaction' when you see it, and know about what to expect in each case. Disconnect the yoke and note what happens to the cathode current reading on the meter or to the flow of the pilot light. Get a set of test adapters and carry them in your caddy. They'll be well worth the money. ■

**WATCH FOR  
ELECTRONIC  
TECHNICIAN'S  
TWO-WAY RADIO  
ISSUE IN  
JANUARY**

■ Let's face it: the TV do-it-yourselfer is here to stay! So it's about time we all face the facts and adjust our thinking to accommodate him instead of resenting him.

If you think about it a minute, the number of do-it-yourselfers is not surprising. After all, most high schools and many colleges have had electronics courses for a long time, and thousands (perhaps millions) of men who now own TV sets received some training in electronics while in military service even though they don't now make their living at it. Electronics touches so many parts of our lives that almost any knowledgeable person knows something about it.

Look at your records. Your house calls that end up in simple tube replacements have dwindled. You can expect even more! Why? Partly because the average TV set has only half as many tubes as it did 15 years ago. More likely, however, many of the bad tubes are located by set owners themselves. In fact, a study by Wayne University four years ago showed that at that time, at least one third of all TV set owners had tested their own TV tubes. By now the number of TV test-it-yourselfers may have doubled.

Yet, despite their enthusiasm, TV do-it-yourselfers often run into (and create) technical problems, and it doesn't take much of a problem to stump them. That's when they turn to you. You can't do much about the well-merchandised testers and tubes in supermarkets, drug stores, gas stations, etc., but you can merchandise *yourself*—you personally. There's money to be made if you just forgive him for trying to fix his own TV set—if you can forgive him for trying to save money!

#### The Correct Attitude

When you walk into a house and the TV is already away from the wall, the back off and tubes all over, do you gloat and proceed to rack up a large bill or do you walk out? We don't do either. We try to act the part of the sympathetic rescuer. We admire the repair attempt and assure the set owner that he didn't

*If you forgive him  
for wanting to save money  
you can prosper in a  
'sympathetic rescuer' role*

*by Art Margolis*

cause any harm that is going to double his bill. Like a 17-in. department store TV that I serviced in the home (actually in the back yard) of a fireman.

It seems that the audio had died on him, and being good mechanically and electronically inclined, he removed all the audio tubes—a 6T8, 6SN7 and a 6K6. He brought the tubes into the do-it-yourself area in the front of our store. The 6T8 read gassy, the 6SN7 had one side low and the 6K6 read "no emission." I sold him three new tubes at our do-it-yourself counter, and he left.

Less than a half hour later the phone jangled and he yelled, "Art, come over. My set was just on fire!"

I drove over and the TV was in the back yard, water running out of the chassis into a puddle the TV was sitting in. I didn't say much, as I placed the TV in the back of the truck.

On the bench I found the 6K6 audio output tube in the 6SN7 audio amplifier socket and vice versa. As you know, the heaters on the 6SN7 are pins 7 and 8, but

the 6K6 filaments are pins 2 and 7—pin 2 on the 6SN7 is a plate, so B+ was neatly grounded by the swap (see Fig. 1). A 1K resistor in the plate circuit was a charred victim of the mistake.

Although the water ruined the wax job on the cabinet, it didn't hurt a thing in the chassis.

I could really have stuck the knife into him and told him that he incurred shop charges by being incompetent, but restraining an impulse to act superior, I didn't say a word.

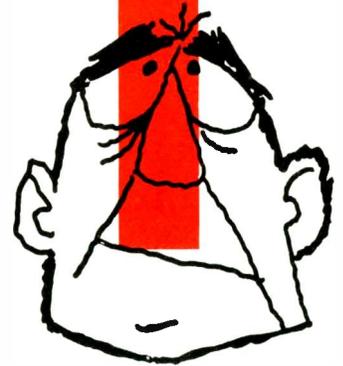
When I delivered the set, he asked, "I didn't do anything wrong, did I?" I answered, "When the fire started, you put it out, didn't you?"

He came back proudly. "Well, I should know how to put out a fire shouldn't I."

I smiled, "If you don't, I don't know who does."

He paid his bill without a qualm. As a first bonus he recommended us to all the fellows in the fire house. As an extra bonus he shuttles every TV set to us that catches fire and is worth saving. We've received some very large jobs out of it too.

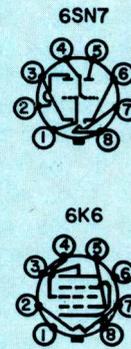
# HANDLING 'DO-IT-YOURSELF' PROBLEMS



# 'DO-IT-YOURSELF' PROBLEMS

Continued

Fig. 1—Heaters on 6SN7 are pins 7 and 8 but the 6K6 heaters are pins 2 and 7. The fireman made a fire with this combination.



## Sharing Your Knowledge

It's a funny thing about sharing knowledge. No matter how you honestly try to instruct somebody, unless they have the proper background, they'll not get it. When you give a customer information he won't understand the technical end of it. You know it, you own it, nobody can clean your brain out, but it's hard to pass it on to an inexperienced person. So you should have no fear, your trade secrets of training and experience are safe. The few people who might possibly get some good out of it are too few to hurt your pocketbook at all. You can honestly try to give technical advice and end up with not giving it, yet reap the benefits of trying to anyway.

To illustrate what I mean, let me tell you about a 21 in. Olympic that I serviced recently. It's owned by the architect who designed the building we are housed in. I owed him a few favors for some of the things he does for me. He came walking in and asked, "Art, I'll have an eye bee three."

I said, "What's wrong with your TV, Len?"

He answered, "The picture is weak. When I turn up the brightness, it disappears altogether. Sounds like blooming, doesn't it?"

It did, so I sold him the 1B3. An hour later he was back and placed the chassis on my bench. I turned it on. The picture was weak all right. Weak video. The picture disappeared when the brightness was turned up because the brightness overpowered the

weak video. It was not blooming in the least.

Adhering to our policy of patience with do-it-yourselfers, I didn't tell him he was wrong. Instead, I began examining the video amplifier circuit. The plate voltage was 220 v instead of 125 v, and the screen voltage was 0 v instead of 100 v. I let him stay and watch and explained what I was doing as I went along. He listened intently and appeared to comprehend.

I turned off the TV and began scanning the components in the screen circuit. A 4  $\mu$ f filter in the screen to ground measured 4K. It was tapping off the voltage to ground (see Fig. 2).

I replaced the 5  $\mu$ f capacitor and the video came back in nicely. Len was pleased, and he was whistling cheerfully as he lugged the chassis out the door.

An hour later he was back again. "Art, let me have another eye bee three for this one you gave me before. Evidently that filter blew it out before we caught it. The set's blooming again!"

I went over to his apartment with him instead. The 12BY7 video output tube was the culprit, and I replaced it.

Len's a smart cookie, yet he hadn't gotten a thing I told him, even though he worked with me on the bench and I explained it as carefully as I could have. So don't worry about giving away technical trade secrets. You couldn't do it even if you wanted to!

## Sell Them Parts

The TV technician is the logical

one to sell a do-it-yourselfer parts; yet great portions of the business are lost to drugstores, gas stations and the like. Why? Number one is their location, which you can't help. However, number two is the do-it-yourselfer's sensitivity to the fact that technicians resent their efforts. This you can help. You must make him feel welcome in order to attract him in for the bread and butter items and not just the tubes the drugstore doesn't carry. You must compete with pleasant surroundings and discount prices.

In fact, this puts you in a better position than the cut-rate house, and over the long pull you will be able to build up a large do-it-yourself following. It's a struggle, though, and you have to exploit cases—like this one.

A customer brought an old Admiral copper-plated chassis into the shop for repair. I asked, "What seems to be the trouble?"

He said, "No high voltage." I knew he was a knowledgeable type as soon as I ascertained that the TV really didn't have high voltage. I checked out tubes to no avail and carried the TV back to the bench.

I inserted a horizontal scanning signal from my flying spot scanner into the horizontal output tube grid with the coupling capacitor disconnected. No action. This eliminated the oscillator circuit and pinned the blame on the output circuit or further on. Since the flyback was readily available, I tested it with my flyback grid dip meter. I was lucky. It had shorted turns.

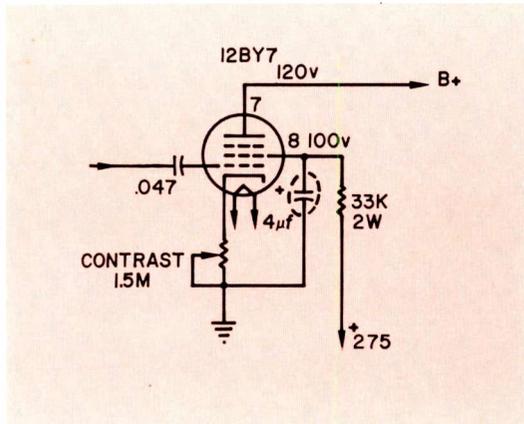


Fig. 2—The do-it-yourselfer thought a 1B3 would substitute for this defective 4  $\mu$ f capacitor.

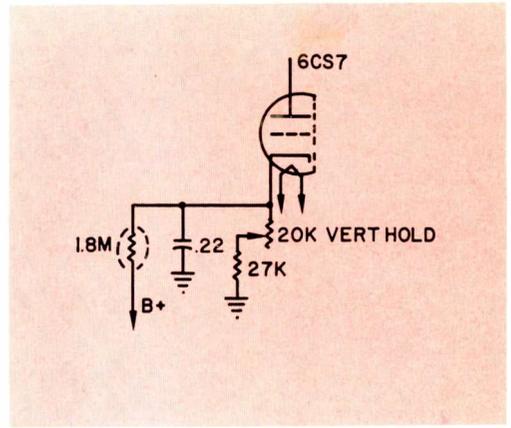


Fig. 3—It took 10 minutes to locate this defective 1.8 M $\Omega$  resistor in the do-it-yourselfer's home. He replaced it himself and paid for a service call. The business he later turned toward the shop has been very substantial.

The high voltage cracked on, and a new flyback was installed, and a raster appeared on the screen. There seemed to be a little too much width, however, so I checked the screen and cathode of the output tube. The cathode was grounded but the 8.2K screen resistor measured about 3.5K, so I replaced it.

The width came in a little and seemed almost all right, so I placed the TV on checkout and called the customer to tell him it was about done. When he arrived about an hour later and I went back to the checkout rack, the TV's tubes were lit but the raster was gone. It was the high voltage.

I turned off the TV and felt the flyback. It was very warm. I quickly installed another flyback. The high voltage came on again. Meanwhile, the customer sat at the counter reading some ad literature.

As a check I felt the new flyback. It was getting warm too. Then I noticed that the fat 6BQ6-type tube was brand new. I examined it. It was a 6DQ6, not a 6BQ6. I installed a 6BQ6 instead and the flyback cooled right down.

The 6DQ6 drives much harder than a 6BQ6. It was drawing too much current from the flyback and killing it.

Since I had to charge for the 6BQ6 and give the customer an explanation, I said, "Seems like you had the wrong replacement in here."

"Is that what was burning out the transformers?" he snapped.

I answered, "Can't tell for sure but it was working it harder than it's designed to."

He shook his head and gritted his teeth. "That clerk at the drug-store told me it would work better than the old one."

I kept quiet after that, but the point was made and I'm sure he'll relate the story to other people.

This making the point nicely, is a slow process but over a period of time you'll develop a lot of customers if you tactfully prove your point without showing that you resent their not starting their repairs with you in the first place.

#### Sell Them Labor

The hardest thing for you to do is give away to a do-it-yourselfer the hard-won skill in your hands. Yet, you can do this profitably, and the one piece of technical information a customer buys is not going to put you out of business.

Take the job I had the other day. We have been catering to do-it-yourselfers for years, and we are known for it. So we attract jobs like this. One of the steelworkers from the nearby mill came into the shop and ordered a 21FLP4 rebuilt tube. I sold it to him over the counter for a dollar an inch, which was a decent markup. He wanted me to service his TV that evening, not to install the CRT but to locate a bad component.

I arrived after dinner and he took me to his basement workshop. It was a model woodworking shop. He had the TV chassis cooking on his bench. It was a Philco 8L42, and it was all apart, ready for action. The factory schematic was lying in front of it. I looked at the picture. There was a vertical roll.

I tried to adjust the vertical hold

pot, but it had little effect—the oscillator was running off frequency. I checked the oscillator and output tube, a 6CS7. It was new and had been purchased in our store.

I opened my tube caddy and placed my VOM on the bench top and then took some voltage readings at the vertical hold pot. There was supposed to be 10 v bias there but there was only 4 v.

A glance at the schematic showed that there was a 1.8 M $\Omega$  resistor leading from B+ to the pot. It was a bit charred, it measured infinite resistance. (See Fig. 3.)

I didn't have a replacement resistor with me, but the customer said, "That's fine, that's all I need." I packed up and he gave me the service charge. I checked my watch—I had been there less than ten minutes.

The steelworker came into the shop the next morning and picked up the resistor. He called me later that day and thanked me and said that the TV set was working fine.

I was happy, he was happy and the one repair I sold him does not put him in business as my competitor. In fact, all it did was increase the amount of business we get from the steelworkers as he proudly tells the story.

Do-it-yourself is here to stay. We must not only adjust our attitude to accept it, because it is actually part of the changing complexion of our business, we have to change our entire public relations approach to the do-it-yourself problem to prevent further profit losses in this area.

# Unscrambling TV Vertical Sweep Puzzles

How to troubleshoot and repair TVs with vertical bounce, foldover, 'jitters' and 'soft-hold' conditions

by Jay Shane

■ All TV receiver circuits have servicing tricks, short cuts and brain scramblers peculiar to each circuit. Vertical problems, particularly multivibrator types, easily fall into this category. The conditions of foldover, jitters and poor hold may all be tied into one symptom.

#### Deteriorated Capacitors

Many of these difficulties show up in GE's 17T025, 17T026 and

Hotpoint's 17S301, for example. These chassis are also known as the "MM" line, and use an identical multivibrator vertical system.

Too many times the printed board is blamed. In 90 percent of the cases, however, the board is not to blame at all, but thermal deterioration of components usually is. The vertical circuitry of these receivers is shown in Fig. 1.

Each of the aforementioned ver-

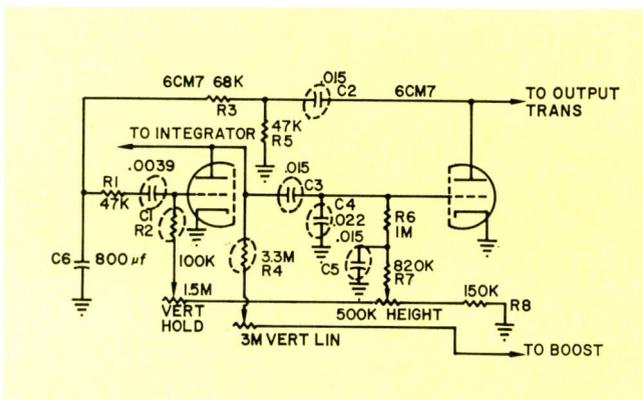


Fig. 1—Schematic of typical multivibrator circuit showing components that deteriorate because of ambient heat, causing vertical troubles—including foldover, jitters and poor hold conditions.

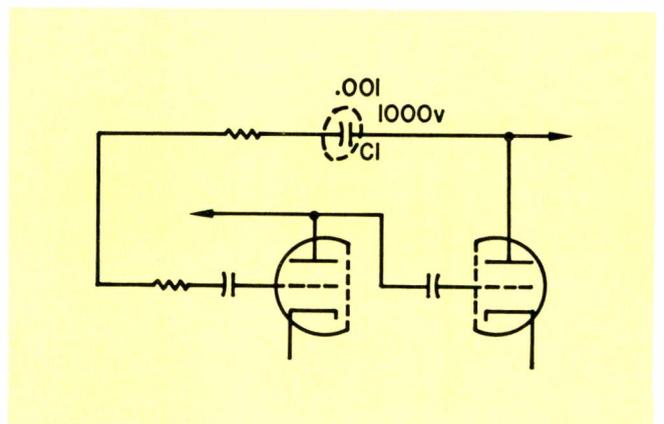


Fig. 2—Vertical collapse or poor stability in Admiral 14 in. portables may be caused by defective capacitor C1.

tical conditions is normally resolved by replacement of a specific part. But when one of these "MM" chassis comes into the shop with "vertical trouble" the surest cure for all difficulties is to go right down the line and change the capacitors and resistor R4 and possibly R2 (Fig. 1). It would be well to use single-ended capacitors or Mylars. Make no bones about it, failure to change *all* the capacitors is begging for a call-back.

The integrator rarely, if ever, causes trouble. Neither do the controls (except for possible cleaning), unless the customer has worn them out fighting the problem before finally surrendering to the service technician.

So many technicians have skipped around the seat of the difficulty in these receivers that some customers have incorrectly suspected that the problem is inherent with the set. The technician who cures the trouble for keeps is often considered quite a hero, and a darn good TV man.

A couple of changes can be made to improve the set's vertical stability. Especially is this true when it favors upward roll. Change C1 from 0.0039  $\mu$ f to 0.004  $\mu$ f.

In some instances R2 has been omitted in production. If a chassis

has this resistor, jump it with a shorting wire, thus tying the grid directly to the hold control.

Admiral portables, 14YP3D and 14UYP3C, D use essentially the same circuitry as the GEs and Hotpoint. There are several models in this Admiral group, from the 10-in. to the 17-in. All use the same vertical multivibrator circuit.

Vertical collapse or poor stability is caused when C1, Fig. 2, becomes leaky or shorted. Expansion at the top, with compression or fold-over at the bottom after the set warms up (with a lowering of boost voltage ranging from 50 to 75 v) is invariably caused by yoke saturation. There is no trapezoidal condition when this occurs, and it may or may not visibly affect the width. Do not blame the flyback, but change the yoke.

### Sync Problems

Vertical bounce (very disconcerting) may develop in Philco's 9L35, 9L37 and 9L38. It usually appears in fringe or poor signal areas. Faulty vertical sync information is the cause. A big improvement can be obtained by shortening the sync separator grid time constant.

Referring to Fig. 3A, we reduce the separator grid resistor to 1.5 M $\Omega$ . This is done simply by filing off the coating material at the top corner of the module, Philco part #30-6519-2, and soldering a 1.5 M $\Omega$   $\frac{1}{2}$  w resistor to the junction of the 680K, 180 pf, and the 0.008  $\mu$ f then to ground. This point is identified by the fact that the other end of the 180 pf capacitor is connected to module lug #6.

To compensate for the grid leak reduction and to prevent video pick-off, it is now necessary to short out the 18 K resistor in series with

the grid. A short piece of wire soldered to module lug #2 and L1, a wire-wrap lug on the panel, will accomplish this.

Care should be taken when filing the module corner so as not to file off the clip holding the 180 pf capacitor.

### Faulty Integrator

RCA receivers KCS109A, KCS111A, B, C, etc., and KCS120 A, B, have a similar vertical circuit (Fig. 4). On rare occasions one of the integrator capacitors may become excessively leaky and cause poor hold, but when foldover at the bottom occurs, a filter capacitor is usually at fault. In the ac/dc models this is a three-section can-type capacitor. In the ac models it's a quad can.

The foldover doesn't show up right away, but after warmup. As ambient heat affects the capacitor, its power factor changes, causing the B+ to drop off. Since the output of these vertical circuits is fed by B+ instead of boost voltage, the 6AQ5 tube saturates. There may or may not be instability and waviness in the picture at low contrast level. Sound is unaffected.

Heat is the most destructive element in television receivers. By this simple deduction, we know that if a circuit develops a malfunction after a time, then "heat condition" has occurred, changing the value of parts, primarily capacitors and certain resistors which are subjected to loads and heat.

