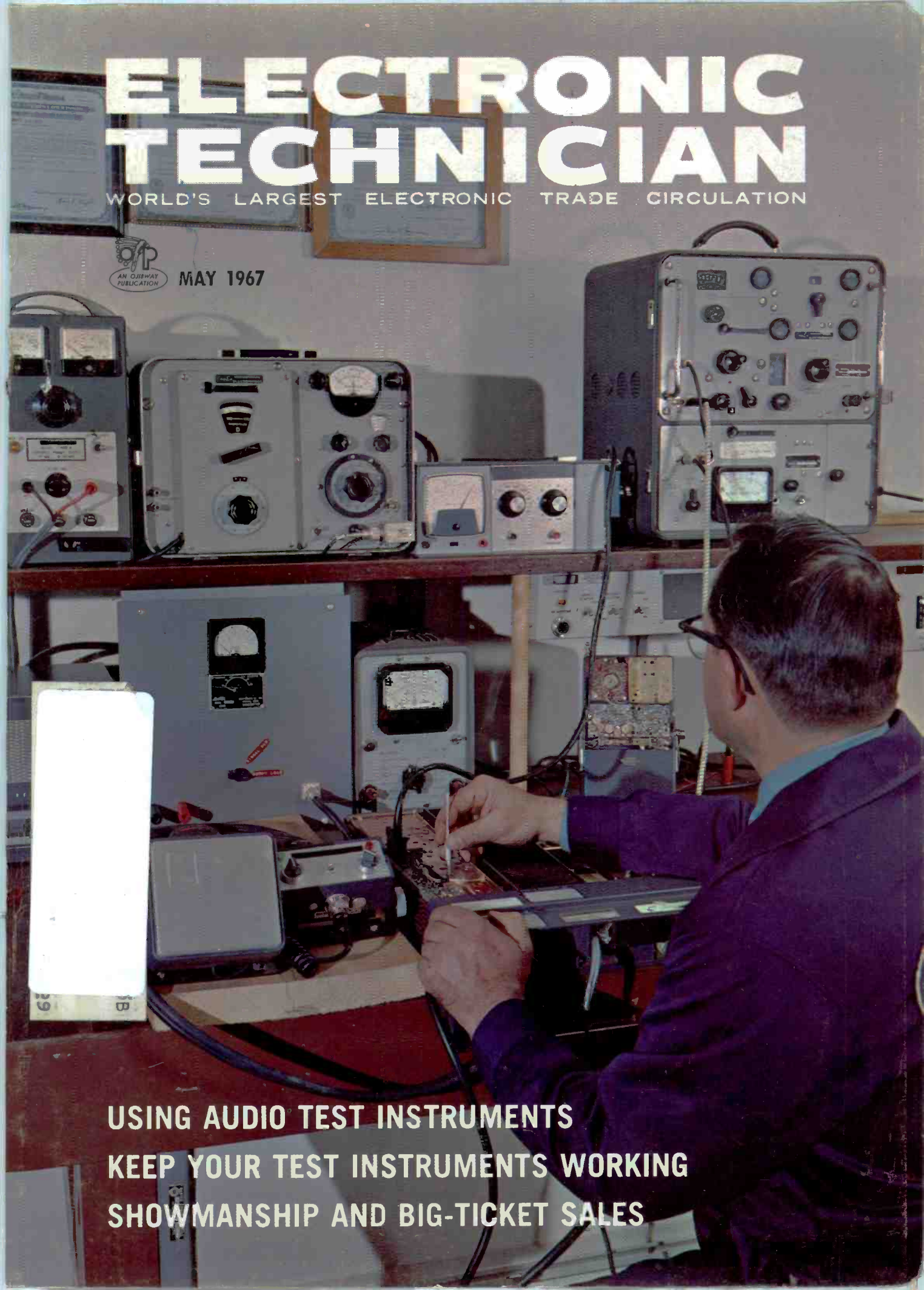
ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

AN OJIBWAY PUBLICATION

MAY 1967



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B & K has done it again . . . put you a "jump ahead" by looking into your future . . . your problems, *your* needs. This is the "Little Corporal," the CRT Rejuvenator and Checker, designed to provide maximum obsolescence protection by providing continuously variable voltages for all CRT elements. You can make the most accurate possible tests, even on future CRT types, because the heater voltage is metered and is continuously variable from 0 to 13 volts with any tube heater current. And, using the required adaptors, you can test and correct all tube, transistor or integrated circuit black and white and color picture TV tube troubles (including GE 11" color and imported color tubes) in a few minutes . . . in the home or on the bench . . . without removing tubes from the TV set.

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B&K
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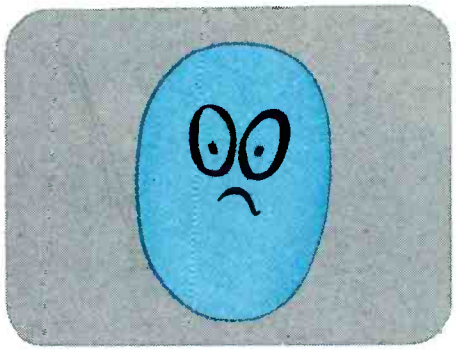
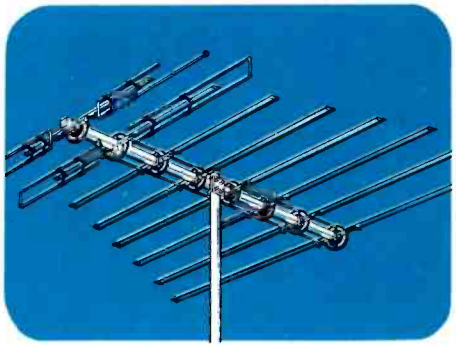
Where Electronic Innovation Is A Way of Life

. . . for more details circle 101 on postcard

Help stamp out blue people



Focus on Jerrold Paralog Plus™ Coloraxial Antennas for true color



Jerrold Paralog Plus Antennas show a definite improvement in the sharpness, fidelity and color stability of the image on any TV set. Sharp directivity, uniform response and perfect matching see to that! And the rugged construction insures that the quality stays high—not for months—but for years. It's the high-gain Coloraxial antenna for people who insist on VHF and FM reception—without compromise. And there are seven models to choose from.

The Paralog Plus is one of a complete spectrum of problem-solving Jerrold TV reception aids—Pathfinder, VUfinder and Colorpeak antennas... Powermate pre-amplifiers, amplified-couplers and splitters . . . Coloraxial cable, wall outlets and wall plates. See your Jerrold distributor today. Catalog available on request.

JERROLD®

Focusing on one thing—better reception

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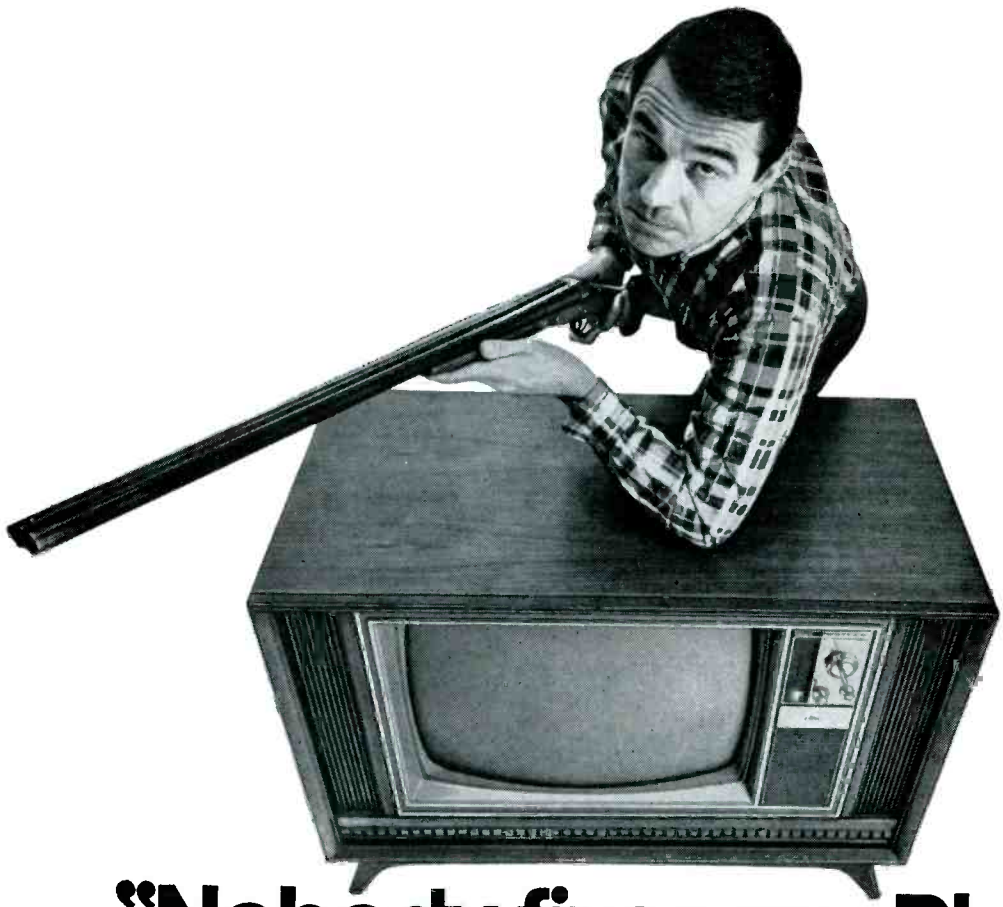

"Nobody fixes my Philco but a Philco technician!"

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Get new customers — more business. Your shop can appear in our Yellow Pages listings, and you become your area headquarters for Philco Service. There's plenty of attractive identification material wherever your firm name is used.

Philco owners are sold on the idea of specialist service. Shouldn't you be? Your local Philco-Ford Distributor will give you all the details. Call him now and ask for the Service Manager.

Philco-Ford Corporation
Philadelphia, Pa. 19134

PHILCO Ford

FAMOUS FOR QUALITY THE WORLD OVER

... for more details circle 130 on postcard

MAY 1967

VOL. 85, NO. 5

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

OJIBWAY PRESS, Inc.

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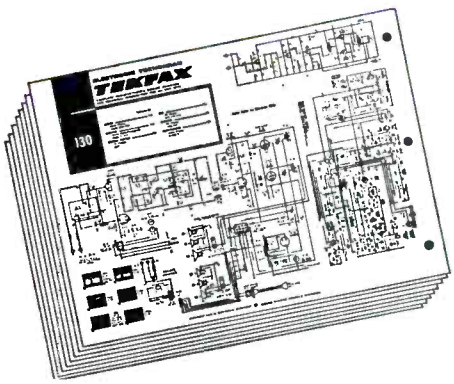
Cover

More service-dealers and technicians are going in for two-way communications sales and service. Some are specializing and others are diversifying. We visited a modern, nearby two-way shop recently and took along our photographers. Our cover shows an area of the work-bench in the service and check-out section of this specializing operation.

FEATURES

DEPARTMENTS

TEKFAX — 16 PAGES OF THE LATEST SCHEMATICS



Group 177 — May • 1967

ADMIRAL: Color TV Chassis 3H10, 4H10, 5H10 Series

AIRLINE: TV Model GEN-1967A

PACKARD BELL: Color TV Chassis 98C15

PHILCO-FORD: TV Chassis 17J25

SYLVANIA: TV Chassis A06-1, -2

ZENITH: TV Chassis 13X18

EDITOR'S MEMO

Where There's a Light

Ever been asked to describe the difference between an optimist and a pessimist? The best we've been able to come up with goes like this: "An optimist is a person who sees a light where there is no light, and the pessimist is the guy who blows the light out." We've never had much respect nor sympathy for the viewpoint of either the blind optimist nor the equally blind pessimist.

This reminds us of the small-town retail merchant we knew years ago. He always saw trouble where there was no trouble — business was bad and getting worse. The problems he had were strictly unsolvable. The jobbers were loading him down with "junk" he couldn't sell. The customers were a pain in the neck and overdemanding.

This was the tune the merchant played, day in and day out, for 40 years. But when he died, he left a cash and property estate larger than any citizen who ever lived in our modest township up to that time. He must have led a miserable existence during his entire life and died long before his time.

Then comes the modern corporation executive who would be called an optimist by some (we prefer to call him a realistic, hard-headed businessman). He sees the future clearly by extending and projecting an exponential curve into the future — based on readily available census and business statistics.

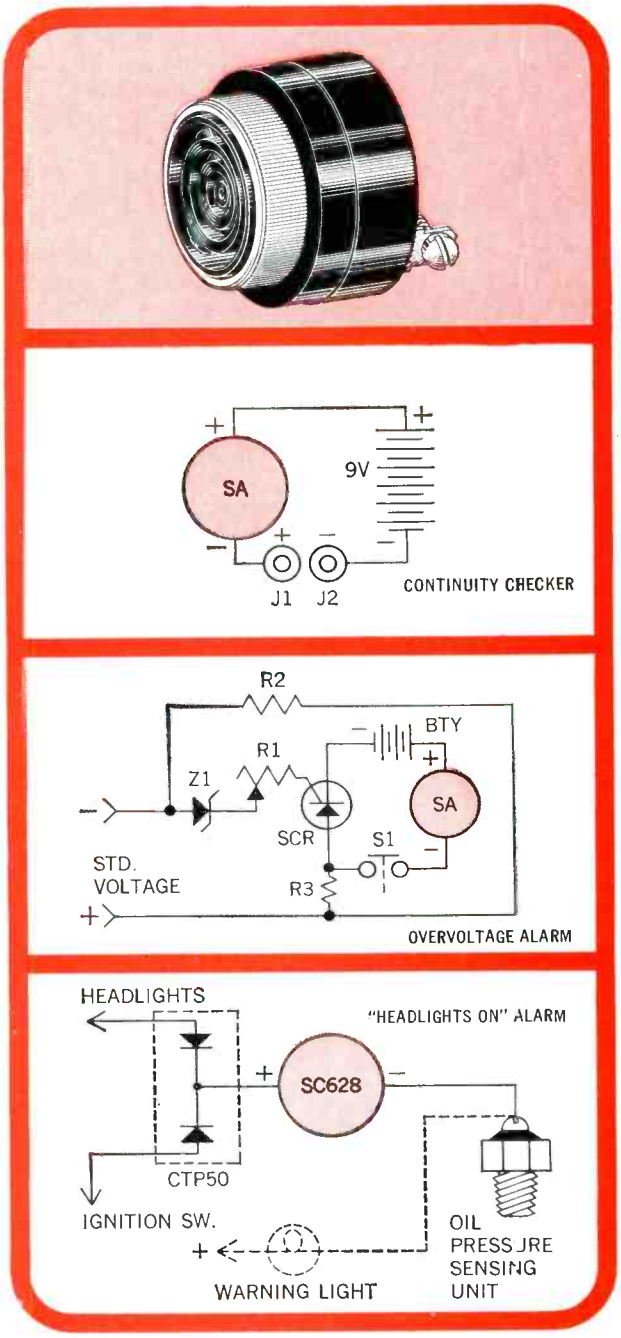
He sees a future which will bring more millions of families with higher incomes. These families will want something a little bit better, something a little different and something of substantially more value, he knows.

He believes consumer spending will be $832 billion by 1980 — less than 15 years from now — compared to $455 billion in 1965.

During the past 10 years, he can tell us, gross national product grew at the rate of 3.4 percent annually. In the next decade, the GNP will grow at a rate greater than 4 percent per year. This hard-headed businessman believes we're heading from a GNP of over $700 billion in 1966, to about $1.6 trillion by the year 1980.

This man sees a light where there is a light and nothing short of a world-wide disaster can blow that light out.

Sonalert®...
versatile signal for service shops



Ever hear of the audible signal that works on only a few milliamps? We have one. It's called the Sonalert, and it's a solid-state tone device that you can find lots of uses for in your shop, your car and your home.

For instance, it makes a wonderful continuity checker. Just hook it to a 9-volt battery . . . a Duracell® TR-146X mercury battery is ideal. You can test circuits having resistance up to about 1000 ohms, with complete safety against accidental burn-out of fine-wire components such as coils and transformers. At 9 volts, Sonalert draws only 3 milliamps. Its distinctive 2800 Hz tone helps make circuit tracing easy. A convenient way to put this useful gadget together is described in our booklet "How to Use Sonalert".

Or maybe you'd like an alarm that will sound when voltage gets too low or too high. If your equipment already has an over- or under-voltage signal light, it's easy to convert a Sonalert in parallel to give you a tone alarm that can't be ignored. Just make sure to choose a Sonalert with the right voltage rating. You can also rig a high or low voltage alarm circuit using a zener diode as the reference. The signal circuit illustrated here will keep sounding once an overvoltage has happened, until you open the switch.

And here's an idea for your service truck. A guy in a hurry will sometimes forget to turn off the headlights when he leaves the truck . . . and find the battery dead when he returns. It's easy to connect a Sonalert to sound a warning when headlights are left on when the engine is turned off. One side of the Sonalert goes to the oil pressure sensing unit, which actuates the low pressure warning light. The other goes to both the headlights and the ignition switch, through a pair of silicon rectifiers which prevent coupling those two circuits (a Mallory CTP50 package fits this job ideally).

If you'd like some more tips on how to use Sonalert, ask your Mallory Distributor for "idea folder" No. 9-406. Or write Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

DON'T FORGET TO ASK 'EM—*"What else needs fixing?"*

. . . for more details circle 121 on postcard

LETTERS TO THE EDITOR

'Old' Tubes

Reader Harold Koutsky in the January 1967 issue asks about 35A3s and 35D5s—which you head 'Needs Old Tubes.'

My tube index goes back 40 years and I have been unable to find these tubes listed. Recent experiences point to the possibility that reader Koutsky is looking for a recent Japanese tube . . . On the matter of Japanese equipment—how about an article or two on basic problems?

RICHARD GREENGARD
Bergenfield, N.J.

• *We also have been unable to identify these tubes.—Ed.*

Interesting Department

Your "Letters to the Editor" columns have become one of the most interesting and informative departments in ET. . . .

Franks Auto Radio, El Monte, Calif., wanted information on speaker cones. Try Waldom Electronics, 4625 W. 53rd St., Chicago, Ill., and Ercona Corp., 432 Park Ave. S., New York, N.Y.

MERLE BARKER
Concordia, Kan.

Japanese Schematics and Parts

Schematics and parts for Candle TV sets should be available to Mr. Raymond Kuhn (February 1967 ET letters) from: **Candle America Corp., 1457 Venice Blvd., Los Angeles, Calif. 90006.** At last report this firm was very much in business.

ROBERT E. GERSON
Electronics Div.
Japan Light Machinery
Information Center
437 5th Ave.
New York, N.Y. 10016

Orchid-of-the-Month

. . . ET is the best of all electronic magazines. I am looking forward to next month's edition.

A. O. SMITH
Warner Robins, Ga.

Old Subscriber

I first subscribed to ET when it took over "Service" magazine—years ago. I must say I have enjoyed every issue and have been helped out of many problems by information published in it. Enclosed check in the amount of $8 to extend my subscription an additional two years.

G. ROSEBERRY
Porter, Tex.

Hobbyists

Have just read your Editor's Memo in the February issue. I have tried several times to make a living as a service-dealer with my own business. I'm working as a technician now. If the "hobbyists" would stick to their basements instead of trying to learn the business in other peoples' living rooms, I think the industry would be more respected and I believe more successful.

FRANK SHEARER
Pleasant Grove, Ala.

Signal Tracer Manual

I need the operators manual for a Silver Spark Signal Tracer, model 906, made by McMurdo Co., Hartford, Conn. Can any reader help me? Write via ET.

FRANK SZPIECH
Newark, N.J.

WHY risk your reputation with "just-as-good" capacitors?

When you pay little or no attention to quality in tubular replacement capacitors, you leave yourself wide open for criticism of your work . . . you risk your reputation . . . you stand to lose customers. It just doesn't pay to take a chance on capacitors with unknown or debatable performance records when it's so easy to get guaranteed *dependable* tubulars from your Sprague distributor!

There's no "maybe" with these 2 great SPRAGUE DIFILM® TUBULARS!

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A "must" for applications where only radial-lead capacitors will fit . . . the perfect replacement for dipped capacitors now used in many leading TV sets. Double-dipped in rugged epoxy resin for positive protection against extreme heat and humidity. No other dipped tubular capacitor can match Sprague Orange Drops!

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1967

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LETTERS TO THE EDITOR

New Reader Needs Help

I am well pleased with my recent subscription to ELECTRONIC TECHNICIAN. Your articles on color TV and transistors are tops. Can a reader help me locate a schematic for an Electronic Measurements Corp., model 300 VTVM?

JOE FISSMER
Claymont, Del.

Lost: One Copy of ET

About two weeks ago my brief case was stolen and the January issue of ELECTRONIC TECHNICIAN was in it. To date this has not been returned to me. Whatever the cost, send me another copy and bill me. Your magazine is the "greatest."

EARL RAPP
Dearborn Heights, Mich.

• *You caught us with an extra copy. It's on the way.—Ed.*

Trust and Goodwill

. . . I feel that association committees have been somewhat negligent in keeping you informed of national activities.

. . . Our 1967 convention will be held in August at Des Moines, Iowa. We would certainly appreciate advance publicity on dates and locations of upcoming important events. I suspect you have many readers in the industry who would be grateful for this advance information.

I will send reports following our meetings, news releases, and resolutions passed. You will be free, at your discretion, to print whatever material we send.

It is our sincere desire to upgrade the image of electronics technicians and create trust and goodwill with our customers. This can only be accomplished through high ethical standards and upstanding efforts of the members of organizations like the National Electronics Associations . . . .

BILL FRANK
NEA Publicity Chairman
252 South Main St.
Columbiana, Ohio 44408

New Subscriber

I am a new subscriber to ET. In the March issue, TECHDIGEST, page 28, the second paragraph says "the mono FM from the collector of the lst 19kHz amplifier passes through a de-emphasis network." Shouldn't this read "the mono FM from the emitter?" In the same paragraph it states "the first 19kHz amplifier that acts as an emitter follower to all frequencies except 19kHz." In the fourth paragraph it reads "the stereo information splits at the first 19kHz amplifier; the 19kHz pilot appears at the collector."

I may be incorrect in my assumptions, but I'm not wrong in saying your magazine is extremely interesting and educational. I have learned much in just the three issues I have received.

BERT ASPLUND
Spokane, Wash.

• *We just happened to have one copy of the schematic and original service literature from the manufacturer. We are sending it to you and hope it will help you clear up any doubts which you may have regarding the way this equipment functions.—Ed.*

Needs Tuning Indicator

Can any reader of ET help me locate a tuning indicator tube (UM80) used in a multi-band Philips receiver? I have been unable to locate one on the west coast. Write via ET.

ET has furnished me and my men with many hours of time-saving service tips and fine-reading, timely articles. Keep it up.

RUDOLPH NATOLI
Santa Monica, Calif.

Editorial Feedback

Your editorial blasting Educational TV uses the same generalities you accuse ETV of using in the program on unethical practices of TV-radio service-dealers. Unethical practices exist in most fields of endeavor and the professional approach is to locate them and see that such practices are terminated. What does NATESA and ELECTRONIC TECHNICIAN do to feret out unscrupulous technicians?

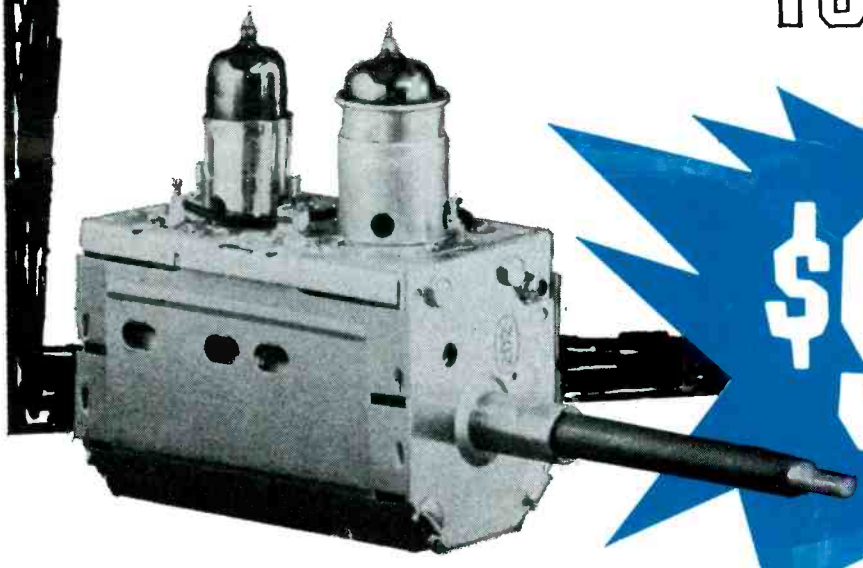
Good electronic technicians are in short supply and there is a definite need for good public relations work to inform the public and students planning careers as technicians.

We believe that most ETV stations would welcome good program material based on the importance of the technician in industry, in local service and as a citizen active in civic affairs.

You have an excellent magazine and great potential for controlling unethical practices in this industry.

CLAUDE H. MCALLISTER
New Media and TV Coordinator
New Hanover County Schools
Wilmington, N.C.

Complete TUNER REPAIR for only



$9.50

Sarkes Tarzian, Inc., largest manufacturer of TV and FM tuners, offers unexcelled tuner overhaul and factory-supervised repair service. Completely-equipped and conveniently-located Service Centers offer fast, dependable and factory-supervised repair service on all makes and models. Centers are staffed by well-trained technicians, assisted by engineering personnel.

Most Tarzian-made tuners received one day will be repaired and shipped out the next. More time may be required on other makes. Every channel—not just the channels existing in any given area—is checked and re-aligned per original specifications. Exclusive cleaning method makes the tuner look—as well as operate—like new.

Cost, including ALL labor and parts (except tubes) is only $9.50 and $15 for UV combinations. No additional charge. No hidden costs. Too, you get a full, 12-month warranty against defective workmanship and parts failure due to normal usage.

Always send TV make, chassis and Model number with faulty tuner. Check with your local distributor for Sarkes Tarzian replacement tuners, parts or repair service. Or, use the address nearest you for fast, factory-supervised repair service.