Since the foregoing circuits are so basic and in such common use today, familiarization and complete understanding of their operation is a must if you are to hold time-consuming costs down to reasonable levels and still make a profit. ■

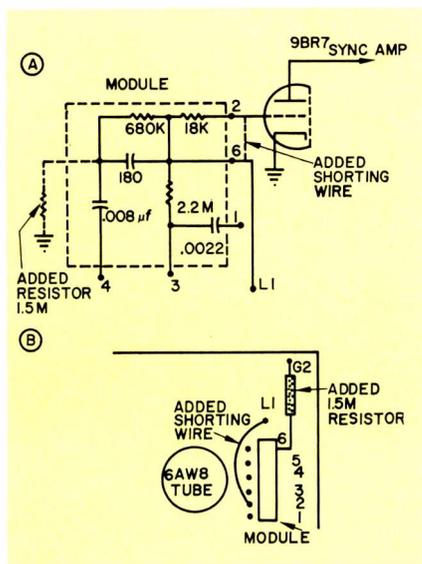


Fig. 3 (A)—Sync separator module circuit in Philco TV. (B)—Modification details to eliminate vertical bounce.

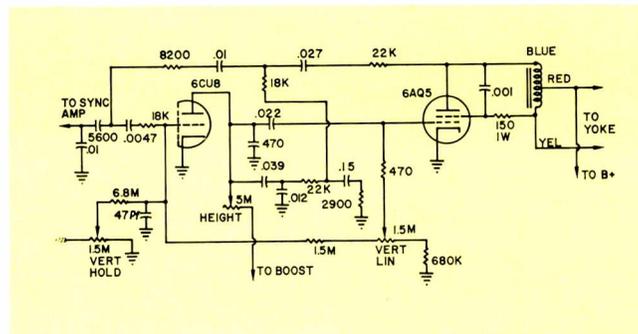


Fig. 4—Vertical oscillator-output circuit of some RCA TV receivers.

■ What's your reaction when a customer brings in one of those little ac-dc table radios? Some shops take the easy way out—they just refuse the job. Others silently cuss them as nonprofit headaches, taking them just to keep the customers happy but farming them out to an electronically inclined neighborhood teenager or moonlighter who will work for a buck an hour plus parts.

The technician who's on the ball and really knows what he's doing, however, welcomes the little five-tuber as a profitable addition to his business. He can do so, however, only because he: (1) took the trouble to learn how they work, (2) adopted a thorough troubleshooting procedure, and (3) made it a policy to accept every ac-dc repair job he could get until he became as familiar with table-radio

mining the problem is to check all the tubes. Some technicians check the tubes while the customer is still in the shop because they feel that he will be happier if, five minutes after he walks in with a dud, he can walk out with the set playing again. In many cases, it would be all right to do this, but not all tube failures are caused by old age, and putting in a new tube might be only a temporary cure. In addition, you might be out of the particular tube needed, you might have an embarrassing time just getting the case open, and you will certainly lose the opportunity to impress the customer by giving the alignment its first touch-up in years or discovering unsafe conditions in the line cord, switch or other circuitry.

After the customer has left, pull the tubes and check them. If a

ac-dc radio is shown in Fig. 1, and a complete schematic appears in Fig. 2. Most ac-dc radio problems fall into one or more of the categories listed in Table 1, and their most common causes are listed according to category in Tables 2 through 8.

If the set is not completely dead, Tables 3 through 8 should give you some idea as to which stage is affected and what the trouble is. The quickest way to find the cause of a dead set, however, is to follow a fairly standardized troubleshooting procedure.

The value of a good signal generator and signal tracer cannot be stressed too highly. Instead of using a signal generator, some technicians touch the tube grids with one lead of a 0.01  $\mu$ f capacitor while holding onto the other lead. If the stages are operating properly,

*while other technicians ignore  
the little table model set,  
you can make a healthy profit  
if you know the secret*

*by Donald Teal*

## **SERVICE AC-DC**

idiosyncrasies as he is with those of TV sets.

### **How Does It Act?**

The first step in any ac-dc radio troubleshooting procedure is to find out what the problem is. When the customer brings in a set for repair, he knows more about the problem than you do. So the first thing to do is ask him how it acts. Although he may initially say only that "It doesn't work right," careful questioning on your part may translate his original answer into "It starts out all right but after about ten minutes it starts sounding fuzzy and before long I can't stand to listen to it."

After you have learned as much as you can from the customer, thank him for the business and then put the receiver on the shelf until he has left. The next step in deter-

mining the problem is to check all the tubes. Some technicians check the tubes while the customer is still in the shop because they feel that he will be happier if, five minutes after he walks in with a dud, he can walk out with the set playing again. In many cases, it would be all right to do this, but not all tube failures are caused by old age, and putting in a new tube might be only a temporary cure. In addition, you might be out of the particular tube needed, you might have an embarrassing time just getting the case open, and you will certainly lose the opportunity to impress the customer by giving the alignment its first touch-up in years or discovering unsafe conditions in the line cord, switch or other circuitry.

After the customer has left, pull the tubes and check them. If a bad tube is found, check the circuitry associated with it before plugging in a new one and turning on the set, to make sure that the failure was not caused by a defective component. If you find no circuit faults, plug in the tubes again (along with the new one) and turn on the set. If it does not operate properly, remove all the tubes and replace them with a set of tubes you know are good (bad tubes don't always show up even on the best tube testers). Again turn on the set. If it plays properly, you know that one of the tubes is bad but was not detected by the tube tester. If the problem still remains, however, the next step is to analytically isolate it to a single stage.

### **Troubleshooting Techniques**

The block diagram of a typical

touching audio grids may cause hum output, while touching IF and RF grids may create loud "pops" and scratching noises in the speaker. If no signal generator is available, you can do nothing else, but this procedure is very unreliable. Worse yet, it is not "quantitative;" that is, while it creates some noise, you can't tell how much noise was caused by how much input—the input level will depend on the temperature, humidity, location and a host of other unknown variables. Most important, the method precludes the use of a signal tracer or signal injector.

When working on an operating ac-dc radio, remember that circuit ground is actually one side of the 117-v power line. Because of the danger of accidental electrocution, and because it would otherwise be necessary to turn off the set every

**Table 2**  
Causes of dead receivers

Burned out fuse  
Defective ballast tube  
Defective selenium rectifier  
Defective switches  
Defective tubes  
Defective volume control  
IF transformers grossly misaligned  
Open coil  
Open heater voltage-dropping resistor  
Open or shorted antenna  
Open or shorted coupling capacitors  
Open or shorted transformers  
Open resistors  
Open speaker voice coil  
Shorted B+  
Shorted filter capacitors  
Shorted filter choke  
Shorted line filter capacitor  
Shorted variable capacitors  
Touchy oscillator stage

**Table 3**  
Causes of weak reception

Bent tuning or trimmer capacitors  
Broken ferrite-rod antenna  
Corroded IF cans  
Defective antenna  
Defective antenna, RF or IF transformer  
Defective input filter capacitor  
Defective self-bias resistors  
Defective tubes  
Defective volume control  
Floating grid circuit in output stage  
Leaky coupling capacitors  
Leaky screen bypass capacitors  
Moisture in tuned circuits  
Open avc bypass capacitor  
Open audio tube cathode bypass capacitor  
Open coupling capacitors  
Open plate bypass capacitor  
Poorly or incorrectly seated tubes  
Receiver misaligned  
Weak batteries

**Table 4**  
Causes of excess hum

Cathode-to-heater leakage  
Corroded contacts  
Defective rectifier tube  
Defective volume control  
Leakage between capacitors in a multiple can  
Open cathode bypass capacitor  
Open decoupling filter capacitor  
Open filter capacitors  
Open grid circuit  
Open line filter capacitor  
Oscillating stage  
Overbiased tube  
Poor lead dress  
Poor shield grounding

**Table 1**  
Types of complaints

Dead Receiver  
Distortion  
Excessive Hum  
Interference from other stations  
Intermittent operation  
Noise  
Oscillation "birdies"  
Repairs needed too frequently  
Weak, poor performance

# RADIOS AT A PROFIT

**Table 5**  
Causes of squealing and motorboating

Corroded or poor connections  
Defective antenna, RF or IF transformer  
Defective supply filter capacitor  
Gassy tubes  
Improperly grounded tuning capacitors  
Low bias  
Microphonic tube  
Open agc filter capacitor  
Open bypass capacitor  
Open detector RF bypass capacitor  
Open grid circuit  
Open plate decoupling capacitor  
Open screen bypass capacitor  
Open screen voltage-dropping resistor  
Poor grounding  
Poor lead dress  
Poor rubber mounts  
Poor shielding  
Poor wiper contact in tuning capacitors  
Weak batteries

**Table 6**  
Causes of noise

Bad battery connectors  
Bent stators and rotors of tuning capacitors  
Break in antenna lead-in  
Conductance between tube pins  
Corroded solder joints  
Corroded windings in RF, IF and AF coils and transformers  
Cracked printed circuit board  
Cracked resistors  
Defective line filter capacitor  
Defective or dirty volume and tone controls  
Defective switches  
Defective tubes  
Dirt in speaker  
Dirty wiper contacts on tuning capacitors  
Dusty tuning capacitors  
Intermittent shorting of wires inside receiver  
Leaky capacitors  
Loose loudspeaker spider  
Loose parts in receiver  
Loose pilot light  
Loose voice-coil wires  
Torn loudspeaker cone  
Tubes seated improperly in sockets

**Table 7**  
Causes of intermittent operation

Cracked printed circuit board  
Defective solder joints  
Defective switches  
Defective tubes  
Defective volume controls  
Dirty tuning capacitor wipers  
Faulty taps in wire-wound resistors  
Intermittent shorts inside receiver  
Intermittently open fixed capacitor  
Intermittently open resistors  
Intermittently open coils  
Intermittently shorted variable capacitors  
Leaky coupling and filter capacitors  
Loose tube and wire shields  
Resistors changed in value  
Shorted coils  
Weak batteries



the ohmmeter leads across the primary of the output transformer. A schematic of typical ac-dc radio audio circuitry is shown in Fig. 5. If the transformer and speaker are OK, you will hear a "pop" when the leads are disconnected.

If the speaker and output transformer seem OK, turn the set back on again and connect the 400-cps output of the signal generator to the control grid of the power amplifier tube. A 1.5-v input to the grid should result in loud 400-cps output from the speaker. If the output is too loud, it may be distorted; on the other hand, distortion might result from a faulty stage or speaker. Therefore, reduce the output level of the signal generator until the speaker output is not uncomfortable when your ear is about a foot away from it. If the audio is still distorted, check the operating voltages of the stage. If they seem correct, disconnect the speaker and substitute a speaker known to be good. If the audio is still distorted, the trouble is in the power amplifier circuitry or tube. If the audio from the substitute speaker is not distorted, a new speaker probably is needed.

The next stage to check if the power amplifier is OK is the first audio amplifier. Connect the 400-cps output of the signal generator to the hot end of the volume pot. With the pot set to maximum gain, a 30-mv audio signal should provide loud 400-cps audio at the speaker. If there is no output from the speaker, the trouble is somewhere in the circuitry of the first audio amplifier. Some of the voltages which should be found at

various audio-circuit points are as follows:

|                         |              |
|-------------------------|--------------|
| First amp cathode ..... | 0 v          |
| First amp grid .....    | -0.5 v       |
| First amp plate ....    | 50 to 70 v   |
| Pwr amp grid .....      | 0 v          |
| Pwr amp screen ....     | 80 to 90 v   |
| Pwr amp plate ....      | 110 to 125 v |

If the trouble is not found in the audio stages, it probably is in the IF amplifier, mixer, local oscillator, RF amplifier (if the set has one) or antenna circuitry.

### Checking the IF and RF Stages

To troubleshoot the IF amplifier, connect the 400-cps-modulated 455-kc output of the signal generator to the plate of the IF amplifier. (See Fig. 6 for typical IF, detector and AVC circuitry.) It may be necessary to rock the frequency of the signal generator up to 50 kc either side of 455 kc if the IF cans are not tuned to exactly 455 kc. A 0.1-v input signal should produce a strong 400-cps output from the speaker. Strong speaker output indicates that the second IF can and the detector stage are OK.

Next connect the modulated signal generator output to the grid of the IF amplifier tube. A 3.5-mv input signal should result in loud 400-cps output from the speaker, the lack of which indicates that the IF amplifier or its associated circuitry is defective.

To check the first IF can, connect the modulated 445-kc, 3.5-mv signal generator output to the plate of the converter tube. If a strong 400-cps output from the speaker is heard, the trouble probably is in the stages which precede the IF section. Some of the volt-

ages normally present in the IF and detector circuits are as follows:

|                          |        |
|--------------------------|--------|
| Diode plates .....       | -0.5 v |
| IF amp cathode .....     | 0 v    |
| IF amp control grid .... | -0.5 v |
| IF screen grid .....     | 85 v   |
| IF plate .....           | 85 v   |

The converter stage is checked in two steps. First, short out the local oscillator tuning capacitor in order to stop the oscillations. (An ac-dc radio converter schematic is shown in Fig. 7.) Connect the modulated 445-kc signal generator output to the mixer grid. A 50  $\mu$ v input signal should produce a loud 400-cps output from the speaker. If it does not, the trouble probably will be found in the converter circuitry not associated with the local oscillator.

If speaker output was obtained in the previous step, remove the short from the local oscillator tuning capacitor, set the signal generator frequency to 600 kc, and connect the output leads to the converter RF input grid. Attempt to tune in the 600-kc signal. A 50- $\mu$ v input signal should produce loud 400-cps speaker output. If the 400-cps audio is not heard, check the voltage at grid No. 1. If the local oscillator is oscillating properly, grid No. 1 should measure approximately -10 v.

If the converter and other stages are operating properly, the next step is to check the RF amplifier (if the set has one). Leave the signal generator and receiver tuned to 600 kc and connect the signal generator to the plate of the RF amplifier. With an input level of 50  $\mu$ v, listen for loud 400-cps out-

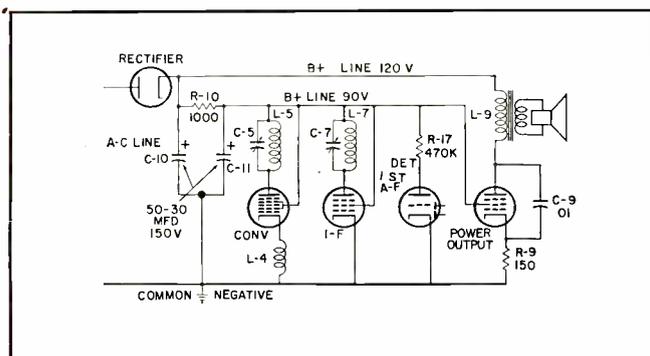


Fig. 4—B+ distribution circuits for typical table model radio

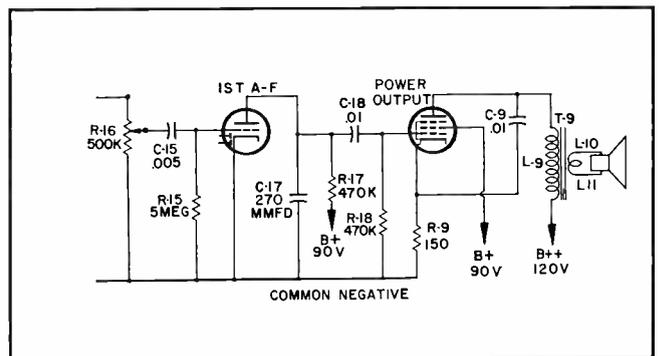


Fig. 5—Schematic of standard ac-dc radio audio circuitry

## SERVICE AC-DC RADIO AT A PROFIT

Continued

Fig. 6—IF, detector and AVC stage circuits

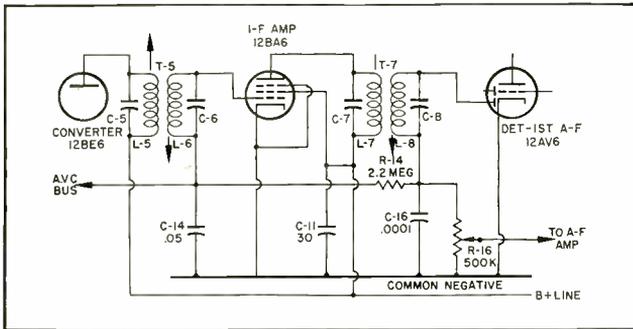
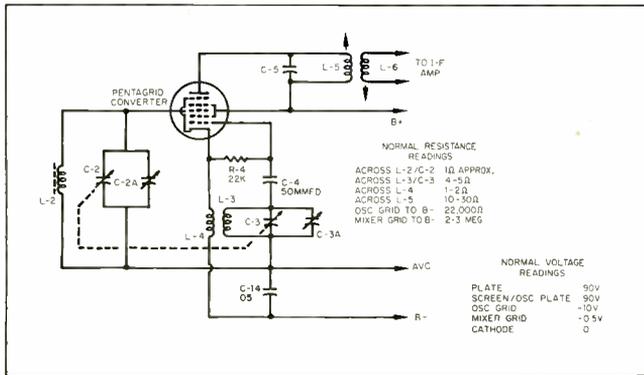


Fig. 7—Schematic of ac-dc table radio converter stage



put from the speaker. This checks the RF coupling circuitry. If the output is heard, connect the modulated 600-kc signal to the RF amplifier grid. A 10- $\mu$ v input signal should produce the loud 400-cps speaker output. If the RF and other stages are operating properly and the set is still dead, the trouble probably is in the antenna circuitry.

This completes the troubleshooting procedure for ac-dc sets. If it is followed closely and intelligently, it will help you a long way toward ac-dc repair jobs that are easier, quicker and profitable. ■

## CATV Under Fire

Twelve television antenna and accessory manufacturers recently formed "TAME," the Television Accessory Manufacturers Institute, for the purpose of organizing a common effort against the uncontrolled growth of community antenna systems throughout the country. It reportedly is not the systems which serve unmistakable technical needs which are under fire, but the great number which are emerging in areas where the group believes good TV reception has been attainable for years with a properly designed TV antenna installation.

The group includes Alliance Corp., Antennacraft Co., Antenna Designs, Inc., Channel Master Corp., Clear Beam Antenna Corp., Cornell-Dubilier Electronics Div., The Finney Co., JFD Electronics Corp., Kay-Townes Antenna Co., S & A Electronics, Inc., Spaulding Products Co. and Winegard Corp.

In his remarks to the group, Mr. L. H. Finneburgh, president of the Finney Co., stated, "The electronics distributor has been lulled to sleep by the supposed large amount of business which cable systems can bring him."

Mort Leslie of JFD Electronics contends that, "Up to now CATV has had no major opposing group—only individual campaigns."

Sam Schluskel of the Channel Master Corp. maintains that, "More people should be brought into the fight. Let's get other interested groups in the foray."

## NCTA Fights Back

"TAME's" challenge to CATV was taken up by Fred J. Stevenson, chairman of the National Community Television Association, NCTA, which is the national spokesman for the community television industry, representing over 1000 CATV systems serving more than 3 million CATV viewers.

He said, "The antenna manufacturers should turn the clock back a half century and read about the money wasted by buggy-whip manufacturers in trying to prevent the advent of the automobile. In thousands of communities throughout the United States, the public demands CATV service because it wants clear TV reception and a wide choice of TV signals. This it gets from CATV systems. Evidently this is something the public has not been able to get from home antennas.

"No amount of money spent in a public relations program will obscure those facts. It would seem to me that antenna manufacturers could make a better use of their funds in trying to develop, if this is feasible, a rooftop antenna which does not begin to deteriorate perceptibly in performance within a few months from the erosion of the elements. In many fringe TV reception areas, this would mean the difference between good and poor reception of the TV signals available in the immediate area. Obviously, no antenna will provide reception of the signals of very distant TV stations as CATV systems do."



# YOU, The Salesman

■ You are a salesman. Surprised? "But I don't sell radios or TV sets, I just fix them—I'm no salesman," you say?

Balony! The only repair jobs you get are from people you have "sold" on your services. Your repeat business is from people who stay sold. Sometimes you have to "sell" people on not doing things, such as sinking a lot of money into a 15-year-old TV that should have been junked five years ago. And sometimes you have to sell them on a rather extensive repair job that is not necessarily needed now but will in the long run save the customer twice its cost later.

Not a salesman? Balony! Of course you are. But what kind? How do you tell? What part of the professional technician is a salesman?

A salesman does not necessarily sell a product, as such. He creates his sales by selling an idea, creating a need, arousing a desire, destroying complacency, unearthing a problem, or making the prospect unhappy, dissatisfied and "hungry." He makes the product or service indispensable to the customer's well-being, enjoyment, peace of mind, or even his survival. A professional salesman knows the sale begins with the prospect and not the product.