TSC

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(Factory-supervised tuner service authorized by Sarkes Tarzian)

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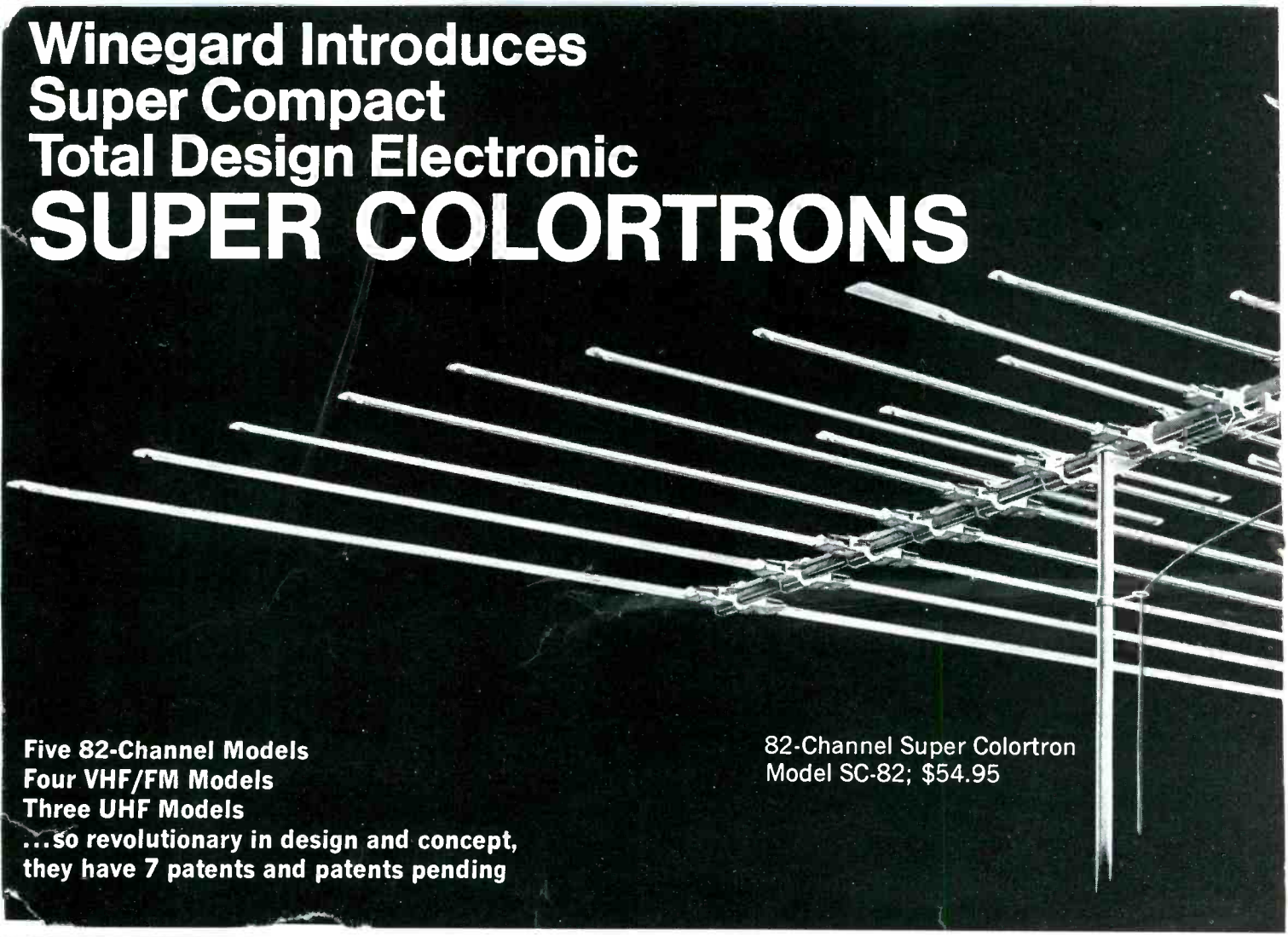
Tel: 201-792-3730

SOUTH-EAST—938 Gordon St., S. W.
Atlanta, Georgia
Tel: 404-758-2232

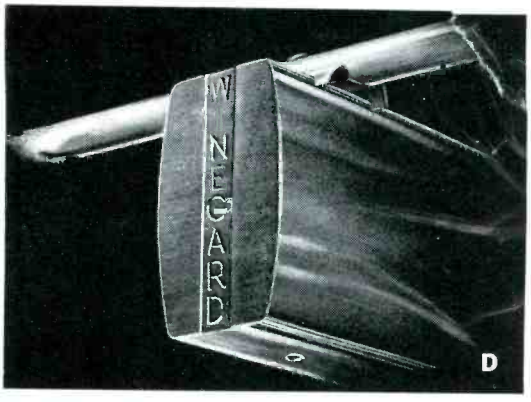
WEST—
SARKES TARZIAN, Inc.
Tuner Service Division
10654 Magnolia Blvd.,
N. Hollywood, Calif.
Tel: 213-769-2720

Winegard Introduces Super Compact Total Design Electronic SUPER COLORTRONS



Five 82-Channel Models
Four VHF/FM Models
Three UHF Models
...so revolutionary in design and concept, they have 7 patents and patents pending

82-Channel Super Colortron
Model SC-82; $54.95



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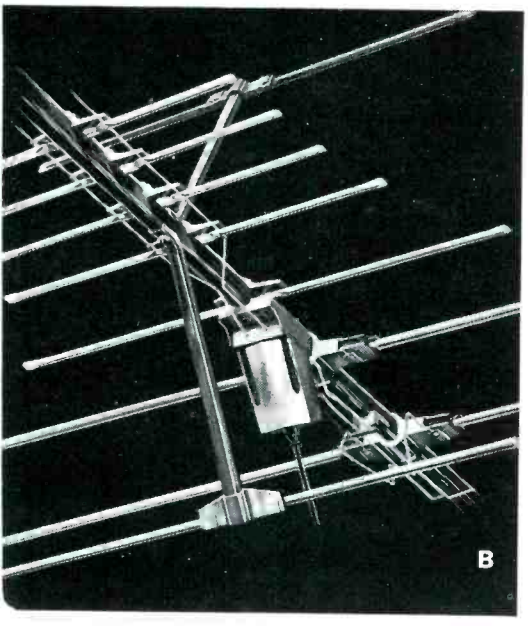

B

The World's First Total Design Antennas

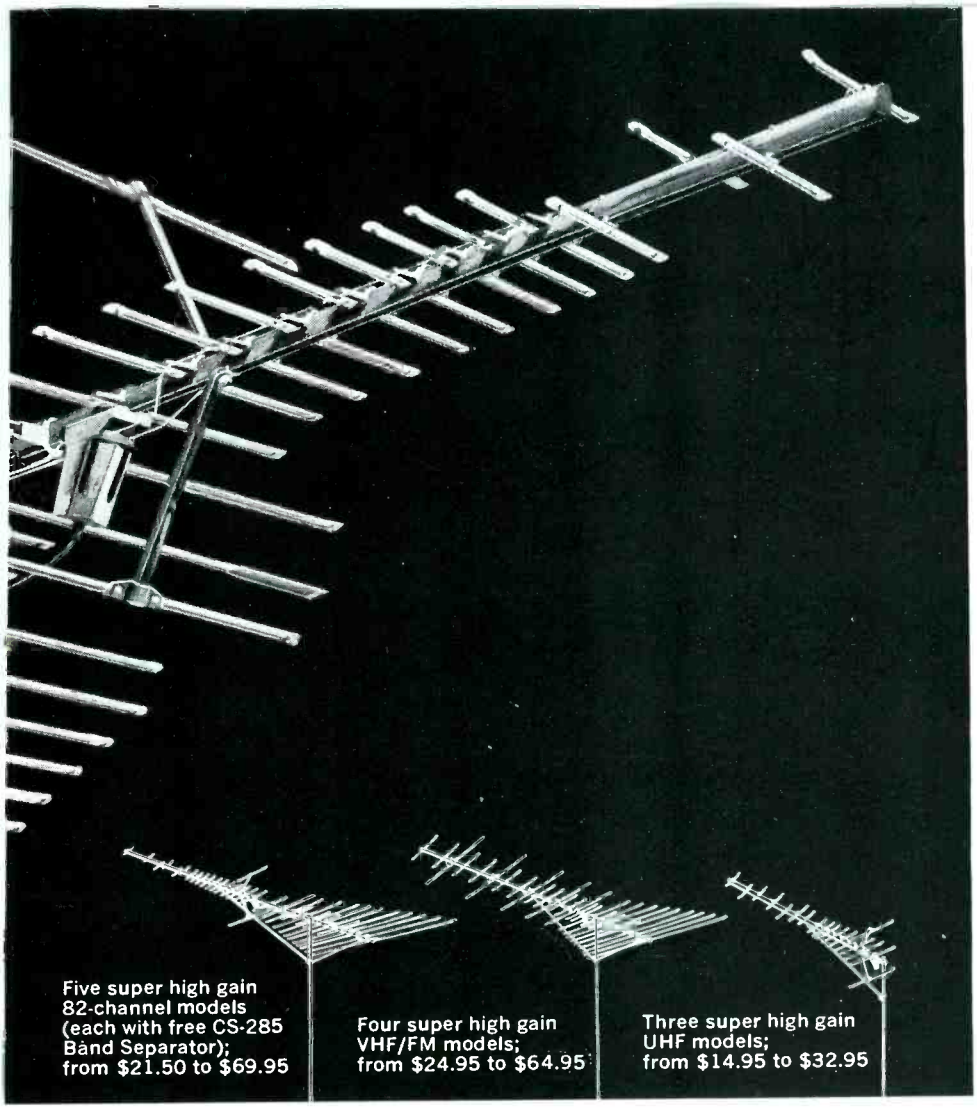
New antennas come and go. But there's never been an antenna like the amazing Winegard Super Colortron. 12 models in all—totally designed with more exclusive electronic, construction and performance features than all other antennas combined. It's taken us a while to create and develop and perfect the Super Colortron. But it was worth the time. See for yourself. Read about the Super Colortron's exclusive features. Then call your Winegard distributor. Or write for full color, 8-page brochure.

(A) Total Design Cartridge Pre-Amps: Exclusive solid state, instant-loading cartridge pre-amps drop into totally enclosed, weatherproof cartridge housing at point of signal interception. Models for 82-channel (VHF-UHF) antennas, VHF only, UHF only—plus a color spectrum filter. Custom-match the Super Colortron to any reception requirements.

Total Design Impedance Correlators: Exclusive impedance correlators (2 patents pending) automatically increase 75 ohm driven elements to 300 ohms to provide 100% signal transfer from antenna to set. Enables antenna to be 20% more compact!

(B) Total Design Vertical Resonant Reflectors: Exclusive UHF vertical resonant reflectors achieve highest realizable gain on channels 14-83 because of exceptionally large vertical capture area. More UHF gain than any other 82-channel antenna design.

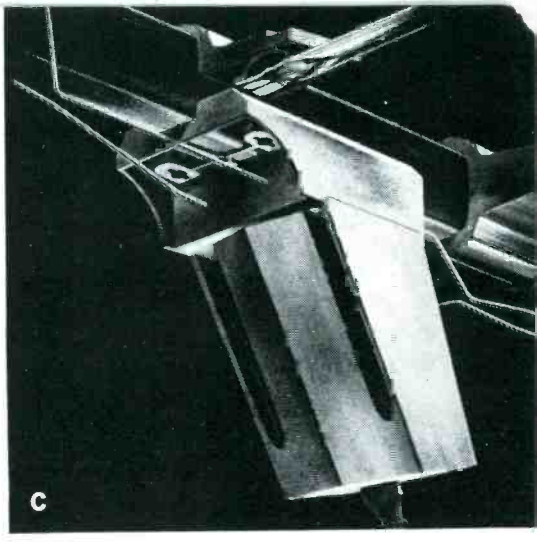
Total Design Electro-Lens Director System: Exclusive patented Electro-Lens system (U.S. Patent 2,700,105; Canada 511,984) absorbs entire signal and focuses it directly onto the driven elements to give Super Colortrons pinpoint directivity.



Five super high gain 82-channel models (each with free CS-285 Band Separator); from $21.50 to $69.95

Four super high gain VHF/FM models; from $24.95 to $64.95

Three super high gain UHF models; from $14.95 to $32.95



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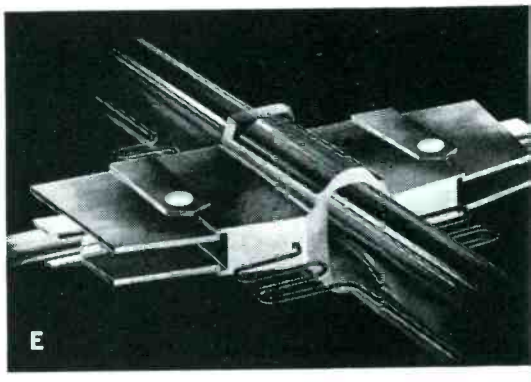

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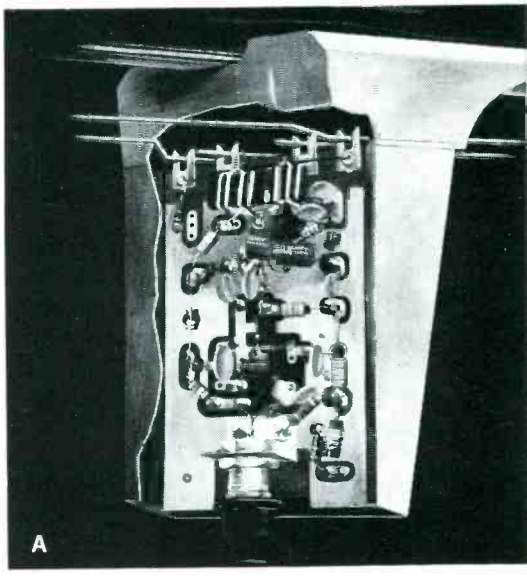


A

Total Design FM Control Element: Exclusive FM element provides high gain on FM bands—and enables you to attenuate FM bands in areas where strong FM signals interfere with TV reception.

(C) Total Design Cartridge Housing: Exclusive housing is an integral part of Super Colortron—built-in and permanent. Completely weatherproofed to protect solid state cartridge pre-amps and connections.

(D) Total Design Ellipsoidal Boom: Exclusive boom is the first aluminum tubing shape engineered especially for antenna use. Proved far stronger than any other existing boom design.

(E) Total Design Wrap-Around Insulators: Exclusive low loss dielectric insulators completely encapsulate and weatherproof elements and correlators at point of electrical contact. Hi-impact polystyrene. Provide perfect alignment of elements and eliminate sagging and loosening.

. . . for more details circle 137 on postcard

Total Design High Tensile Aluminum Elements: Exclusive aluminum alloy has PSI rating of 38,000 as compared to 27,000 PSI for alloys used in other antennas. More than 49% stronger—and 29% more resistant to bend and wind distortion.

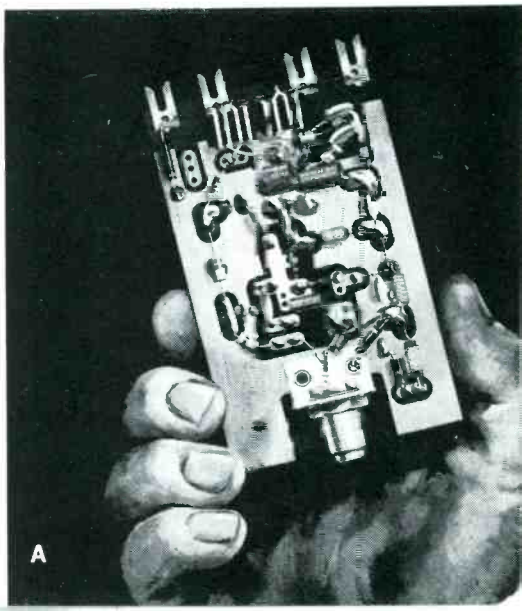
Total Design Wrap-Around Mast Clamp: Exclusive mast clamp has 4 pair of locking jaws (not just 2) to automatically align antenna on mast and for greater strength and durability. Requires only one U bolt.

Total Design Gold Anodizing: Exclusive Gold Anodizing is the only permanent gold finish used on any antenna—the only positive protection against corrosion and fading.

Total Design Assembly: Exclusive construction makes the Super Colortron truly easy-to-install—unfolds in seconds—completely factory pre-assembled.

Winegard
ANTENNA SYSTEMS

WINEGARD COMPANY, 3000 KIRKWOOD STREET, BURLINGTON, IOWA 52601



A

RCA VICTOR

Mark 8 Stereo Tape Player—Technical and Circuit Description

These players, models YHD38 and MHC60, use an 8-track prerecorded tape cartridge. Both models employ the same basic mechanism.

The cartridge serves as the basis for the tape music system employed in the series. The cartridge is made of molded plastic construction and contains in addition to a continuous tape loop, a pressure roller and a pressure pad

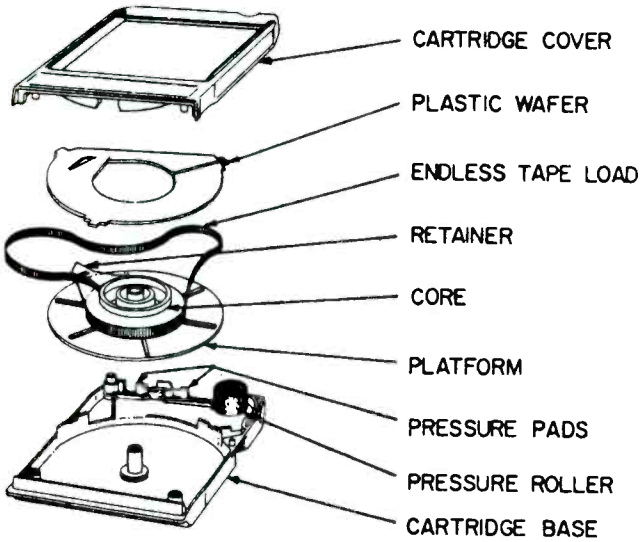


Fig. 1—Exploded view of the tape cartridge.

assembly (see Fig. 1). The continuous tape loop contains four recorded dual tracks (8 total). Each dual track will play about 20min for a total maximum playing time of 80min. At the end of each recorded selection, a metallic strip on the tape makes contact with a pair of track selector contacts which shift the playback head to the next dual track (see Fig. 2).

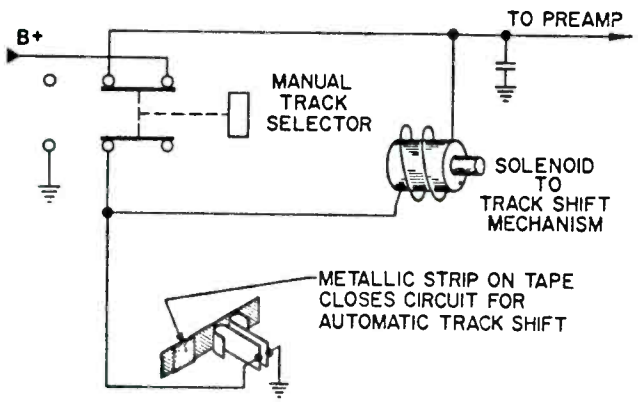


Fig. 2—Automatic track switching on the Model MHC60.

In operation, tape is withdrawn from the inside of the coiled tape loop. As the tape is pulled from the cartridge it causes the platform, on which the tape coil rests, to rotate. The tape is pulled past the automatic track-shift contacts and the stereo playback head by the pinch action of the capstan shaft in the mechanism and the pressure roller in the cartridge.

The cartridge pressure pads press the tape against the track-shift contacts and the tape head. After leaving the rotating capstan and pressure roller, the tape is rewound on the outside of the tape coil.

As successive turns are wound on the coil and tape is withdrawn from the center, the turns move toward the center of the endless coil. The tape coil, because of the lubricant on the tape back, slides freely, minimizing the possibility of the tape binding within the cartridge.

The tape transport mechanism is quite simple since only one direction and one speed (3ips) are used. Also, since the cartridge contains some functional parts, such as the pressure pads and pressure roller, the transport mechanism is further simplified.

When the cartridge is inserted into the mechanism it closes a micro-switch and applies power to both the amplifier circuitry and the split phase synchronous drive motor.

A motor belt drives a flywheel capstan assembly and the tape within the cartridge is pressed against the capstan by the built-in pressure roller in the cartridge. Because of the constant speed characteristic of the synchronous motor and the inertia of the heavy flywheel, tape is pulled past the playback head at a constant speed of 3-¾ ips.

At the end of each prerecorded stereo (dual) track, an aluminum strip on the tape activates the track selector solenoid and shifts the head position down to the next step and the next pair of tracks are played. This continues until all four dual tracks are played. At this point, the playback head moves back to the first position and repeats the sequence.

Attached to the end of the solenoid plunger is a two

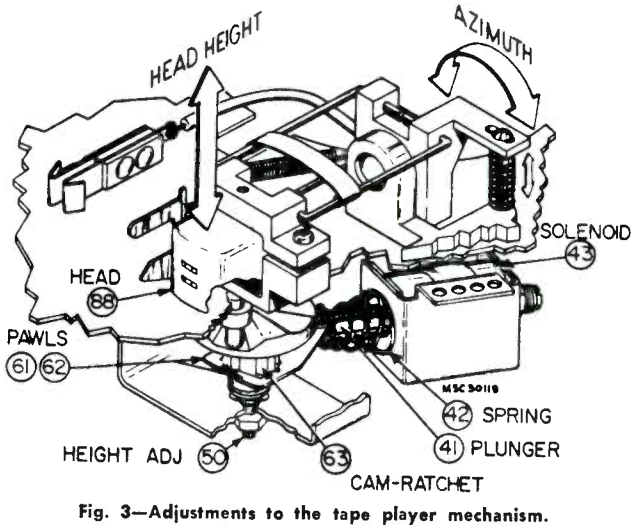


Fig. 3—Adjustments to the tape player mechanism.

piece pawl (see Fig. 3). A spring presses the pawl pieces against an eight-step ratchet which is part of the head positioning cam. When activated by either the tape's

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TECHNICAL DIGEST

conductive strip or the channel selector bar, the solenoid pulls in.

As the plunger moves in, a tooth on one of the pawl pieces engages the ratchet causing it to rotate partially to the next position. When the solenoid coil power is interrupted, a return spring pushes the plunger out of the coil. This action causes the tooth on the other pawl piece to contact the ratchet and complete the rotation to the next step.

A pin, which rests on the stepped surface of the head positioning cam, moves the playback head up and down (from track to track) as it follows the discrete steps on the cam surface. Because the cam has eight indexed positions only a half revolution of the cam is required to sequence a tape cartridge completely.

The eight tracks on the prerecorded tape are arranged so that tracks one through four are left channel tracks and five through eight are right channel. Thus, the first of the four head positions plays track one left channel and track five right channel. As the head shifts through the remaining steps, tracks two and six, three and seven and four and eight are sequentially played.

The solid state amplifiers used in these players are said to be less complex than tape recorder amplifiers (see Fig. 4). Without the "record" function on the tape players,

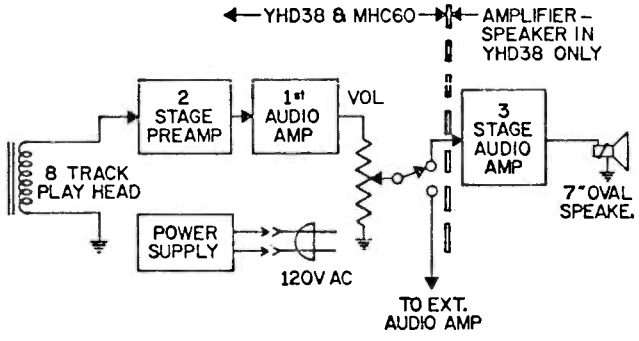


Fig. 4—Block diagram of the stereo tape player.

there is no need for function switching or bias circuitry. In this system, the cartridge is never "turned over," tape travel is always in one direction only, and this is said to simplify the electrical circuits since no "track switch" is required.

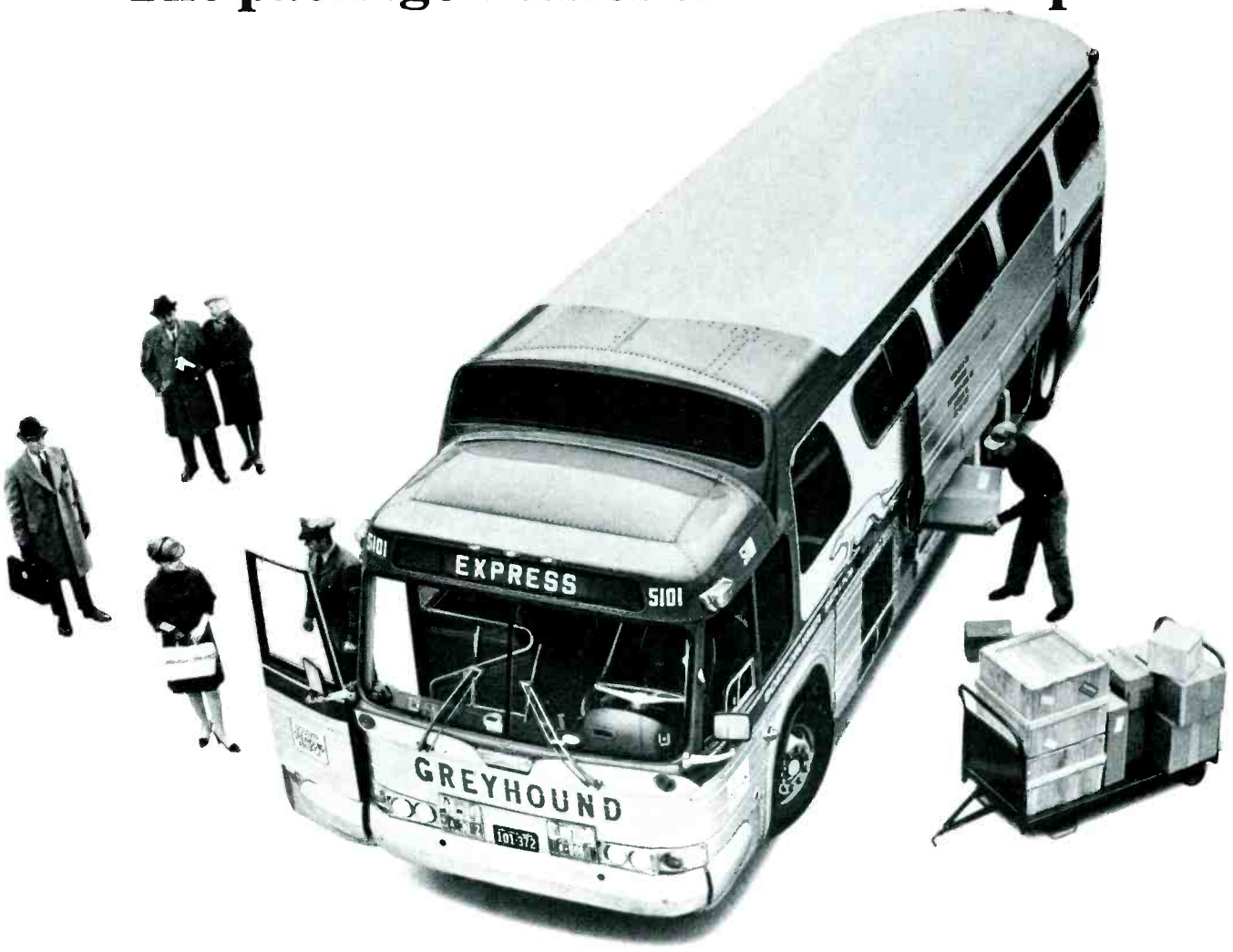
Track switching takes place through mechanical means only — by vertical travel of the play head — to play back the prerecorded information.

Both the YHD38 and MHC60 use a 4-transistor (2 per channel) solid-state preamplifier equalizer. These two preamplifiers are combined on a single circuit board mounted on the tape transport mechanism. This reduces hum pickup and permits shorter lead length from the tape head to the preamplifier. The design provides the required tape playback frequency compensation.

A dual audio amplifier (mounted separately on the chassis) feeds a dual volume control. In the MHC60 a 6-ft shielded cable then connects to an external amplifier system.

The YHD38 table model tape player includes a 6-transistor dual channel power amplifier (see Fig. 5). Tone

The package carrier that never sleeps



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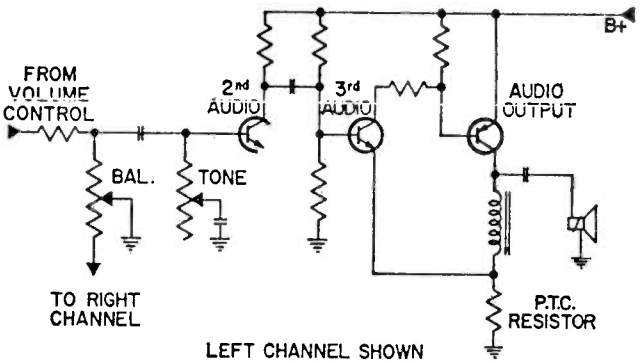

Fig. 5—Simplified power amplifier schematic.

and stereo balance controls are used and a single voltage amplifier stage following the tone and balance control circuitry provides high level audio for the drive power output stages. The output stage is impedance coupled by a choke-capacitor combination to drive a 35Ω 7in. oval speaker.

Proper power amplifier circuit stability requires the positive temperature co-efficient resistors to be replaced only with components having similar characteristics.

The manner in which recorded information is placed on the tape differs depending on the system used. Track placement and direction of travel for 2-track, 4-track reel-to-reel and 8-track stereo tapes are shown in Fig. 6.

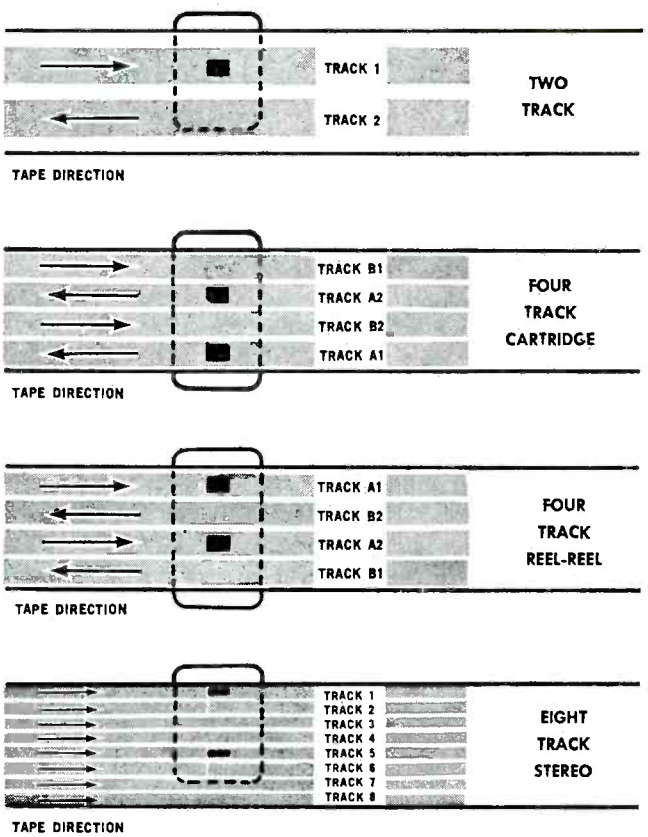

Fig. 6—Track placement and direction of travel.

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ULTRA LOW LOSS UHF/VHF RG-59 TYPE COAXIAL CABLE

- **LOWEST COST 82 CHANNEL CABLE**
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100% SHIELDING literally creates a direct line to color.

Until now, total shielding has been used only on transmission cables in commercial and military communications, radar, and in professional audio and broadcasting installations. Here, where complete shielding from radiation and interference pick-up are critical, the solid tube type of shield has always proven most effective.

NOW, Channel Master has applied this proven 100% shielded construction... for the first time in TV history ...to 75-ohm coaxial cable designed for MATV and home television installation. Yet, it has all the flexibility and handling ease of ordinary coax.

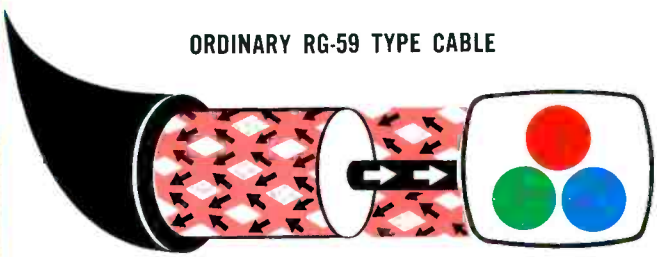
Channel Master's over-all shield is created by laminating aluminum foil to both sides of high tensile strength mylar.

This shield is then totally wrapped and over-lapped around the virgin polyethylene dielectric core containing the copper clad center conductor.

Before the black outer jacket is applied, four equally spaced, parallel wires are positioned around the circumference of the shield. In addition to providing extra strength to the cable, these wires maintain electrical conductivity even if a break should occur in the shielding.

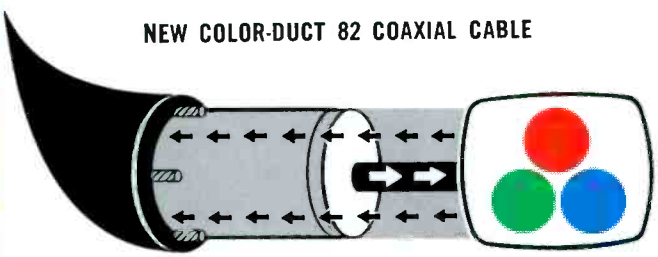
In ordinary braided shielding, air spaces are formed between the wire strands, reducing both the conductivity and the shielding effect from 80 percent in the best quality coax to as low as 50 percent in lower grade cable where fewer strands have been used in the braid.

ORDINARY RG-59 TYPE CABLE



While current in the center conductor flows in a straight line with minimum resistance, to complete the circuit between set and antenna, return current must traverse individual braid strands in a "maze" pattern that creates a resistance loss. In lower grade standard coax with fewer strands, this loss is even greater.

NEW COLOR-DUCT 82 COAXIAL CABLE



The over-all shield, plus four wires, conducts current through the same low resistance, straight-line path as the center conductor. The result is lower db loss per 100 feet at both VHF and UHF. In fact, at higher UHF frequencies in the average installation, use of Color-Duct 82 instead of ordinary coax is actually the equivalent of adding a 3 db amplifier to the installation! This is a tremendous advantage for UHF color as well as VHF fringe area coaxial installations.

Finally, new Color-Duct 82 is so economical you can now give the owner of any set... UHF, VHF, Color or Black and White... the luxury of a professional coax installation.

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From now on, the antenna is the only equipment you'll ever need change to make any MATV Installation 82-channel.

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So... if you're designing for VHF, use these amplifiers. If it's UHF, use these amplifiers. If it's UHF **and** VHF, use these amplifiers.

15 DB COLOR BOOSTER (Model 7264). Mast-mounted 75 ohm preamplifier with separate power supply. Also available in 300 ohm (Model 0062).

15 DB COLOR DISTRIBUTION AMPLIFIER (Model 7263). 75 ohm MATV distribution amplifier. Also available in 300 ohm (Model 7260).

30 DB COLOR TANDEM AMP (Model 7261). Separate 75 ohm preamplifier and amplifier. Also available in 300 ohm (Model 7262).

And, these new amplifiers are matched with a complete line of UHF/VHF coordinated equipment: Baluns, Splitters and Mixers, Attenuators, Wall Tap-offs, Line Drop Taps, and Matching Transformers. Add new Channel Master Color-Duct 82 Coax Cable (its loss is so much lower you can actually revise your cable calculations) and you're ready **now** to install the most efficient 82 channel MATV systems available anywhere.

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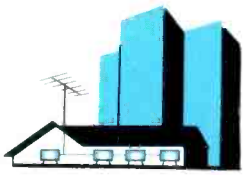


TECHNICAL DIGEST

The approximate playing time per single track for various tape footages and tape speeds is listed in Chart I shown below.

TAPE FOOTAGE	TAPE SPEED	PLAYING TIME (APPROX.) per single track
600	1⅞ IPS	1 hr.
	3¾ IPS	½ hr.
	7½ IPS	¼ hr.
1200	1⅞ IPS	2 hrs.
	3¾ IPS	1 hr.
	7½ IPS	½ hr.
1800	1⅞ IPS	3 hrs.
	3¾ IPS	1½ hr.
	7½ IPS	¾ hr.
2400	1⅞ IPS	4 hrs.
	3¾ IPS	2 hrs.
	7½ IPS	1 hr.

PLAYING TIME CHART

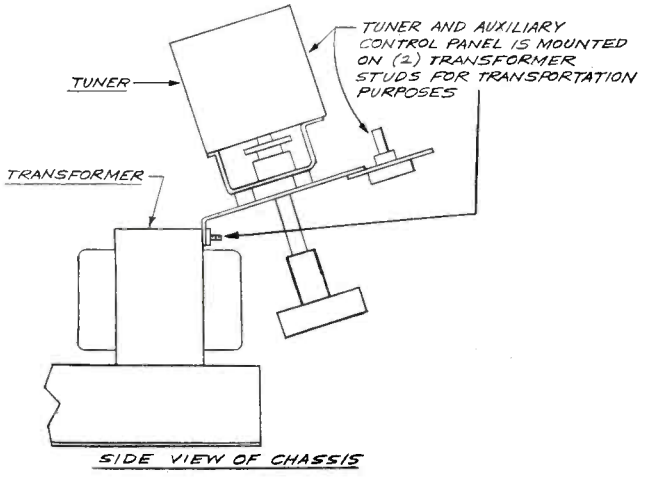
Chart I—Approximate playing time per single track.

Stereo cartridges contain approximately 400ft of tape in a continuous loop; at 3-¾ ips. This gives a playing time of about 20min for each stereo selection or 80min playing time for a 4-selection cartridge.

OLYMPIC

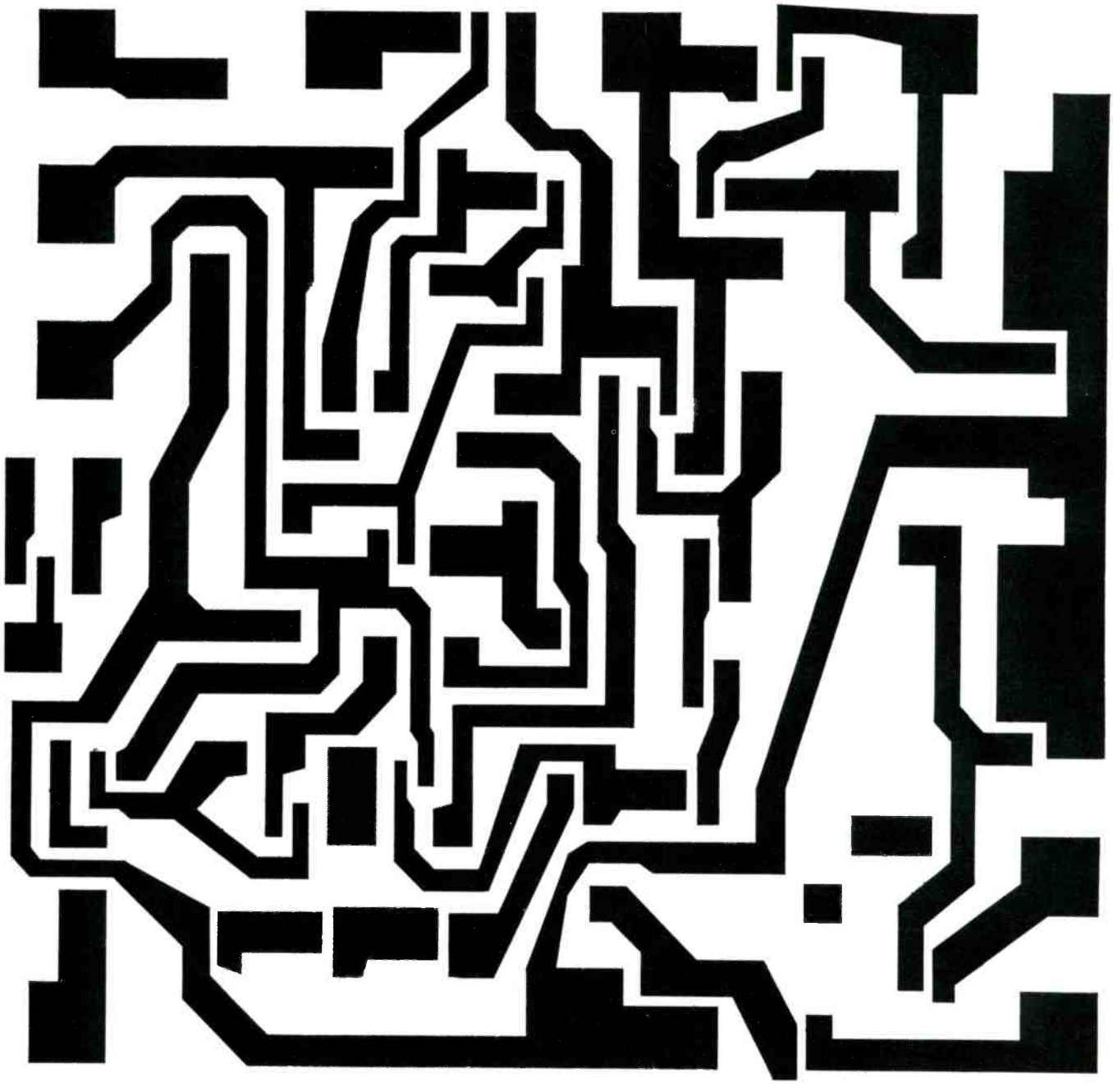
AM/FM Tuner Models 19, 20 & 21— Removing Chassis From Cabinet

The tuner and control panel assembly will dangle when the chassis is removed from the cabinet, and it may damage other components if placed on top of the



chassis. Damage can be prevented if the tuner and control panel assembly are mounted on the power transformer. By attaching the two as shown in the illustration above, the chassis can be transported without danger of damage to components.

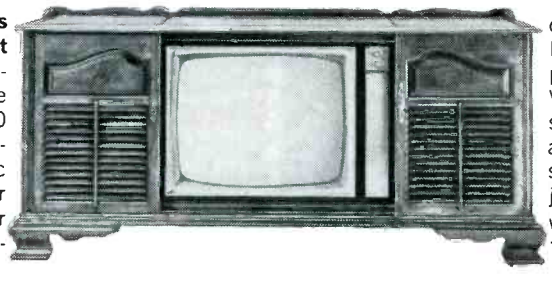
Start here:



and come out dollars ahead.

(It's an integrated circuit—and RCA Victor uses it now.)

Blown up to several thousand times its actual size, an RCA integrated circuit looks like no more than a maze. In actuality, it's no less than amazing. Just one of these silicon chips may incorporate 40 or 50 electrically interconnected components. Patterns that make up the mosaic are as narrow as two human hairs. Far more amazing than that, though, is their dollar-making potential. Integrated circuits are designed to be the most reliable kind of circuitry ever made for a consumer product. Reliability is what prompted RCA Victor to use integrated circuits in the sound system of some of our newest color and black-and-white TV sets. When you start with an integrated circuit, there's just no telling where it can take you.



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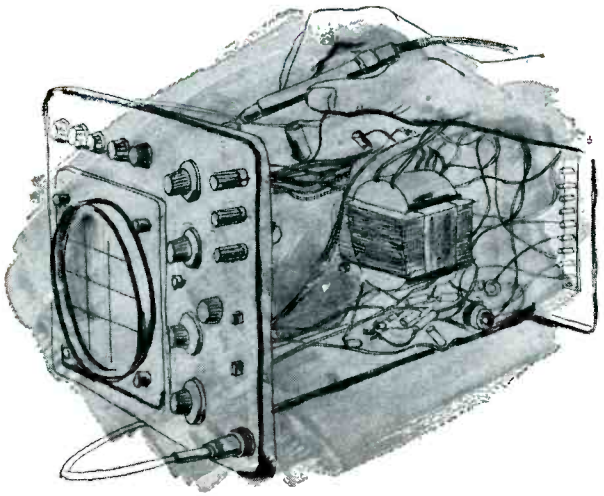
MAY 1967

Keep Your Test Instruments Up to Par



Learn how to maintain your 'bread-and-butter' tools in top operating condition

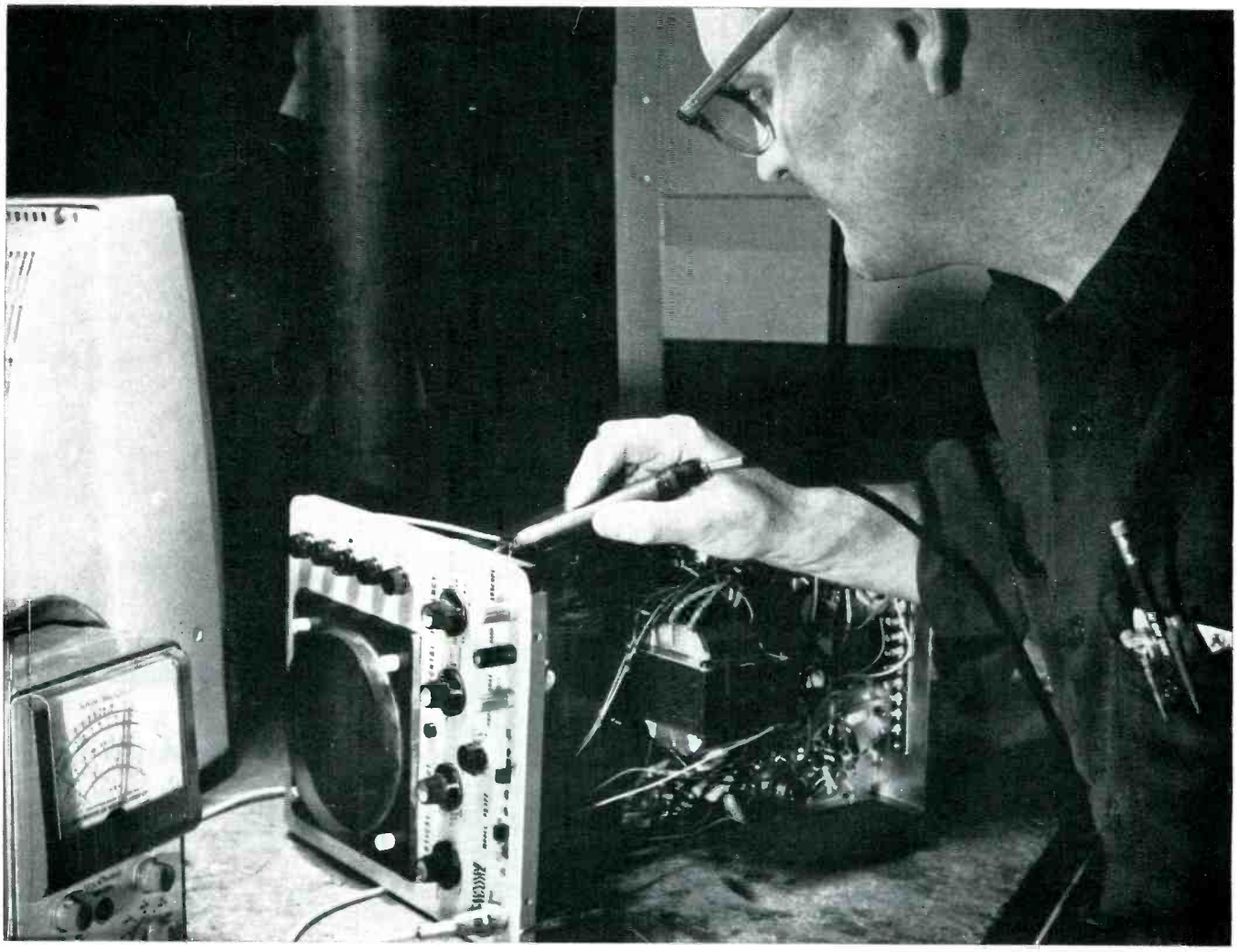
■ Accurate, dependable test instruments are the most important tools used by service technicians. We lean heavily on tube testers, VOMs, VTVMs, scopes and other test gear to quickly diagnose failures in TV, radio, Hi Fi, two-way audio and radio communications equipment. But test instruments are not worth much unless we keep them in top working order.

If you do not have a test instrument preventive maintenance program, then you may run into test instrument problems at any moment. If this happens, you should know the trouble symptoms and how to get the instruments back into working order quickly.

Test instruments must be checked, repaired and calibrated periodically. The technician who is "too busy" to check his test instruments is being "minute-wise and hour-foolish," to paraphrase an old saw.

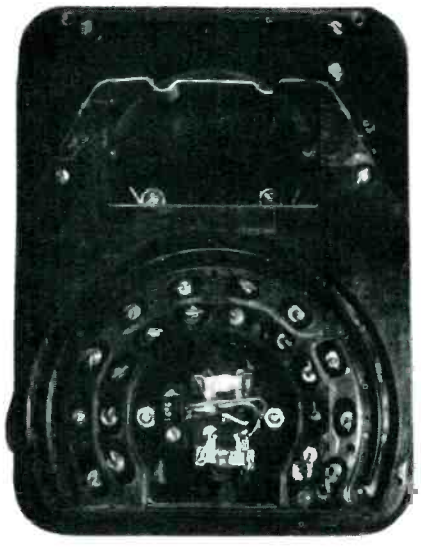
The Tube Tester

Do you have an up-dated roll-chart for your tube tester so you can check the latest tubes? If not, you may find yourself badly embarrassed any moment — and lose money too. Write the manufacturer for the latest roll chart. And when you replace the roll-chart and have the front panel off your tube tester, see if any of the tube socket pin-contacts are loose or worn. Some tube testers have an entire socket assembly that can be replaced peri-



Making voltage checks on the horizontal section of a defective scope.

Fig. 1—Two silicon diodes soldered across the meter terminals will prevent meter damage.



Burned wirewound resistor (bottom) disabled this VOM.

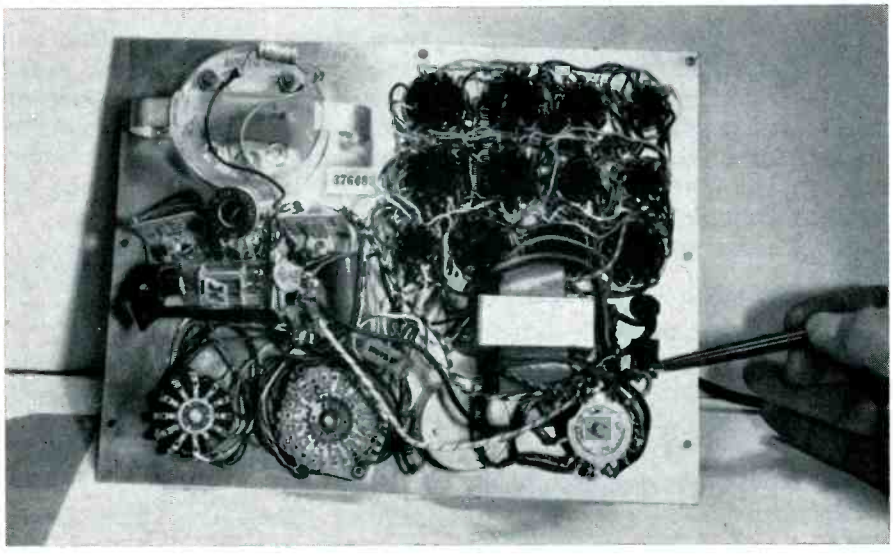
odically when sockets become defective.

If in doubt about a tube tester's voltage, for example, substitute a new low-voltage rectifier. A dirty or worn bias-shunt control can cause erratic readings. These controls can frequently be cleaned — but if badly worn, they should be replaced.

When the tester is dead, you would naturally check the line fuse first. Then, depending on circumstances, check the ac switch or power cord. Generally, a break in the power cord will be near the plug. Also check the cord at the point where it enters the tube tester chassis.

If the meter needle does not register properly on LINE-TEST, check the meter's zero setting. Also, look for a dirty or worn rheostat or

Fig. 2—Important information may be taped to the bottom of a test instrument for safe keeping.



Pencil points to small wire broken from neon pilot light and dropping resistor.

a loose line-test control knob. And, in the event an instrument meter becomes defective, it is usually best to return it to the factory for repair.

If a tube does not light when you insert it in a tester socket, try another known-good one. Recheck the chart settings and make sure the tester is at fault before you begin taking it apart. If a known-good tube does not light, the heater terminals of the tube socket are worn or the heater selector switch is defective. Clean the heater selector switch and all function switches with a good contact cleaner.

For instance, if a 12v tube fails to light in a 7-pin socket, try a 12v tube in the 9-pin socket. If the tube lights OK, you know that the heater selector switch is OK but the 7-pin socket is defective or a wire to a heater terminal on the socket is broken or making inadequate contact.

The VOM and VTVM

Besides the tube tester, the VOM and VTVM are two work-horses in any electronics repair shop. Generally, when a prod or alligator clip breaks off a test lead, the lead becomes shorter each time the prod or clip is replaced. Before too many years pass, the VOM and VTVM leads become very short. It is best to install a complete new set of test leads when a prod or clip comes off. Worn or loose jacks should also be replaced.

Check all voltage and ohmmeter scales to see if they are working properly. Weak cells are generally the cause of zero problems. And several sets of cells may be used in larger volt-ohmmeter instruments.

In a typical VOM, if the pointer does not adjust easily to the ZERO point when the switch is in the low-ohm-range position, the problem can usually be solved by replacing the large 1.5v cell. If the Rx10K scale will not zero in, any one of the four penlight cells can be weak.

If any one voltage scale of a VOM does not function, suspect a burned or open multiplier resistor. Some resistors are carbon and some are wirewound. These resistors can be ruined if too much voltage or current is applied to them.

To protect you VOM from meter burn-out, install two 1N1692 silicon diodes parallel across the meter terminals as shown in Fig. 1. Many recently made VOMs have these diodes already installed.

Clean the meter case with soap and water or denatured alcohol. Spray all function switches with contact cleaner. Cracked or broken plastic cases can be mended with cement.

When a test instrument is first purchased file the instruction manual and schematic where you can find it easily. And don't forget to read it periodically. It may prove helpful also to tape certain important information beneath the test instrument for quick reference (see Fig. 2).

Make a quick inspection of the test leads on the VTVM. Replace all defective test leads and jacks. Check all controls for rough spots and dirty contacts. Sometimes the low-ohm scale won't zero in because the 1.5v cell is weak. These cells should be replaced at least twice a year. Check and replace all shorted, leaking or low-emission tubes.

The high megohm resistors in the VTVM test probe should be checked for accuracy. This is important when it is necessary to make high or low voltage measurements — especially when working on solid-state equipment and when checking or adjusting HV sections on color TV equipment.

Calibrating Your Meters

The VOM and VTVM voltage scales can be checked for reasonable

accuracy by using new cells. Several cells can be placed in series to make a battery to provide a required scale reading. If a certain voltage scale if far out of tolerance, suspect a voltage dropping resistor. The low voltage scale should have a tolerance close to ±2.5 percent. The higher voltage scales can be within ±10 percent and still be OK.

If you have a variable dc voltage power supply, with known outputs, it can be used to check each voltage scale of the meter by measuring the various known voltages. Another method is to compare the various voltage readings of the meter being checked with those of a new meter which is known to be within tolerance. There are usually several VOM and VTVMs in the well-instrumented shop.

The ac voltage scale can be checked against a known ac voltage — like an ac power line voltage which is known to be within ±10 percent. A variable transformer is necessary for this work. This voltage can be checked against an RMS-calibrated scope screen.

If your meter appears off, suspect a voltage-dropping resistor or a diode rectifier.

Check the ohmmeter scale with resistors known to have a tolerance of not more than ±5 percent. Place them in series or parallel to check the required ohmmeter range. A multiplier resistor will give a poor reading on a given ohmmeter scale and weak cells will also cause incorrect ohmmeter readings.

The milliammeter scale of VOMs must be accurate when checking todays' solid-state circuitry. Likewise when checking current in horizontal output circuits of color receivers. It can be calibrated by comparing it with another known-good milliammeter. Simply connect both meters in series across an open ON/OFF switch of a portable transistor radio. The current drawn by the radio should register the same on both meters.

Checking Your Scope

Your oscilloscope has a few circuits similar to those in a TV receiver. A horizontal oscillator, phase splitter and horizontal amplifier produce the horizontal sweep time-base, while vertical amplifiers boost the actual waveforms. There is also a low and HV rectifier.

A good spare scope may be used to check the various horizontal stages of the defective instrument. Begin at the horizontal oscillator and trace the sawtooth waveforms to the scope screen. Most scope manufacturers furnish proper waveforms with their scope manuals.

Loss of gain or trouble in the vertical section can be checked with an RF or audio signal generator. When suspecting vertical gain problems, go directly to the vertical amplifier section. This also applies to the horizontal and power supply stages.

Check all tubes in the defective section first and if necessary, proceed to voltage and resistance checks. Before placing the scope chassis back in the cabinet, check both the horizontal and vertical centering controls. Also check the focus for a sharply defined pattern.

Actual Instrument Troubles

We had one scope that showed nothing but a green dot on the screen. There was no horizontal base line when the horizontal gain control was full up. But when the vertical input probe was grasped in one hand, the vertical sweep went straight up and down. This proved the vertical section was working.

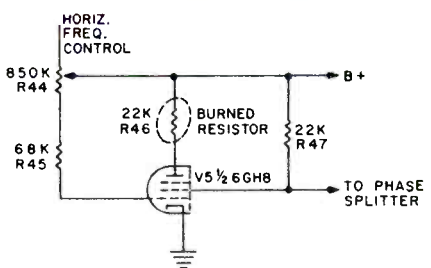


Fig. 3—Resistor R46 measured 1.8K after overheating.

All horizontal tubes were checked on a tube tester and a 6GH8 horizontal oscillator tube showed a short. The tube was replaced but we still had no horizontal sweep. Voltage checks were then made and the voltage at element 6 (plate) was too high (see Fig. 3). This potential should normally be 40v but it was 275v. The plate load resistor measured 1.8K and should normally be 22K. When the plate load resistor was replaced, horizontal sweep became normal.

A tube tester had one neon shorting lamp that remained unlit. All five neon lamps must light in this tester before a tube is placed in a socket. When any neon is out, this indicates a short between two tube elements. The neon short assembly was removed from the front panel and one wire was found broken from a neon lamp.

A portable tube tester's pilot lamp would not light. This small tester is used for home and emergency calls. The trouble turned out to be simple: a broken lead on the neon voltage dropping resistor.

One morning one of our audio signal generators was connected to check out the stereo section of a phono amplifier. Either the entire amplifier section was dead or we had trouble in the generator — nothing came out at the speaker. Since the left channel amplifier was working in the cabinet, we suspected the signal generator.

The generator's connecting cables and plugs were checked and found to be good so the chassis was pulled from its cabinet. A quick visual inspection turned up a dead 6X4 rectifier tube. All tubes were checked before replacing the chassis.

A solid-state auto radio seemed to have at least two separate troubles — intermittent audio and loud filter hum. First, the filter capacitor was replaced but the hum was still there. We checked for an ungrounded transistor base and other hum sources but nothing turned up. A large electrolytic was shunted across the radio's filter capacitor and the hum diminished.

The same filter was shunted across the 12v bench power supply and the hum was much lower. The bench power supply was opened and both electrolytic capacitors were replaced. We had no more trouble with hum in the auto radio.

Practically all test instruments found on the TV service bench can be repaired and kept in top condition by a shop technician.

Faults can be located by using ordinary troubleshooting techniques and by following schematics. ■

Showmanship Builds Big-Ticket Sales

Emphasis on high-quality, 24-hour service keeps this service-dealer operation humming

■ When you're selling TV you're in show business.

That's the approach Don E. Wheeler, Bakersfield, Calif., takes in building TV sales and service.