### Help Him Decide

Most people hate to make decisions. A major part of the salesman's selling job is to get past this barrier and help the customer make a decision. He must do this so smoothly the customer is convinced it is his own decision.

The customer's mind is like a sine wave. It swings continually

from the positive to the negative. The salesman must sense when an attitude is negative and work to bring it back to the positive.

Many salesmen admit a weakness in closing sales. Some will excuse it by saying, "I don't believe in high pressure." They say this because of low desire or fear of closing the sale. No salesman believes in cramming a sale down the prospect's throat, but everyone agrees that persistence is ethical and necessary in selling. Surveys have indicated that the majority of sales are made after the fifth attempt.

In many instances, high pressure is regarded as such only by the salesman, not by the customer. The prospect hopes the salesman will be skillful enough to overcome his objections. He wants to be persuaded, because at the moment of making a decision he develops fear. He wants the reassurance from an expert—the salesman.

The customer wants you to take over at this critical time. He wants a summary of the benefits and a review of the most appealing features of your proposition. He may offer his objections at this time. If he does, you can deal with them calmly, helping dispel his doubts.

### Establish a Foundation

Many salesmen fail to make the grade because they fail to first establish a foundation for making the sale. They do not spend enough time making sure the customer understands exactly what they are talking about. This is carelessness and neglect.

Make your pitch snappy but complete. Say everything from the

customer's point of view. Don't be too technical unless you're selling to a technical expert. Avoid industry jargon and talk in simple language. Check to make sure the customer understands by asking him if he does.

### Investigate by Questions

You do not put a customer in a buying mood by arguing with him. Yet, you must clear away objections if you are to make the sale. Always attempt to turn objections into questions. An argument closes the mind, while a question opens it.

The selling effort is really a series of sales. You must sell your prospect on looking at your proposition. You must sell the interview and arouse his curiosity.

You must sell your customer on listening in an unprejudiced, open-minded manner. Relate your proposition to his self-interest. You must convince him that he has a legitimate need. Create a problem for him and come up with the solution.

Finally, you must sell your prospect on wanting your product or service now and paying a fair and equitable price. Profits, quality, service and other factors are more important than price.

After you have sold an intellectual need for your product and aroused a desire for it, you must sell the customer on the idea that he "wants it now." Here are some specific closing techniques for getting the order:

### Closing Techniques

● The assumptive or implied-consent close—You know the customer wants your service and pro-

*Continued on page 79*

# Stereo multiplex repairs can be a profitable part of your business, and the heart of a stereo set is the demodulator

## Sampling

### PART I

by Edward M. Noll

■ Do you know your left from your right (stereo channels, that is)? All these new stereo multiplex sets flooding the market are an added source of profit for the capable technician—provided, of course, that you know how they operate. Do you? What kind—there's more than one basic type, you know.

Perhaps the most significant difference between stereo sets is the kind of demodulator used. However, not all technicians are aware that there are presently two types of stereo demodulators: the subcarrier demodulator, and the time-division, or "sampling," demodulator.

Let's take a look at the two types of demodulators, but first, for the benefit of the tyro (and the old pro who's gotten a little rusty), let's review some stereo multiplex fundamentals, so that we don't get lost later just because we don't know where we started out.

#### Basic Principles

In our stereo FM broadcast system, left and right channel information is conveyed as two sum and difference components,  $(L + R)$  and  $(L - R)$ . These are matrixed at the receiver to reconstruct the original L and R channel variations:

$$(L + R) - (L - R) = 2L$$

$$(L + R) + (L - R) = 2R$$

At the transmitter, the  $L + R$  signal is applied directly to the FM

transmitter as a modulating wave. It occupies a span of frequencies that extend up to 15,000 cps. The  $L - R$  signal is transmitted as subcarrier side frequencies ( $L - R$  double sideband component). This signal occupies a modulating frequency spectrum that falls between 23 and 53 kc. The  $L - R$  DSB signal is formed by amplitude modulating a 38-kc subcarrier. In the modulation process this subcarrier is suppressed, leaving only the two side-frequency spectra.

A weak 19-kc pilot frequency is also transmitted, positioned between the  $L + R$  and  $L - R$  DSB frequency spectra. At the receiver it is used in the subcarrier demodulation process.

#### Basic FM Multiplexers

One of two methods is used to recover the L and R channel information at the receiving multiplexer (see Fig. 1). In the frequency-division multiplexer, frequency filters segregate the three signal components. The  $L + R$  signal is sent through a low-pass filter directly to the receiver matrix, while the  $L - R$  DSB component is supplied to the subcarrier demodulation via a bandpass filter.

In the subcarrier demodulation system it is necessary to regenerate the subcarrier. This is done under control of the transmitted pilot frequency. When the subcarrier is combined with the  $L - R$  DSB signal, an amplitude modulation envelope is formed. This envelope

can be applied to a conventional type of AM detector to recover the  $L - R$  signal. The  $L + R$  and  $L - R$  signals can then be matrixed to re-form the original L and R signals.

A time-division demodulation process also can be used. In this system it is not necessary to segregate the  $L + R$  and  $L - R$  DSB components; both are applied as a composite signal to the sampling type of demodulator. In a time-division multiplexer, too, it is necessary to regenerate a subcarrier under control of the pilot frequency. In this case, however, the regenerated subcarrier is used as a switching, or sampling, wave. It takes subcarrier-rate samples of the  $L + R$  and  $L - R$  DSB signals. In fact, a direct conversion to the original L and R signals can be made. This article covers the operation of this popular type of FM stereo demodulator.

#### Double-Sideband Modulation (DSB)

The make-up of a double-sideband modulation envelope is important in the operation of a sampling, or time-division, type of demodulator. The DSB envelope is formed by a balanced modulator similar to that shown in Fig. 2. The modulating wave feeds the two grids in phase, while the subcarrier is applied in push-pull. The output plates are connected in parallel.

Let us consider the operation of the balanced modulator with only an applied subcarrier signal and no

# Demodulators for FM Stereo

modulation. The two grids are driven out of phase. Therefore, the signals contributed by the two tubes appear in the common plate circuit out of phase. In fact, if the modulator has been carefully balanced, the two components will be of equal amplitude and opposite polarity. Therefore, there will be no output—the carrier is cancelled, or suppressed.

How does the modulating wave influence the operation of the balanced modulator? The modulating wave changes the two grid voltages in unison at a frequency lower than the subcarrier rate, and the two components mix to produce sum

and difference frequencies. For example, if the subcarrier is 50 kc and the modulating frequency is a 2000-cps sine wave, two side frequencies will be produced at 48 and 52 kc. These side frequencies will not cancel, because the modulating wave drives both grids in parallel.

The waveforms and vector diagrams of Fig. 3 show the signal relationships in both conventional and balanced modulators throughout a complete cycle of the modulating wave. For conventional amplitude modulation (carrier present), the modulation envelope is the summation of the carrier and the two sidebands. Example A shows this

relationship for 100-percent modulation.

The vector diagram assumes that the carrier has a reference phase of zero degrees. Throughout the envelope period the sidebands shift in phase with respect to the carrier. The two sideband vectors rotate in opposite directions because one is at a higher frequency and the other at a lower frequency than the carrier. Throughout the envelope period these three components add and subtract vectorially.

The vectors show relations for each 90 degrees of the period of the modulating wave. At zero and 360 degrees, the sidebands and carrier

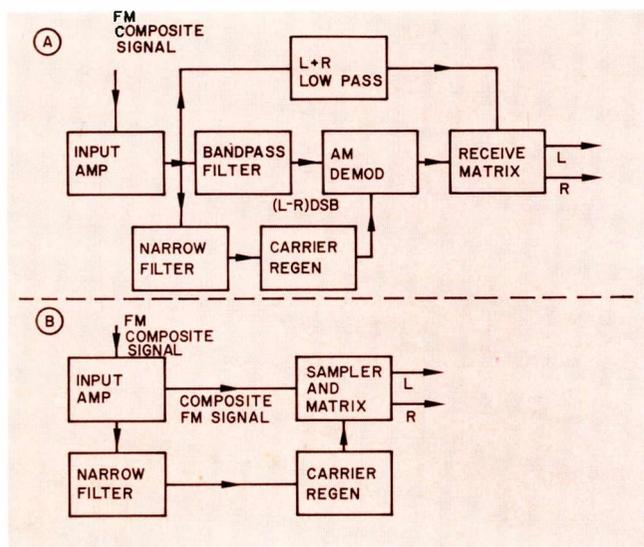


Fig. 1—Basic types of multiple demodulators: (A) subcarrier demodulator; (B) time-division demodulator.

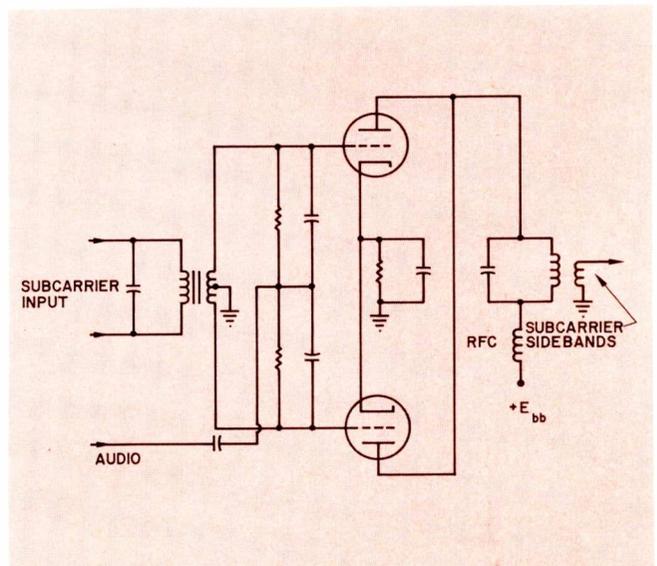


Fig. 2—Balanced modulator diagram.

# Sampling Demodulators

Continued

are all in phase to produce maxima in the modulation envelope. At the 180-degree position, the carrier and sidebands are out of phase and cancel, producing the zero amplitude point of the modulation envelope. At the 90- and 270-degree positions the two sidebands are out of phase with each other and related 90 degrees to the carrier. Hence, at that time the sidebands cancel and only the carrier remains. In this manner the variations of the modulation envelope follow the modulating wave.

In a double-sideband, suppressed carrier modulation system there is a similar vector relationship between the two sidebands. Since they are not of the same frequency, their relative phase rotates throughout the cycle of the modulating wave. However, the modulation envelope

here is composed of only two sidebands because the carrier has been suppressed. These relationships are shown in example B.

The two sideband vectors are in phase at 0, 180 and 360 degrees. Notice that this is quite different from the make-up of a conventional amplitude-modulated wave. At the 90- and 270-degree positions the two sidebands are out of phase. Since there is no carrier, the modulation envelope falls to zero at the 90- and 270-degree positions.

In effect, the variation of the envelope associated with a double sideband modulation system has a frequency twice that of the modulating wave. It is important to note the sideband phasing at the 90- and 270-degree points. Both sidebands cancel at these times. However, at 270 degrees the two sidebands are of opposite polarity with respect to their relative positions at 90 degrees. This indicates that the phasing of the sideband cycles is the reverse on opposing sides of the 180-degree position. This is very significant to the operation of a sampling type of demodulator.

The above relationship is brought out more clearly in Fig. 4, which emphasizes the phasing between the

carrier and the sideband envelope cycles for the 0- to 180-degree segment and for the 180- to 360-degree segment. Note in the first segment (first alternation of the modulating wave), that the subcarrier and sideband cycles are essentially in phase. The sideband cycles in the modulation envelope reverse at the 180-degree position. Thus, in the second segment (second alternation of the modulating wave) of the envelope, the envelope cycles and the subcarrier cycles are essentially out of phase.

In our stereo FM broadcast system it is the L — R signal that is converted to a DSB signal before it is used to modulate the FM transmitter.

## A Basic Sampling Circuit

A simple sampling circuit is shown in Fig. 5. Waveform A is called the switching, or sampling, wave. It is used to switch the sampling diode on and off. In the example, the diode conducts at the positive crest of each cycle of the sampling wave. In example 1 only the sampling wave has been applied to a demodulator. Thus, the diode draws bursts of diode current of constant peak amplitude. Since the

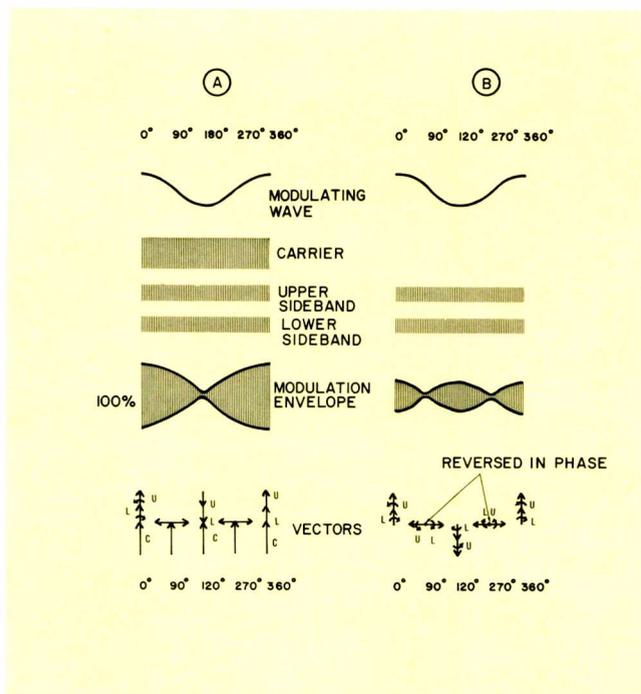


Fig. 3—Modulator waveforms: (A) conventional amplitude modulation; (B) double sideband modulation.

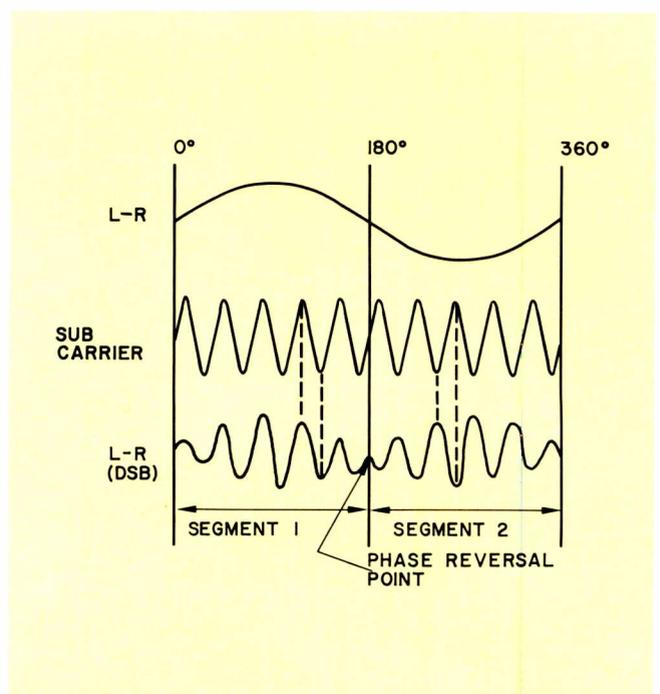


Fig. 4—Phase relationships between carrier and sidebands in stereo multiplex signal.

output of the demodulator contains a filter circuit that filters out the sampling-rate frequency, there will be no output for example 1.

In example 2 a lower-frequency sine wave is applied to the modulator along with the switching wave. The diode conducts again at the positive crest of the sampling wave. However, the amount that the diode conducts also depends on the low frequency wave's amplitude at this same instant. In example 2 there is a variation in the peak diode current which follows the low-frequency wave being applied to the demodulator. The filter smooths out the subcarrier components in the output, forming a replica of the low-frequency input wave. The important thing to realize is that it was reconstructed even though only samples of the wave were passed by the diode to the output.

Example 3 shows the sampling operation on a signal of a frequency identical to the sampling rate. The phasing between the signal and the sampling waveform is such that the positive peaks of the sampling waveform are coincident with the positive peaks of the applied signal. Inasmuch as there are variations in the magnitude of the signal peaks,

there is a corresponding peak variation of the diode current. After the sampling-rate frequency is filtered out, the resultant wave is a sine wave that corresponds to the positive peak variation of the applied signal.

Example 4 shows the result of a change in phasing between the applied signal and the sampling wave. In this case the positive peaks of the sampling waveform are coincident with the negative peaks of the applied signal. Since there is no variation in the magnitude of the negative peaks, there is no variation in the peak diode current. Consequently, for this phase relationship there is no output from the sampling circuit.

Examples 5 and 6 show how it is possible to sample the peak variation on the negative side of the applied signal. In example 5, the positive alternations of the sampling waveform are coincident with the peaks of the negative cycles of the applied signal. If the sampling-rate phasing is such that the positive peaks are coincident with the positive peaks of the applied signal, as in example 6, there will be no output because there are no positive peak variations. ■

## NEW Tape Recorder

■ A new tape recorder, the Roberts Cross Field Model 770, which permits Hi Fi recording at 1 7/8 ips, was slated for an in-depth test market study in St. Louis. The new recorder development is said to be the result of a major technological breakthrough. It was revealed that a new octave in the HF spectrum can now be recorded and played back on the unit which employs a third head to separate recording and biasing functions.

Other recorders, it was noted, combine the function of both recording and biasing in a single head, thus erasing these high frequencies as soon as they are recorded. The device has a patented head configuration leading the recording tape away from the bias before erasure of the high frequencies occurs.

It was said that up to eight hours of Hi Fi stereo music could be recorded on a single tape reel, representing savings in tape costs and storage space. The machine operates at speeds of 7 1/2 ips, 3 1/2 ips and 1 7/8 ips (with 15 ips accessory kit available). To reproduce these high frequencies, engineers devised a playback head having a gap width of only 40  $\mu$  in. It was said that the new head assembly also reduces head wear.

Since the bias is produced by the third Head, which never touches the tape, it will be unaffected through the life of the recorder. In order to protect the 40  $\mu$  in. gap from wear during playback, alloy NC88, a new material more resistant to wear than any previous head material, has been used. Other features of the new recorder include a new motor and drive system employing a heavy duty hysteresis synchronous motor and electrical speed-changer to reduce wow flutter at slow speeds. A special blower ventilation system has been designed to keep the unit cool. ■

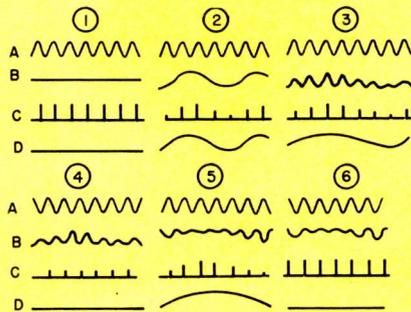
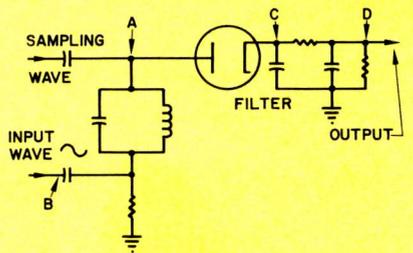
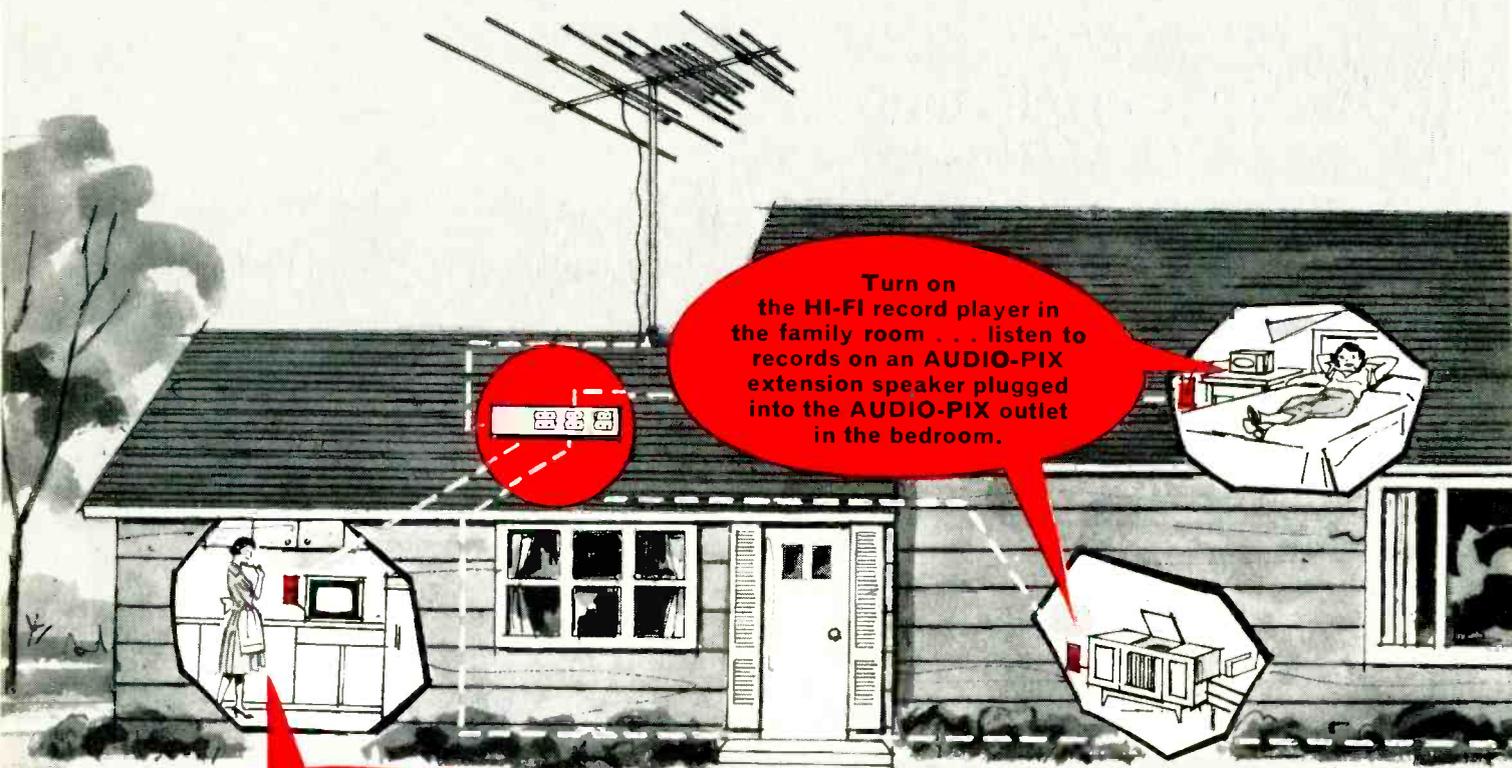


Fig. 5 — Sampling circuit and examples of waveforms.

# NEW IDEA

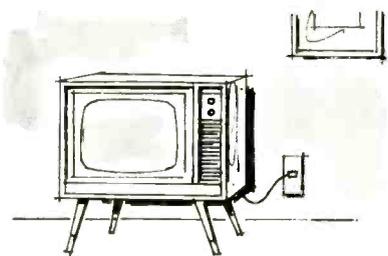
## Winegard Introduces An Amazing New Home TV and Music Outlet System



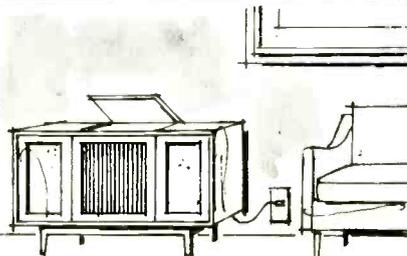
Turn on the HI-FI record player in the family room . . . listen to records on an AUDIO-PIX extension speaker plugged into the AUDIO-PIX outlet in the bedroom.

Watch TV in the kitchen (plug the TV set into an AUDIO-PIX outlet and receive TV antenna signals.)

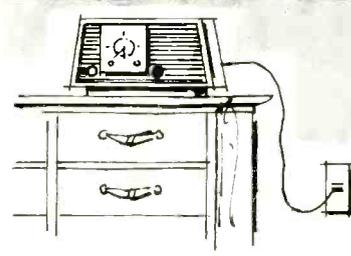
*All this electronic entertainment can go on simultaneously over a single wire without interference! That's the amazing new AUDIO-PIX system by Winegard.*



Plug TV set into any AUDIO-PIX outlet. Run one or more sets simultaneously from a single antenna.



Run a HI-FI (record player, FM or AM, or tape recorder) and feed the sound into the system to be picked up at any AUDIO-PIX outlet.)



Plug an FM receiver into the AUDIO-PIX. The AUDIO-PIX serves as an FM antenna signal source, and at the same time automatically feeds the FM sound back into the system to the extension speakers.

# AUDIO-PIX delivers TV, FM or HI-FI

Anywhere Inside or Outside the House Over a Single Wire



*Audio-Pix comes beautifully packaged in a Winegard selling display carton with built-in carrying handle.*



Watch TV on the patio (the portable TV set is plugged into an AUDIO-PIX outlet and is receiving TV signals from the same antenna.)

AUDIO-PIX is two systems wrapped into one simple, inexpensive installation. It is both a TV-FM system (distributes TV/FM antenna signals) and a HI-FI music system at a price any home owner can afford. No new home is truly modern without AUDIO-PIX.

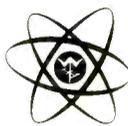
The AUDIO-PIX is a revolutionary new electronic entertainment convenience for the home which—

- (1) ... feeds TV (Ch. 2-83) and FM antenna signals to each AUDIO-PIX outlet.
- (2) ... feeds sound from a HI-FI (record player, FM and tape recorder) to the same AUDIO-PIX outlets.

The complete Winegard AUDIO-PIX system comes in a kit which contains a special AUDIO-PIX 6-outlet

coupler\*, 4 AUDIO-PIX outlets and plugs (any number of additional outlets may be added if desired), special AUDIO-PIX HI-FI extension speaker, a special AUDIO-PIX attachment for FM or HI-FI system, and 100 ft. of lead-in wire. Model APK-360, list price \$49.95.

Start selling AUDIO-PIX to your customers now. Write for spec sheets or ask your distributor.



\*Pat. Pend.

## Winegard

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## Difficult Service Jobs Described by Readers

### Ground Strap Noise

A customer called to report that the picture on her TV set was vibrating in step with the audio. While still on the phone I asked her to turn the volume down and tell me the results. The vibrations disappeared.

I made the service call the following day armed with my soldering gun and even a couple of forty mike filters. The set was on as I walked into the room and the picture was bouncing like mad. I turned the volume down and sure enough the picture became quiet. It was an obvious case of poor filtering in the audio output stage so I proceeded to remove the chassis from the cabinet and turned it over.

The moment I looked at the four section filter can the problem became apparent. The two negative side can lugs that had been soldered to the chassis for good ground connections had been snapped, probably due to some rough handling, and the filter can was sitting loosely on the chassis by virtue of the remaining two lugs. I soldered the can down tight, put the chassis back in the cabinet and the trouble was gone.

Much to my surprise I was back two days later on the same complaint. This time as I walked into the room, although the set was on, the volume was turned low and the picture was steady. As I walked across the floor toward the receiver, I noticed that even my footsteps were causing the picture to tremble a bit. I tapped the cabinet with my hand and again the picture trembled. Again I was faced with something loose or microphonic.

By tapping here and there I concluded that all that was needed was a good tuner cleaning. I seemed to be on the right track because all the channels worked perfectly after the cleaning except channel four. It was still very sen-

sitive to vibration. I took the chassis out again and went over the channel strips once more giving channel four the bonus treatment. I checked the oscillator and RF strips for poor soldering but all looked well. The chassis went back into the cabinet and now it was worse than ever. Every channel became extremely sensitive to the slightest vibration. It had me puzzled. While the chassis was on its side on the floor, I could poke it unmercifully without getting the slightest disturbance and yet in the cabinet the picture was completely erratic.

What did the cabinet have to do with it? The built-in antenna was properly dressed and out of the way. I flashed my light around the cabinet interior looking for anything and then it finally came to me. Over in a dusty little obscure corner there was a thin copper strap that was grounding the front mask to the chassis. Due to its age the strap had gotten soft and had lost its spring. Consequently, when the chassis was slipped into position, the strap just loosely made contact and rubbed at the slightest provocation. This rubbing was causing the trembling picture. I cured the trouble by folding over a piece of aluminum foil into several thicknesses and inserting it between the strap and the chassis.—*Frank A. Salerno, Long Island City, N. Y.*

### Bad Joint

This dog, at least, had a good pedigree. It was a Capehart CT-77 chassis with the typical heavy construction that was so common ten years ago. The complaint; blank raster on Channel 2, other channels normal—or nearly so. It didn't take long to diagnose the trouble as oscillation and the chassis was removed to the shop.

The set was prepared for repair and turned on. Channel 2 worked

perfectly and so did all others. So it was intermittent as well. While it was "cooking" everything was laid out in readiness so not a minute would be lost if and when it did cut out again. The first day went by with only a couple of brief flare-ups which subsided as soon as any tests were made.

A spare set of slugs were tried in the tuner with no effect. But now the set was cutting out regularly and diagnosis proceeded rapidly. All strips except Channel 2 were removed for better accessibility. In-circuit capacitor tests were made.

To confirm the tests, all bypasses were shunted with the set operating, using a 1000 pf capacitor with short leads, fastened in the end of a slotted polystyrene rod. No results. The oscillation persisted with the RF stage removed and the voltage at the look-point was about 6 v on the VTVM instead of the usual 3 v due to oscillator injection. It had to be an oscillating mixer.

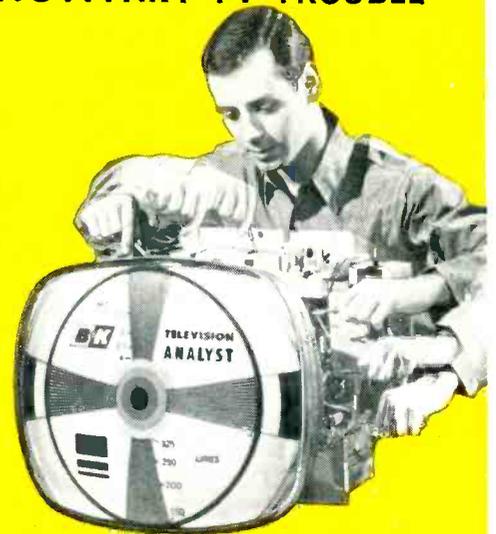
An LC neutralizing circuit is connected from a junction of mixer plate load coils to the mixer grid circuit. The end of the feedback coil had a poorly soldered joint between the coil winding and the lead. Ohmmeter tests showed an open and a flash of about 500 v from a capacitor checker showed a healthy sparkle at the trouble spot. Resoldering effected a permanent cure.—*Francis C. Wolven, Saugerties, N. Y.*

### TOUGH DOGS WANTED

\$10.00 paid for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photographs are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to "Tough Dog" Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth 2, Minnesota.

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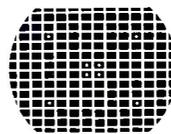
Simplified technique stops lost hours never recovered on "tough dogs", intermittents, and general TV troubleshooting. This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half... service more TV sets in less time... satisfy more customers... and make more money.

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Model 360 V O Matic Automatic VOM



Model 375 Dynamatic Automatic VTVM



Model 700 Dyna-Quick Tube Tester



Model 445 CRT Rejuvenator Tester

See Your B&K Distributor or Write for Catalog AP 21-T



### B & K MANUFACTURING CO.

Division of DYNASCAN CORPORATION

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Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.

# SHOP HINTS

TIPS FOR HOME AND BENCH SERVICE

## 6SN7 CRT Heater Dummy

When you pull a chassis and leave the picture tube at the customer's home with intent of using a test CRT in the shop, you may find that even the small picture test tube gets in the way for checking some components. It's much handier to use an old 6SN7 having a good heater and with its keyway and all pins except the heater pins clipped off, for use in tracking down audio and other ailments. Be sure to tape out of contact the second anode lead, and use your test picture tube for final testing after repair.—*H. Muller, Danboro, Pa.*

## Tape Holds Parts

A piece of masking tape one or two in. wide, fastened to a block of wood sticky side up, is very effective for holding small parts in their correct order until they are needed.—*Richard J. Reed, Albert Lea, Minn.*

## Transistor Alignment Aid

Because of the low impedance characteristics of transistors, it is difficult to obtain enough reading on an output meter when aligning the output stage of many transistor radios. The simple accompanying circuit shows how a plate-to-speaker transformer will boost the output readings when aligning the transis-

tor radio. Make sure that the secondary of the transformer is connected to the speaker terminals of the set to be aligned.—*A. von Zook, Corralitos, Calif.*

## 80 Substitute

If you are in a bind for an 80 tube (or a customer doesn't want to spend \$4.20 for a new one) take the two large pins off the old 80 tube with a hack-saw, remove solder and wire from inside and you will find that they slip neatly over pins 2 and 8 of a 5U4 (filaments). Clip pin one and remove bakelite center piece by breaking with pliers and you have an "80" tube that fits perfectly and takes about five minutes to prepare.—*K. A. Kirby, Vashon, Wash.*

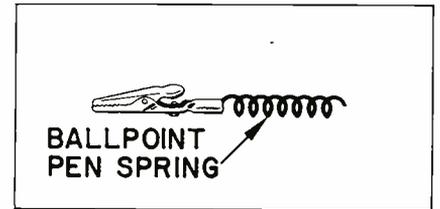
## Removing House Fly From TV Mask

To remove a house fly from between the safety glass and CRT, cover the screen with a drop cloth and turn the back of the TV to a bright light. The fly will go to the light and escape.—*Fred L. Herron, Hughes, Ark.*

## Test Clips

A miniature alligator clip soldered to one end of a plunger spring from a discarded ball-point

pen make a good test clip. The open end of the spring is pushed

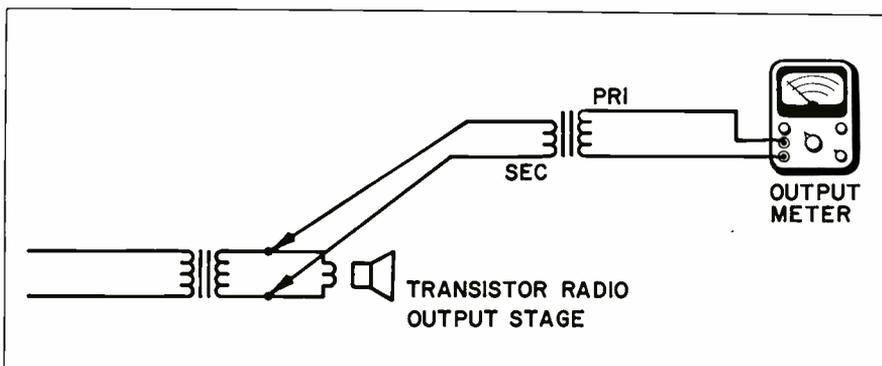


Spring from ball point pen makes alligator clips easy to connect to probe.

on to the phone-tip probe of the test instrument (VTVM, VOM, etc.). Alligator clips can be fastened to the instrument's handle when not in use.—*Harry Meermans, Wooster, Ohio.*

## Poor Ground

In the past few years we've had quite a few '59 Ford radios come into our shop with the same complaint: distorted tone and low volume. The car speakers all tested OK, and when the sets were hooked to our bench speaker, they played fine. But back in the car, the same distortion and low volume was present. In each instance we found the same defect—the speaker receptacle was ungrounded and a touch of the soldering gun at that point restored normal in-car operation in all cases.—*Henry Mullen, Cleveland, Ohio.*



Tube type speaker transformer reverse-connected to transistor radio output transformer aids voltage measurement.

## SHOP HINTS WANTED

\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, Ojibway Building, Duluth 2, Minn. The hints published in this column have not necessarily been tried by ELECTRONIC TECHNICIAN editors and are the ideas of the individual writers.

# LETTERS TO THE EDITOR

Continued from page 26

● *Someone who can develop all the necessary qualities will have ample reward. Those who lack them are the "underpaid" and problem technicians.—Ed.*

## Licensing

Any who are in favor of licensing please show me where there aren't enough laws already in force which, if properly enforced, would clear up any and all shady and illegal operators? It can't be done, because everyone knows that "the book", when it is thrown at you, is enough to do anything up to and including hanging. What is being asked for is an extra legal means of industry regulation. As imperfect as it is the law is the only protection we have. To remove lawful penalties means also to remove lawful protection.

The law operates from the principle that a person is innocent until proven guilty. Further, that to be proven guilty twelve of your fellow citizens must be convinced without a shadow of a doubt. Licensing operates from a different principle: that a person is guilty until he proves himself innocent. In other words, the License Boards make their own regulations. They make the laws, they enforce them and they apply the penalties. That is the definition of a kangaroo court. It's a lot easier to defend yourself from charges in a court before a jury than it is to prove that you are innocent after your license and your source of income has been taken away by being put out of business by decree of a license board.

Let's get off this licensing kick and get back to common sense. This is like putting ones head in a noose. I am a charter member of King County TSA (Seattle, Wash.). Also, I voted for the resolution to seek licensing. After careful observation of government regulation at all levels, I'm convinced bigger government is worse than moonlighters.

Let's demand justice that is ours under the laws we have now. We can then solve our own problems. Seattle, Wash. D. T. GUDGEL

# NEW SECO MODEL 107B TUBE TESTER SPEEDS REPAIRS, DETECTS SLEEPERS

● 8 sockets wired to 14 lever type pin selectors for testing tubes circuit by circuit!

● 40 prewired sockets accommodating 63 basic arrangements for testing thousands of popular tube types with no set-up data required!



**FOOLPROOF READINGS**—all test information reads on one meter and one scale! Eliminates errors that can be made reading off closely packed multiple scales. Wide sweep increases accuracy of readings.

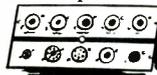
**3 COMPREHENSIVE TESTS** find tube faults that slip by other testers that cost much more. Pull out more "sleepers" on your first try—save time and call-backs.

● **GRID CIRCUIT TEST** makes up to 11 simultaneous checks for leaks, shorts and grid emission—indicates "hard to find faults" that conventional short tests pass by.

● **DYNAMIC MUTUAL CONDUCTANCE TEST** indicates relative transconductance—incorporates gas error test.

● **CATHODE EMISSION TEST** provides the best method for testing pulse amplifier, power output and damper type tubes.

Readings can be made for element identification and analysis of elements for shorts. A "life" test checks for allowable drop in mutual conductance or emission current under reduced heater supply conditions. The exclusive Grid Circuit Test above is a test originated and patented by Seco.



**PLUG-IN-SOCKET CHASSIS** is easily replaced or interchanged to accommodate the widest possible range of tubes. In addition to 8 sockets, panel has 3 pin straighteners for 4 most popular types. Inexpensive and easy to keep up to date as new tubes appear. Plug in chassis can be customized at low cost to fit your needs.

**WIDE RANGE** of tube types tested includes all modern TV, radio, industrial and foreign tubes using the following sockets—seven pin, nine pin, octal, loctal, novar, nuvistor, compactron, magnoval and ten pin.. Special circuit for low voltage hybrid types. Complete set-up data book is included—pages covering new tubes that appear are mailed periodically to all registered owners at no charge.

ALWAYS UP TO DATE



Model 107B \$169<sup>50</sup> NET



For complete information see your distributor or write:

**SECO ELECTRONICS, INC.**

1211 S. Clover Drive, Minneapolis 20, Minnesota  
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- - - for more details circle 35 on post card

# NEW PRODUCTS

FOR MORE INFORMATION CIRCLE PRODUCT NUMBERS ON POSTCARD FOLLOWING PAGE 82

## MICROPHONE 200

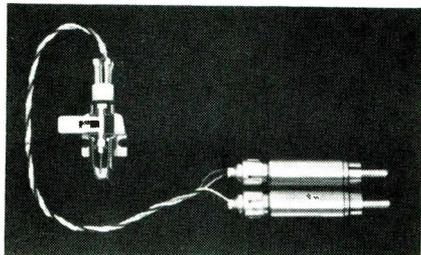
The T46 microphone, for tape recording and communications applications, reportedly has an impact-



and temperature-resistant case and smooth frequency from 50 to 8000 cps. Its polar pattern is said to be essentially omnidirectional, becoming directional above 3 kc. The average output is -54 db. The unit has a flip-out stand on the back of the case and is supplied with 6 ft of shielded cable and a molded-on phone plug. \$6.50 list. Euphonics Corp.