Showmanship at Wheeler TV includes a can't-be-missed store exterior located in a heavy-traffic area, a luxurious shopping environment with a big presentation of TV, stereo and records, a vigorous advertising program and a shop that gives around-the-clock service.

Wheeler TV is topping $200,000 yearly in sales and service in a city with a population of 130,000. Bakersfield, with an economy based on agriculture (mostly cotton) and oil, did not have a good year in 1966 because of the depressed cotton market.

"But our December sales ran five percent above the previous year," Mr. Wheeler says. "Sales so far during 1967 indicate that we'll continue to show small increases through this year. I believe this is because we have the proper sales and service format to gain our share of the market."

Wheeler TV is selling quality to a broad market. The total merchandising format is geared toward reaching all income groups.

"We've eliminated the low-profit models and lines," Mr. Wheeler continues, "but this emphatically doesn't mean we're selling only to the upper income brackets.

"First, it's necessary to recognize that some changes in "status symbols" have taken place. A big, shiny car is still a status symbol but a handsomely appointed home is becoming an even better symbol for people in all income brackets. This gives the service-dealer a broader market for quality and style.

"Another factor is the rise of the big youth segment of the market and their special interest in stereo. Put the two together and the future looks bright for the independent service-dealer, even though manufacturers are reporting that the mass merchandisers will bite off a continuing larger share of the market."

Don Wheeler has been in business in Bakersfield for 20 years. Sixteen years ago, he relocated his business on a heavy-traffic street used by most of the trading area shoppers when they travel between the two big discount houses in Bakersfield.

Showmanship . . .

"We've got the best kind of location for an independent service-dealer," Mr. Wheeler smiles. "The discount houses promote heavily and we get the benefit of their traffic because people can't miss us when they drive down this street.

"People who are buying a big-ticket item are going to shop around, and they'll give you a look, too, if you're conveniently located and have plenty of parking space."

The can't-be-missed exterior of Wheeler TV has an all-glass front that turns the showroom into a big showcase. At night, strong lights left on inside the showroom attract the attention of passing motorists. A large lightbox sign flashing "Wheeler's TV—Stereo" and the big parking lot across the entire front of the store invite motorists to stop and shop.

"Good parking facilities are a must," Mr. Wheeler points out. "We need some time to explain to shoppers why they should pay fifty to a hundred dollars more to get the most out of home entertainment. If they're worrying about overtime parking, that's going to interfere with our getting the message across."

Wheeler TV started with a 25-ft front, added 50-ft as the business grew. Sales and service departments now take up 7500 sq ft of space and there is 2500 sq ft in parking area to handle 25 cars comfortably.

Separate Showrooms

The sales area is set up in separate showrooms—two showrooms for TV, one for stereo, one for records and tapes. Each department has a separate entrance from the parking lot.

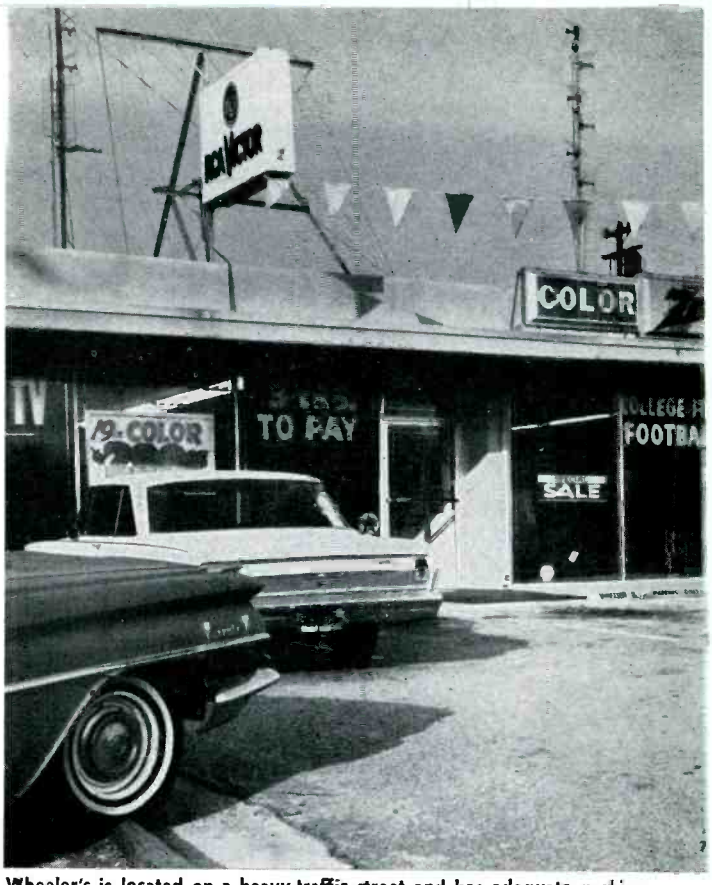
Each of the two TV rooms has a specific purpose. One room, at the front, is for shoppers who are taking a look around at all the sets. The rear room is the demonstration room. It has "dimmer switches" set in the wall, permitting salesmen to show sets under different lighting conditions — through various stages of dim, up to brighter lights than are used in most homes.

Stereo Center

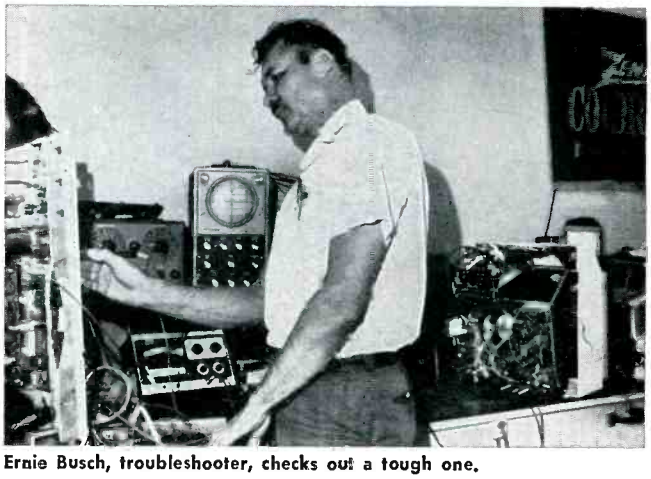
The stereo showroom is between the TV and record department. A wide door at the rear of this showroom leads into the service department which runs behind the stereo and record departments.

A glass wall, from waist-high to the ceiling, separates the stereo sales floor from the record department. The two are thus tied together visually while at the same time stereo demonstrations are not interrupted by sounds from the record department. The record department attracts the young people who are the big customers for stereo.

Except for a few table models shown unobtrusively along the walls, the TV and stereo departments are



Wheeler's is located on a heavy-traffic street and has adequate parking space for drop-in customers.



Ernie Busch, troubleshooter, checks out a tough one.

Service manager Hoyt Ridings takes a service call.

Partial view of stereo department. Note look-in windows to service department and glass wall at right which separates the stereo section from the record department.

jam-packed with console models. Nearly all sales are being made in the $300 to $500 category, with 30 percent of sales being made in home-entertainment centers.

Sales Techniques

Salesmanship at Wheeler's means spending plenty of time with the shopper and pushing for a complete demonstration.

Since most shoppers are first of all interested in price, the dealer recognizes that his luxurious environment, so important in closing the sale, makes it harder to open.

When approached, most shoppers say "just looking around." The salesman welcomes them and a few moments later offers a demonstration. The specially lighted room at the rear of the TV floor is generally the breakthrough to a demonstration when the salesman points out that he'd like to show how color TV looks under any and all lighting conditions that may be found in the home.

Mr. Wheeler has two TV and stereo salesmen and also does his share of the selling. There is some problem, he says, in finding salesmen who will carry out the store's low-pressure selling techniques. The salesman must be a showman who is 100 percent sales-minded, but that doesn't mean he must be high-pressure.

"A salesman has to be somewhat aggressive or he's no salesman," Mr. Wheeler emphasizes. "He must think selling — from $10 to $1000. If he tends to oversell, however, he's not for us. The main way salesmen oversell is to promise more than the house or the product can produce.

Product knowledge is the primary weapon of a good salesman, Mr. Wheeler says.

"Once the salesman knows his product, he need only be pleasant and honest." The only reason people come into a TV showroom is because they're planning to buy. Therefore, we always have a positive sales approach — every shopper is a potential customer. Our problem is how to upgrade the sale and overcome the shopper's tendency to be concerned with price. Knowing the product equips the salesman to make an easy and effective demonstration and gives him confidence in his ability to handle the soft sell.

"We also try to keep our people alert to suggestion-selling — for example, to suggest a portable transistor radio or a new clock radio for the kitchen. We find we can increase the size of most sales by $50 to $60 in this way."

Mr. Wheeler doesn't believe in individual quotas he says, because "keeping a happy house" is part of his sales philosophy. He does, however, set yearly quotas for the television/stereo/radio sales department, the service department and the record department.

Quotas for the three departments are broken down to monthly goals based on the previous year's figures. He discusses the quotas thoroughly with his people in each department and has a check-up session at the end of each month to review results.

Trade-In Policy

Trade-in allowances are a tough point in establishing a policy for salesmen, the service-dealer says. It has now reached the point where B/W cannot be sold except for portables and some 23in. sets not over one year old.

Showmanship . . .

At this stage, a rigid policy has been set as the only way to get over the hump. When the shopper asks about a trade-in allowance on his B/W, he is frankly told there is little market for B/W sets but that $10 will be allowed.

"The overwhelming majority say they will keep the set, either to give to someone they know or put in the children's room," Mr. Wheeler says.

"Our figures show that where we fail to meet the B/W trade-in situation head-on, we're simply increasing the percentage of our cost per unit sold. Unless we limit the allowance to $10, we defeat the whole purpose of stepping up to a higher unit sale.

"We're now beginning to take in color sets up to three years old from customers who don't want them repaired but want what's new. And so the B/W trade-in situation is beginning to ease somewhat. In the interim, we have to hold to a rigid policy because it just doesn't make sense to reduce the markup on color by a poor trade-in policy."

Advertising

While Wheeler's location between two leading discount houses generates traffic, a large weekly ad in Bakersfield's daily newspaper keeps the dealer's name before the entire trading area. Space used is 32 to 60 in., depending on the time of year.

Wheeler TV has never held a major sale and generally does not emphasize price in advertising material. The exception is one low-price portable in stereo.

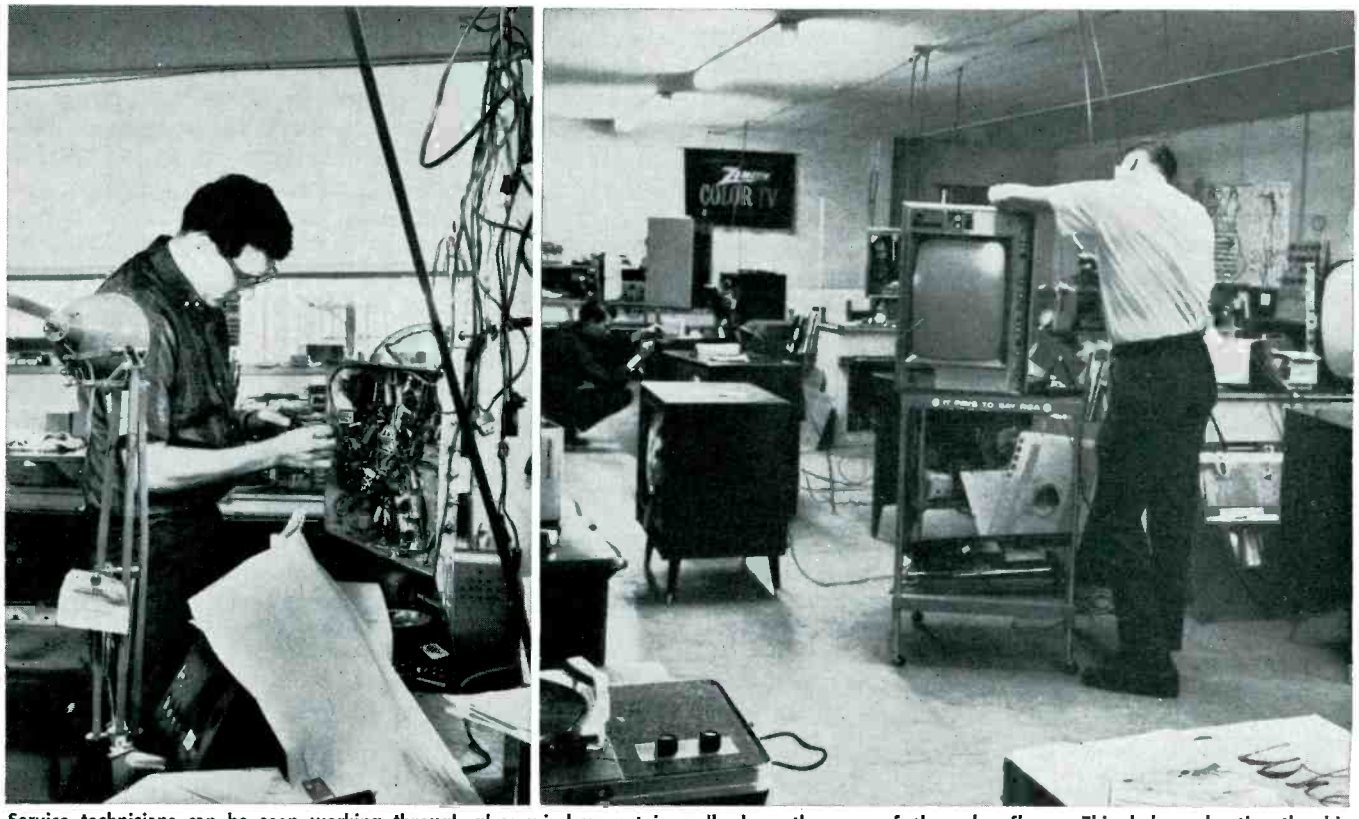
The reason for the exception is the big stereo appeal to the youth market. Many young marrieds begin with a low-priced portable stereo, Mr. Wheeler says, expecting to move up later as their income increases. About 50 percent of the young people coming in can be convinced to move up now, investing up to $100 more in the stereo they really planned.

Mr. Wheeler creates his own advertising copy. He admits his layout and copy may not be as slick as if he entrusted it to an advertising agency, but what is lost in professionalism is gained in immediacy of impact, he believes.

Some radio advertising is used in the fall. Thirty-second spots on news, sports, and special events programs are preferred. All spots feature good service, good selections, and "open evenings for your convenience."

"We're using some twenty-second TV spots on sports programs to get the man of the house thinking about color TV," Mr. Wheeler says. "We probably should use more TV advertising but since I prefer to handle all advertising myself, I find it requires too much work to make up a more elaborate presentation.

"At this juncture, newspapers are pulling well for us, and with the big demand for color TV we find all we have to do is to let the trading area know we have it and they will shop us. If sales fall off, we'll advertise



Service technicians can be seen working through glass windows set in wall along the rear of the sales floor. This helps advertise the big service department to customers.

heavier on radio and TV while continuing our present newspaper advertising schedule."

Service Emphasis

The service side of Wheeler TV receives emphasis at point of sale and in advertising. The service department, with a five-man crew, is presently just a break-even operation for Wheeler, partly because of time required to get sets ready for the sales floor.

Like most other service-dealers, Mr. Wheeler notes that the big push for color production at the factories has apparently resulted in some lowering of quality controls.

"Quite a few sets are coming in with minor things wrong with them," he points out. "We've even had them come in without tubes. The service department test-runs each set for three days minimum before putting it on sale. This check-out is costing us fifteen dollars per set — but it amounts to performing a public relations service for the manufacturers as well as for ourselves.

"Service costs are rising but the public is not being trained to pay more for service. This is another factor making it difficult if not impossible to show a profit on our service department at present.

"Perhaps we could show a profit on service if we tried to cut corners. But after 20 years in this business, it's my contention that having the best service department in the trading area is the only way to step up to a higher unit sale. If we can break even on service that's enough — we make it back on higher unit sales."

The basic scale in the Bakersfield trading area is $4.50 per call, plus labor time and parts. The break-even point for Wheeler's quality service shop requires generating $8 to $10 per hour per call.

It's as necessary for service-technicians as it is for salesmen to understand they're in show business, Mr. Wheeler declares.

"We give the promptest possible service, he says, "because many customers don't forgive you easily if they miss their favorite program. And we give *friendly* service. We expect our technicians to apply the old show business technique: always leave them laughing — or at least smiling."

House calls are handled not later than the day after the call, and preferably on the same day. This requires some oversupply of service technicians.

Service 24 hours a day, 365 days a year, is also regarded as a part of being in "show business" and a necessary feature to build the dealer's quality identity.

Wheeler TV has an emergency number which can be called after hours. Technicians alternate in handling the after-hours calls and are paid for an extra day if they have to go out after working hours when they're on 24-hour call. When on call, technicians take a completely equipped service truck home and are ready to go promptly when a call comes in.

"On holidays and in the evenings after work is when people are in a relaxing mood," Mr. Wheeler points out. "If the TV set is not working properly, that spoils their mood. If you can fix it promptly and get it back into operation, you have made a happy customer and that's a part of 'show business.'

"Emphasizing that we're on call twenty-four hours a day is a big help in trading-up against price competition."

A hard and fast shop rule, comments Hoyt Ridings, Wheeler's shop foreman, is: "Never sell anything that is not needed, never install a used part unless you so inform the customer, never make a claim that can't be fulfilled."

From the viewpoint of good customer relations, Mr. Ridings believes that service technicians must be trained *not to underestimate* the cost of repairs when the set must be brought into the shop.

"The customer thinks he's been 'taken' when it turns out it costs more," he explains. "The only way to handle this situation is to *overestimate* in the home, and face up to it on the spot. Then, when the customer sees the final bill, he's pleasantly surprised.

To help take some of the pressure off the regular service technicians and to give the shop more flexibility, Wheeler TV has a troubleshooter who works part time. The troubleshooter, Ernie Busch, is an electronics technician who teaches at a nearby college.

Backing up the shop with a top expert in the field not only permits Wheeler's to handle everything in TV and stereo, but costs no more over the long haul. The reason: regular shop technicians' time can be used more effectively when they don't spend time searching for solutions to difficult problems.

Technological Advances

"The present situation in service is tight because a lot of the older men got out of TV when color came in — it became too complicated for them," Mr. Busch says. "At the same time, quality controls were apparently relaxed at the factories with the drive for more output."

Mr. Busch believes this situation is only temporary. "The technological advances in TV are leading to a third generation of electronic components," he notes. "First was the electron tube, then the transistor. Now the micro-electronic circuit has been announced by one manufacturer to be used first on radios, then on TV.

"The development of solid-state, and most recently of micro-electronics, is leading to more reliability and potentially lower maintenance costs," he explains. "There will be fewer repairs on the one hand, but on the other, technicians will have to be more knowledgeable than they now are."

But the TV and stereo business is still going to be "show business," Don Wheeler concludes, irrespective of technological advances.

Since the service-dealer is selling entertainment, the business has the brightest future as hours are shortened and leisure time grows. And, with more time in the home, the trend toward quality and style will also continue to grow. With the two pulling together, there's no reason why the quality dealer who concentrates his sales effort on making higher unit sales need worry about the growing price competition. ■

UNDERSTANDING MODERN

Cut these 'tricky' circuits 'down to size' by knowing how they operate

Part two of a continuing series

■ The first article in this series covered basic principles of keyed AGC and described the functions of some practical circuits. Additional circuits and their functions will be discussed here. Solid-state AGC circuits will also be introduced—to be more fully discussed in a later article.

It should be noted at this point that many TV-technicians still find modern AGC circuit problems difficult to solve. But electrons act the same way in AGC circuits as they do in other electronic circuits and it seems logical that the key to keyed AGC is a methodical trouble-shooting approach—once you know how the circuits work. Now let's look at a few more keyed AGC circuits. And once again, as we did in the previous article, we'll begin with an older chassis.

As previously indicated, keyed AGC circuits vary in design but all perform identical functions by various means. Take a look at the circuit in Fig. 1. This AGC circuit is used in the G-E "U-4" chassis. Note that something has been added to this circuit which did not appear in keyed AGC circuits previously described. That's the diode clamp tube—which we'll call attention to again later.

The keyer tube in this circuit is a high-mu triode section of a 6AW8A. Like other keyed AGC systems, the keyer tube conducts during flyback time. Similarly, a positive-going composite video signal from the video amplifier is dc-coupled to the keyer grid.

The keyer plate is supplied by a 270v P-P positive-going pulse from the flyback transformer. This pulse causes the keyer to conduct and charges C251 negatively, with respect to ground. A positive voltage from the B+ supply goes to the keyer cathode from a voltage divider network composed of the fixed resistor R253 and the 40K AGC control, R254.

When the keyer is cut off, a part of the charge from C251 leaks to ground through R255. But, since R257 is smaller than R255, a larger part of the voltage from C251 charges the AGC filter, C252. This negative potential represents the AGC voltage which controls the 1st and 2nd video IF tubes.

To provide a rather wide tolerance, or swing, in AGC voltages, a 135v B+ supply goes to the AGC bus through the voltage divider network consisting of R255 and R256. The potential at the plate terminal of the keyer tube is approximately 25v—with the tube removed from the socket. No-signal circuit voltages are specified in the boxes shown in the schematic.

Keyer tube dc bias is established by the divider network R250 and R251 and because this network is dc connected to the 1st video amplifier plate, sudden changes in the video amplifier's conduction will cause the keyer grid bias to change.

Because the IF amplifiers are stacked, plate current flow through the 1st IF stage is controlled by the AGC voltage. Since the 2nd IF is in series with the 1st IF stage, the gain of the 2nd IF is controlled by current flow through the 1st IF stage. Additional gain is obtained by returning the 1st IF cathode to the keyer cathode. Hence, a change in the IF gain is fed back to the keyer.

When signal conditions are strong enough to drive the keyer near cutoff, the voltage across R153 will be a positive value—let's say, approximately +2v. Simultaneously, the grid-to-ground voltage will be a comparatively high negative value —say, approximately –6v. When the signal becomes weaker, the two voltages increase in the positive direction and the difference between the two is reduced.

We mentioned "delayed RF AGC" in the previous article of this series. We also called attention to the clamper diode shown in Fig. 1 of this article. In this circuit, the tuner RF tube is supplied with "delayed" AGC and the diode clamper is used to accomplish this. The clamp circuit maintains RF bias at approximately –0.3v under fringe area signal conditions.

Up-To-Date Circuit

The simplified AGC circuit shown in Fig. 2 is used in many Magnavox color TV chassis and the same circuit, with slight variations, is also used in many of that company's

AGC CIRCUITS

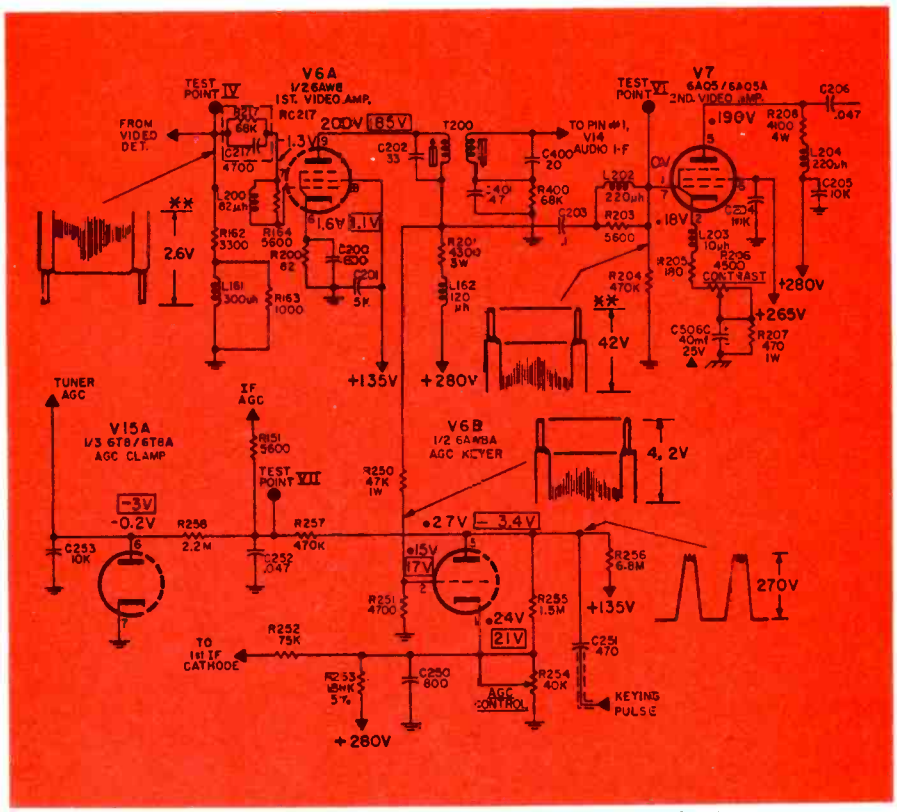
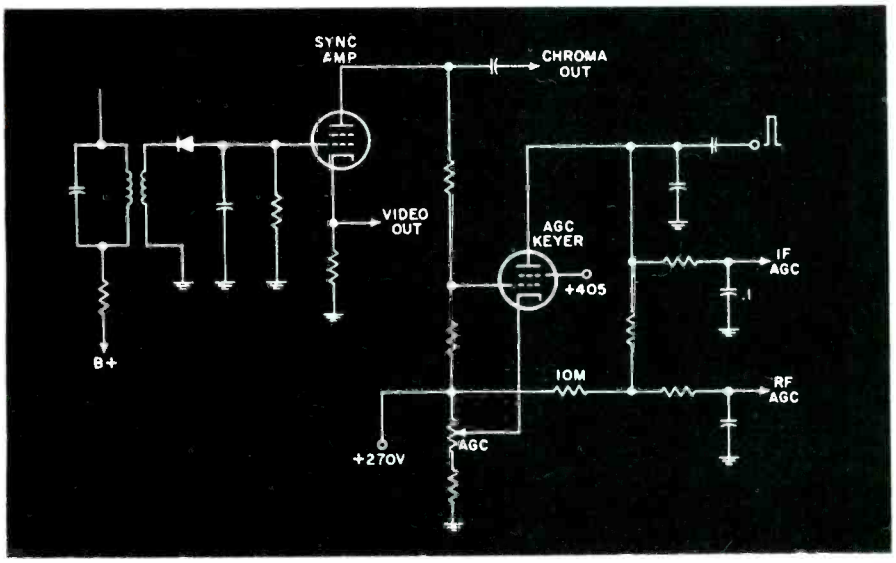


Fig. 1—Schematic of keyed AGC circuit used in General Electric "U-4" chassis.

Fig. 2—Keyed AGC circuit used in some modern Magnavox color and B/W TV chassis.



B/W chassis. Its design variations are interesting to note.

Here, a negative-going composite video signal from the video detector is dc-coupled to the control grid of the sync amplifier. The bias on this amplifier is set so its plate current is high compared to its plate voltage —under no-signal conditions. When a signal arrives at the grid, the negative dc component increases the tube's bias—which reduces plate current and the plate voltage rises. The stronger the incoming signal becomes, the more the plate current and voltage change.

The sync pulses at the plate of the sync amplifier are, of course, positive-going. These signals are dc-coupled to the AGC keyer grid. The keyer is biased by action in the sync amplifier plate circuit. Current flowing through the plate load resistors to the B+ supply and especially the voltage drop across the lower load resistor, establishes the keyer grid voltage. The keyer cathode is made more positive than the grid and the difference between the two voltages is the keyer bias.

Under no-signal conditions, the sync amplifier draws maximum plate current which makes the voltages higher across the lower load resistor. This drop may range up to 100v which makes the keyer grid much more negative than the cathode. At this point, the keyer is cut off and no AGC bias is developed. The AGC control is adjusted to vary the cathode voltage so the optimum keyer operating point is maintained for average received signals.

When signals are being received, sync amplifier plate current is reduced by the negative voltage from the detector diode. The voltage drop across the lower plate load resistor becomes less and the AGC keyer grid becomes more positive. The positive sync tips of the video signal further increase the keyer grid voltage so the bias becomes low enough for the keyer to conduct. The stronger the received signal, the more positive the dc voltage and sync pulses become on the keyer grid—and thus, the lower the bias. Hence, conduction of the keyer is dependent on the sum of the dc voltage and the positive sync pulses

on the grid at any given instant.

Plate voltage for the AGC keyer is provided by a positive-going horizontal pulse which is capacitively coupled from a winding on the flyback transformer. The keyer will conduct only when the positive pulse is present on the plate. Noise pulses which arrive between keying pulses cannot affect the AGC voltage. As the keyer conducts, a negative charge is developed on the plate side of the pulse coupling capacitor. The charge on this capacitor is the AGC voltage source.

To repeat, as the keyer plate current varies with signal strength, the negative charge on the capacitor also increases or decreases in proportion to signal strength. This voltage is then coupled through filter circuits to the grids of the RF and 1st IF amplifier to reduce gain.

Delayed RF AGC is provided in this circuit by using the grid and cathode of the RF tube as a clamping diode. A positive voltage from the 270v supply is coupled through a 10M resistor and a 2.2M isolating resistor to the RF tube grid. A small amount of grid current flows which holds the RF amplifier at zero bias—or maximum gain.

When a signal is being received, the positive voltage applied to the tuner is decreased by the negative AGC voltage on the keyer plate. A point is reached where the grid is no longer positive with respect to the cathode and the clamping action stops. The grid is then moved in the negative direction by the AGC voltage which reduces the amplifier's gain. The amount of "delay" is determined by the 10M resistor. Its value is chosen to fit the AGC characteristics of the particular IF amplifiers and RF amplifier used.

We will now divert attention briefly from electron tube keyed AGC circuits and explore some important principles and characteristics of solid-state keyed AGC circuits.

Solid-State Keyed AGC Circuits

Solid-state keyed, or gated, AGC systems perform the same functions as electron tube systems. And it is assumed here that you are now thoroughly familiar with the general concepts and functional basics of semiconductors.

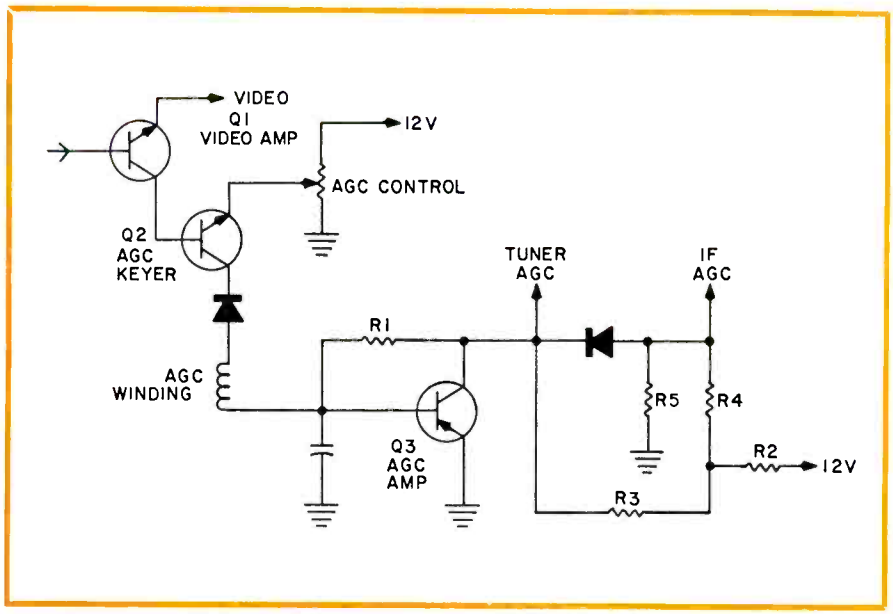


Fig. 3—Typical transistorized keyed AGC circuit.

A simplified transistorized keyed AGC circuit is shown in Fig. 3. We will briefly describe how this circuit functions and explain it as simply as possible. Note first that the video amplifier and the AGC keyer are NPN-type transistors. The AGC amplifier is a PNP-type transistor.

If you will remember that "forward AGC" is used in most transistorized circuits it will be easier to understand how these circuits function. Forward AGC means that an *increase* in collector current causes a *decrease* in gain. This can be more clearly and fully understood by recalling that gain is reduced in an electron tube system by increasing the negative bias on the tube's control grid. This process reduces plate current and thus the stage gain. Although some transistorized circuits use this system, most use the technique of increasing the forward bias.

As in tube-type keyers, the transistor AGC keyer has no collector voltage supply except that provided by a positive pulse from a flyback transformer winding.

In the circuit shown in Fig. 3, a positive-going composite video signal is coupled directly from the 1st video amplifier's collector to the keyer transistor base. Because the AGC keyer is an NPN-type, the positive-going sync signal will make the transistor conduct. Note that the AGC control is in the keyer emitter. This control is used to decrease or increase keyer gain.

A diode is used in series with the collector to prevent the transistor from conducting except when the positive HV pulse is applied to the collector. This is necessary because a positive dc voltage would be applied to the collector through the return side of the flyback winding. Note that the flyback winding return goes to the AGC amplifier base circuit. The amount of current drawn by the AGC amplifier base circuit is proportional to the amount of keyer conduction. And this conduction is also in proportion to sync pulse amplitude.

The capacitor in the base circuit of Q3 charges to a certain voltage through R1. When the sync pulse amplitude rises, the drain on the capacitor increases. As the charge on the capacitor decreases, so does Q3's conduction.

As you can see, this system causes the AGC amplifier to *increase* conduction when the signal *decreases* and vice versa. Hence, under strong signal conditions, the AGC amplifier moves toward cutoff which raises its collector voltage to a maximum. Thus, maximum positive AGC causes minimum amplifier gain.

A system of delayed AGC for the RF stage is provided in transistorized circuits as in tube circuits. A forthcoming article will describe how these systems function. ■

Part two of a

TEKLAB REPORT

test instrument series

Using Audio Test and Alignment Instruments

Know how your audio test instruments work and learn how to use them

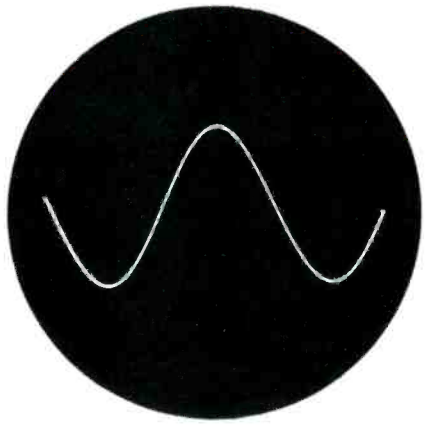


Fig. 1—Left input signal (and L+R amplitude since R=O).

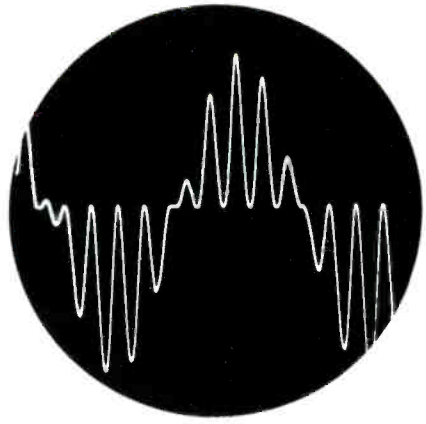


Fig. 2—Total left signal without pilot.

■ The previous article in this series (ELECTRONIC TECHNICIAN, March 1967), pointed out that more FM broadcasting stations are transmitting FM/stereo, sales of FM/stereo receiving equipment are increasing and that many service-dealers and technicians have not bothered to either up-date their technical knowledge or their test instruments.

It was also pointed out that FM/stereo reception standards established by the FCC make it necessary to use top-grade test instruments to properly align FM/stereo multiplex receivers. This article covered FM/stereo principles, discussed a typical multiplex generator, how to use it, how to check channel separation and went into other details regarding checking a multiplex receiver. We will continue to explore these and other essential instruments and how they are used to speed troubleshooting and alignment.

Generator Modulation

Multiplex (MPX) signal generators have been designed to closely follow FCC standards. A sinusoidal left-only signal, L+O, at one stage of such an MPX generator modulation unit is shown in Fig. 1. It is not easy to design this circuitry because the filters required in the double sideband suppressed carrier modulator cause unavoidable phase shifts over the frequency band which must be duplicated exactly in the main channel. This can be done, but expensive and very complex filters and phase shifting networks would then be necessary. A total left signal without pilot (Fig. 2) is produced by a different method to generate a stereo multiplex signal (Fig. 3). If a switch is connected between the left and right modulation inputs as shown, and the switch samples between the left and right signals at a rate of 38kHz, then the resultant signal would resemble that shown in Fig. 2. This occurs as follows: For one-half cycle (of 38kHz), the output signal follows the left input signal, then the switch instantly flips over to the right input. Since there is no right signal, the output voltage will be zero for the next one-half cycle of the 38kHz driving signal. Then the switch flips back to the left input and the output voltage follows again the left signal, and so on.

This "switch-derived" signal is very similar to that shown in Fig. 2, except that it contains more harmonic frequencies. Almost the same signal is derived as in the first system, however, by simply connecting a 38kHz switch between the left and right inputs without the complications of the suppressed carrier modulator — matrixing, filters, phase shift or carrier suppression. All that is needed to convert to an acceptable FCC stereo signal (see Fig. 3) is to pass it through a simple low-pass filter.

This switching system, sometimes called the "time multiplex" system, is used in this particular generator.

The left and right signals are alternately shorted to ground by switches, at a switching rate of 38kHz.

Using Audio Test . . .

Individual "chopped" signals are passed through buffer stages and then combined in the resistor adding network. The pilot-carrier (with the correct phase and amplitude) and the Subsidiary Communications Authority (SCA), channel is added here. At this point the total composite signal still contains all the harmonics that were generated in the switching process.

The actual switches used in the circuit are diode types as shown in Fig. 4.

The diodes in this circuit are connected so they are forward biased and conducting during one-half cycles of the 38kHz driving signal, reverse biased and "open" during the other half cycle. During their conduction period they present a low impedance path to ground (about 300Ω), while the resistance to ground during the "open" time interval is several megohms. The diodes form an effective switch capable of suppressing the switching voltage at the audio take-off point. Because of the balanced bridge arrangement, silicon diodes work well here because of their stability over a wide range of temperatures and high front-to-back resistance ratio.

Phase Adjustment

The phase relationship of the pilot carrier to the stereo signal, as defined by FCC standards, evades a nulling method of adjusting the phase relationship and makes it difficult to discriminate between left and right stereo signals. Had the FCC decided on a phase relationship of 45deg shifted forward or backward as compared to present practice, then it would have been comparatively easy to adjust the phases and to discriminate between left and right signals.

This particular generator provides a 19kHz voltage on the front panel which is 45deg out of phase with the pilot carrier in the composite signal.

If this 45deg out-of-phase 19kHz signal is used for the horizontal deflection of a scope with the stereo signal (pilot carrier amplitude at zero) applied to the vertical inputs, the patterns shown in Fig. 5 & 6 will be obtained.

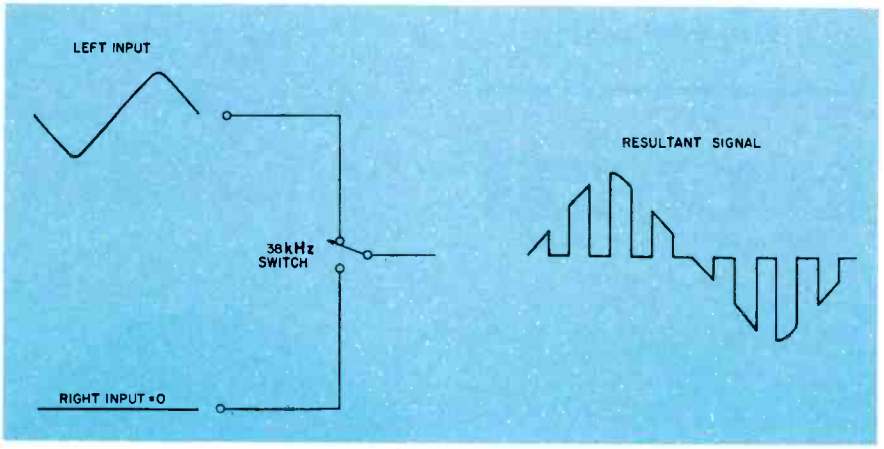


Fig. 3—A "38kHz switch" and the resultant signal.

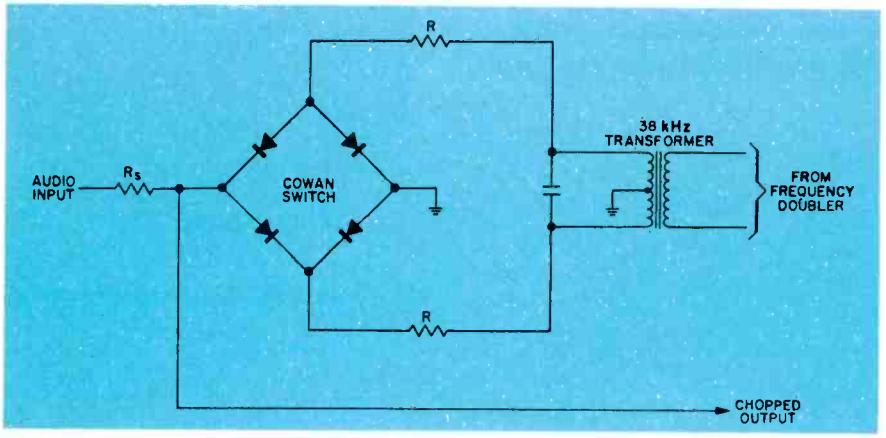


Fig. 4—Cowan-type diode switches.

A correctly phased right signal, when the pilot carrier is not suppressed in the composite output, is shown in Fig. 7.

These scope patterns are used to adjust and monitor the phase in the pilot carrier. The PHASE-CALIBRATE push button removes the pilot carrier from the composite output signal.

FM Generator

The basic oscillator in the FM generator circuit uses a 6AB4/EC92 triode with a 6AU6/EF94 pentode acting as the modulating capacitance. The circuit is capable of delivering a ±300kHz linear sweep with 1 percent harmonic distortion. Typical measured distortion for a standard ±75kHz deviation is below 0.2 percent.

High frequency modulation performance of this particular FM generator is achieved by a very low impedance audio input circuit, (about 2K) that allows modulation frequencies up to 300kHz to be transmitted.

The meter circuit employs an audio frequency amplifier driving a high time constant meter rectifier resulting in a true P-P indication. For a true indication of an MPX signal, this type of meter is necessary because this complex signal defies the simple rules for normal RMS indication of audio signals. No fixed relationship exists here between the RMS indication and the P-P voltage, this ratio may vary as much as 100 percent.

Crystal Oscillator and Frequency Doubler Circuit

A 12AT7/ECC81 dual triode is used in the oscillator circuit and provides ample gain for sustained oscillation even when the 19kHz crystal shows tiring effects as it ages. The double tuned plate circuit allows fine adjustment of the oscillator frequency. The secondary of

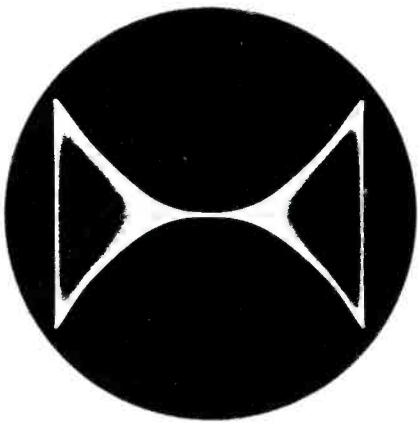


Fig. 5—Correct pilot-carrier phase. Left input signal.

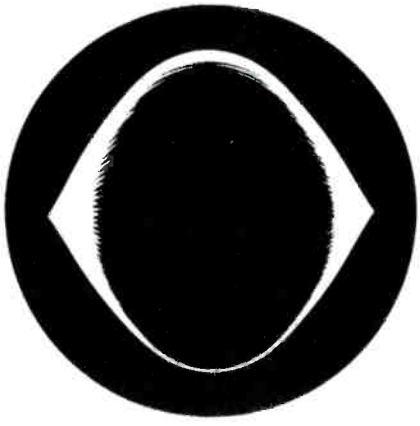


Fig. 6—Correct pilot-carrier phase. Right input signal.

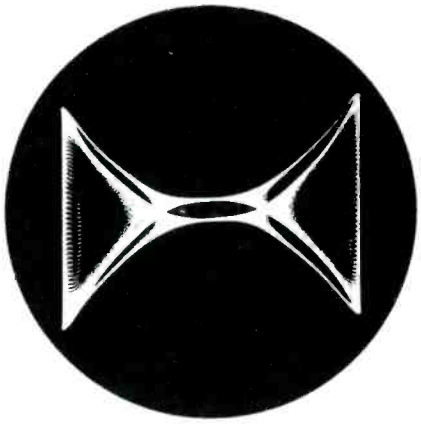


Fig. 7—Correct phasing of pilot-carrier but pilot carrier in composite output signal not suppressed.

this plate circuit drives a pentode operating as a frequency doubler and is capacitively tapped to provide a low-distortion, low-impedance source for the fixed 19kHz output voltages and the pilot carrier. Both 19kHz voltages are taken from the same point, which is important in the phase adjustment.

The crystal oscillator is factory adjusted to within one-half cycle of 19kHz even though the FCC permits ±2 cps.

The plate circuit of the frequency doubler pentode is a 38kHz double-tuned circuit where the secondary drives the diode switches in the modulator previously described. A double tuned circuit is used to completely remove any 19kHz components from the switching voltage.

This particular generator can be used with two types of FM stereo equipment, integrated FM/MPX tuners and separate MPX adapters. The IF and detector circuits of the FM tuner will influence the performance of the MPX section. A separate MPX adapter should be aligned together with the tuner with which it will be used. Closely follow the alignment instructions of the manufacturer.

Alignment procedure for most MPX adapters includes:

1. Adjust SCA traps, if used.
2. Adjustment of the 19kHz and 38kHz timing circuits.
3. Adjustment for optimum stereo separation.

FM/MPX Stereo Tuner Alignment

Before any alignment of the tuner is done we suggest a "warm up" for at least 15 min. The FM tuner itself should be operating and properly aligned before any adjustment of the MPX section is attempted.

Apply power to the generator and proceed as follows:

1. According to the manufacturer's instruction, adjust SCA traps.
2. Connect the antenna output cable to the 100MHz FM/MPX output jack of the generator.
3. Adjust the generator controls as follows:

   Power ON
   Pre-emphasis OFF
   LEFT signal 7
   RIGHT signal 7
   Selector 1kHz LEFT

4. Rotate the composite signal level control for a reading of 1 on the top scale of the meter (this equals 75kHz deviation).
5. Depress the 19kHz AMPLITUDE pushbutton. Rotate the 19kHz AMPLITUDE ADJ. control for a reading of 100mv on the center meter scale.
6. Connect the RF output cable of the generator to the antenna terminals of the tuner. If it is inconvenient to do this, simply position the end of the cable near the antenna terminals.
7. Use the manufacturer's recommendations for alignment procedure.

MPX Adapter Alignment

The alignment of separate MPX adapters is basically the same as alignment of complete FM/stereo tuners except that the composite signal is used rather than the FM/MPX signal.

It is important to use the proper level of composite signal—the same level that will be applied to the adapter from the FM discriminator circuit of the tuner with which it will be used. To determine the level, use manufacturer's data.

If it is impossible to determine the level use a 1v composite signal.

1. Apply power to both the adapter and the generator.
2. Adjust the MPX adapter SCA trap on filter if used, according to manufacturer's instructions.
3. Adjust the generator as follows:

   Power ON
   Pre-emphasis OFF
   LEFT signal 7
   RIGHT signal 7
   Selector 1kHz LEFT

4. Rotate the COMPOSITE SIGNAL level control to the desired level, as previously discussed or to 1.0v on the top meter scale.
5. Depress the 19kHz amplitude pushbutton and rotate the 19kHz AMPLITUDE ADJ. control for this same meter reading.
6. Complete the alignment procedure according to the manufacturer's instructions.

General Alignment-Test Data

After technicians gain experience with available FM/stereo receiving equipment and generators, the time required for alignment or troubleshooting will be reduced.

Rapid alignment, for example, can often be carried out with the generator set to the "1kHz LEFT, 60Hz RIGHT position."

Channel separation can also be visually adjusted as shown in Fig. 8 and 9 with this same selector posi-

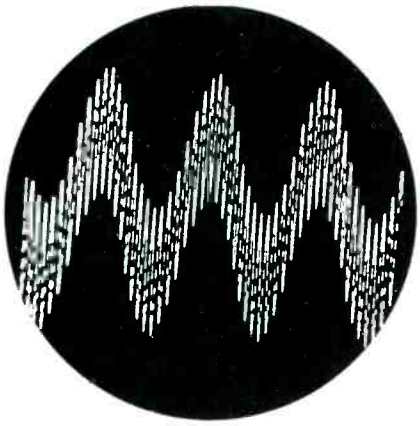


Fig 8—Visual channel separation adjustment using monophonic operation.

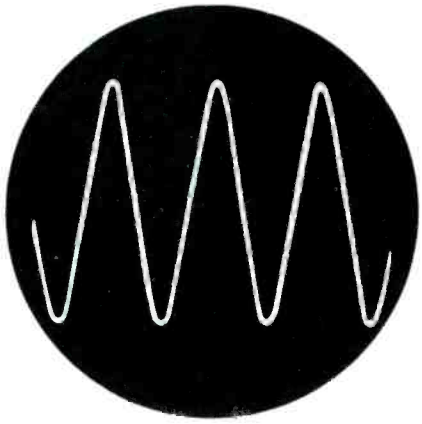


Fig. 9—Visual channel separation adjustment. Stereo operation—good separation.

The Fisher Model 300 multiplex generator.

tion. These waveforms were obtained at the right channel output jacks of an FM/stereo tuner.

Measurements of channel separation at 1kHz and 8kHz can easily be accomplished by exciting one of the channels and measuring the output of the other with an audio type VTVM (calibrated in db) as previously mentioned.

Distortion can be checked by applying the output of the excited channel to a harmonic distortion analyzer.

For separation and distortion measurements, a low pass filter is generally required for complete removal of the 19kHz and 38kHz components.

Listening Tests

This particular generator can be employed as a small high quality broadcast station by applying the appropriate program material to the RIGHT INPUT and LEFT INPUT EXT MOD jacks.

These input signals should have an average level of 1.0v. In general, tuners can be directly connected to the generator while record and tape players will require standard preamps with the appropriate equalization.

For listening tests, set the generator controls as follows:

Selector switch EXT MOD

Left signal MAX

Right signal MAX

Composite signal 50kHz deviation (max during modulation peaks)

Pre-emphasis ON.

Important specifications for the generator described here are listed in Table I.

Forthcoming articles will review other instruments used in audio test and alignment. ■

TABLE I

Output Signals:

1. FM/MPX signal
   - Output voltage: 300mv
   - Output imp.: 60Ω
   - Modulation frequency response: 20Hz to 150kHz ±0.5db
   - Harmonic Distortion: below 0.25% for ±75kHz deviation
   - Hum and Noise: more than 50db below ±75kHz deviation
   - Stability of carrier frequency: 0.02%
2. Composite MPX/Signal
   - Output 0-6v P-P
   - Output imp.: 300Ω
   - Frequency response: Choice of 20Hz to 20kHz +½db or Standard 75μsec pre-emphasis ±1db
   - Harmonic Distortion: Below 0.25% at max output level
   - Hum and noise: more than 55db below full output
3. 19kHz pilot-carrier
   - Output voltage: 0-250mv variable and 1.5v fixed from extra output jack
   - Output imp : 300Ω
   - Accuracy: 1.9kHz ±2Hz
4. Audio Oscillator
   - (Signal available on rear jack)
   - Output voltage: 2.5v RMS
   - Output imp.: 5K
   - Frequency: 1kHz ±5% and 8kHz ±5% (switched by selector)
   - Harmonic Distortion: below 0.3%

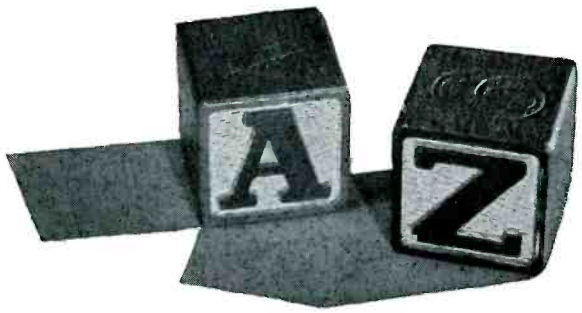
Outputs
- MPX composite output
- 100MHz FM/MPX output
- 19kHz output
- Audio oscillator output (in rear)

Inputs
- Ext. modulation inputs (left, right)
- Input imp: 200K
- 1.25v (RMS) input voltage required for full output
- SCA input (in rear)
- Input imp.: 100K
- 0.5v (RMS) input voltage for FCC required 10% modulation

Size
- 8in. wide by 10in. high by 12in. deep

Weight
- 17 pound (7.7 kilograms)

The Tenth Article in a Continuing Series



Semiconductors from A to Z

Understand integrated circuit characteristics and make your troubleshooting and repairs easier

■ The previous article in this series described a constant-current-source amplifier and an unbalanced differential amplifier. By combining some of the features of these two amplifiers, a differential amplifier can be made that is virtually balanced. Balanced differential amplifiers are frequently used in the integrated linear amplifier circuits found in radios and TV sets.

A Balanced Differential Amplifier

The unbalanced differential amplifier circuit, shown in Fig. 9 of the SEMICONDUCTORS FROM A TO Z article in the April 1967 issue of ELECTRONIC TECHNICIAN, can be revised (Fig. 1) to be more

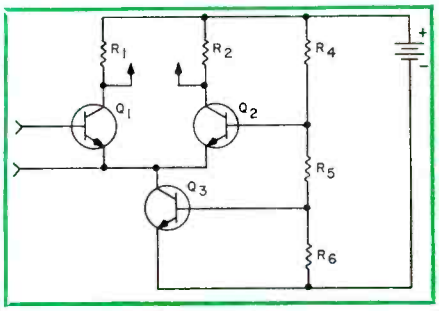


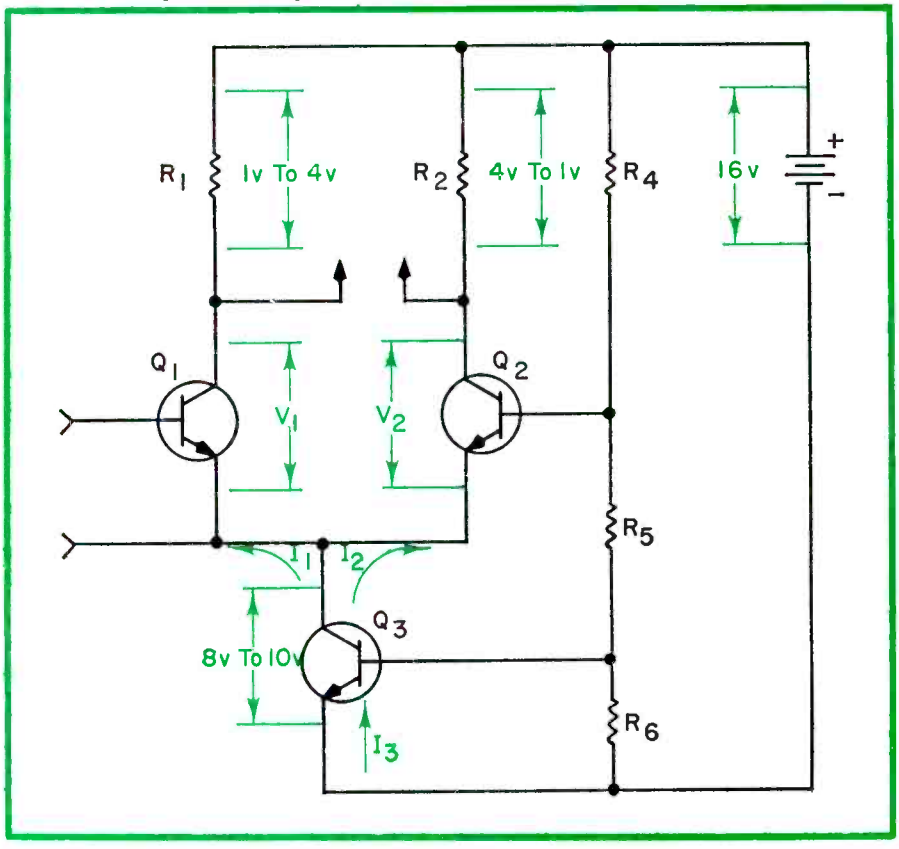
Fig. 1—A balanced differential amplifier circuit.

nearly balanced by substituting a current regulating transistor (Q_3) in place of the common-emitter resistor (R_3). The voltage divider resistors (R_4, R_5 and R_6) serve to provide nearly constant base bias currents to the two transistors (Q_2 and Q_3).

If the current regulating transistor has the same characteristics *(The characteristic curve is shown in* Fig. 6 *in the previous article.)* as the transistor used in the constant-current-source amplifier circuit, the current flowing through the transistor will vary from 9.0 to 9.5ma as its collector-to-emitter voltage varies from 8 to 10v.

If the pair of transistors (Q_1 and Q_2), used in the unbalanced differential amplifier circuit (Fig. 10 *of the previous article),* are biased as before; 1/5th of the resulting current (1.8ma) will flow (Fig. 2) through the first transistor (Q_1),

Fig. 2—Voltages present in the balanced differential amplifier circuit.