## STEREO CARTRIDGE 201

The "Mark IV," with matched velocity equalizers, is a ceramic stereo cartridge designed expressly for velocity or magnetic stereo input systems. Specifications include response  $\pm 1/2$  db from 20 to 6000 cps,  $\pm 2$  db to 17,000, with deliberate rolloff to 20,000 cps; separation 30 db between channels; compliance  $15 \times 10^{-6}$  cm/dyne in all directions; and tracking force 1.5 to 3 g for professional arms and



3 to 4 g for changers. The needle shank is gripped in a resilient butyl rubber mount that reportedly allows the needle to be flexed in any direction without damage. The cartridge is available in two needle combinations: diamond with sapphire, and a double-diamond model. Sonotone.

## COLOR TV 202

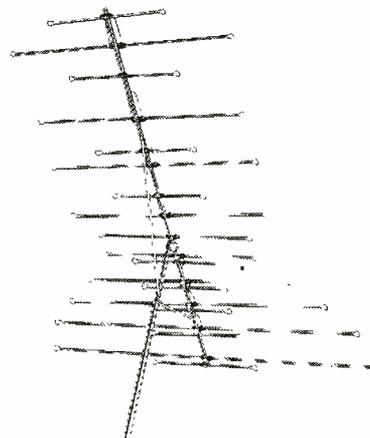
Color TV set Model 21LC3 features two-knob control of color intensity and hues and has grained finishes in mahogany and walnut. In addition, the set also features all-channel UHF convertibility which can be accomplished in the home by a technician through the



installation of a UHF conversion kit, without the alteration of the outward appearance of the set. \$529.95 list. Sylvania.

## OUTDOOR COLOR ANTENNAS 203

The Series 200, 300 and 400 all-channel VHF outdoor TV antennas utilize a cross-fed, stagger-tuned driven element assembly. These antennas are said to combine the desirable features of the all-channel yagi and the multiple cross-driven element array, while, at the same time, eliminating the drawbacks of the endfire array. They reportedly have high gain, flat

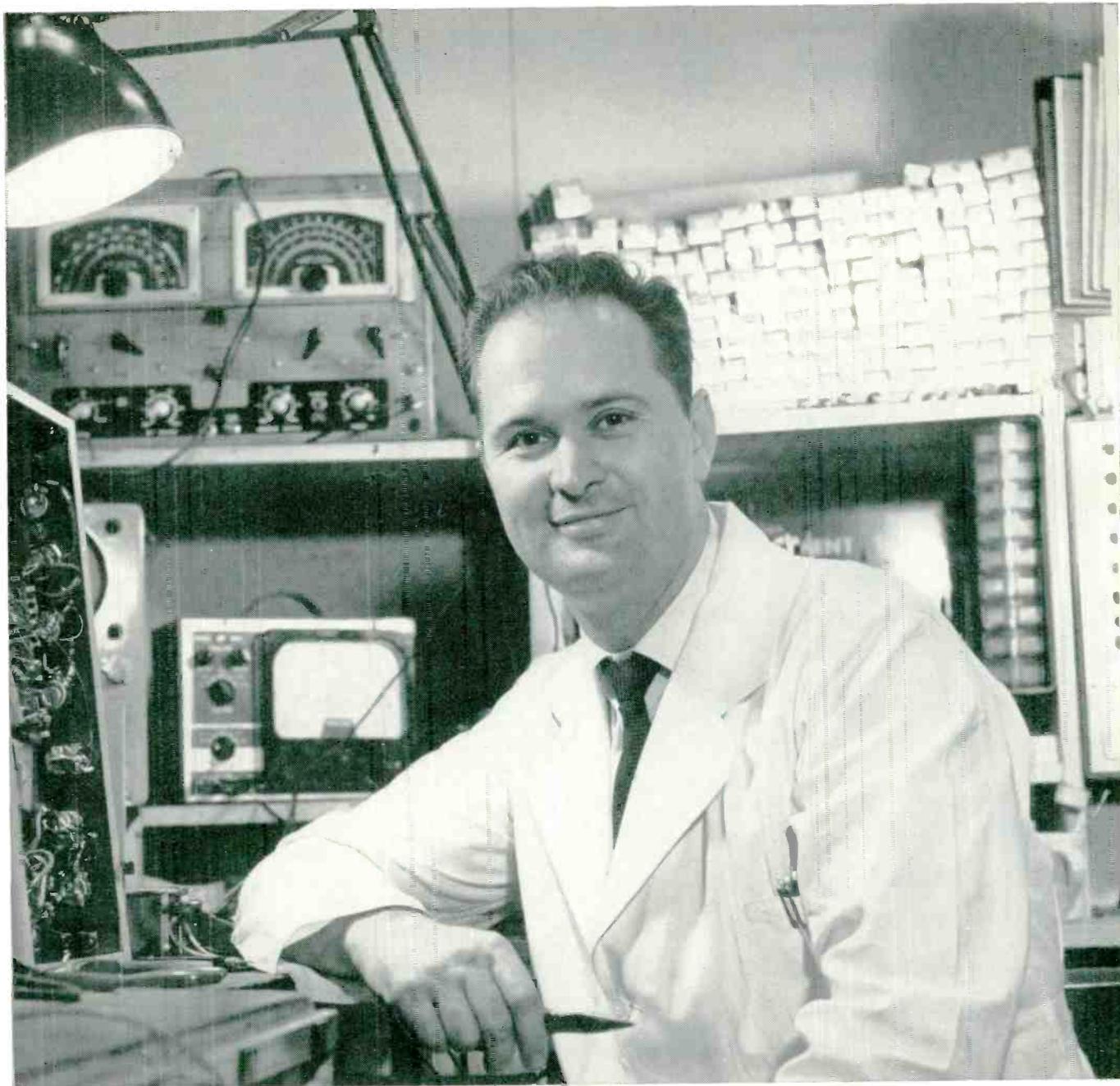


frequency response and high front-to-back ratio, so that they are suited for both color and black and white TV. RCA Parts & Accessories.

## PORTABLE STEREO 204

The Model RP2128 "Pillow Talk" stereo portable four-speed phonograph features an orange corduroy pillow housing two 4-in. speakers which replace the units that in conventional models are permanently mounted in the phonograph cover. A two-position "listen" switch with both "pillow" and "phono" settings allows the cushion also to be used as a conventional speaker system when stored in the lid of the phonograph, or as a self-standing unit remote from the phonograph. The speaker-pillow, concave and molded on polyurethane foam, is stored in the port-





“At least ten people a week tell us they found us through the Yellow Pages!” says Dale Sanford, proprietor, Dale Sanford Television Service, Berkeley, Calif. “And I find that the detailed listing of all our repair services in our Yellow Pages display ads is what pulls in most of our new customers. About 95 per cent of our service calls are by telephone. The effectiveness of our Yellow Pages program is great. It’s good to know that the directory is doing such a fine selling job in thousands of homes!”

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**LA 5-9833**

EXPERT REPAIRS ON COLOR OR BLACK & WHITE

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|--------------------|-------------|-------------------|
| ✓ ADMIRAL          | ✓ HOFFMAN   | ✓ RCA             |
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6 MONTHS TO PAY ON APPROVAL OF CREDIT - WE USE YOUR BUDGET CARE

ALL APPROVED CREDIT CARDS WELCOME  
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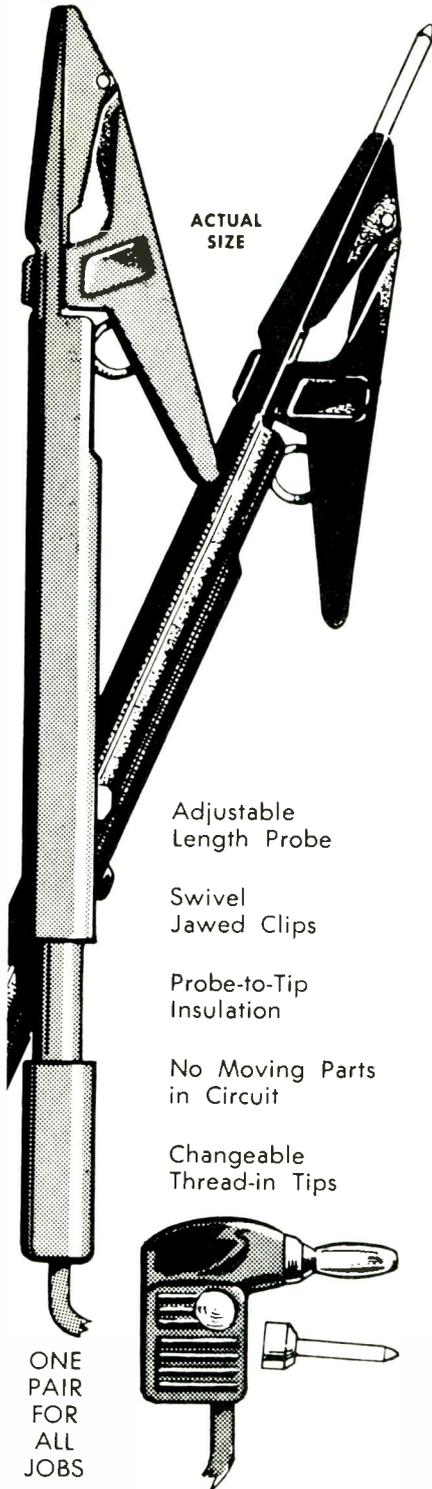
**DALE SANFORD TV**

One of the Largest Shops in the Bay Area  
AT HOME 1405 GROVE STREET LA 5-8833 BERKELEY

Display ad (shown reduced) runs under TELEVISION REPAIRING. Call your Yellow Pages man to plan your program. Find him in the Yellow Pages under: ADVERTISING - DIRECTORY & GUIDE.



# Newly Developed TEST LEADS Gator-Probe



ACTUAL  
SIZE

Adjustable  
Length Probe

Swivel  
Jawed Clips

Probe-to-Tip  
Insulation

No Moving Parts  
in Circuit

Changeable  
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ONE  
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Your Distributor Has All Information  
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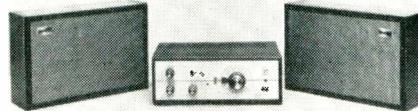
**GATOR-PROBE CORP.**  
HOLLISTER, CALIFORNIA  
A Subsidiary of HOLEX Incorporated

## NEW PRODUCTS

able's cover and is equipped with 15 ft of extension cord. Other features include separate right and left channel volume controls, a 45 rpm spindle, on/off switch and record and speed selector mounted on the changer, automatic shutoff of the entire phonograph after the last record is played, and a crystal stereo cartridge with two synthetic, reversible sapphire styli for stereo and monophonic records. \$79.95 list. General Electric.

### STEREO SYSTEM 205

The Model 2510 FM stereo tuner-amplifier-speaker system includes a high-fidelity FM stereo



tuner-amplifier with inputs for ceramic-crystal phono and tape recorder, plus a stereo pair of high-fidelity two-way speaker systems in oiled walnut cabinets. A transistorized stereo magnetic phono preamplifier-equalizer is available as an accessory. The tuner-amplifier features a rotary tuning dial with illuminated readout, a bar-type electron-ray tuning and stereo program indicator, a four-position input selector, a stereo program quick-check switch, and tone and loudness controls. The extruded aluminum panel is brushed silver on the upper half and brushed pale gold on the lower half. Eico.

### EXPANDER-COMPRESSOR 206

The Model KN-777 stereo expander-compressor automatically increases the dynamic range of program material compressed by record and tape manufacturers, with no change in frequency response. Low- and average-level



passages reportedly are not altered. This effect can be reversed with a switch, to compress high levels when background music is desired. The unit reportedly may be connected between the program source and the amplifier and works with any amplifier with 4-16 $\Omega$  output impedance. Needs no power supply. Allied Radio Corp.

### CAR RADIO 207

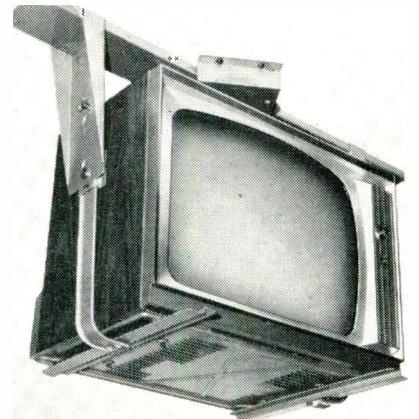
The Model 707 all-transistor "Karadio" features seven tuned circuits including RF stage, tone



control, superheterodyne circuit, automatic volume control, three-section tuner and hand wiring (no printed circuitry). The unit utilizes seven semiconductors, which include five transistors and two diodes. The radio has a built-in speaker and an external speaker jack. The unit measures 5 $\frac{1}{2}$  x 6 $\frac{1}{2}$  x 2 in. and weighs 4 lb, reportedly permitting under-dash mounting with standard trim plate kits. \$29.95. ATR Electronics, Inc.

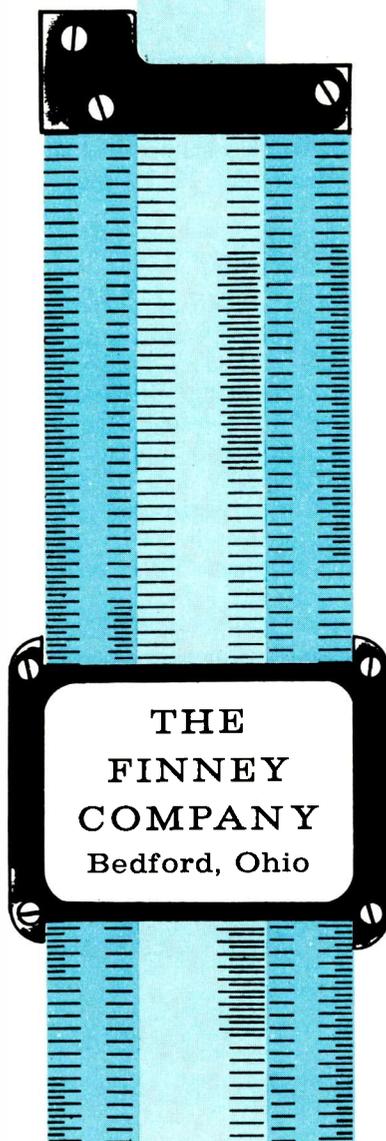
### TV MOUNT 208

A TV mount for suspending TV receivers from the wall or ceiling is designed to accept any make or



model TV receiver in screen size from 12 in. up to 27 in. It has a baked-on beige enamel finish to blend with the colors of most TV receivers. The mount attaches to the ceiling or wall (with wall-attaching bracket), bolts into the

**As you read this ad . . .**  
**A Finco Engineer is designing**  
**A "special area" TV Antenna**  
**Finco has produced 3,152 already**  
**Each one is the best in its area**  
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**NEW**  
**CONTACT CLEANER**



**FORTIFIED with SILICONE  
NOT HARMFUL TO PLASTIC!**

JIF away dust, dirt and corrosion on contacts, switches, controls with this NEW siliconized cleaner. JIF cleans and lubricates, providing contacts and controls with the longest possible protection. Fast and efficient, JIF saves time and money. CLEAN — LUBRICATE — PROTECT. Safe, quick-easy to use—JIF won't harm plastics.

Part No. Net  
8670-6 New 6 oz. spray can 1.79  
8670 New 3 oz. Pocket size spray can .99



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JUST OFF THE PRESS  
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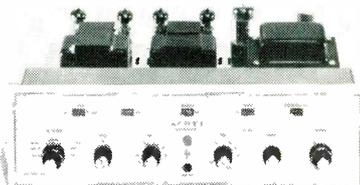
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68

**NEW PRODUCTS**

sides of the TV receiver, or supports the receiver from the bottom. A 7-in. ball-bearing swivel permits the receiver to be rotated 60 deg, and rocker pins permit tilting from 0 to 15 deg downward. H. Wilson Corp.

**STEREO AMPLIFIER 209**

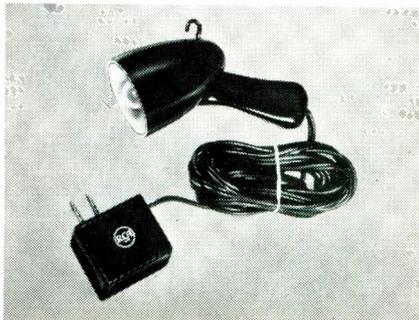
Model 200B 30-w stereo amplifier features new decorator styling, non-magnetic electrolytic alumi-



num chassis for reduction of hum and more efficient dissipation of heat, separate bass and treble controls for each channel and stereo headphone outlet. H. H. Scott, Inc.

**EXTENSION LIGHT 210**

The "Loca-Lite" is a transformer-powered extension light that reportedly eliminates many of the awkward servicing problems encountered when using a flashlight. It is equipped with a plastic swivel hook strategically located to hold the lamp in a horizontal position. The transformer is enclosed in a high-impact plastic case and plugs into a standard 110-v outlet. The transformer is equipped with a protective device which guards against short-circuit hazards. The transformer construction isolates the secondary winding from the primary winding, which further eliminates shock hazard. A 10-ft length of plastic cable enables free and ample



movement. The lamp housing has a silver-coated reflector and a deep seated bulb with a rated life of 1000 hr. RCA Parts and Accessories.

**FM STEREO TUNER 211**

The Model 350C FM stereo tuner incorporates time-switching multiplex circuitry, a monitor which



signals when stereo is on the air, and an illuminated tuning meter. Additional features include a silver-plated front end, 2-Mc wide-band detector, switchable AGC and cascade RF stage. Dimensions, in accessory case, are 15½ in. wide by 5¼ in. high by 13¼ in. deep. H. H. Scott, Inc.

**OHMMETER CALIBRATOR 212**

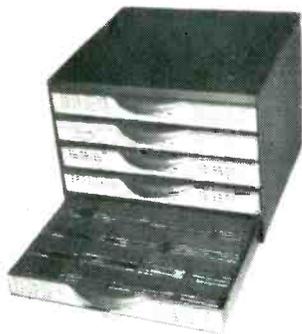
A resistance calibrator covers 1Ω through 100 megΩ and has a shorted and an open position for



zeroing meters. The unit was designed for speedy checkout and calibration of ohmmeters or ohmmeter sections of multimeters in schools and industrial calibration labs. Accuracies available are: 1 percent, 0.1 percent and 0.05 percent. The 1-percent calibrators use carbon resistors, while the 0.1-percent and 0.05-percent units are made with wirewound resistors. The unit measures 3¾ x 6¼ x 3 in. Panco Products.

**SHAFT CABINET 213**

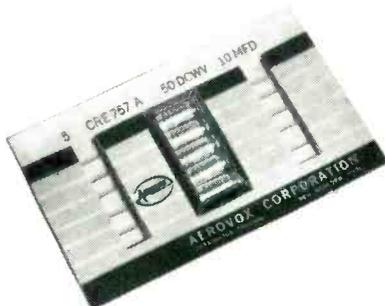
A shaft cabinet is now available supplied with four each of 136



individually marked shaft types which reportedly will meet every "Uni-Tite" replacement control requirement. Designed to provide an efficient and economical method of stocking "Uni-Tite" shafts, the new cabinet features rugged, all-metal construction and high-visibility, labeled drawers. Clarostat Mfg. Co.

#### CAPACITORS 214

Type CRE 85°C tubular aluminum cased electrolytic capacitors are available in a 3 x 5 in. "Cradle-Pak" package. These ultraminiature capacitors are used in bypass,



filter and coupling applications in low-voltage, compact miniaturized equipment. Available in ratings from 3 wvdc to 150 wvdc, all units the rated for operation from -30°C to +85°C. Aerovox.

#### TELEPHONE AMPLIFIER 215

A telephone amplifier reportedly enables the user to speak and listen



## New Sonotone Sono-Flex® Stylus



**try this with any other cartridge**  
(at your own risk)

No way to treat a cartridge, for sure—That is, any cartridge except the Sonotone models featuring the new Sono-Flex® needle. No more bent or broken needle shanks caused by flicking off some lint, dropping the arm, or scraping it across the record.