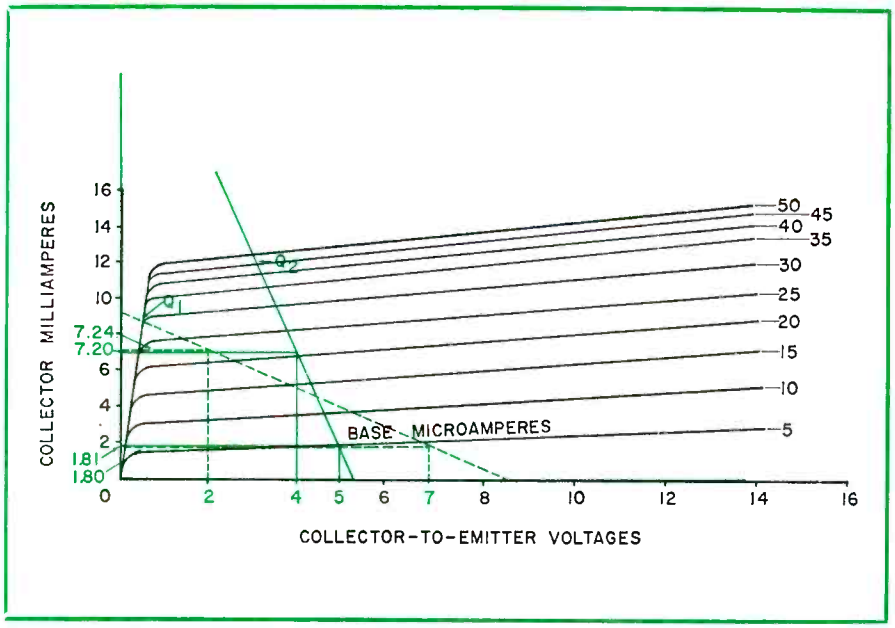


Fig. 3—The effective load lines of transistors Q_1 and Q_2 in the balanced differential amplifier circuit.

when there is an 8v drop across the current regulating transistor (Q_3), and the remaining current (7.2ma) will flow through the second transistor (Q_2). When the bias in the first transistor is changed and there is a 10v drop across the current regulating transistor, 4/5ths of the resulting current (7.6ma) will flow through the first transistor (Q_1),

1v	4v		
1.8ma	7.2ma	9.0ma	8v
1.9ma	7.6ma	9.5ma	10v

TABLE I

while the remaining current (1.9ma) will flow through the second transistor.

The current flowing through the first transistor has fluctuated from 1.8 to 7.6ma, resulting in a 0.99 to 4.18v fluctuation across its 550 Ω collector resistor (R_1); and the current flowing through the second transistor has fluctuated from 7.2 to 1.9ma, resulting in a 3.96 to 1.045v fluctuation across its 550 Ω collector resistor (R_2). The voltage drop across the first transistor fluctuates between 7.01 and 1.82v, while the voltage drop across the second transistor fluctuates between 4.04 and 4.955v.

The 0.99 to 4.18v fluctuation across the one resistor (R_1) is now nearly equal the 3.96 to 1.045v fluctuation across the other resistor (R_2) than it was in the unbalanced differential amplifier circuit described in the previous article. This differential amplifier can be even better balanced if we substitute another transistor with better current stability for the third transistor (Q_3). If the current through this substituted transistor fluctuates only from 9.00 to 9.05ma as the collector-to-emitter voltage fluctuates between 8 and 10v, the current through the first collector resistor

1v	4v		
1.80ma	7.20ma	9.00ma	8v
1.81ma	7.21ma	9.05ma	10v

TABLE II

(R_1) will vary from 1.80 to 7.24ma, and the current through the second resistor (R_2) will vary from 7.20 to 1.81ma.

The voltage drop across the first resistor will then vary from 0.99 to 3.98v while the voltage drop across the second resistor will vary from 3.96 to 0.9955v. By rounding these voltages off to a practical number of significant figures, we see that the differential amplifier circuit can be considered balanced and a variation of 1 to 4v across one resistor corresponds to a variation of 4 to 1v across the other resistor.

Load lines can be drawn (Fig. 3) for the two transistors (Q_1 and Q_2) using a pair of known voltage-current combinations for each transistor. When the voltage drop across the first transistor's collector resistor (R_1) is 0.99v, the transistor's collector-to-emitter voltage must be 7.01v, and both the resistor and transistor conduct 1.80ma. When the voltage drop across the collector resistor is 3.982v, the collector-to-emitter voltage is 2.018v, and the current is 7.24ma. By connecting the two points representing these voltage-current combinations, an effective load line can be drawn. When extended, this load line indicates an effective maximum current of about 9.44ma and an effective maximum potential of about 8.67v. This would correspond to an effective load resistance of about 900 Ω.

When the voltage across the second transistor is 4.04v, it conducts 7.20ma; and when 5.0045v, it conducts 1.81ma. By connecting the points representing these voltage-current combinations, an effective load line can be drawn which, if extended, would indicate an effective maximum current of about 29.78ma and an effective maximum potential of about 5.25v. This would correspond to an effective load resistance of about 200Ω.

The CA3005 Integrated Circuit

The initial design of an integrated circuit is a major factor in deter-

Fig. 4—The enlarged artwork for an integrated circuit is shown on the screen of a 25-ft. long camera. Courtesy of Cutler-Hammer, Inc.

mining the cost of the circuit. Once a circuit has been drawn and the photographic masks are prepared (Fig. 4) for various "growth" processes, the design is ready for mass production. The greater the production run of these circuits, the more economically they can be produced. Because of the nature of the expenses encountered, it is more economical to produce an integrated circuit with a few extra components that may not be used, than it is to produce a greater assortment of integrated circuit designs. The amount of additional material, if any, required to produce one or two extra transistors of microscopic dimensions is insignificant.

Since all of the components in an integrated circuit are made with the same process, the only factor that determines their relative cost is the area of the integrated circuit chip that they require. Since resistors and capacitors require larger areas than transistors or diodes, they are the most expensive components to use. To reduce the cost of an integrated circuit, the circuit should be designed to include as few capacitors and resistors as possible, even if several more semiconductors are required to accomplish this.

The manufacturer's schematic of

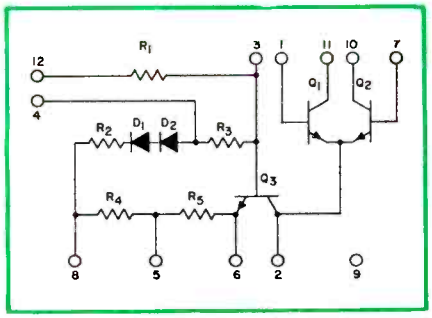


Fig. 5—The manufacturer's schematic of integrated circuit no. CA3005. Courtesy of RCA.

integrated circuit CA3005 is shown in Fig. 5. This circuit can be more readily understood if it is shown as a standard transistor circuit (Fig. 6). Note the similarity between the basic portions of this circuit and the balanced differential amplifier circuit discussed earlier (Fig. 1). The major difference between the two circuits is the addition of two diodes (D_1 and D_2) in the base biasing circuit of the current limiting transistor (Q_3). These diodes are used to compensate for the changes in the characteristics of the transistor (Q_3) with changes in temperature. (The article SEMICONDUCTORS FROM A TO Z in the September, 1966, issue of ELECTRONIC TECHNICIAN discusses the use of diodes for temperature compensation in a similarly biased circuit. The effect of heat on the transistor's base voltage is illustrated in the October, 1966, article.)

By attaching external circuitry to the integrated circuit (Fig. 7), it can be used as a balanced differential amplifier. *Because of the arrangement of the integrated circuit components on the substrate, the manufacturer indicates that terminal 9 of the integrated circuit must be at least as positive as any other portion of the integrated circuit. This terminal has, therefore, been connected directly to the collector voltage source* (V_{CC}). *Not all integrated circuits have such*

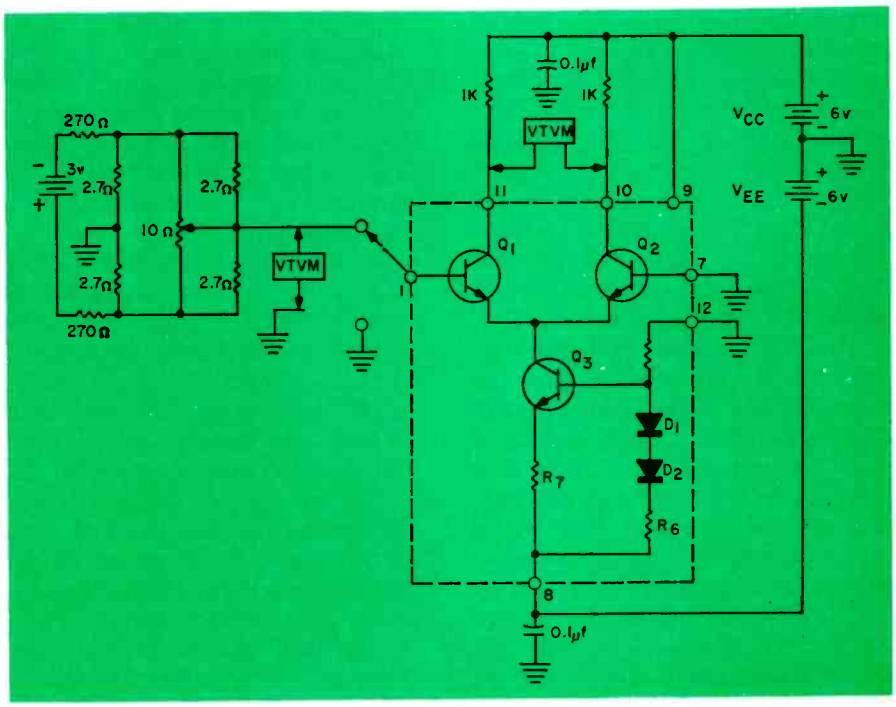


Fig. 8—A simplified diagram of the CA3005 differential amplifier circuit.

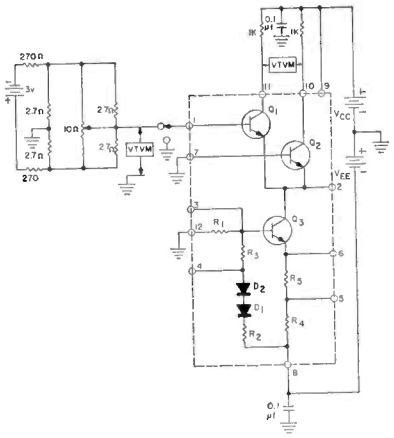


Fig. 7—A differential amplifier using the CA3005 integrated circuit.

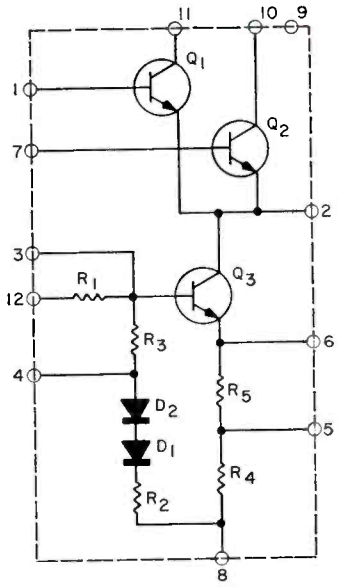


Fig. 6—A more conventional diagram of integrated circuit no. CA3005.

a requirement. This diagram can be simplified without actually changing the circuit (Fig. 8). No actual change has been made in the integrated circuit — the unused leads are no longer shown, and for simplicity series resistors R_2 and R_3 are shown as a single resistor ($R_2 + R_3 = R_6$), and resistors R_4 and R_5 are also shown as a single resistor ($R_4 + R_5 = R_7$).

The 1K collector resistors attached to leads 10 and 11 serve the same function as the 550Ω resistors described with Fig. 1 and 2. A 0.1μf capacitor connected to these two resistors shunts to ground any portion of the ac signal that would otherwise appear across the collector voltage source (V_{CC}).

The collector and emitter voltage sources (V_{CC} and V_{EE}) not only supply power to the circuit, but act as a voltage divider for the circuit. Since the common battery terminal and the base terminal of transistor Q_2 are both connected to ground, one voltage source (V_{CC}) serves to make the transistor's collector more positive than the base while the other voltage source (V_{EE}) serves to make the transistor's emitter more negative than the base. The corresponding transistor (Q_2) in Fig. 1 received the same base bias current through a resistor voltage divider circuit (R_4, R_5 and R_6).

Another 0.1μf capacitor connected to the emitter voltage source (V_{EE}) shunts to ground the ac signal that would otherwise appear across the battery.

The base of the current limiting transistor is biased in a manner similar to the one described previously. In Fig. 1, voltage divider resistors (R_5 and R_6) serve to make the base of transistor Q_3 less positive than the base of transistor Q_2. In Fig. 8, resistor R_1, in conjunction with resistor R_6 and the diodes (D_1 and D_2), acts as a voltage divider to make the base of transistor Q_3 less positive than ground and the base of transistor Q_2.

Another voltage divider (left portion of diagram in Fig. 8), connected to a 3v battery, is designed to make the base of transistor Q_1 more or less positive than ground. When at ground potential, the base of transistor Q_1 is biased at the same potential as transistor Q_2. By changing the base bias of transistor Q_1, that transistor (Q_1) conducts more or less current while transistor Q_2 conducts less or more current. Their alternate fluctuations of current occur in the same manner discussed earlier for Fig. 2.

Certain terms are used by the manufacturer to list integrated circuit characteristics. The input offset voltage (V_{IO}) is the difference in the dc voltages that must be applied to the input terminals to obtain a zero output voltage differential at the output terminals. This is the amount of voltage that must be applied between terminal 1 and ground (Fig. 8) to reduce to zero any difference in potential that may occur between terminals 10 and 11 of the integrated circuit. The manufacturer indicates that a typical input offset voltage for an integrated circuit of type CA3005 is 2.6mv, while the maximum input offset voltage is 5mv.

It is not economically feasible to produce every integrated circuit with identical characteristics. The characteristics vary slightly with production batches. Some integrated circuits of the same design have a typical input offset voltage of only 0.8mv and a maximum voltage of 1mv. These circuits are classified as type CA3006. This is the only rated difference listed by the manufacturer for these two types of integrated circuits. The price of type CA3006 integrated circuits was listed by an electronics supply company for $4.00 more than the price of the type CA3005 circuits. (As had been mentioned in the previous article, that electronics supply company listed the type CA3005 circuits for $2.80.)

The input offset current (I_{IO}) is the difference in the amount of current passing through the base leads of the two transistors (Q_1 and Q_2) when their collectors are connected directly to the voltage source (V_{CC}). This is measured (Fig. 9) by connecting one milliammeter between terminal 1 and ground and another milliammeter between terminal 7 and ground, while terminals 10 and 11 are connected, along with terminal 9, directly to the voltage source. The typical input offset

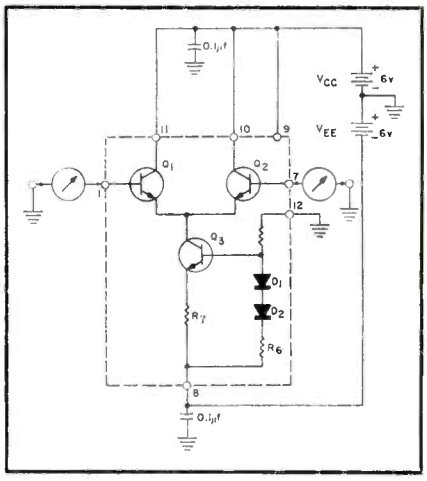


Fig. 9—A circuit for measuring the input offset current and input bais current of the CA3005 differential amplifier circuit.

current for these circuits is 1.4μa.

The input bias current (I_I) is the average value of the two currents measured when determining the input offset current. That current, as you probably know, would be half the sum of the two currents.

The quiescent operating current is the average dc collector current of either of the two transistors (Q_1 or Q_2). This current is measured (Fig. 10) by connecting the base

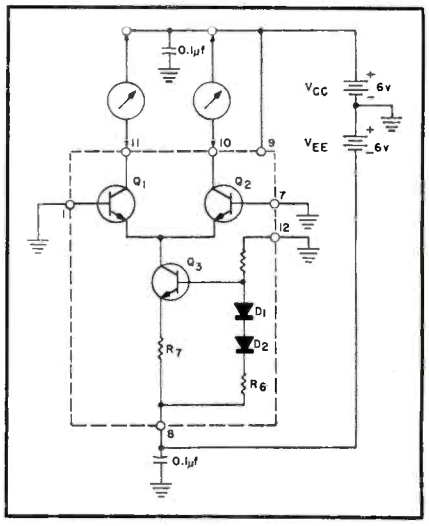


Fig. 10—A circuit for measuring the quiescent operating current of the CA3005 differential amplifier circuit.

of both transistors to ground (terminals 1 and 7 to ground) and connecting milliammeters between the transistor's collectors and the voltage source (between terminal 11 and V_{CC}) and between terminal 10

continued on page 80

TEKLAB REPORT

Conclusion of a three-part series

A Technician Looks At G-E's 'Porta-Color' TV Receiver

Understand circuit functions and save time when troubleshooting and making service adjustments

■ The second part of this series covered this set's color demodulator, color difference amplifiers and some common troubles associated with these circuits.

A cursory glance at the sweep section will raise at least one question: what happened to the horizontal width control, HV adjustment, kine bias and the service switch? Apparently the manufacturer of this small-screen color set had the service technician in mind when these controls were eliminated. What was done to eliminate the controls is only one important point to be considered in this third and final article.

Horizontal Oscillator and Phase Detector

The "Porta-Color" receiver employs conventional type circuits here. A 6LT8 serves as the phase detector and horizontal oscillator. Horizontal sync information, from the plate circuit of the clipper, is coupled through a 270pf capacitor to the phase detector where the sync phase is compared with the phase of a reference sawtooth pulse taken from the horizontal oscillator plate circuit (see Fig. 1). A dc error voltage proportional to the phase error is developed by the

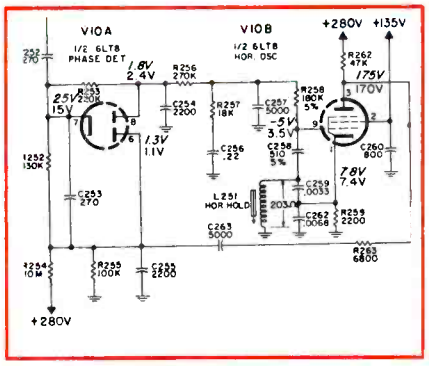


Fig. 1—Horizontal phase detector and oscillator circuit.

phase detector and coupled to the horizontal oscillator grid circuit which controls the oscillator frequency.

The oscillator, tuned by a coil — actually the HORIZONTAL HOLD — is adjusted from the set's back. A Colpitts oscillator circuit employs the 6LT8 pentode section as the oscillator. A 180K resistor in the control grid circuit provides grid leak bias, while the cathode is biased through a 2.2K resistor. The cathode connection to the series capacitors across the coil forms a feedback path to the grid circuit. The oscillator is electron coupled to the plate circuit which provides immunity to plate-loading changes.

The horizontal hold is adjusted by tuning the horizontal hold coil, L251 (see Fig. 1). Use a medium amplitude signal and set all controls for a normal picture. Turn the contrast control to maximum and the brightness control for a low brightness level. Place a clip-lead from point VI (see Fig. 2) which is

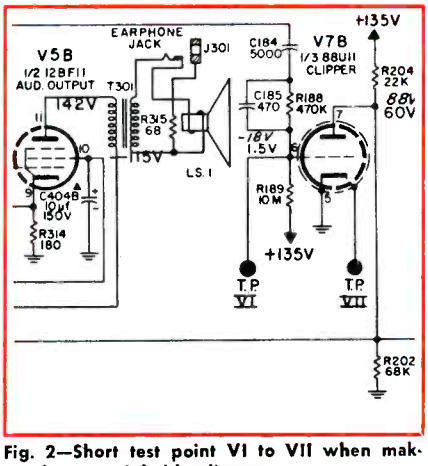


Fig. 2—Short test point VI to VII when making horizontal hold adjustment.

socket terminal 6 of the 8BU11) clipper tube, to point VII, or ground. Set the horizontal hold control to obtain a floating picture. L251's core should be positioned away from the front of the set. Remove the short from test points VI

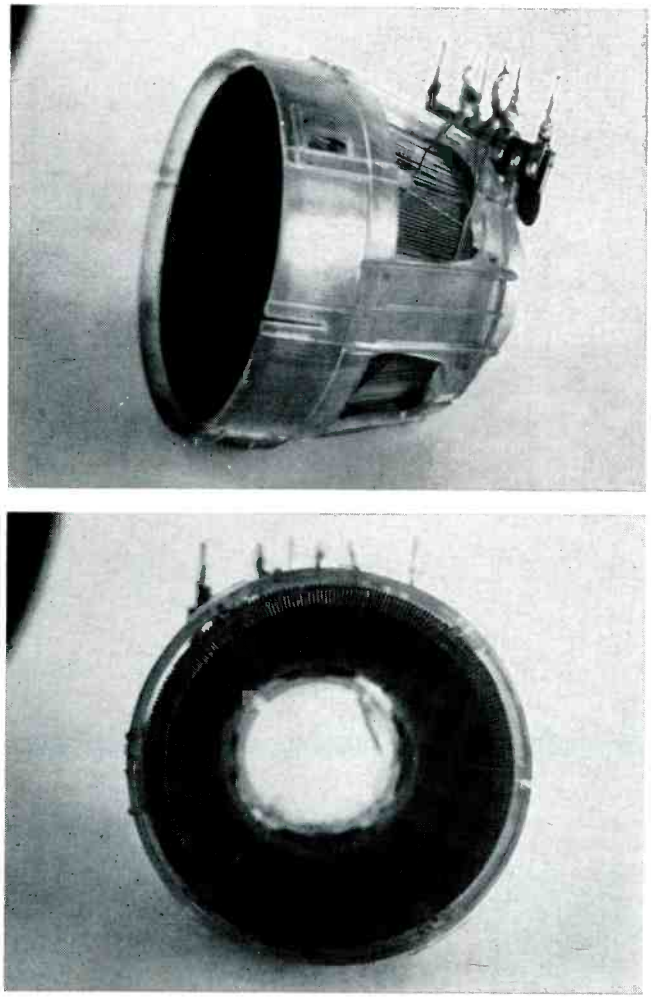


Fig. 3—Side and front view of the toroidal wound deflection yoke.

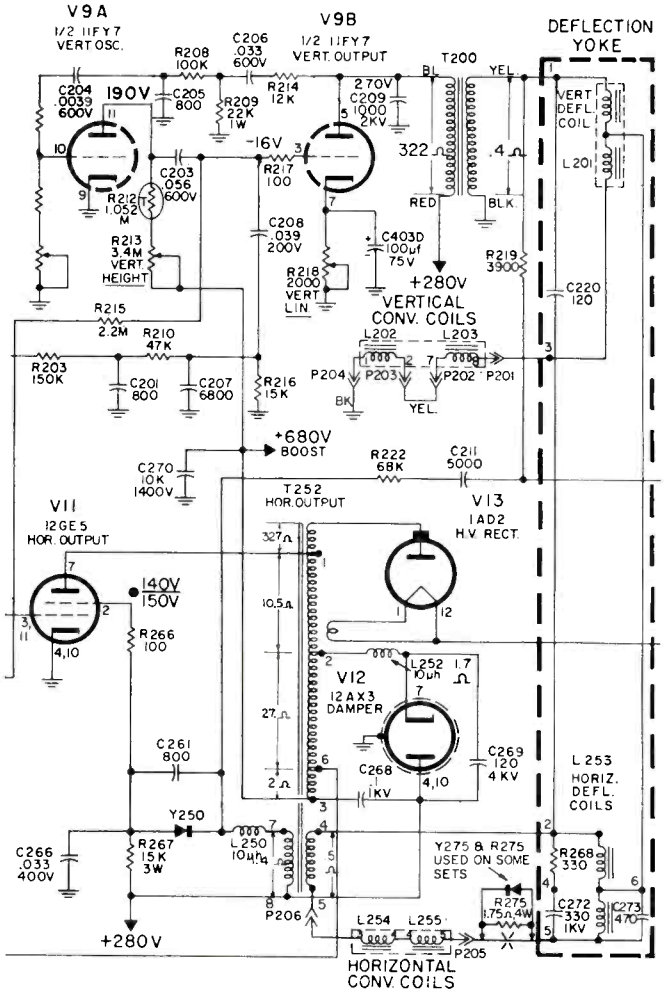


Fig. 4—Schematic of horizontal and vertical deflection circuits.

and VII. The picture should lock into position.

Horizontal Deflection and HV

The horizontal and HV systems combined, employ three compactrons in conventional circuits. The circuits, in general, are similar to those used in conventional B/W receivers — but for a few exceptions. These exceptions include an automatic width control circuit, toroidal-wound horizontal deflection coils (see Fig. 3) and dynamic horizontal convergence coils connected in series with the horizontal deflection coils.

Normally, when the CRT beam current requirements are increased by brightness control adjustments or picture highlights, a loading effect occurs first on the high voltage and is reflected back to the horizontal sweep system. Without compensation, the horizontal size would tend to shrink. TEKLAB checks from low to high levels showed very little picture shrinkage here at ET.

Partial compensation is provided by a diode, Y250 (see Fig. 4), in series with the horizontal blanking winding of the horizontal output transformer. These components are shunted across the screen dropping resistor. The diode's anode is connected to the horizontal output tube screen and its cathode is returned to B+ through the blanking winding on the transformer.

If the screen resistor, R266, changes value in the high direction, this will cause a narrow raster and make convergence very difficult.

Discounting the pulse developed by the blanking winding, the diode would be dc reverse biased because of the voltage drop across screen resistor R267. For medium or ordinary beam current requirements, however, the pulse amplitude across the blanking winding (which is effectively across Y250), is slightly more than 150v — slightly forward biasing diode Y250. This establishes a conduction axis and charge on capacitor C266 from which to operate. When a charge has been established on C266, the diode may be caused to conduct heavier or may be biased for less conduction — depending on the pulse amplitude presented to the diode by the blanking winding. The total effect then is a raising or lowering of the available screen voltage to the horizontal output tube and this increases or decreases output tube, V2, conduction. The pulse amplitude presented to the diode is de-

STEP	FROM	TO	MIN. OHMS	MAX. OHMS
1	Shorted power plug blades with S401 in the "ON" position. See (3) in text.	Channel selector Knobs, & earphone jack	Open circuit	
2		Secondary knobs on front of Receiver		
3		3 hex head screws in cabinet back		
4		3 Phillips head screws at top front of cabinet		
5		Carrying handle and handle escutcheon		
6		Each VHF antenna element and/or antenna input screws	600K	2.2 Meg.
7		UHF antenna and/or antenna input screws	600K	800K

Chart 1

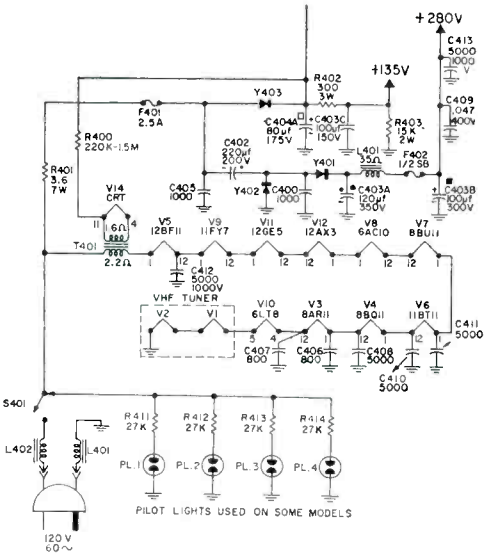


Fig. 5—Schematic of the power supply.

termined by CRT beam requirements.

The circuitry also tends to stabilize the high voltage to approximately 15kv and additionally provides automatic compensation for variations between horizontal output tubes, eliminating the need for current, high voltage and horizontal size adjustments.

Vertical Circuits

The vertical sweep system uses an 11FY7 compactron which has two dissimilar triodes in one envelope (see Fig. 4). The basic circuit is a plate coupled multivibrator. An exception is the resistor connected from the grid of the vertical output triode to the network in the grid of the horizontal output stage. This provides a negative bias voltage which allows increased sweep from the vertical output triode. The negative voltage at the grid of the horizontal output is developed because of grid current flow and the bleeder provides a take-off point with a 0.1μf capacitor acting as a filter to remove undesired vertical information. The negative dc voltage thus developed is coupled to the vertical triode grid.

Vertical blanking pulses are taken from the top of the vertical output transformer secondary and coupled to the cathode circuits of the chroma amplifiers.