The newly developed Sonotone Sono-Flex® needle to the rescue! Gripped in a resilient butyl rubber mount, you can flex this needle shank in a 360-degree orbit without breaking. Pluck it—flick it—bend it—bump it—it will continue to perform as good as new.

Moreover, the Sono-Flex brings advantages in performance never before offered by any replacement cartridge: Higher compliance, wider and flatter frequency response, lower IM distortion, and longer needle and record life.

#### Sonotone Sono-Flex® increases your profits two ways

Sonotone cartridges are better than ever, easier to sell, because they're better performers. Further, you eliminate callbacks because of broken needle shanks. Sono-Flex needles are standard right now in these Sonotone cartridges models: 9TAF, 16TAF, 916TAF and the Velocitone Mark III.

Sono-Flex opens up lucrative needle replacement business for upgrading these Sonotone cartridges models: 9T, 9TA, 9TV, 9TAV, 16T, 16TA, 16TAF and 916TA, original equipment in over a million phonographs. Replacement is fast, simple—requires no tools—assembly snaps into position easily, and gives immediate proof of better performance plus abuse-proof, longer needle life.

See your distributor today and ask for Sonotone cartridges with the Sono-Flex® needle.

**SONOTONE CORPORATION** Electronic Applications Division Elmsford, New York  
In Canada: Atlas Radio Corp., Ltd., Toronto • cartridges • speakers • batteries  
• microphones • electron tubes • tape heads • hearing aids • headphones

- - - for more details circle 37 on post card



Dimensions:  
3/4" by 3/4" by 2" high

If both ends are accessible it can be tuned from both ends, but if access to one end is restricted or inconvenient, both cores can be tuned from the same end.

### TOP-TUNED MINIATURE IF TRANS

| Cat. No. | Item                                |
|----------|-------------------------------------|
| 14-H1    | 262 kc Input I.F.                   |
| 14-H2    | 262 kc Output I.F.                  |
| 14-H6    | 262 kc Output I.F.*                 |
| 14-C1    | 455 kc Input I.F.                   |
| 14-C2    | 455 kc Output I.F.                  |
| 14-C6    | 455 kc Output I.F.*                 |
| 14-C7    | 455 kc Input I.F. Battery Radios    |
| 14-C8    | 455 kc Output I.F. Battery Radios   |
| 14-C9    | 455 kc Input I.F. AC-DC Radios      |
| 14-C10   | 455 kc Output I.F. AC-DC Radios     |
| 6270     | 4.5 Mc Input or Interstage          |
| 6271     | 4.5 Mc Ratio Detector               |
| 1457     | 10.7 MC Input or Interstage         |
| 1458     | 10.7 MC Discriminator               |
| 1459     | 10.7 MC Ratio Detector              |
| 1464-WB  | 10.7 MC Discriminator 900 kc P to P |
| 1465-WB  | 10.7 MC Ratio Detector 800kc P to P |
| 6230     | TV Converter I.F.                   |
| 6231     | TV 44 MC First I.F. Trap            |
| 6232     | TV 42.5 MC Second I.F. 41.25 MC     |
| 6233     | TV 45.5 MC Third I.F. 47.25 MC      |
| 6234     | TV 44 MC Fourth I.F.                |

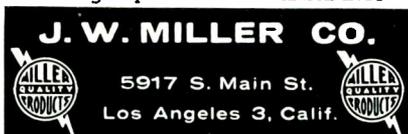
### PRINTED CIRCUIT IF TRANS

| Cat. No. | Item                              |
|----------|-----------------------------------|
| 16-PH1   | 262 kc Input I.F.                 |
| 16-PH2   | 262 kc Output I.F.                |
| 16-PH6   | 262 kc Output I.F.*               |
| 16-PC1   | 455 kc Input I.F.                 |
| 16-PC2   | 455 kc Output I.F.                |
| 16-PC6   | 455 kc Output I.F.*               |
| 16-PC7   | 455 kc Input I.F. Battery Radios  |
| 16-PC8   | 455 kc Output I.F. Battery Radios |
| 16-PC9   | 455 kc Input I.F. AC-DC Radios    |
| 16-PC10  | 455 kc Output I.F. AC-DC Radios   |
| 6270-PC  | 4.5 Mc Input or Interstage        |
| 6271-PC  | 4.5 Mc Ratio Detector             |
| 6230-PC  | TV 44 MC Converter I.F.           |
| 6231-PC  | TV 44 MC First I.F. Trap          |
| 6232-PC  | TV 42.5 MC Second I.F. 41.25 MC   |
| 6233-PC  | TV 45.5 MC Third I.F. 47.25 MC    |
| 6234-PC  | TV 44 MC Fourth I.F.              |

\*with diode filter capacitors

Miller general catalog

Available through your local distributor



- - - for more details circle 26 on post card

## NEW PRODUCTS

from anywhere in the room with both hands free. Compact (slightly larger than a pack of cigarettes), transistorized and portable, the unit is suitable for both home and office use. \$12.95. Gilwin Corp.

### REJUVENATOR-TESTER 216

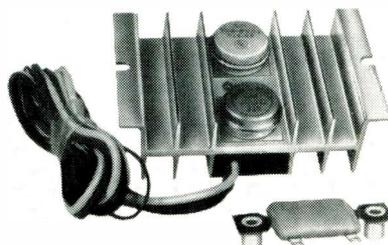
The CRT 445 reportedly tests and rejuvenates all picture tubes at correct filament voltages from 1 to



12 v, tests and rejuvenates all Hi G-2 and Lo G-2 picture tubes, including tubes that require a G-2 voltage as low as 30 v; supplies all three necessary voltages, Hi G-2, Lo-1 G-2 and Lo-2 G-2; tests and rejuvenates 110-deg tubes and new 19-in. and 23-in. tubes; tests and rejuvenates color picture tubes, including the new 90-deg 23-in. 23BG22; and checks and corrects each gun of color tubes separately. The unit operates on 117 v 50-60 cps ac, measures 14 x 8 x 4 3/4 in. and weighs 10 lb. \$74.95 net. B & K Manufacturing Co.

### TRANSISTORIZED IGNITION 217

A transistorized ignition system features a twin-transistor and twin-diode circuit reportedly compatible with all 6- and 12-v negative-ground engines in cars, boats,



trucks, etc. The system comes complete with heat sink and molded ceramic ballast resistor. The original induction coil reportedly need not be replaced. The unit carried a 1-year warranty. \$34.95. Gavin Instruments, Inc.

### HOME OUTLET SYSTEM 218

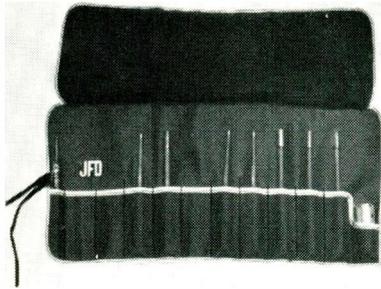
The "Audio-Pix" home entertainment outlet system operates as a multiple TV-FM antenna system. A



rooftop antenna is connected to plug-in outlets through a special coupler. A TV or FM set can be plugged into any of these outlets and receives the signal from the antenna. The system also operates as a piped-in Hi Fi system, where a phonograph, tape recorder or FM tuner in one room can be heard on extension speakers plugged into outlets in other rooms. The system uses only one wire to carry TV, FM and Hi Fi music to the outlets. All reportedly can operate simultaneously without interference. The kit includes a coupler, an attachment for the FM or Hi Fi, an extension speaker, four plug-in outlets and 100 ft of twin lead. The standard kit is packaged in a display-type carry-home carton and lists at \$49.95 complete. A transistorized version, for weak signal areas, lists at \$64.95. Additional speakers and outlets can be purchased separately. Winegard.

### TUNING TOOLS 219

A kit of eight tuning tools is packaged in a compact cloth folder with three extra "pockets" for other tools of the user's choice. Tools 7104-1, 2, 3 and 7 have 3/4-in. long by 1/4-in. dia metal ferrules. Tool 7104-1 has a 0.115-in. wide aperture in the ferrule with an internal 0.019-in thick screwdriver blade. Tool 7104-2 has a 0.072-in. wide ferrule hole with the same thickness blade. Tool 7104-3 offers an 0.088-in. dia ferrule opening with



a recessed 0.037-in. wide female opening for flatted screw stud adjustment. Tools 7104-4, 5 and 8 have male 0.050-in. hex sockets and screwdriver blades 0.015 in. thick by 0.100 in. wide and 0.015 in. thick by 0.087 in. wide, respectively. Tool-7104-7 has ferrule tip construction with a 0.090-in dia aperture and a 0.038-in wide female slot. All ferrule tools are of different colors for easy identification. JFD Electronics.

**WIRELESS INTERCOM 220**

An intercom said to be the "first noiseless intercom" reportedly eliminates buzz and noise normally caused by various types of elec-

trical appliances and fluorescent light fixtures. When turned on, the units are held silent until spoken into by a squelch circuit. Each unit, which can be controlled independently, has an amplifier. The units plug into any ac electrical outlet and need no additional wiring. The units may be left on,



for unattended monitor operation. \$109 per pair; \$54.50 each unit, list. Vocaline.

**FLYBACKS 221**

Four new flybacks include two exact replacements for Magnavox television sets, an exact replacement for Silvertone and an exact replacement for Philco. Two units are used in two series of Magnavox chassis.

THE BIG NAME IN TV TUNER OVERHAULING

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VHF AND UV COMBINATION\* TUNERS

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In Canada: 136 Main Street, Toronto 13, Ontario  
\*Major Parts are additional in Canada

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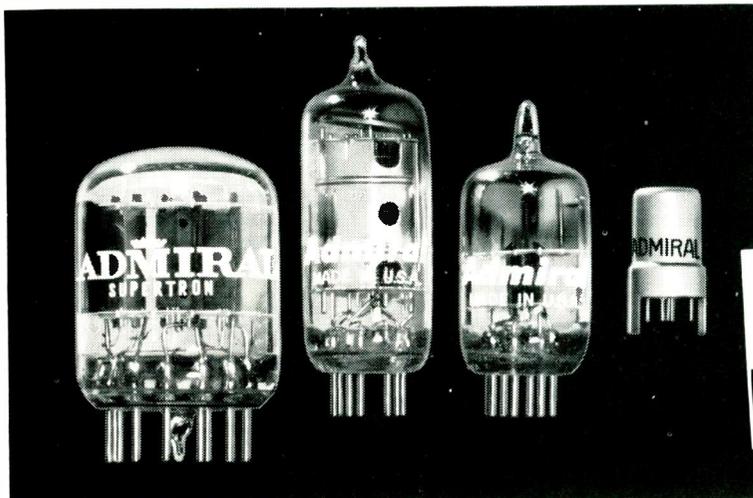
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# PLECTRON CORPORATION



DUOTONE CHIEF

The PLECTRON "Alerting System"—used with existing transmitting equipment—provides instant response to emergency situations. Alarm with voice instruction enables personnel to go directly to the alert area. The DUOTONE CHIEF is a combination tone activated and continuously monitoring squelch receiver. Crystal controlled, the DUOTONE CHIEF works with the VHF (FM—25 to 54 mc or 148 to 174 mc) two-way radio base station. Excellent sensitivity of 2 microvolts and a specially designed built-in antenna permits reception from a transmitter up to 10 miles away. All circuit connections of the DUOTONE CHIEF are hand soldered—with ERSIN Multicore 5-Core Solder—for continued trouble-free performance to meet emergency conditions.



ERSIN Multicore 5-Core Solder costs PLECTRON a trifle more than ordinary solders—but this is more than compensated for by the vital savings realized through more joints-per-pound, and virtually no costly rejects due to cold or H/R joints. For production efficiency, guaranteed by 5-cores of exclusive ERSIN flux and fast melting thin-wall construction, quality manufacturers have come to rely on ERSIN Multicore, the world's finest cored solder.

Multicore conforms to all applicable Federal Specifications



For information, write Department MX 553B

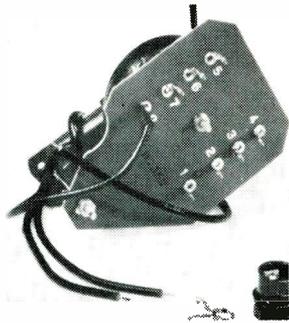
ERSIN

# Multicore

5-CORE SOLDER

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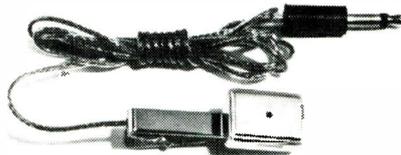
## NEW PRODUCTS



The third flyback is used in 61 models and 59 chassis of Silvertone sets. The fourth, a Philco replacement, is used in 8 chassis and 91 models. Stancor.

### TIE-CLASP MIKE 222

The MM-1 "Tie-Mike" is a miniature magnetic-type microphone reportedly usable with any standard



tape recorder. The mike measures 3/4 in. long x 1/2 in. wide x 1/4 in. high and is soldered to a 1 1/2-in. long spring-clip tie-tack for concealed recording. Suggested list \$6.95. Graig-Panorama.

### COAXIAL SPEAKER 223

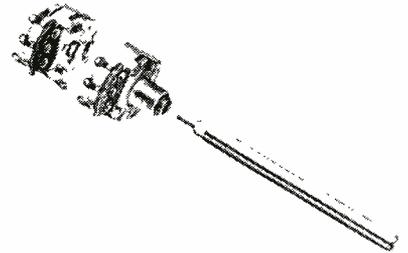
A 12-in. coaxial loudspeaker has a 3 1/2-in. tweeter nested near the



apex of the low-frequency cone. The design of the Model K-120 speaker places both surfaces in the same plane, reportedly minimizing phase and distortion problems, delivering exceptionally smooth response through the crossover point. The speaker has a rated frequency response of 30 cps to beyond audibility and a power-handling ability of 15 w of music. Rated output impedance is 8Ω. Minneapolis Speaker Co.

### DUAL CONTROLS 224

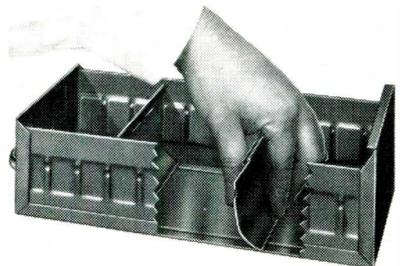
The Series DA field-assembled, single-shaft dual controls offer a practical means for making up a wide variety of combinations of controls and shafts, including ON/



OFF switches. The panel units, rear units, shafts and switches snap together permanently and are automatically locked. The Series DA dual controls reportedly are available in all standard replacement values and in all shaft styles. Clarostat.

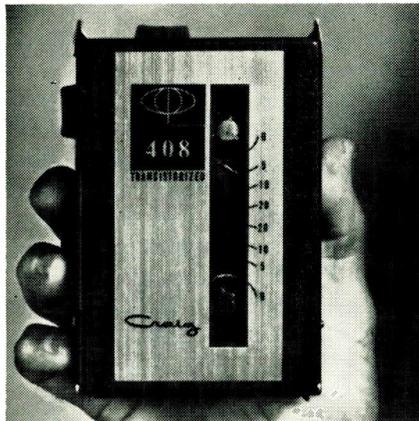
### SMALL PARTS STORAGE 225

A curved bottom "Scoop Divider" makes it easy to remove small parts from drawers. Even



the tiniest, most difficult-to-grasp parts are said to easily and quickly slide out of the these drawer compartments, where there reportedly are no corners or crevices. The dividers lock into the sides of the drawer, yet are adjustable. The sloping top of the divider has a label holder. Equipto.

The "Electronic Notebook" pocket-size transistorized tape-recorder is designed for up to 30



minutes recording time and needs less than three minutes rewind time. Measuring 5½ x 3 9/16 x 2 1/16 in., the unit offers double-track recording, variable tape speeds and a sensitive microphone. Its power comes from four 1.5-v "Penlight" batteries. The recorder is shipped complete with remote control microphone, earphone, batteries, one empty and four full reels of tape, a genuine cowhide carrying case and a telephone pickup. It weighs 2½ lb. \$54.95 list. Craig-Panorama.



"GOOD GRIEF! A capacitor! I thought I was pulling a tube!"

## MOVING?

Be sure to let us know your new address. Please enclose a complete address label from one of your recent issues.

## NEW BOOKS

RCA RECEIVING TUBE MANUAL RC-22. Published by Electronic Components and Devices, Radio Corp. of America, Harrison, N. J. 544 pages, soft cover. \$1.25.

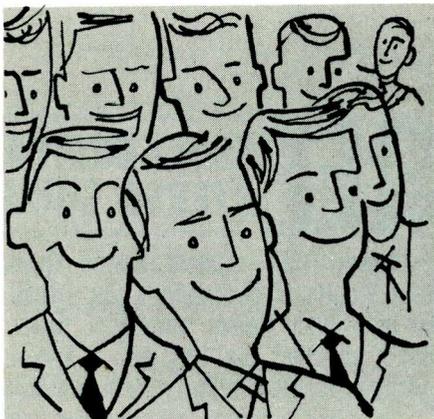
The newest RCA Receiving Tube Manual, RC-22, is the largest edition yet of this complete and authoritative reference book. The manual contains data on more than

1000 receiving-tube types for home-entertainment applications, including nuvistor, novar and other new tube types. A revised and expanded Application Guide classifies types by structure for 38 specific functional classifications. Data is also provided for RCA black-and-white and color CRTs. The easy-to-read text material on theory, installation and application of electron tubes and the interpretation of tube data has been revised, expanded and brought up to date. New material includes information

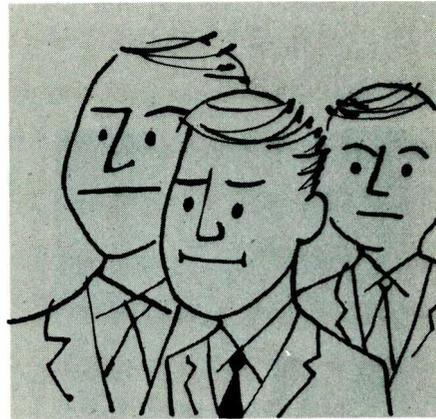
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**QUAM**  
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other brands of  
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\* According to the findings of Brand Name Surveys, Chicago, Illinois in March and April 1963, more servicemen prefer Quam speakers than all other replacement brands combined. Major reasons stated for the preference: Quality! Availability! Performance!

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226H E. Marquette Road, Chicago 37, Illinois

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# NEW BOOKS

on tube and circuit noise, phono-graph and tape preamplifiers, and application and installation of high-fidelity amplifiers. The popular Circuits Section now contains 33 circuits illustrating varied tube applications, including several AM broadcast receivers, a 144-Mc receiver, a citizens-band transceiver, an AM/FM receiver, AM and FM tuners, an FM stereo multiplex adapter, several high-fidelity amplifiers; two stereo amplifiers, a two-channel audio mixer, microphone and phonograph amplifiers, preamplifiers and tone-control circuits, a code practice oscillator, an intercom set, an all-purpose power supply, a cathode-ray oscilloscope, an audio signal generator, and an electronic volt/ohm meter.

**BASIC RADIO REPAIR**, Vol 1 and 2. By Marvin Tepper. Published by John F. Rider Publisher, Inc., New York. Soft cover, 106 pages each. \$2.65 per volume.

According to the author, these books are intended for the technician who already understands how the different radio circuits operate but needs the benefit of practical servicing experience he hasn't had time to accumulate. Except for 40 pages of test-equipment discussion that a technician of this level probably already knows, the author follows his avowed course very well.

Yet we were left with the impression that these books were edited in inexcusable haste or on an inadequate budget (or perhaps both). Just a few days efforts of a competent technical editor would have made a world of difference. Such sentences as, "An output frequency differing from input frequency does not often require neutralization" and "An open circuit at the ground return would place the potentiometer and the resistor closest to the B-plus line as a series voltage-dropping circuit, with virtually no control over the screen voltage" are as journalistically careless as overlooking the map symbol for swampland that is used as border on page 1-35.

While these books may be lacking in editorial craftsmanship, the

ultimate measure of any book is its value to the reader, and in this regard the reader gets more than his money's worth.

The illustrations are terrific! In fact, you could almost use this book without the text, just by looking at the illustrations. That they are well integrated with the text is an added bonus, difficult to achieve. The reader seldom has to flip back-and-forth between text and illustration.