When making symmetrical height and vertical linearity adjustments, use a test instrument which produces a crosshatch or test pattern. The station test pattern obtained from a local TV station can be used if it represents the "average pattern" on the most commonly viewed stations. Make final adjustments to overscan the mask area by ¼in. at top and bottom. Excessive overscan may cause the vertical hold control to become critical.

Video IF and Detector

A series resonant trap tuned to 47.25MHz is used in the IF input for adjacent-channel sound rejection. AGC is applied to the 1st IF amplifier and since the 1st and 2nd IF amplifiers are in series for B+, this control is remotely applied to the 2nd IF amplifier. The 1st and 2nd IF amplifier pentodes are contained in one 8AR11 compactron.

The 3rd IF amplifier is self-biased with a 68Ω cathode resistor bypassed by an 800pf capacitor. Additional gain is provided by ½ of an 8AR11 compactron — the pentode of which exhibits a higher gain characteristic.

Output from the 3rd IF amplifier is inductively coupled to the video detector by the 3rd video IF plate transformer. This transformer has a coupling winding and trap in its secondary. The trap, tuned to 41.25MHz, provides audio carrier attenuation before and after detection. Residual audio information, at 4.5MHz, is further attenuated by the 4.5MHz trap. A bifilar-wound coil, besides acting as a 4.5MHz trap, dc couples the diode video detector output to the video amplifier grid. An 8.2K resistor terminates the cold end of the coil and the high side is terminated by a 6.8K resistor.

The video amplifer (V6A) is the pentode section of an 11BT11 compactron and employs a color (chroma) take-off transformer and contrast control in the cathode circuit. The delay line in the plate circuit is terminated at the input by R178 and at the output by the network consisting of L160, L161, and R184. The output of the amplifier is capacitively coupled through C-183 to the paralleled cathodes of the CRT. If the delay line coil opens it will cause improper color and a smeared picture.

Keyed AGC and Sync Clipper

The AGC keyer generates a voltage during retrace time which is used as a bias control voltage for the 1st IF amplifier and the RF amplifier. The triode keyer tube is ⅓ of an 11BT11 compactron. Composite signals from the plate circuit of the 4.5MHz sync amplifier are

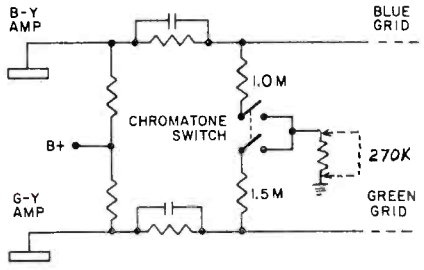
continued on page 78

COLORFAX

Magnavox Gray Scale Adjustments And 'Chromatone'

The "CB" production of the T920 chassis use solderless connectors in the cathode leads to the CRT socket. This feature is employed to assist in color temperature adjustment (gray scale). Normally the blue and green cathodes are connected to the blue and green drive controls respectively, and the red cathode is driven directly. Some picture tubes, depending on the characteristics of the three guns, may require less drive to the red gun and more to either the green or blue gun. The "quick disconnect" solderless connectors make it easier to change the drive connections to the CRT cathodes to accommodate for this difference.

At the present time 25AP22 and 25XP22 picture tubes are being used in production and with the 25AP22 the cathode leads are connected normally (red to red, etc.). Under these circumstances the color temperature adjustments as outlined in the service manual will apply. With the 25XP22,



in most cases, the red cathode will be connected to the GREEN DRIVE control and the green cathode to the RED DRIVE connection. Color temperature adjustment procedure in this case is somewhat different. As a first step, check the drive controls by varying the controls and watching the CRT screen to determine how they are connected. If turning up the GREEN drive control causes the screen to go red this means the green and red connectors have been transposed to equalize the gun characteristics. In this case set the BLUE drive to maximum and the control that now affects the RED drive to minimum, then proceed with the screen control adjustments as follows:

1. Set the BRIGHTNESS control to minimum, SCREEN controls fully CCW, CRT BIAS fully CCW and be sure that the "Chromatone" switch is at the OFF position.
2. Set the service switch to SERVICE and advance each screen control to a point where they produce a barely visible horizontal line. (If one or more controls fail to produce a line with its screen control at full CW, advance the CRT BIAS control slightly and readjust the other two screen controls.)
3. Return the service switch to NORMAL, tune in a monochrome picture and set the BRIGHTNESS to maximum. If necessary, advance the CRT BIAS control so a slight picture blooming is noticeable at maximum brightness.
4. Turn the BRIGHTNESS control down to normal brightness and adjust the RED, BLUE and GREEN drive controls as necessary to maintain the same color temperature in highlight and lowlight areas.
5. While adjusting the BRIGHTNESS control, check to see that the screen maintains essentially the same color temperature. If one color predominates at low brightness, adjust the corresponding screen control (if red predominates turn the RED screen down) to minimize the effect.

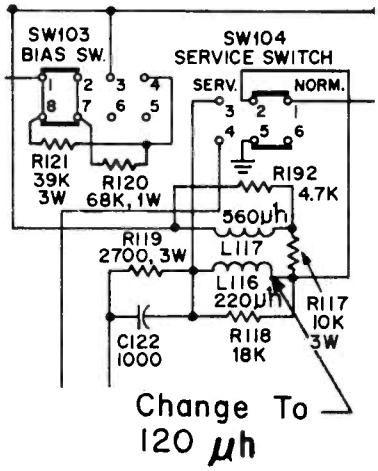
The "CB" production of the T920 chassis also includes a circuit change in the "Chromatone" circuit as shown: The 1.5M resistor (R147) connected to the green grid was 2.4M and the 1M resistor (R146) was 1.5M in earlier production. Also the 270K has been added in series with the switch to ground. When the 25XP22 CRT is used this resistor is shorted out by a jumper wire as shown. When the 25AP22 CRT is used, the jumper wire is clipped out.

'Ringing' or 'Ghosting' in CTC-19/20/21 Olympic Color

On some early production runs, a pronounced "ringing" or "ghosting" may be noticed trailing dark objects, but not necessarily tuneable.

To eliminate this "bounce" and also improve video definition on the CTC-20 chassis, replace peaking coil L116, part number CL32345-13 (220μh) with new coil number CL32442-19 (120μh). This coil is located behind the rear control panel, straddling the NORM-SERV switch. For each reach, tilt panel backward by removing several self-tapping screws.

On the CTC19/21 chassis connect



a jumper wire between the blue and red dot connections of peaking coil T107, located on a terminal strip on the rear apron of the rear control panel to eliminate this "bounce."

To eliminate further noise content in the picture of the CTC19/20/21 chassis, particularly in semi-fringe areas, parallel R231, a 22M resistor, with another 22M resistor, bringing its combined total value down to approximately 10 to 11M. A convenient point for installation is between the AGC terminal on the tuner and the +280v lug of the terminal strip located adjacent to the tuner.

Adjusting Video Drive Controls On Olympic Color Chassis

All current production of the CTC-19/20/21 chassis will employ a RED drive control in addition to the present GREEN and BLUE drive controls. This control has been added so the best tracking conditions can be obtained with the color picture tubes employing the improved rare-earth, red-emitting phosphor which features unity cathode current ratios.

Generally, the best positions for the drive controls are fully clockwise. Check the picture from highlight to lowlight, adjust the VIDEO drive controls when necessary to maintain the gray raster throughout the usable brightness range.

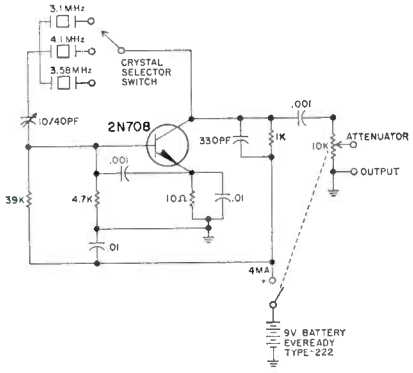
The aforementioned adjustments are made after the regular screen adjustments are made according to the manufacturer's service instructions.

Adjust the "TRUECOLOR" control to mid-range before making any screen adjustments.

COLORFAX

Field Alignment of Chroma Amplifiers Sylvania DO2

Touch-up chroma adjustments are often necessary in the field when weak, improper or no color presentation is encountered. With the necessary instruments listed here and crystal oscillator (schematic shown)



a quick alignment can be made. Following the procedure given here, results comparable to the original factory alignment are possible. If this procedure does not solve these problems, a complete realignment should be made using the applicable service literature.

Instruments Needed:

1—Dot-Bar Generator
1—Electron tube voltmeter
1—Demodulator probe
1—Crystal oscillator with a 4.1MHz or 3.1MHz crystal and variable output 0 to 2v.
1—Hex tuning wand

Procedure:

1. Verify that the complaint is valid and the trouble is not caused by improper operating voltages or defective tubes.
2. Remove receiver back cover and horizontal output tube.
3. Set controls as follows:
   a. Color killer open to allow bandpass stage operation.
   b. Color control set to mid range.
   c. Tint control set to mid range.
4. Remove one IF tube to prevent spurious chroma signals.

Test Instrument Connections:

1. Connect the crystal oscillator output to test point "S" on the IF board. (1st video amplifier grid.)
2. Connect the VTVM with demodulator probe to test point "S" on the chroma board. (Chroma input grids of "S" and "Z" demodulators.)

Alignment Procedure:

1. Apply power to receiver and test instruments.
2. Set crystal oscillator to 4.1MHz and adjust chroma take-off coil (L604) to maximum VTVM reading.
3. Turn bandpass transformer (T600) slugs all the way to top and bottom positions.
4. Set crystal oscillator to 3.1MHz and turn bottom slug to peak VTVM reading — then turn an additional one turn clockwise. If the first peak obtainable appears when the slug is in the extreme position, reverse steps 4 and 5 then tune top slug to 3.1MHz and bottom to 4.1MHz.
5. Set crystal oscillator to 4.1MHz and turn top slug to peak VTVM reading. Do not adjust beyond obtained peak.

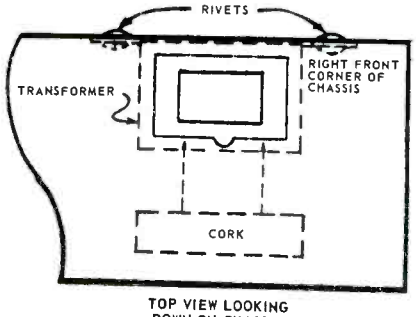
Receiver Checks:

1. Disconnect power to receiver and remove test instruments.
2. Replace tubes and switch set on.
3. Apply a color bar pattern and adjust to best presentation of colors.
4. Check tint control range and adjust transformer (T602) if necessary.
5. Using VTVM and demodulator probe, peak (T604) 3.5MHz oscillator output transformer.
6. View a color program and evaluate color presentation.

Low Volume Buzz in G-E KC Color Chassis

A few cases of low-volume buzz have been traced to the vertical output transformer.

This problem may be easily solved

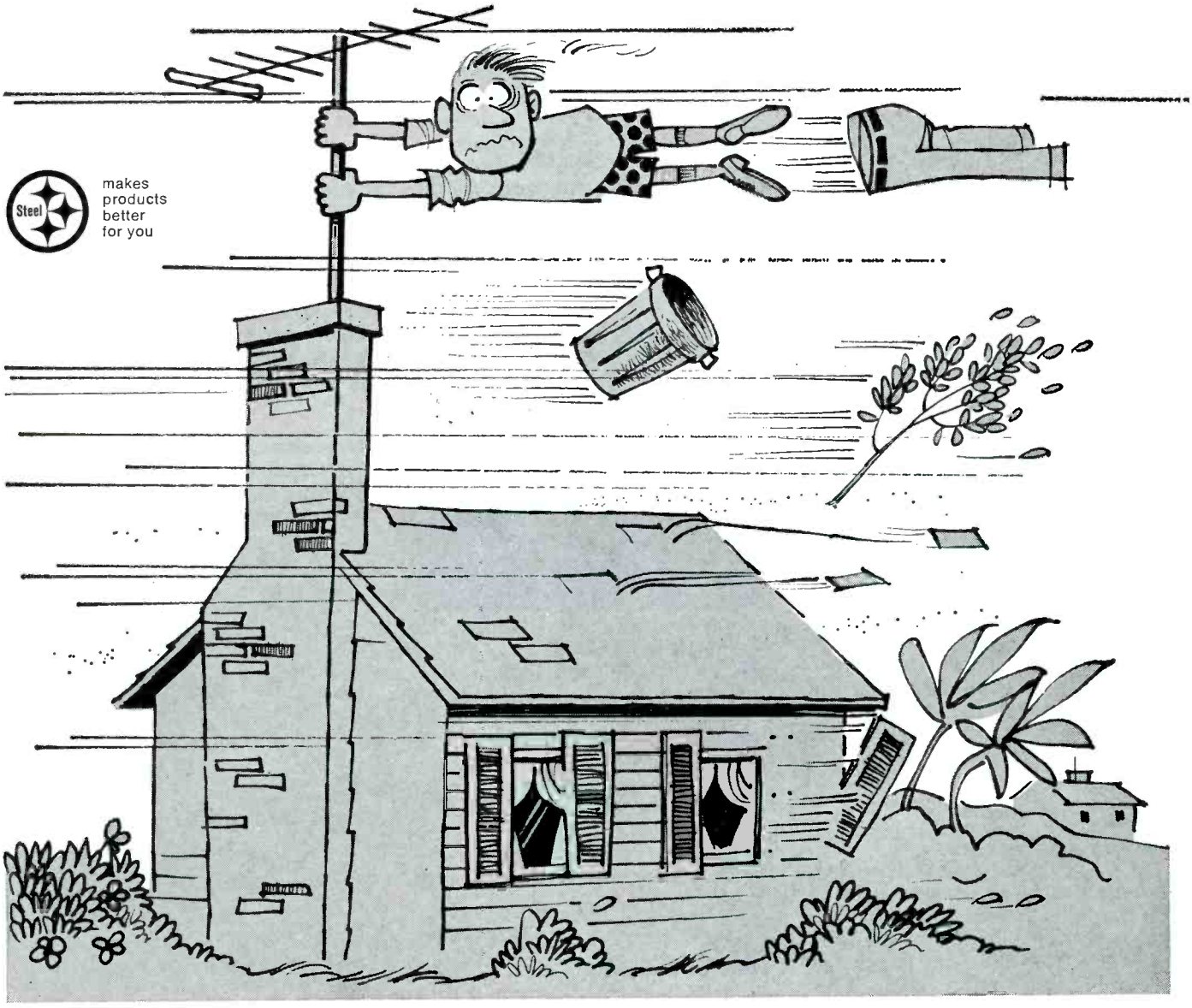


TOP VIEW LOOKING DOWN ON CHASSIS

by inserting a piece of cork gasket or other soft non-perishable packing between the vertical transformer coreframe and the underside of the chassis as shown here.

Only those sets having a complaint of low volume buzz should have the packing added.

For more information about NEW PRODUCTS See page 87 and 88 READERS SERVICE



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NEW PRODUCTS

For additional information on any products in this section, circle the numbers on Reader Service Card. Requests will be handled promptly

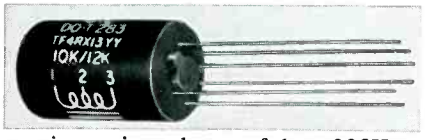
PA Amplifiers 700

A series of audio amplifiers is announced in 10-, 20-, 35-and 75-w models. Optional plug-in transformers change the microphone channels from high to balanced low impedance and

the program channel from high impedance to a balanced 600Ω line for wired background music. All models have 4, 8 or 16Ω outputs and a 70v line with an additional 25v line on the 35- and 75-w models. Bell.

Transistor Transformer 701

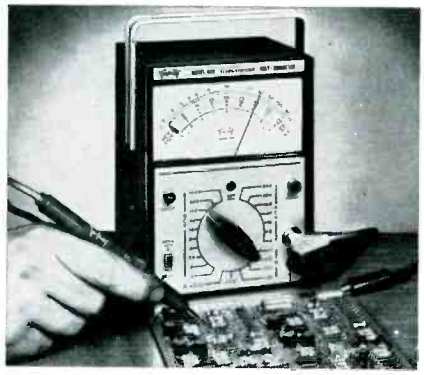
A line of ultraminiature, transistor transformers, with straight pin terminals, is announced for printed circuit application. Specifications indicate



a primary impedance of 1 to 200K, a secondary impedance of 50Ω to 12K and an operating level of 25 to 100-mw: They have a maximum diameter of .350in. and a maximum height of 9/16in. United Transformer.

Transistorized VOM 702

A transistorized VOM is announced that is designed to have the portability of a standard VOM with the high input impedance of a VTVM. Specifications indicate that it has an accuracy of ±3 percent of full scale on both ac and dc at 77°F. One probe is used for all functions, ac, dc and ohms. The probe has a built-in sliding switch that places a resistor in series with the instrument on dc voltage readings. The dc input impedance is reportedly 11M on all ranges except 0.4v and 0.8v, which are 2.75 and 3.5M, respectively while the acv scale has a minimum impedance of 0.75M



over a range of 15 Hz to 2MHz. The dcv scales are 0 to 0.4, 0.8, 1.6, 4, 8, 16, 40, 160, 400 and 1600. The acv scales are 0 to 4, 8, 16, 40, 160, 400 and 800. The ohms scales are 0 to 1K, 10K, 100K, 1M, 10M and 100M. The cell and battery complement consists of one size D cell, two size AA cells and one 9v battery. Dimensions 3-3/16 x 5⅛ x 6½in. Weight 2½lb. Price with cells and battery $78. Leather carrying case $14 extra. Triplett.

Monitor Receivers 703

Three lines of receivers are announced that are designed to operate on two crystal-controlled, VHF channels plus the broadcast band. They reportedly can receive 150 to 175MHz, 25 to 50MHz or 108 to 136MHz. The

receivers come with a built-in adjustable antenna and measure 5⅞ x 2½ x 1-5/16in. Weight 11oz. Price $39.95. Sonar.

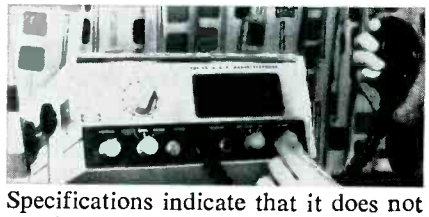
Hypodermic Oiler 704

Announced is a ¾-oz squeeze-type, polyethylene bottle fitted with a ½in. long, 19 gage (.042in. dia with a .027-

in. bore) hypodermic needle. This tool may be used to apply some cleaning solvents, oil, glue, cement or graphite mixtures. A polyethylene cap protects the needle when not in use. Price 60¢. Gaunt.

Marine Radiotelephone 705

A VHF band radiotelephone is announced, that reportedly can transmit at full power with a 20-in. antenna.



Specifications indicate that it does not require a ground plate attached to the boat's hull. The manufacturer indicates that the 12-channel, two-way radio can be used to talk with other boats, call the Coast Guard for assistance or talk with anyone ashore through a telephone company operator. Price $595. Raytheon.

RCA Transistors Rectifiers Integrated Circuits

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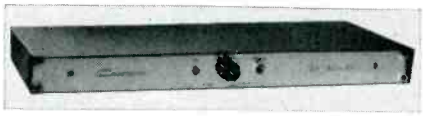
NEW PRODUCTS

Power Amplifier 706

Announced is a power amplifier reportedly capable of supplying 20w of sinewave power per channel to an 8Ω speaker. Specifications indicate that full output is obtained with an input level of 0.6v. The input impedance is said to be at least 12K, the frequency response 20Hz to 20kHz ±0.1db and that third harmonic distortion is less than 0.2% at 1kHz.



The manufacturer indicates that the 7½-lb. amplifier can be mounted in a case or a standard 19-in. rack, using only 1¾-in. of rack space. Price $199 for rack mounting, $215 with cover. Crown.

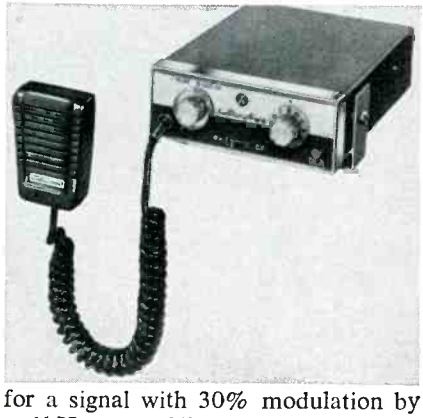
Phone-Message Recorder 707

Announced is a tape recorder designed to handle telephone messages automatically. The unit greets callers in a pre-recorded voice and records the information received. This provides service-dealers and technicians with the advantage of a 24-hour

answering service. Specifications indicate that the tape recorder contains solid-state circuitry and is installed by placing the telephone into position and plugging the unit into a 117v outlet. Price $189.95 Sonar.

CB Transceiver 708

A 5-w, 17-transistor, solid-state CB transceiver features dual-conversion. Specifications indicate that the receiver section has a 0.4μv sensitivity



for a signal with 30% modulation by a 1kHz tone. The IF amplifiers are reportedly designed for 6.5 ±1kHz bandwidth at 6db and 18kHz at 40db. The manufacturer indicates that the RF power output averages 3.5w at 5.0w input, with modulation peaks at 100%. The transceiver measures 2-3/16 x 6 x 8in. and weighs 5½ lb. Price $139.95. Hallicrafters.

CRT Tester 709

A CRT analyzer/rejuvenator is reportedly designed to test all color and B/W TV CRTs. Specifications indicate that it checks gas, emission, shorts, opens, grid cut-off and cathode life. The SCR circuiry is designed to provide continuously variable, meter-monitored test voltages for correct heater potentials and protection against instrument obsolescence. The manufacturer indicates that the heater voltage ranges from 0 to 13v at 2amp

while the grid voltages range from 0 to 100vdc negative for the control grid and 0 to 300v positive for the screen grid. Both grid voltages are metered. The solid-state circuitry reportedly contains one unijunction transistor, three silicon diodes and one SCR. Dimensions are 10¾ x 10½ x 5¼ in. Weight 9 lb. Price $99.95. Hickok.

CB Transceiver **710**

Announced is a CB transceiver

designed to give boat owners two-way communications with similarly equipped land or marine units. Specifications indicate that the 11-channel, all transistor model features a welded steel chassis that is spray coated for protection from moisture and salt elements. The speaker is reportedly splash-proof and built to conform with Navy specifications. Designed for 12vdc power, the transceiver measures 2-7/8 x 6-3/8 x 7-13/16in. Price $175. Regency.

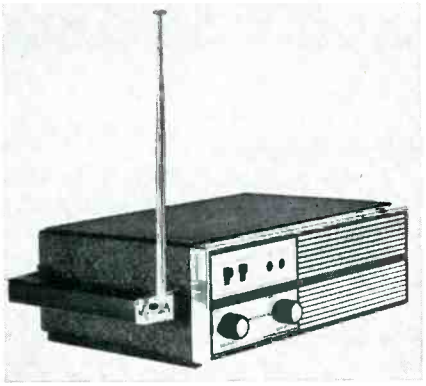
Multi-Color Pen **711**

Announced is a ball-point pen capable of writing in eight colors. The retractable tips can be selected by

eight push-buttons located along the side of the barrel. The colors are black, orange, green, blue, red, purple, brown and aquamarine. Price $2. STILO.

FM Monitor Receiver **712**

A 7-lb, solid-state, FM monitor-receiver is designed to be carried between home and work. Specifications indicate that it can be powered by a 12vdc external supply, 117vac or in-



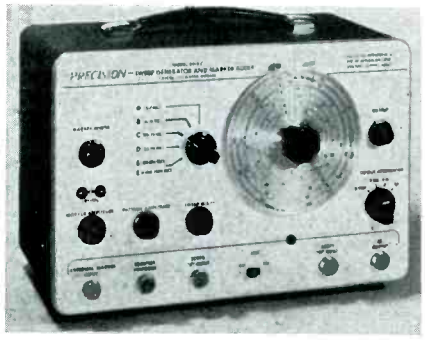
ternal rechargeable batteries. Three selective-call models reportedly have built-in decoding units compatible with current radio alerting systems. A rechargeable power supply is available for hand-carried equipment. The unit is available in the 30 to 54MHz and 150 to 174MHz bands. It measures 3½ x 11¾ x 7¼ in. and weighs 11½ oz. Motorola.

For more information on these
NEW PRODUCTS
See pages 87 and 88
READERS SERVICE

NEW PRODUCTS

Sweep Generator 713

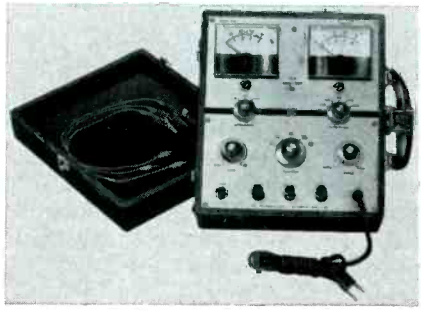
A sweep generator and marker adder is announced that reportedly combines a wide-range, frequency-modulated signal source with marker adder circuitry specifically designed for alignment and maintenance of TV, FM and other HF to UHF wide-band receivers and circuits. Its 6-band frequency coverage extends from 3MHz to 1080MHz. Specifications



indicate that the features include continuously variable sweep width, marker adder, internal blanking, automatic gain control and fixed frequency markers. Dimensions 13 x 8½ x 7in. Price $169.95. Precision.

Rectifier Analyzer 714

A solid-state analyzer has been developed for measuring the gate-firing voltage and current and the PRV and



current of SCRs. The instrument is self contained, mounted in a vinyl-covered carrying case and measures 10½ x 9 x 5in. Net $144.50. Seco.

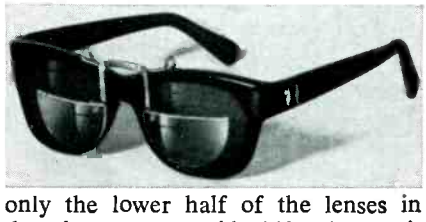
Flat Cable 715

A line of flexible flat cable is introduced for electronic wiring systems. Two manufacturing methods are used to produce the cable, depending on application requirements. For the

heavier current carrying conductors, individual wire ribbons are encapsulated between polyester films but when extremely thin dielectric or fine-line conductors are required, the cable is etched from copper-clad polyester laminate. G. T. Schjeldahl.

Clip-On Lenses 716

Announced are clip-on lenses designed to slip over the nose-bridge of all prescription and plano safety glasses. They are designed to cover



only the lower half of the lenses in the glasses to provide bifocal magnification. They are made in three magnifying powers — 1.25, 2.00 and 3.00. Edgewater Branch.

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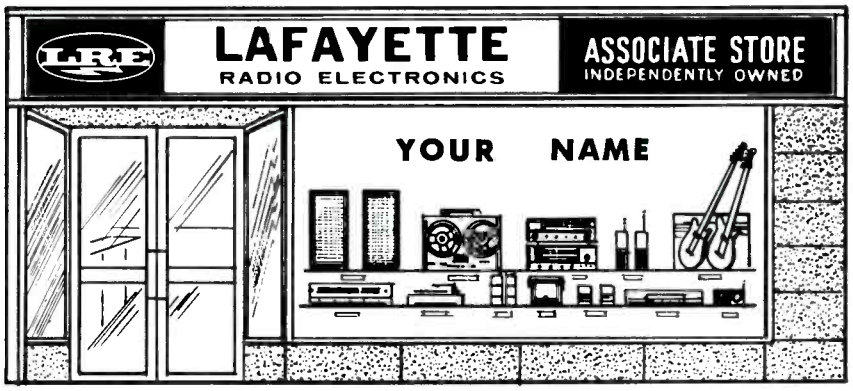

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NEW PRODUCTS

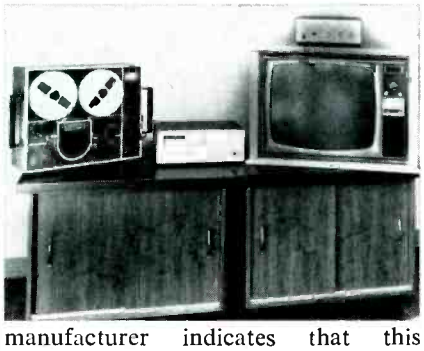
Wrench Set 717

Announced is a set of three adjustable wrenches that are reportedly drop-forged from alloy steel, heat-

treated and nickel-chrome plated. Packed in a blue vinyl tool bag, these wrenches measure 6, 8 and 10in. Kraeuter.