The most outstanding portion of these books is the section on servicing transistor radios, which contains a great deal of valuable, practical information per page. In fact the transistor radio section is alone worth the price of the whole book.

## Retirement Plans for Self-Employed Businessmen

■ The Self-Employed Individuals Tax Retirement Act of 1962 is designed to help you set up a retirement plan. Known also as Public Law 87-792, and sometimes as H.R. 10, the law's purpose is to encourage you to prepare yourself and your employees for the exigencies of disability, death and old age. The encouragement takes the form of income tax advantages.

The law amended Section 401 of the Internal Revenue Code of 1954 (relating to qualified pension, profit-sharing and stock bonus plans). This amendment gives you, as a self-employed businessman, additional income tax deductions when you set up a retirement plan for yourself and for your employees. The law allows you to deduct from your taxable income 50 percent of the funds that you put into your retirement plan with a maximum annual deduction of \$1,250.

### Who is Eligible?

Estimates are that about 9 million self-employed persons are eligible under the new law. Owner-managers of small stores, shops, and manufacturing companies (sole proprietorships of any kind) are among these individuals.

You are also eligible, if you are self-employed as a pharmacist,



## FREE SCOTT CUSTOM STEREO GUIDE

New 24-page 1964 Custom Stereo Guide packed with photos, descriptions, and specifications of all Scott tuners, amplifiers, tuner/amplifiers, speakers, and kits. Also... articles and pictures on decorating your home with stereo, selecting a tuner and amplifier, and how FM multiplex stereo works. Send for your Scott Custom Stereo Guide today.

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architect, farmer, accountant, dentist, lawyer, real estate agent, broker or doctor.

Self-employed individuals who derive earned income and "owner-employees" are eligible to participate. "Owner-employees" as defined by the Act includes "an employee who — (A) owns the entire interest in an unincorporated trade or business. . . ." (In other words, you are eligible to start a retirement plan if you are the sole owner of a small unincorporated business).

Part B of the Act's definition of "owner-employee" concerns the partnership form of business. It says that in the case of partnership an "owner-employee" is "a partner who owns more than 10 percent of either the capital interest or the profit interest in such partnership."

Earned income is the key to whether a person is eligible to set up a plan for himself. And he has to be working—has to be self-employed. This means that if you have only investment income, you are not eligible for the tax benefits of the new law.

#### Requirements of a Plan

As you think about setting up your own retirement plan, you will need to examine several requirements and provisions which the new law contains. Among these are: coverage, vesting, tax deductions, distribution of the benefits and contributing plans. You do *not* have to get your plan approved in advance by the Internal Revenue Service.

If you, as a self-employed person, (whether a sole proprietor or a partner) are to be covered by a retirement plan, *your employees must be covered also*. The law says that you must include all of your employees provided they have at least 3 years of service with your firm. However, you do not have to include part-time employees or seasonal workers.

Your employees must also be vested in the contributions or benefits under the plan. Vesting means that each employee has a right to the funds that are put into the plan for him or the benefits occurring



# Hy-Gain

## prices CB dealers **INTO** the CB Antenna market with an exclusive new **DEALER PROFIT DISCOUNT PROGRAM**

Now, with Hy-Gain's new and exclusive Dealer Profit Discount Program, you, a Citizens Band Radio Dealer, can buy world famous Hy-Gain antennas and accessories through a Hy-Gain distributor near you and profitably sell them to your customers at nationally advertised CB Net prices. Hy-Gain, the antenna manufacturer with a record of engineering "firsts", has priced you INTO the rapidly expanding CB antenna market.

*How will Hy-Gain's exclusive Dealer Profit Discount Program help you?*

1. It will put you in a competitive position to sell Hy-Gain's COMPLETE line of antennas and accessories to both the new and replacement antenna market.
2. It will give you a source of supply for your Hy-Gain antennas and accessories near at hand and eliminate costly freight charges.
3. It will assure you of more inventory stock turns because there are no minimum purchase requirements.
4. It will provide you with handsome profit margins on every Hy-Gain antenna or accessory you sell to your customers at nationally advertised CB Net prices.
5. It will put you INTO the CB antenna market with the antenna line with a record of engineering "Firsts"...the "First" gain collinear base station...the "First" beam antennas that double the radiating efficiency of a transceiver...the "First" top loaded mobile antennas...the "First" workable Co-phaser...the "First" AM-CB mobile coupler... and the "First" life-time lightning arrester.

Put them all together, and what do you have? You have the greatest opportunity in the world to skyrocket your sales and your profits with the most complete, most advanced and most popular Citizens Band antenna line available. Get on the Hy-Gain bandwagon today...write, wire or phone for the name of the Hy-Gain Distributor nearest you who offers Hy-Gain's exclusive Dealer Profit Discount Program.

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## books et al

### HIGH FIDELITY SYSTEMS — A User's Guide by Roy F. Allison

AR Library Vol. 1 70 pp., illus., paper \$1.00

A layman's practical guide to high fidelity installation. We think that it will become a classic work for novices (and perhaps be consulted secretly by professionals). From the **Bergen Evening Record**: "completely basic ... If this doesn't give you a roadmap into the field of hi-fi, nothing will." From the **American Record Guide**: "really expert guidance ... I would strongly urge this book as prerequisite reading for anyone contemplating hi-fi purchases." From **High Fidelity**: "welcome addition to the small but growing body of serious literature on home music systems." From **Electronics Illustrated**: "To my mind, this is the best basic book now available on high fidelity."



### REPRODUCTION OF SOUND

by Edgar Villchur

AR Library Vol. 2 93 pp., illus., paper \$2.00

Vol. 2 explains how components work rather than how to use them, but it presupposes no technical or mathematical background. Martin Mayer writes in **Esquire**: "far and away the best introduction to the subject ever written — literate, intelligent and, of course, immensely knowledgeable." From **HiFi/Stereo Review**: "just the book to satisfy that intellectual itch for deeper understanding."



### AR Needle Force Gauge \$1.00

The same gauge that is supplied with AR turntables. It is an equal arm balance with weights to 1/4 gram, accurate enough to be used at the AR plant ( $\pm 5\%$ ), and complete with instructions and case.



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therefrom. That is, he does not lose his part of the retirement plan, if he leaves your firm.

If you are self-employed either as the sole proprietor of a business or have more than a 10 percent interest in a partnership, you may contribute up to 10 percent of your earnings from self-employment or \$2500 a year (whichever is less) to a retirement fund. You are then allowed to deduct one-half of your contributions. For example, if your contribution is \$2500, you can deduct \$1250 from your income taxes.

This applies regardless of the number of employees participating in a plan and regardless of the number of plans the owner-employee has. The maximum that he may deduct in any 1 year for contributions on his own behalf is \$1250.

The measuring rod for deductions and contributions is "earned income" as described in Section 911 (b) of the 1954 Internal Revenue Code. This means all income from personal services where professionals such as doctors, lawyers, accountants and so on are concerned.

However, for the individual business owner, when both capital and personal services are material income producing factors of "earned income" means not more than 30 percent of the total net profits from the business. If he renders full-time personal service to the business, not less than the first \$2500 of his share of the net profits is considered as earned income.

For further information, write to John E. Horne, Administrator, Small Business Administration, Washington 25, D. C. Ask for "Small Marketers Aids" #93 ■



"I enjoyed your description of your set's symptoms. It was beautiful—simply beautiful."

## FREE LITERATURE

### REPLACEMENT GUIDE 300

A 154-page general catalog and replacement guide describes 23,000 replacements for 48 types of coils, 31 types of audio transformers, 21 types of power transformers, 14 types of TV sweep components, 6 transistor transformers, 5 RF chokes and 5 LF chokes. Schematic diagrams, mounting dimensions and mounting types are given along with other technical information. The catalog includes a Part No.-to-page index and a listing of the trade names under which the products of 81 manufacturers are sold. Exact replacements (and a few that require only minor changes, which are described) are listed for 270 different brands of TV, home and auto radio, Hi Fi, tape recorder and commercial sound equipment components. Merit.

### ANTENNAS, ACCESSORIES 301

A 16-page, two-color brochure describes a line of antennas for black and white and color TV and for FM stereo master antenna systems. Broadband VHF types are featured along with the "Color Guard," for both color and black and white TV; the "Topliner" series VHF's; "T-Bird" broadband VHF's; the "Trapper" series of "Penta-Phase" drive types; and VHF yagis and dipole arrays. A special section is devoted to UHF antennas including log periodic

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## FREE LITERATURE

dish types, yagis, UHF broadband and translater models, and the J-series of VHF-UHF high-reliability antennas. A third section describes omnidirectional FM antenna and antenna kits as well as FM stereo-multiplex antennas. Data is also contained on antenna bi-mounts, mixing couplers, TV set couplers, switches and attenuators, impedance transformers and traps. Jerrold Electronics Corp.

### COMM TERMINAL GEAR 302

A two-color, 16-page publication describes the manufacturer's line of communications terminal equipment, including handsets, headset-microphones, mobile microphones, dynamic and carbon noise-canceling microphones, magnetic and carbon transmitter and receiver elements, and such accessories as switches and connectors. Equipment is available for all industrial and avocational applications, ranging from a stereo Hi-Fi head set to explosion-proof and battle assemblies. Roanwell Corp.

### DESOLDERING IRON 303

An electric desoldering iron that speeds electronic circuit repairs is described in bulletin E-63. The soldering iron described, known as the Endeco, melts and vacuums solder, reportedly leaving terminals and mounting holes clean. With solder extracted, parts can be removed without damage. Replacements may then be resoldered with the same iron. Enterprise Development Corp.

### HI FI EQUIPMENT 304

A 24-page, illustrated, 2-color catalog, No. 165-J, describes stereo and monaural Hi-Fi loudspeakers, headphones, private stereo listening devices, speaker components and speaker system kits for customizing or economizing. Acoustical and dimensional specifications and prices are given. Among the products included are a group of Hi-Fi loudspeakers embodying low-resonance, high-compliance acoustic design with die-cast alloy housings, and three-way 15-in. unitary speakers made with

three electrically and acoustically independent L-F, M-F and H-F radiating and driving systems. For the do-it-yourselfers who wish to make the enclosure or built-in, four complete speaker system kits and a "step-up" speaker performance kit are offered along with other products and accessories. Jensen Manufacturing Co.

### FILTER ELEMENT 305

Two-page bulletin 94-20 contains application data on the model TF-01 emitter bypass "Transfilter," designed to replace the conventional emitter bypass capacitor in transistorized IF amplifier circuits. The publication describes use of the ceramic unit in the circuit of an ordinary radio. Circuit diagrams and a step-by-step discussion point out advantages and features of the units, and a set of curves compares the selectivity of the IF stage employing the "Transfilter" with that of the stage using a conventional bypass capacitor. Clevite Corp.

### CONSOLE 306

An illustrated stereo console catalog contains specifications, descriptions and photographs of the entire Copley and Exeter console series, in addition to drawings and detailed explanations of interior features. H. H. Scott, Inc.

### CRYSTAL HEADPHONES 307

Bulletin No. 910-2 contains descriptions and specifications of Hi-Fi extended range and general purpose crystal headphones. The illustrated, 12-page booklet discusses typical installations and includes wiring diagrams for headphones installed in resistance-coupled circuits without tone control, inductance-coupled circuits without tone control, resistance-coupled circuits with tone control and multiple headphones with individual tone controls. Stereophonic versions of these installations also are included along with a cord connection diagram. Clevite Corp.

### NEON INDICATOR LIGHTS 308

A six-page, two-color catalog presents a line of neon indicator lights which includes round "Snap-lites," rectangular indicator lights, and miniature "Tineon" pilot lights. The units are designed to operate

# 30 watt transceiver for Industrial Service

## THE ALL NEW HALLMARK 3000

A rugged unit  
that *really*  
means business



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## FCC Type Accepted

The compact Hallmark 3000 has been engineered for business and industrial service where top performance in dependable, long range communications is a must!

With crystal controlled operation in the 25 to 50 mc band, the "3000" has an input power of 30 watts and features an improved noise limiter and unique squelch circuit for quiet stand-by operation.

Designed to take full advantage of the best features of tubes and transistors, the "3000" uses a fully transistorized mobile power supply for low power drain. The small size means easy installation in any vehicle.

Receiver sensitivity is 0.3  $\mu$ v for 10db S + N/N ratio. Transistorized modulator gives the Hallmark 3000 maximum transmit modulation and "talk power". Available in 115v AC and 12v DC models.

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| 6 oz. spray can — with extender | LIST 2.79   |
| 3 oz. spray can — with extender | LIST 1.79   |

Quietrole is your guarantee of the most effective, quick silencer of noisy radio and TV controls — the quality product that is a top value. Get Quietrole at quality jobbers.



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## FREE LITERATURE

on circuit voltages up to 250 v and are UL listed and approved by the Canadian Standards Association. Actual size illustrations show a variety of lens styles, terminal types, legend styles, etc. Complete data is given, including dimensional drawings, catalog number charts, specifications, etc. A page is devoted to illustrations and listings of lampholders covering a wide variety ranging from the midget screw through the intermediate screw types. Leecraft Mfg. Co.

### CONVERTERS 309

Three new top-of-the-set UHF converters are illustrated and described in two-color catalog sheet DS-CS-023. The data covers two all-channel (14 to 83) UHF converters—the "Super Vista," for weak-to strong-signal areas, and the lower priced "Vista," for strong-signal areas. Also described is the "Ultra Vista," a special MPATI and translator area (Channels 70 to 83) converter, which features a stage of UHF signal pre-amplification. Jerrold Electronics Corp.

### CLEANING SOLVENT 310

A report on a cleaning solvent with reportedly the least detrimental effect on video magnetic tape is included in the latest issue of "Video Tape Playback," a quarterly informational bulletin. The current issue also contains articles on proposed American Standard dimensions of 2-in. video magnetic tape reels, improved VTR audio response and the new 6½-in. spot-length video tape reel and shipping box. Another feature is "Tape Recorder Roundup," a brief resume of machines currently being offered. 3M Co.

### COAXIAL CONNECTORS 311

Technical and mechanical specifications for a subminiature RF connector for use with semi-rigid coaxial cable are included in data sheet CX-3. The new subminiature RF connector is designated the R-3005 right-angle plug and features an exclusive collet-type clamping action. It is designed for

use with semi-rigid cables which are similar to 188/U coaxial cable except they are constructed with a solid copper shield. Seaelectro Corp.

### TECHNICAL REVIEW 312

"Technical Review 163" is a 24-page book on the design and manufacture of miniature condenser microphones and methods of checking the properties of RMS voltage-measuring instruments. The book is based on two papers which were presented by the authors (Gunnar Rasmussen and Carl Gustav Wahrman) at the 4th International Congress on Acoustics, in Copenhagen, Denmark. The handbook outlines methods for making a given microphone "look acoustically smaller" in a sound field, and describes some of their performance characteristics. The choice of optimum diaphragm thickness for ¼-in. microphones is discussed, and various design problems which faced the development of small microphones are presented. The influence of severe environmental conditions on the operation of the microphone is also covered. On the subject of checking RMS instruments, the book shows that the two-tone test recommended in various sound-level meter standards is insufficient for instruments intended to measure signals having Gaussian noise characteristics. A Gaussian noise check is stated to be better, but still imperfect. The book purports to demonstrate that the best method is to use rectangular pulses of varying peak-to-RMS ratios. B & K Instruments, Inc.

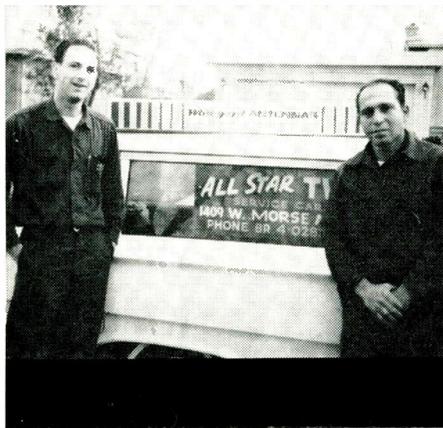
### ... AM/FM AUTO RADIOS Continued from page 38

#### Intermittents

As in other electronic equipment, intermittents can take up more time than most other faults. The procedure is similar to other PC board troubleshooting; try to locate the trouble by tapping lightly through the PC with an insulated probe. A better way is to start at the speaker end of the radio and inject a signal into the output transistor base. Monitor the signal with a meter across the speaker. Now flex the board in this area. If the injected signal remains steady on the meter, move the generator

# Winegard

## Dealer of the month



### ALL STAR TV CHICAGO

Winegard congratulates All Star TV on its growing reputation as an antenna distribution specialist... and Joseph Electronics, Inc., Chicago, All Star's distributor.

For 9 years All Star partners Harvey Somach and Howard Usen have served the same community on Chicago's north side, beginning with a modest TV service operation. After adding radio, TV and phono sales, the partners began installing antenna distribution systems and have enjoyed a steady increase in business ever since. Two years ago All Star expanded, moving to a new, larger shop in the same area.

With a building boom in Chicago, All Star is currently in the midst of a thriving period that keeps both partners on the go. 99% of new apartment buildings specify antenna distribution systems, according to Harv Somach—and All Star gets its share!

"We started with other makes of antennas and equipment", says Somach, "but switched to Winegard". Winegard has greatly simplified installation of distribution systems and gives us the versatile equipment we need. With Winegard we can handle any situation that arises."



D3019-12 Kirkwood • Burlington, Iowa

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DECEMBER 1963

probe to the driver stage and flex the board in this area. Follow this procedure until the intermittent area is tied down.

Just one other thing: If you don't get a "thump" in the radio when it is first turned on, check the fuse-resistor in the output stage before you even start to inject noise signals. ■

### ... YOU THE SALESMAN

*Continued from page 53*  
duct, so you assume he must want it now. This close avoids arguments and fictitious objections. You don't ask the prospect if he wants your proposition now—you simply proceed as if it were a foregone conclusion that he does.

● The subordinate question close—This technique skips over the primary question: "Are you going to buy from me?" It asks the buyer some questions on unimportant points or details. When he answers that question, he has given his consent without being aware he has. This method is smooth, effective and inoffensive.

● The impending event or condition close—This points out that if the buyer fails to take advantage of the proposition, he will suffer loss through breakdown, change in price, style, quality, delivery schedule and other such advantages.

● The inducement technique—This method is effective in dealing with procrastination and often works when everything else has failed. It offers something special to help the prospect make up his mind. The inducement may be as simple as having the set repaired by a specific deadline (like the World Series).

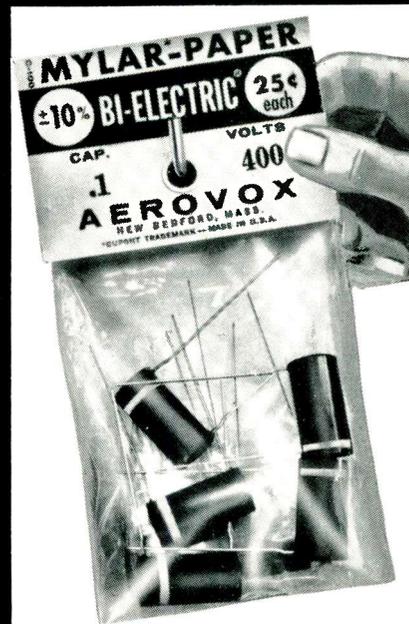
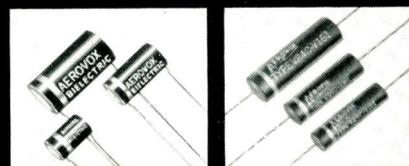
● The narrative technique—This consists of telling a relevant or business story to the customer to get him to see himself in the light of the experience being narrated. This stirs the imagination, enhances "hunger" and capitalizes on the tendency to imitate and emulate others.

There are many other techniques and methods recommended by successful salesmen. Perhaps, the simplest and most effective is to "ask for the order." Experience has proved that your business can be greatly increased by merely asking for it or using the words "I suggest." ■

### IT PAYS TO USE AEROVOX!

Aerovox Type BE Bi-Electric® Mylar Paper Bypass Capacitors combine the advantages of an exclusive Polycap® case from end-to-end, and process controlled end fills to provide complete sealed protection for every service job! Tests prove this superior construction eliminates cracking and chipping problems common with conventional dipped bypass capacitors... even when the Bi-Electrics are used for axial lead installations. □ Aerovox Type V84C-V161 Aero-film® Mylar Capacitors are extremely stable axial lead units offering exceptional protection of Polycap case and epoxy end-seals which will not flow, soften or melt at any operating temperature. □ Protect your reputation and profits—ask for Aerovox!