Color VTR Adapter 718

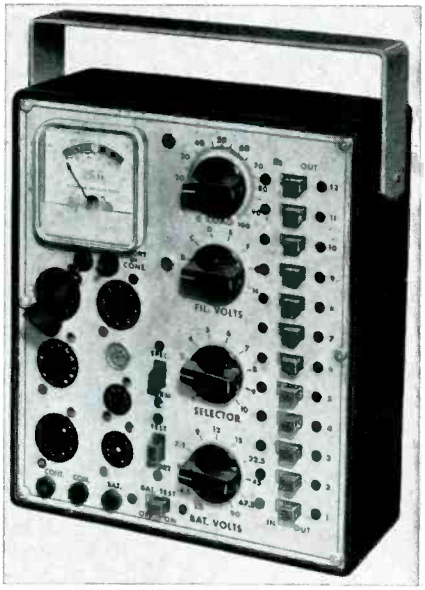
A color adapter is introduced for industrial video tape recorders. The



manufacturer indicates that this adapter can be used to convert the company's VTR models while not affecting the reproduction of B/W tapes previously recorded. Sony.

Tube Tester 719

Announced is an instrument designed for testing electron tubes (octals, loctals, 7- and 9-pin miniatures, novars, nuvistors, compactrons), load-testing commonly used batteries (1.5 to 90v) and go/no-go continuity testing. It features transformer isolation, 3-color meter, neon-



lamp short-indicator and bakelite case. Dimensions 8⅝ x 7½ x 3⅛in. Weight 4 lb. Price $34.95 (wired only) EICO.

Telephone Caddy 720

Announced is a telephone caddy designed to hold over 300 names, addresses and phone numbers in one

concealed drawer placed under the phone. Clear plastic windows protect the phone-address cards. Only slightly larger than a telephone base, the caddy is 1in. high. Price $2.95. Caddylak.

For more information on these NEW PRODUCTS
See pages 87 and 88
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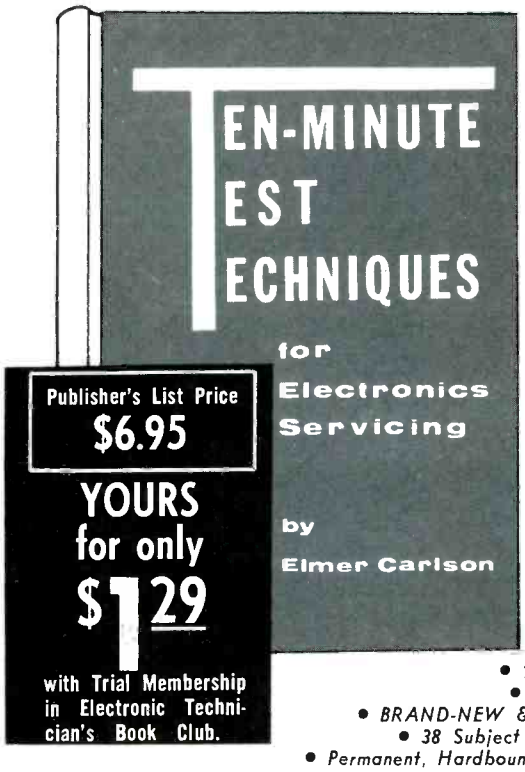

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PARTIAL LIST OF CONTENTS

TEN-MINUTE TEST TECHNIQUES for Electronic Servicing, by Elmer C. Carlson, contains 176 pages — over 125 illustrations — 8 BIG CHAPTERS — 38 separate subject headings. Includes the type of **practical** servicing data **every** electronics technician should have . . . step-by-step techniques for localizing trouble to an improperly operating stage, and then to the defective component itself . . . using a minimum of test equipment. Truly an authoritative servicing guide which will help you solve "tough-dog" troubles fast and eliminate costly call-backs.

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A Massive, Authoritative Compilation

Now you can have at your fingertips, this brand-new book, especially written for service technicians, outlining simple troubleshooting procedures that can be applied to any type of electronic circuit.

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Step-by-step techniques are outlined for pinpointing troubles to a specific improper stage, and then to the defective component itself, using the minimum amount of test equipment. Profusely illustrated, the content describes several specific troubleshooting methods which can be used to analyze the performance of various types of circuits—tube or transistor—in any kind of equipment. Contains just the kind of practical, down-to-earth information you can *immediately* put to use in your everyday service work! Many invaluable "Time and Temper Savers" are included, offering shortcuts and practical hints which will increase your servicing efficiency and cut down on troubleshooting time.

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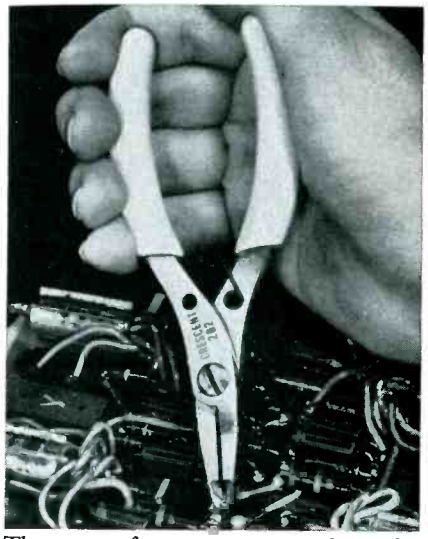
NEW PRODUCTS

Safety Belt 721

Announced is a belt designed to protect technicians from the danger of a fall when doing antenna or other work in high places. The lanyard is designed to be secured to some permanent point such as a pole, beam or stud. A shock absorber reportedly protects the technician against injury-producing forces when falling to the end of the lanyard. Rose.

Cutting Pliers 722

A line of stainless-steel, electronic pliers is announced that features an adjustable screw joint designed to permit disassembly for re-sharpening.



The manufacturer states that the product has undergone severe tests. These pliers are manufactured in three models. The diagonal cutting pliers and shear action cutting pliers are 4in. long, and the needle nose pliers, with cutter at tip, are 4½ in. long. Crescent.

This Remington PREMIER PORTABLE TYPEWRITER

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RCA Electronic Components and Devices, Harrison, N.J.

RCA® **The Most Trusted Name in Electronics**

'PORTA-COLOR' . . .

continued from page 61

dc coupled to the keyer grid. The divider resistors clamp the operating point for the grid. The AGC control is in the cathode circuit and is adjustable from the back of the receiver. The horizontal pulse information for the keyer and burst gate share a common take-off source from the horizontal output system.

The sync clipper is ⅓ of an 8BU11 compactron which functions as a sync separator by allowing only the transmitted sync pulses to pass through the tube. The tube is operated at a low plate potential, essentially clamped by the resistor divider in the plate circuit. A negative bias, proportional to the input signal amplitude, is developed by grid current flow. A positive-going composite signal from the signal amplifier is coupled to the clipper grid. A 15K resistor reduces loading effects on the signal amplifier.

Vertical sync pulses in the plate circuit of the clipper are coupled through the integrator to the vertical multivibrator and the horizontal phase detector.

The Power Supply

No technician will have trouble finding the power supply components. All parts are grouped together in the front left portion of the chassis.

The supply consists of two separate B+ voltage sources with a common 3.6Ω surge resistor and a 2.5a fuse (see Fig. 5). Circuitry for the low B+ 135v source is a conventional halfwave rectifier and the high B+ 280v is a voltage doubler circuit. Silicon diodes are used as rectifiers. Tube heaters are series-string and a polarized ac power input is provided.

In some HC chassis it has been discovered that 680Ω resistors were used instead of 300Ω 3w resistors for R402. It is also possible that some incorrect resistors may have been used in HB chassis production. With the wrong value resistor an audio beat pattern would be produced. The 680Ω resistor lowers the 135v B+ to 100v.

We suggest that you measure the B+ line to determine if it is 135v whenever an HB or HC chassis is serviced.

In addition to the usual safety precautions when servicing an exposed chassis, it should be powered from an isolation transformer while being serviced with the power on. After the serviced chassis has been completely reassembled in its cabinet a safety test should be performed as described in Chart 1. Do not plug receiver into power outlet. Short power plug blades together, turn switch on and make resistance measurements from the plug to other points specified. ■

NEW POWER

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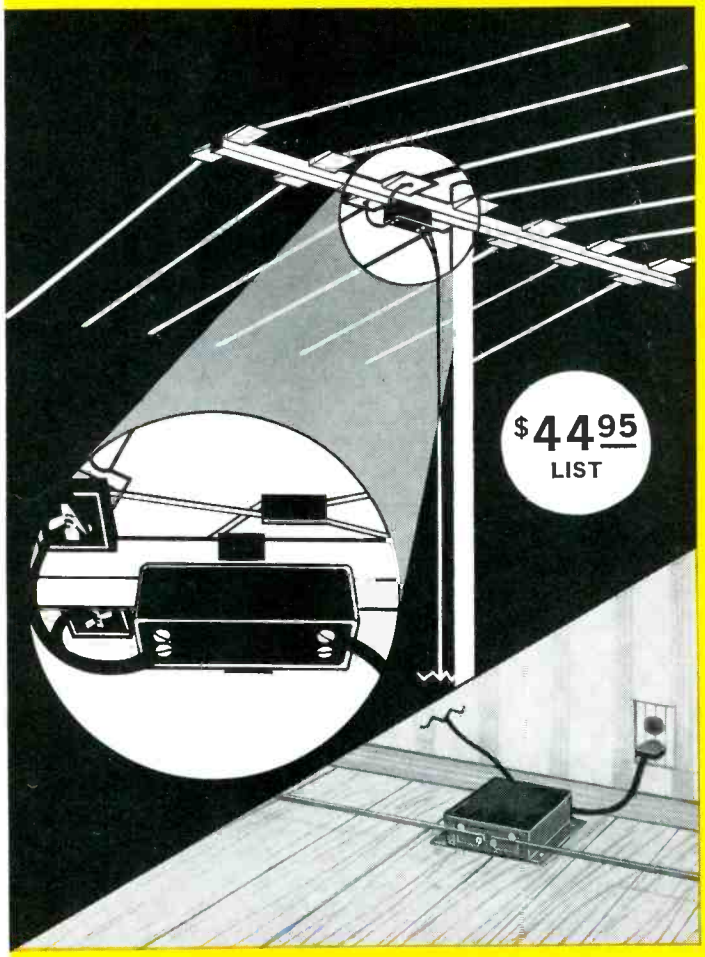

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Semiconductors . . .

continued from page 58

and V_{CC}). A typical value for both of these currents is 1ma.

There will be a slight difference in the two quiescent operating current measurements since the input offset voltage is now zero — the bases of both transistors being grounded. The ratio of these two currents is called the quiescent operating current ratio, and it has a typical value of 1.05.

The characteristic quiescent operating current can be increased by changing the bias of the current regulating transistor (Q_3). If terminal 5 (Fig. 6) is connected to terminal 8 and the emitter voltage source (V_{EE}), the emitter of the transistor will be more negatively biased with respect to its base. [We have reduced the value of resistor R_7 in Fig. 10 (R_7 now equals R_5 instead of $R_4 + R_5$).] The base of transistor Q_3 has been made more positive with respect to its emitter, and the transistor conducts more current to the other two transistors (Q_1 and Q_2). As a result of this change, the circuit's typical quiescent operating current has increased to 2.7ma.

By disconnecting terminal 5 and connecting terminal 4 to terminal 8 (Fig. 6) and the emitter voltage source (V_{EE}), a resistor (R_2) and two diodes (D_1 and D_2) are shorted out of the circuit, making the base of transistor Q_3 less positive with respect to its emitter. Under these conditions, the current limiting transistor conducts less current to the other two transistors (Q_1 and Q_2), and the characteristic quiescent operating current is reduced to 0.45ma.

If both terminals 4 and 5 are connected to terminal 8 and the emitter voltage source, the bias of transistor Q_3 is again changed, and the characteristic quiescent operating current is 1.25ma.

The device dissipation (P_T) is the total power drain of the integrated circuit (Fig. 11) when no signal is applied to it and there are no external load resistances. This power is equal to the product of the total collector current (I_{CC}) times the collector voltage (V_{CC}) plus the product of the total emitter current (I_{EE}) times the emitter voltage (V_{EE}).

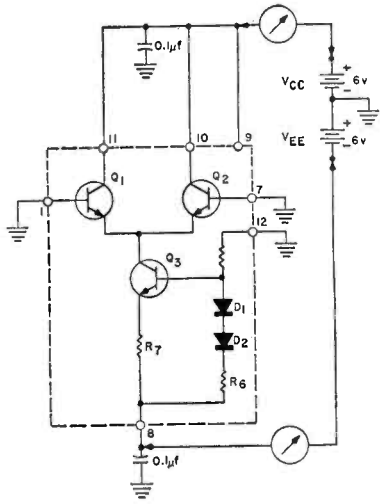
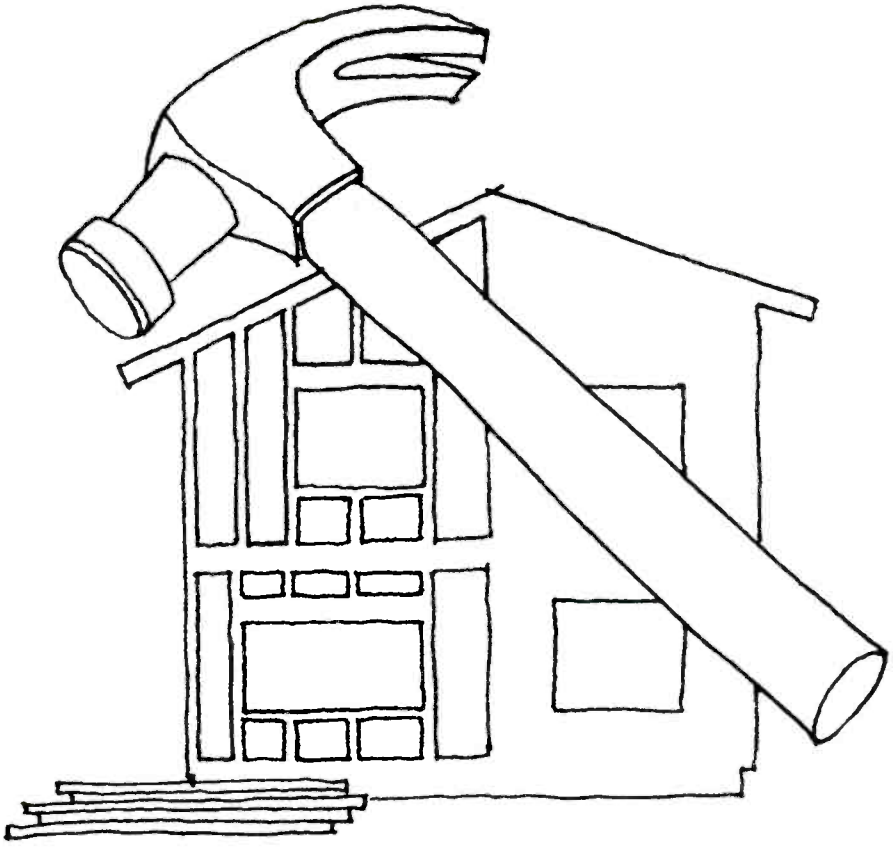


Fig. 11—A circuit for measuring the device power dissipation of the CA3005 differential amplifier circuit.

($P_T = I_{CC}V_{CC} + I_{EE}V_{EE}$.)

The next in this series of articles will describe how integrated circuit CA3005 functions as a cascode amplifier and the use of integrated circuit μA703 in an FM IF strip. ■



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NEWS OF THE INDUSTRY

RCA Introduces New Receiving Tubes for Color TV Sets

RCA has announced the introduction of six new receiving tubes for color TV receivers. The 6CM3, 25CM3 and 34CM3 are intended for damper-diode service; the 6KY6 and 7KY6 for video-output applications and the 6ME8 for color-TV demodulator service.

Specifications indicate that these tubes feature a maximum peak-inverse-plate-voltage rating of 5500v, a maximum peak-plate-current rating of 1700ma and a maximum average-plate-current rating of 400ma. In addition, heaters and cathodes are reportedly insulated to withstand negative-peak-voltage pluses of 5500v, with average values up to 900v.

1967 NEW Show Blends The New with the Old

The 30th Anniversary NEW Show, to be held in the Conrad Hilton Hotel in Chicago, June 19-21, 1967, will present a blend of the new and the old, according to Norman Triplett, president of Electronic Industry Show Corp.

A special emphasis is being put on new products and new promotions Mr. Triplett said, and exhibitors are being urged to come up with show specials and new merchandising themes to give distributors at the show plenty of justification for their attendance.

Special awards may be won by a new product, a new package, a new promotional program or merchandising idea or even a new sales policy—any facet of an exhibitors' program being introduced to the trade during the NEW Show.

Sales Figures Still Increasing

The Electronic Industries Assn.'s Marketing Service Dept. has released figures that indicate January distributor sales of color TV sets were 35.5 percent above the comparable 1966 period. In January 1966, distributors sent out 231,238 color sets, while 1967 figures show that 313,442 color receivers in the same month were ordered by dealers.

FM radio sales were up in January. The January 1966 figure of 203,430 was surpassed by 8.7 percent in the first month of 1967, for a distributor sales total of 221,105 FM radios.

Portable/table phonograph sales in January rose to 254,616 or 29.5 percent over the January 1966 figure. Despite a drop in console phonographs (112,594 vs. 156,-521), over-all phonograph distributor sales managed a 4 percent increase over the comparable 1966 figure.

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Some have training facilities set up in their own places of business . . . so you can send your technicians in for "refresher courses."

Many hold periodic training meetings for large groups. Motorola Regional Service Managers are often in attendance at these meetings to provide detailed information about design and service features.

And in some cases, your Motorola Distributor can enroll your service men in Motorola's "Professional Technician Program." These new "P.T.P." sessions take place *in your place of business* and your technicians work on a man-to-man, face-to-face basis with one of our factory technicians.

The service manager from your Motorola Distributor can help you with almost any type of training activity. Contact him.

Good training can help you keep the service technicians you have. Good training can help you get the service technicians you need.

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NEWS OF THE INDUSTRY

Imports Added to 1966 Sales Totals

The Electronics Industries Assn's. statistical department has correlated domestic factory sales for 1966 with import statistics to develop an accurate profile of the total U.S. market in radios, TV sets and tape recorders.

They found that of the 47,584,000 radios (AM and FM) purchased during 1966, 25,785 were imported. In 1965, 43,953,000 radios were purchased and 19,627,000 of these had been imported.

Of the 7.7 million B/W TV sets sold last year, 6.6 million were table models or portables. Imports accounted for 19 percent of this figure, two-thirds of these imports having been delivered with American brand names.

Although 4.5 million tape recorders were purchased last year, 3.4 million of these were imported and carried foreign brand names. An additional 265,000 were imported bearing American brand names, and 868,000 were made in the United States.

RCA Begins Promotion of Color TV Test Instrument

As the sales of color TV sets continue to climb, it is becoming increasingly important that service-dealers purchase adequate instruments for the repair of these sets. RCA has, therefore, decided that this is a good time to promote the sale of their color bar/dot/crosshatch generator. As an added sales incentive, they are offering a Remington Premier portable typewriter free with the purchase of each instrument.

Electro-Voice Distributor Opens New Office in Memphis

Dick Bellew Sales, Inc., has opened a new branch office in Memphis, Tenn., to handle the distribution of Electro-Voice products. The Memphis office will be managed by Howard Martin, who has been a manufacturer's representative for the past five years.

Zenith in Midst Of Spring Ad Program

Zenith Sales Corp. has begun an advertising and promotional campaign for the spring selling season, which includes page-dominating, national newspaper ads that feature the company's color TV marketing activities.

One-column dealer tie-in ads will pick up the headline idea and illustration technique of each newspaper ad in the spring series.

Point-of-sale displays, plus a special in-store promotion kit, allow a dealer to run a complete store event or spot model promotion.

Reeves Introduces Video Tape

A new general purpose quadruplex video tape for both monochrome and color video recording has been introduced by Reeves Soundcraft.

The tape reportedly features a smooth-oxide surface designed for a tape-to-head contact, during record and playback, that will improve tape and head life.

The new 2-in. tape is available in lengths from 600 to 7200ft.

CATALOGS AND BULLETINS

Megaphone 400

A data sheet describes the characteristics of a solid-state megaphone which reportedly provides 25w of music power and a frequency response of 50Hz to 15kHz. Perma-Power.

Condenser Microphone 401

A specification sheet describes a ¼-in. condenser microphone designed to measure sound and noise at dynamic ranges up to 184db. B & K.

Polyurethane Foam 402

A sheet describes the use of polyurethane foam for impact-absorption packing. American Excelsior.

Relays 403

A large assortment of telephone-type, plate-circuit, latching, time-delay, stepping, dry-reed and mercury-wetted-contact relays are described in a 12-page catalog. Included are photographs, drawings and dimensions, plus coil and contact specifications. Potter & Brumfield.

Power Outlets 404

Pre-wired electrical outlet boxes for benches and racks are described in a 10-page catalog. Also included are scope dollies and speed controllers. Waber.

Polar Relays 405

The electrical, environmental and mechanical characteristics for four types of mercury-wetted-contact, polar relays are contained in a six-page data sheet. Standard part numbers and coil characteristics are also included. Clare.

Switches 406

The basic module elements of a line of push-button switches is described in a 22-page catalog. Complete mechanical, electrical and environmental specifications are included in the catalog along with dimensional drawings for each of the three basic series. Centralab.

Shrinkable Insulation 407

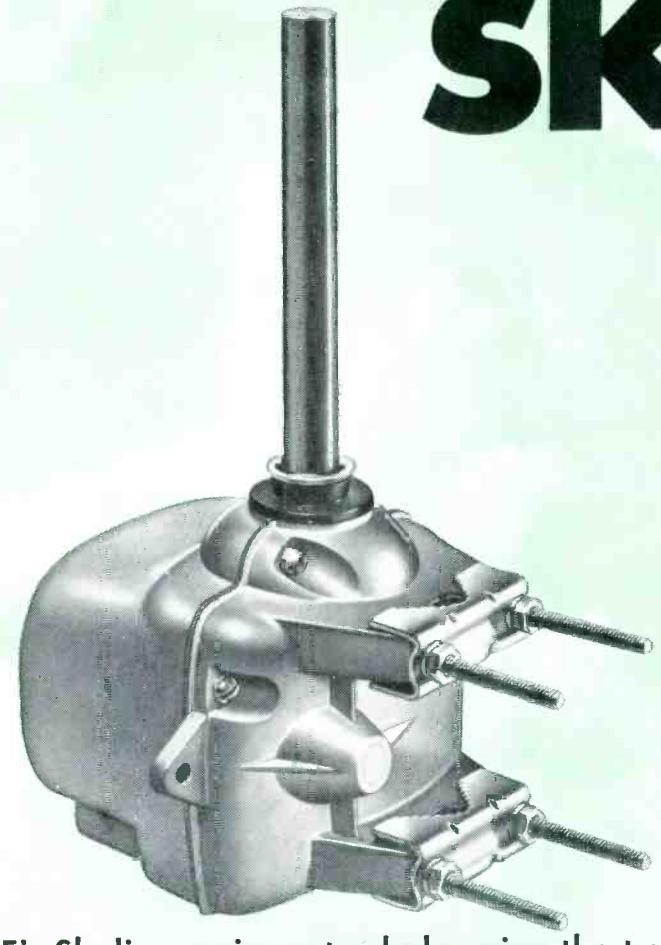
A complete listing of heat-shrinkable insulation materials is contained in a 12-page brochure. Tables of physical, electrical and thermal properties are listed, along with application photos and other information. 3M.

Control Knobs 408

Two four-page bulletins describe two lines of control knobs. Included are drawings, dimensions and a listing of available finishes. National.

ADVERTISERS' INDEX

Help stamp out green sky



CDE's Skyline series rotor helps give the truest urban/suburban color TV reception!

Green sky, purple people and brown water...help your customers avoid these with CDE's Skyline series rotor. It's the most rugged lightweight on the market...the first rotor system designed specifically for metro-suburban area.

It's *dependable*...because of a weatherproof die-cast housing. *Better-performing*...because of a high-torque motor with heavy wormgear drive. *Longer-lasting*...because of heavier-than-average construction throughout.

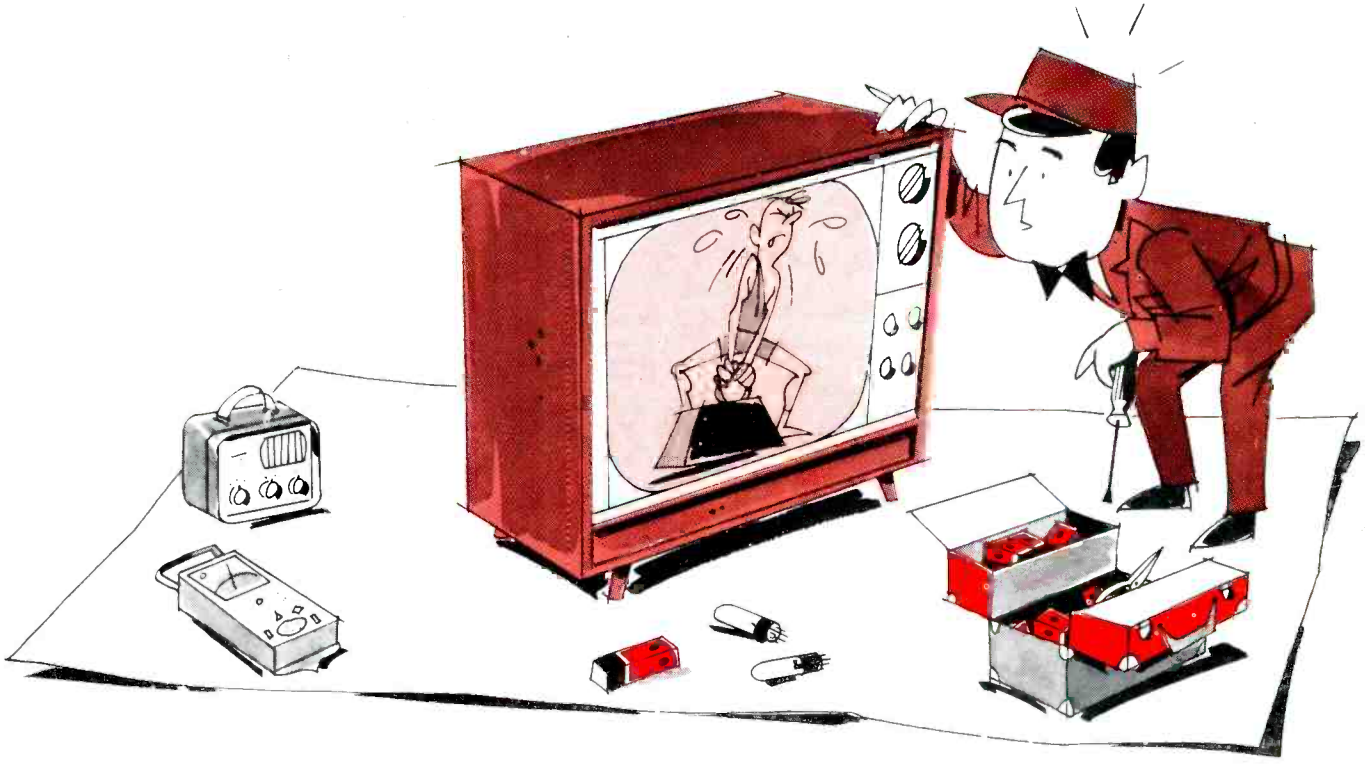
The built-in mast will handle single antennas. And, with the easily-mounted adapter, the Skyline rotor can handle large antennas and stacked arrays, too.

Available for automatic operation, the Skyline series rotor means the very best in color and black and white TV reception. Goes great with FM rigs, too!

CDE CORNELL-DUBILIER

RCA's COLOR TV FASTCHECK #7

WEAK COLOR?



Follow these steps to isolate the trouble area...

If colors lack full saturation, make sure that fine-tuning, brightness and color controls are set correctly. Then determine the receiver section in which signal is attenuated as follows:

1. Apply an rf color-bar signal at the antenna terminals.
2. Connect a scope at the video detector. Check amplitude of the color-bar pulses and sync pulses. They should be approximately the same. If color-bar pulses are attenuated, check for trouble, including poor bandpass, between the antenna terminals and the video detector.
3. If amplitudes are correct, look for trouble in the chroma section, as follows:

   a. Check bar-pulse amplitude at input and output of bandpass amplifier.

   b. Check bar signal at input and output or demodulators and color amplifiers. *Note:* Trouble in only one of these stages will produce a *shift* in colors, which will show up in the color-bar pattern. Loss of color saturation in the demodulators or color amplifiers, therefore, indicates trouble in a circuit common to the demodulators or color amplifiers.
4. Once the defective stage or section has been found, use voltage or resistance measurements to pinpoint the circuit defect.

This is another in RCA's continuing series of color TV service hints, to help make your job easier. Your RCA tube distributor can also make your job easier, because he's your best source for quality RCA receiving tubes for color TV, as well as for black-and-white TV, radio and hi-fi. You enjoy more customer confidence and satisfaction when you replace with RCA receiving tubes,

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

The Most Trusted Name in Electronics