**AEROVOX MYLAR® BYPASS  
CAPACITORS PROVIDE  
SUPERIOR PROTECTION FOR  
EVERY SERVICE JOB!**



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Technical Leadership—Manufacturing Excellence

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TO HELP MAKE FUSE HANDLING MORE PROFITABLE . . .

# BUSS VISUAL- PAK

ANOTHER BUSS FIRST



CLEAR PLASTIC BOX,  
THERE'S NO NEED  
TO OPEN  
TO SEE HOW MANY  
FUSES ARE  
IN IT

- BUSS fuse 5-in clear plastic box—let's you check fuses in each box at a glance . . . guards against running short on needed fuses.
- Size and style of fuses printed in large type on lid of box makes it easier to pick out fuses you want.
- Box fits all fuse display stands and channels.

## BUSS

PIONEERING NEW  
DEVELOPMENTS IN  
ELECTRICAL PROTECTION  
SINCE 1914

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis 7, Mo.

tors gained enough points to take the entire family on the trip.

Over 130 resorts were selected as possible vacation areas. They were located in all parts of the U. S., with others in Canada. The audio products used as credits for the trip points included cartridges, microphones, needles, speakers, headsets, tubes, microphone stands and rechargeable flashlight battery cartridges.

### Four New Tubes

The addition of four new entertainment type tubes to its line was announced recently by Tung-Sol Electric, Inc. The new tubes are as follows:

- 6GF7 —dissimilar dual triode 9-pin novar T-9 bulb
- 6HU8/ELL80—9-pin miniature twin pentode
- 10JY8 —9-pin miniature triode-pentode
- 13GF7 —dissimilar dual triode 9-pin novar T-9 bulb.

### 11-In. TV Fair-Traded

Admiral Corp., Chicago Div., has advised its dealers that, effective immediately, the new 11-in. personal portable television models will be fair-traded to help protect their profit margins.

William A. Larson, general manager, said that the leader model, P1104, in sandal beige, will be fair-traded at the recently announced suggested list price of \$99.95. Step-up models with two-tone cabinets, deluxe metal trim, front channel indicator window and ear-phone speaker attachment for private listening will be fair-traded at \$109.95, Larson said. UHF versions of

## BUSS: the complete line of fuses . . .

### NEWS OF THE INDUSTRY

#### New Division Formed

Shure Brothers, Inc., Evanston, Ill., manufacturer of microphones, Hi-Fi and electronic components, has announced the formation of a Professional Products Div. and the appointment of Robert W. Carr as manager of the new division.

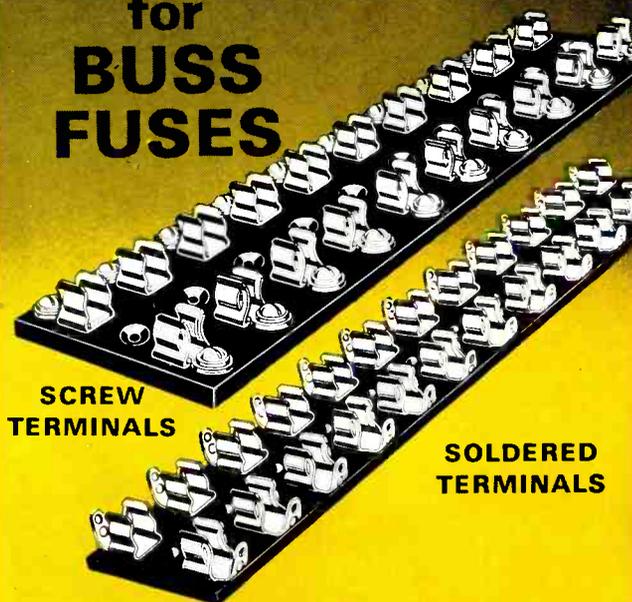
Under Carr's direction the new division will produce special products for the radio and TV broadcasting field, commercial recording industry, motion picture and television film production industry and all applications involving professional sound reinforcement. In addition, the new division will be responsible for supplying technical service and assistance to sound engineers in all of the above-mentioned fields.

#### Awarded Free Vacation Weekends

Sixty-four lucky Sonotone contest winners have won a glorious weekend, in resorts of their choice, awarded free by Sonotone's Electronic Applications Div.

All Sonotone distributors participated in the free Sono-Trip weekend program. Audio products purchased during June, July and August were credited as points earned toward a free weekend. Many distribu-

## BLOCKS for BUSS FUSES



Standard type — 1 to 12 pole.

## BUSS

Write for BUSS  
Bulletin SFB.

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis 7, Mo.

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ELECTRONIC TECHNICIAN

# BUSS FUSEHOLDERS

● LAMP INDICATING SERIES HG

Made To  
Military  
Specifications

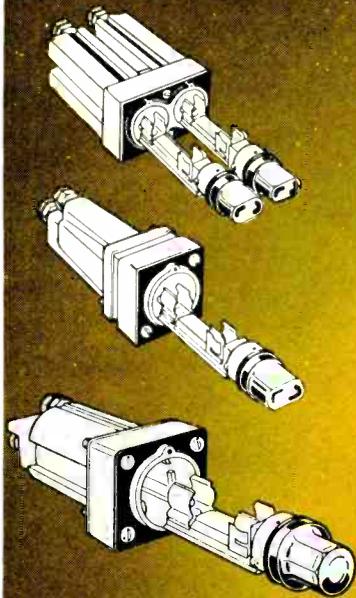
Provides quick, positive, visual identification of faulted circuit. Transparent knob permits indicating light to be readily seen.

Fuses are held in clips on a fuse carrier.

Fuse carrier slides into holder and is locked in place with bayonet type knob.

Holder designed for panels up to 1/8 inch thick.

Holder is inserted in panel from rear. Mounting screws can be conveniently tightened from front of panel.



# BUSS

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To allow full time for visiting exhibits and conferring with manufacturers, no other show activity will be conducted during show hours. The three-day, all-industry show will be held Monday, May 18 through Wednesday, May 20, at the Conrad Hilton Hotel, Chicago, Ill.

## Fifth Straight Million-Unit Year

More than 1 million Zenith television receivers were reported produced and sold (U. S. distributor unit sales to retailers) in the first 9 months of 1963, the company's fifth successive million-plus TV set year. L. C. Truesdell, Zenith Sales Corp. president, said that this year Zenith passed the one million mark "more than a month earlier than in the record-breaking year of 1962. As a result," he said, "Zenith will achieve in 1963 the greatest percentage of total industry sales in its history."

## Playback Head Price Cut

Robins Industries Corp. announced substantial price cuts on its line of record and playback heads. In making this announcement, Herman D. Post, president of Robins, pointed out that magnetic heads for replacement and upgrading tape recorders are now at a price level where they are attractive to tape recorder owners. While business has been good among servicemen who specialize in head replacement and upgrading recorders, Post said the new prices should provide an added stimulant.

... of unquestioned high quality

the above models will be priced \$20.00 higher.

The Admiral branch official said the company plans to rigidly enforce the minimum price schedule. He anticipated full cooperation by dealers.

Admiral Corp., Boston Div., also has initiated fair-trade coverage of the 11-in. portables at the same prices, \$99.95 and \$109.95, while the Metropolitan Div. covering the New York-Newark territory, has been fair-trading the complete Admiral line for 13 months with excellent success.

## 1964 EDPS Show

"The Concentrated Billion Dollar Market Place" will be the theme for the 1964 Electronics Distributors Show, according to J. A. (Shine) Milling, president of Electronic Industry Show Corp.

Mr. Milling pointed out that the show has always been "concentrated," in that it is held entirely under one roof. But at the 1964 show, concentration is being further increased by the arrangement of exhibit areas by market interest.

The entire fifth and sixth floors will be occupied by manufacturers of audio equipment and related products. This area represents almost twice the space set aside for this activity at previous Parts Shows. The lower-level exhibition halls are reserved for manufacturers of other electronic parts and equipment.

Mr. Milling indicated that this new format has already resulted in increased show participation by manufacturers of audio equipment.

## Let BUSS Fuses Help Protect Your PROFITS

To make sure BUSS fuses will operate as intended under all service conditions, each and every BUSS fuse is individually tested in a sensitive electronic device.

This is your assurance that when you sell or install BUSS fuses, you are safeguarded against complaints, call-backs and adjustments that might result from faulty fuses and eat away your profit.

It is just good business  
to sell fuses the BUSS way.

# BUSS

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Bulletin SFB.

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## A SIMPLE SOLUTION

That Solves All Your  
 TV Tuner Problems

One Price **8.95** All Makes

P & H replaces all defective parts, (tubes and major parts extra) and aligns tuner to exact, original specifications.

Send us your defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint.

Try our service and prove to yourself you simply can't afford to handle your tuner problems any other way.

Your tuner will be overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.



## TV TUNER SERVICE

118 Third Street West  
 TWIN FALLS, IDAHO

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"Hello, Acme TV? You were right, he is slower than molasses."

# PLAS-T-PAIR



## A REPAIR KIT FOR PLASTICS SIMPLE TO USE...

repairs

### TV KNOBS - CABINETS

in powder & liquid form

### USE 3 SIMPLE WAYS

### POUR - SPRAY - MOLD

PLAS-T-PAIR is not just cement — it's 100% clear, extremely high strength plastic. Most objects repaired with PLAS-T-PAIR will be stronger than when new. Never again a need to order TV knobs, transistor radio cases and other plastic parts. Repair them in less time than would be required to look up the part number.

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### a convenient, sturdy binder for your ELECTRONIC TECHNICIAN Schematics!



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Here's a sturdy book binder designed specifically for technicians who want to file away the ELECTRONIC TECHNICIAN Tekfax schematics for easy reference. **KING-SIZED.** 11" x 15". Your schematics lay flat, no folding necessary. **EASY TO USE.** Just press back the special spring clamp and slip your new schematics into place. No holes to punch. **STURDY.** Hand-some, reinforced binding. Tough duty fabric cover. **SAVE TIME.** With this convenient binder you'll be able to locate your schematics quickly, easily. You'll be able to protect them, carry them conveniently with you on your service calls.

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Please Rush Me.....Schematic Binders at \$4.95 each

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CHECKS AND REJUVENATES ALL PICTURE TUBES  
WITHOUT ADAPTORS OR ACCIDENTAL TUBE DAMAGE

Featuring Automatic  
Controlled  
Rejuvenation

# The All New SENCORE CR125 CATHODE RAY TUBE TESTER

An all new method of testing and rejuvenating picture tubes. Although the method is new, the tests performed are standard, correlating directly with set-up information from the RCA and GE picture tube manuals.

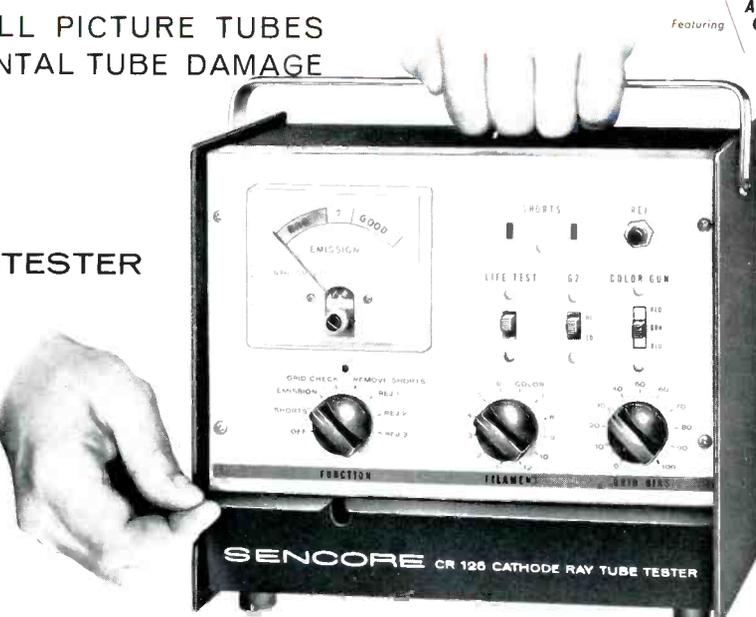
Check these outstanding features and you will see why this money making instrument belongs on top of your purchasing list for both monochrome and color TV testing.

**Checks all picture tubes thoroughly and carefully;** checks for inter-element shorts, cathode emission, control grid cut-off capabilities, gas, and life test. Checks all picture tubes with well filtered DC just like they are operated in the TV set.

**Automatic controlled rejuvenation.** A Sencore first, preventing the operator from over-rejuvenating or damaging a tube. An RC timing circuit controls the rejuvenation time thus applying just the right amount of voltage for a regulated interval. With the flick of a switch, the RC timer converts to a capacity type welder for welding open cathodes. New rejuvenation or welding voltage can be re-applied only when the rejuvenate button is released and depressed again.

**Uses DC on all tests.** Unlike other CRT testers that use straight AC, the CR125 uses well filtered DC on all tests. This enables Sencore to use standard recommended checks and to provide a more accurate check on control grid capabilities. This is very important in color.

**No adaptor sockets.** One neat test cable with all six



All six sockets, including latest color socket, on one neat cable.



sockets for testing any CRT. No messy adaptors, reference charts or up-dating is required. The Sencore CR125 is the only tester with both color sockets. (Some have no color sockets, others have only the older type color socket.)

**No draggy leads.** A neat, oversized compartment, in the lower portion of the CR125 allows you to neatly "tuck away" the cable and line cord after each check in the home.

**MODEL CR128**  
For the man on the go. Same as above but in all steel carrying case . . . \$69.95

Model CR125 . . . . . \$69.95

## PS127 DELUXE WIDE BAND OSCILLOSCOPE AT A SURPRISINGLY LOW PRICE

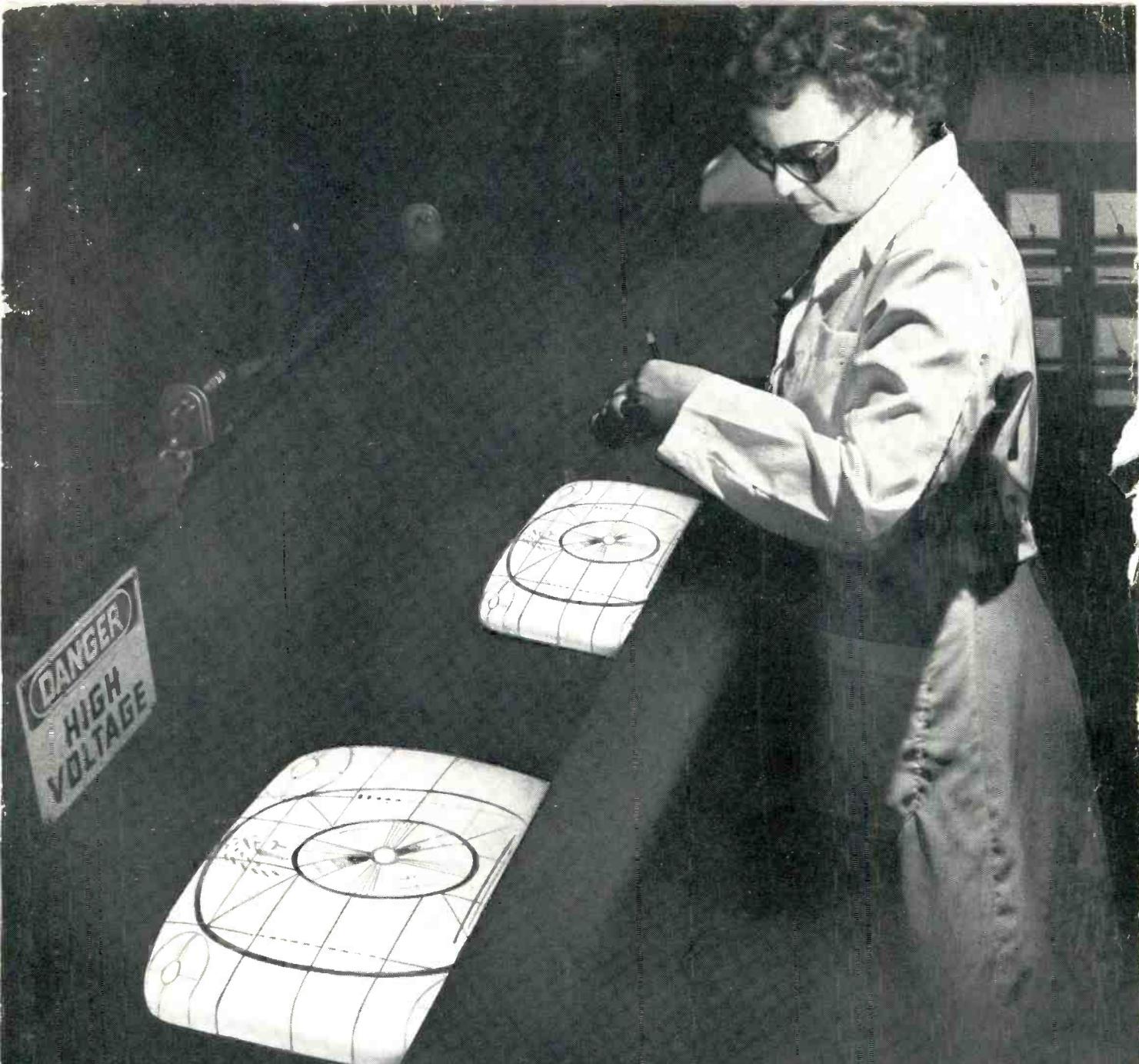
This all new 5 inch oscilloscope offers the finest in performance, portability and appearance. Vertical amplifier frequency response, flat within 1 DB from 10 CPS to 4.5 mc and only 3 DB down at 5.2 mc insures true waveform reproduction. Vertical amplifier sensitivity of .017 volts RMS for one inch deflection on wide band (without band switching) is found only on scopes costing hundreds of dollars more. High input impedance of 2.7 megohms shunted by 99 mmfd (or 27 megohms with 9 mmfd with built-in low capacity probe), insures minimum circuit loading. For the first time, waveforms can be viewed in TV horizontal and vertical output circuits with the low capacity probe that will withstand up to 5000 volts peak to peak. To top that, the vertical amplifier attenuator controls are calibrated directly in peak to peak volts for fast direct reading of all peak to peak voltages.

Horizontal amplifier extended sweep range from 5 to 500 kc in five overlapping steps and frequency response from 10 CPS to 1 mc within 3 DB insures linear sweep and positive sync. External inputs for horizontal sweep and sync, intensity modulation, and smart two-toned case and "designer" styled controls brands the PS127 a truly professional oscilloscope.

PS127 . . . . . \$169.50



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## TRAP FOR FAULTY PICTURE TUBES

### RCA Guards Against Callbacks 26 Ways

Under the watchful eyes of trained inspectors, RCA Silverama® Picture Tubes are carefully scrutinized for screen quality and focus.

All Silverama replacement picture tubes as well as those destined for original equipment undergo a battery of 26 automated tests. These include: warm-up, emission, gas, leakage, electron-gun performance, and other critical factors that can spell the difference between long-term performance or costly callback. Tubes failing a single test are automatically tagged and rejected. In addition to automatic testing, every tube lot leaving the RCA plant has been sampled by Quality Control.

Nothing is left to chance; part by part, inside and out, from base to faceplate the quality of each tube has been carefully controlled and assured prior to assembly. Even the Silverama envelope is carefully inspected prior to re-use, and is internally scrubbed, buffed, and restored to the peak of its optical capabilities. Result: a superior picture tube, an RCA Silverama. Make it your next installation choice.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



**CARRY EACH SILVERAMA FACTORY-FRESH INTO YOUR CUSTOMER'S HOME.** New Foam-Lined RCA Picture Tube Tote Bag makes scratched, marked, or scuffed faceplates a thing of the past. Makes carrying both easier and safer. Two sizes: one for 16" to 19" tubes, one for 20" to 24" tubes.

**SEE YOUR AUTHORIZED RCA PICTURE TUBE DISTRIBUTOR FOR DETAILS**



**The Most Trusted Name in Electronics**